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An Investigation Into The Feasibility Of Providing Intelligent Support For Computer Mediation Decision Making Groups

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A thesis submitted to the University of Plymouth in partial fulfilment for the degree of

Doctor of Philosophy

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Faculty of Human Sciences**

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An Investigation Into The Feasibility Of Providing Intelligent Support For Computer Mediation Decision Making Groups

Abstract

This thesis investigated the claim that the adaptation to the keyboard interface of a computer-mediated (CM) decision making group leads to differences in the style of communication when compared to that of a face-to-face (FTF) group. More importantly it examined the possibility that changes in satisfaction with the process and the decision outcome are determined not by the mode of communication, but rather the style of communication the decision makers employed in response to the keyboard interface.

The decision processes of CM and FTF groups were examined using a simulated panel of enquiry presented via computer databases and containing inconsistent and incomplete shared information that could only be resolved through collaboration between the group members. An analysis of the communication styles employed in real-time CM and FTF groups (Experiment 1) revealed a tendency of CM discussions to exhibit a preference for a normative style of communication exchanging a proportionally high number of value statements and indications of preference, and for FTF groups to rely proportionally more heavily upon factual and inferential statements.

A paradigm for enabling intervention into the decision making process through the monitoring and coding of all group communication was developed (Chapter 2) which permitted the real-time analysis of the differences in communication style and aimed to reduce the differences in communication style. Using this paradigm and the norms for communication of the two forms of group (CM and FTF) established in Experiment 1, a series of studies examining the communication process were undertaken.

Experiment 2 explored the possibility of intervening into the communication process using e-mail based support messages that conveyed the discrepancies between a CM groups communication style and the style a group might be expected to employ where it communicating FTF. Two configurations of support messages that each attempted to shape the communication style of CM decision panels to resemble those of FTF panels were considered. It was found that alerting users to their communication style and instructing

them to increase or decrease certain styles of communication enabled them to more closely resemble the communication process and satisfaction levels of FTF groups. Experiment 3 considered the possibility that the presence of a monitoring system, rather than the content of the support messages provided, was the key issue in securing changes in the communication style of CM groups.

Having established that it was indeed the content of the support messages that enabled CM groups to operate as if communicating FTF, attention turned to effects of the support. By easing the interpretation of the feedback through two configurations of visual feedback, Experiment 4 attempted to increase decision makers adherence to the content of the support messages. This study suggested that visual feedback alone was not sufficient to elicit the desired changes in communication style and that the text-based communication was required. Moreover, Experiment 4 considered the impact of support messages themselves, considering whether the support acted as continual assistance to the users or whether it merely trained the users to communicate in the desired way

Conclusions from this study were slightly inconclusive, however, given that changes in communication styles had been achieved a further analysis of the content of the messages was undertaken. This final analysis (Chapter 7) revealed effects of confirmation bias within the communication and intervention steps that can on occasionally overcome such biases. The possibilities for the development of real-time intervention into these processes are considered and the findings interpreted in the light of existing theories of CM communication and recent developments in computer-based communication.

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Author's Declaration

At no time during the registration for the degree of Doctor of Philosophy has the author registered for any other University award.

A programme of advanced study was undertaken, including a second year honours course in programming using Basic 5, a staff development course on Covariance Structure and a series of guided readings taken from the Master of Science Degree in Intelligent Systems at the University of Plymouth.

Relevant scientific seminars and conferences were regularly attended at which work was often presented, external institutions were contacted for consultation purposes, and several papers prepared for publication.

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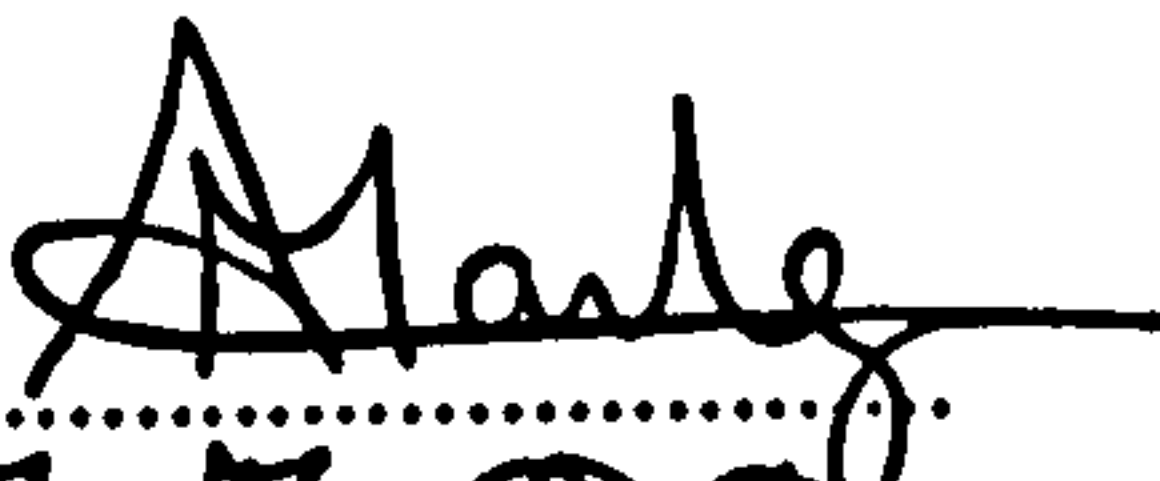
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1.0 General Overview

This thesis is concerned with the communication style of computer-mediated decision making groups and the feasibility of providing communication support, via feedback, during the decision making process. The purpose of this, the opening chapter is to review existing thinking on the area and in doing so establish the field within which the work lies.

This chapter can be divided into four sections, the first of which considers the core findings from the individual decision making literature. This review is intentionally brief but serves to introduce the literature examining groups and group decision making. Having then considered the work upon groups, the issues surrounding group decision making via computer based technologies are addressed. This section precedes the fourth and final section which consists of a review of the existing literature upon supporting groups and group communication support systems (GCSSs). The chapter concludes with a summary of the literature upon feedback paying particular attention to feedback received by groups and introduces the main hypotheses addressed by the thesis.

1.1 Individual Decision Making

1.1.1 Overview

A useful starting point is to consider briefly the existing perspectives upon decision making. The human capacity to interact both within and with an environment has been the focus of interest for centuries. The nature of this interaction can be examined at several levels, but one of the most interesting is the exploration of the processes that govern the thousands of conscious decisions that are made to enable goals to be achieved.

These decisions, including those with both successful and unsuccessful outcomes have formed the focus of a large body of psychological investigation into thinking, judgement and reasoning (For a comprehensive review see Evans, 1989; Evans, Newstead & Byrne, 1993; Evans & Over, 1996).

Much of this research has concentrated on the processes observed in individual decision making. The first component of this chapter reviews the common conclusions from this

research and draws the literature from the individual level of decision making towards that of the group.

1.1.1.1 Reasoning Tasks: their nature and typical problems

The clearest distinction drawn within the decision making literature involves the outcome of the decision making process. Where conclusions involve the generation of information over and above that initially provided to the decision maker, the decision process is said to be inductive. This is to say that the derivation of a solution to the problem presented increases the level of information available to the decision maker. In contrast, deductive inferences permit conclusions to be derived from premises, however this occurs without the inclusion of additional of semantic information. The conclusions explicitly state information that was already contained (implicitly) within the premises.

The study of deductive reasoning is concerned with the examination of how people *actually* reason. The focus of attention originated in the study of the accuracy of decisions but over time has moved towards a systematic examination of the errors that are made. The key point to be drawn from this distinction is that it is the study of errors as much as the study of successful solutions that leads to an understanding of the process involved. Psychological experiments on deductive reasoning often involve the presentation of arguments along with a list of potential solutions or alternative conclusions from which a selection can be made (Evans, 1983: 8). In effect, the participants or decision makers are required to make a validity judgement about a conclusion or conclusions given a set of premises, or in more recent research produce their own conclusions from the premises given.

1.1.1.2 Rationality

Despite the intelligence which humans possess, a considerable number of experiments demonstrate that individuals make errors when faced with reasoning tasks. The common interpretation of these errors is that individuals are influenced by features of the tasks, features that are frequently precisely the information that if examined from the perspective of logic should not be influencing the outcome. It is argued (Evans, 1989; Evans & Over, 1996) that the presence of, and attention to these features results in systematic errors observed.

The recognition of these influences has led to a considerable amount of attention focusing on whether humans are indeed rational. This discussion of rationality is ongoing and looks

far from being resolved in the near future (see Evans & Over, 1996 for a full review). Although clearly an interesting debate, this thesis is concerned less with the rationality debate than the process by which people derive their decision; in effect the process of their reasoning. It is to these theories of reasoning that attention now turns.

1.1.2 Theories of Reasoning

The bulk of the research on deductive reasoning has been reviewed by several authors (for example Evans, Newstead & Byrne, 1993). What is clear from this work is that the wealth of data demonstrates,

“that subjects’ responses are systematically influenced by the logical structure of the problems whilst *at the same time* often biased also by logically irrelevant features of the problems.”

Evans (1989: 10)

In an attempt to comprehend this information three main classes of theory have been advanced: (i) Inference Rule based theories, (ii) Domain/Context Sensitive Rules and (iii) Mental Model Approaches

1.1.2.1 Inference Rule based theories

Mental logic theorists (most notably, Braine & O'Brien, 1991, Rips, 1983; 1994) propose that the mind contains a set of inference rules which are a subset of those used in formal logic. The set of abstract rules is limited and are applied in combination to deduce a conclusion from a set of premises. Generally, people are thought to determine the logical form of the premises and then apply these inference rules to form a “mental proof” of the conclusion to an argument. If a mental proof can be derived then it is possible to conclude that the conclusion necessarily follows from the premises, when no derivation is possible then the conclusion does not follow from the premises. The theory is criticised by researchers such as Johnson-Laird and Byrne (1991) and Evans (1989) because the notion of applying abstract inference rules does not allow them to explain the influence of pragmatic features of the task.

1.1.2.2 Domain/Context Sensitive Rules

Although there are exceptions (e.g. Rips, 1983) the inference based approach is often seen to lack convincing explanations for the effects of introducing realistic content or meaning upon logical performance. The Domain/Context sensitive rule approach accommodates this by proposing that people hold rules (either content or domain specific) which are then selected

and applied to the problem. These “schemas” (e.g. Cheng & Holyoak, 1985; Rumelhart, 1980) need not be logical and although are successful in accounting for some phenomena observed, such as content effects, they do not comprehensively explain logical competencies or the biases that result from syntactic factors. Notably, they do not provide a clear mechanism for how people reason correctly or how systematic biases result (See Evans, 1982; Evans, 1989, for a more comprehensive review).

1.1.2.3 Mental Model Approaches

Reasoning can be achieved without resorting to rules of any form. This is the claim of the now dominant mental models approach (Johnson-Laird, 1983; Johnson-Laird & Byrne, 1991, 1992). The theory proposes a three stage reasoning process; in the first stage, decision makers are thought to construct a mental representation ‘mental model’ of the premises. This model consists of tokens that represent individual elements, specific instances, of the possible state of affairs being described by the premises. The second stage involves the construction of a putative conclusion that is consistent with this representation. In the final ‘reasoning’ stage the conclusion is tested by trying to construct alternative models in which the premises of the argument are true by the conclusion is false. If no such counterexample is found then the conclusion is inferred to be valid. This line of work identifies two possible explanations of performance factors. As Evans (1989: 12) succinctly summarises

“Firstly, subjects are assumed to have limited working memory capacity such that the more models required to evaluate the inference the more likely they are to make a mistake (Johnson-Laird & Bara, 1984). Secondly, belief bias effects may operate since subjects may lack the motivation to seek counter-examples when a congenial conclusion can be found which is consistent with the premises

(Oakhill & Johnson-Laird, 1985)

The important aspect to draw from this literature is that regardless of which explanation of the process of reasoning is correct, there are a number of known errors and flaws that can be identified. It is to these features that attention now turns.

1.1.3 Selective Processing

The most common explanation advanced by researchers for the existence of biases and errors in both judgement and reasoning tasks is the focusing of the decision maker upon

selective information from that available to them. Several notions are advanced to account for this finding: (i) availability, (ii) relevance, (iii) vividness and (iv) working memory capacity.

1.1.3.1 Availability

Availability has its origins in the work of Tversky & Kahneman (1973) and is related to salience of information. Availability refers to information that is attended to during the decision. Their original notion was that:

“A person is said to employ the availability heuristic whenever he estimates frequency or probability by the ease with which instances or associations could be brought to mind.”

The availability of such information can obviously lead to biases especially in cases where recalling one particular solution set is easier than the alternative. Although the notion as originally proposed had a very narrow focus, subsequent authors have expanded on the concept notably Lichtenstein, Slovic, Fischhoff and Layman (1978) and Pollard (1982).

The later, although apparently arguing that “memory retrieval is more effective than reasoning in solving problems” (Evans, 1989: 23), and also “that behaviour only appears biased because it is viewed within the context of an artificial laboratory task” (Evans, 1989: 23) is an attempt to apply availability to deductive and inductive reasoning tasks that do not follow the earlier requirements of probability judgements.

1.1.3.2 Relevance

It would appear from the notion of availability, that the ensuing biases can be overcome by making relevant information available. The notion of relevance has been demonstrated when the attempts to make information relevant have been studied. A number of studies, some of which have focused on the well-known cabs problem (Kahneman & Tversky, 1972; Bar-Hillel, 1980) have demonstrated that the impact of the initial information is greater than should be the case.

This problem informs decision makers that a city has two cab companies, one of which has 85% of the cabs and drives blue cabs and the other, the green cab company owns 15% of the cities taxis. A cab has been involved in a hit and run accident which a witness identified as a green cab. Under tests that are run in similar conditions, the witness is shown to be able to correctly identify the correct colour of a cab in 80% of tests, confusing it on the remaining 20%. The participants are asked whether it is more likely that the cab is, in fact,

a Green or Blue one. Most participants respond Green, although the correct answer is, in fact, Blue.

The important conclusion to draw from this study and other similar tasks is that participants' probability judgements neglect or totally ignore base rate information. Despite the presentation almost cueing participants to the importance of the base rate, they ignore the relevant information. It is argued by Bar-Hillel (1980) that the base rate data are ignored due to a failure to perceive the relevance of this information. Indeed the concept of relevance underpins the distinction between heuristic and analytic reasoning processes central to Evans' (1984) theory of reasoning (Figure 1.1).

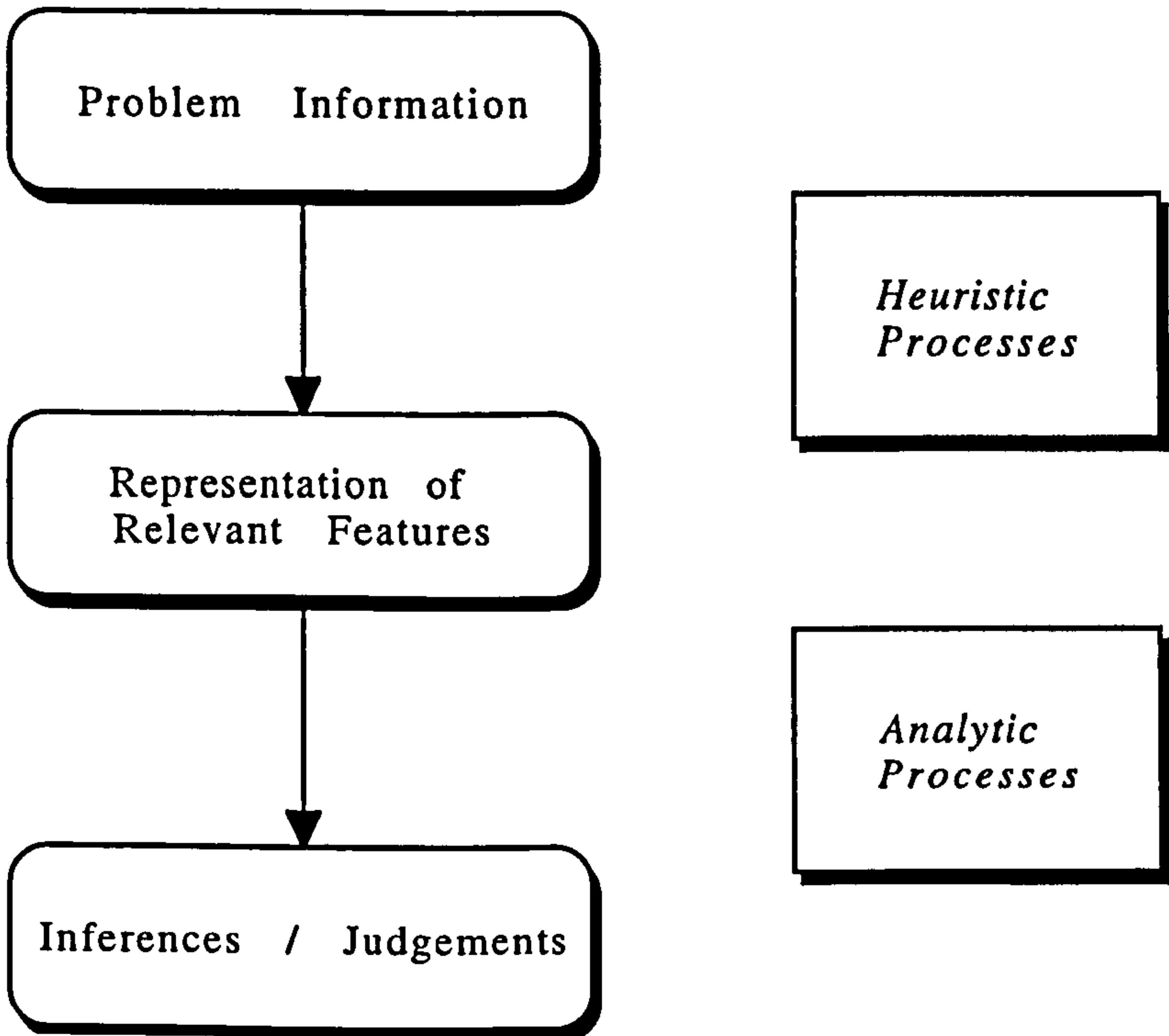


Figure 1.1 Evans' Two stage process of reasoning

The issue is clouded somewhat by the use of the same terms for different concepts by several authors: compare the use of heuristic by Evans (1984) and Kahneman & Tversky in 1972. The earlier work uses heuristic in reference to methods of drawing inferences, describing in essence a process, along with schemas which can be viewed as an alternative to the second (analytic) stage of Evans' theory. Evans (1984) refers more to representational heuristics that determine, at a preconscious level, the participants' representation of the problem.

However, the Evans usage of 'heuristic' has become the more commonly accepted term, in his model the analytic stage of reasoning occurs only after time has been spent in a heuristic phase. The heuristics discussed are what he refers to as "representational heuristics" and not Kahneman and Tversky's "methods of drawing inferences" which are much more analytic in Evans view.

The identification of problem information deemed relevant occurs in the first, heuristic, stage. This process occurs at an unconscious level, indeed they are *pre-attentive*, the purpose of this stage being not only the identification of relevant information, but also to permit the retrieval of associated information of relevance. Then, having identified such information, this and only this information is considered for further processing in the analytic stage. It is from within the analytic stage that the inferences are drawn from the initial set of premises.

A related theory, that of Sperber and Wilson (1986) offers greater insight to the focus of this thesis. They propose a relevance based explanation for verbal communication. They claim that:

"All human beings automatically aim at the most efficient information processing possible. This is so whether they are conscious or ... an individual's particular goal at a given moment is always an instance of a more general goal: maximising the relevance of the information processed."

Although the phenomenon of interest to Sperber and Wilson are different to those being addressed by Evans, in principle the processes described are similar to those in Evans' theory. The notion of intuitive judgements on the relevance of material and the stress upon the necessity for selective information processing as the underlying reason for relevance have parallels with this earlier work. Prior knowledge and belief are argued to determine the interpretation of utterances within context, and relevance is viewed not as a source of error, but rather a source of competence.

Taken together we might conclude that there exists evidence that decision makers (when expanded later to the group level) attempt to maximise their efficiency and that this is conducted through decisions on relevance of information, relevant information is focused upon, and might be discussed whilst materials deemed irrelevant will not feature in the reasoning or decision making processes.

1.1.3.3 Vividness

Since the review of the existence of order effects by Nisbett and Ross (1980) vividness has received considerable attention in literature. This has revived somewhat an area that has a greater tradition in social psychology than either availability or relevance. It is apparent from their work that different decision makers place differing levels of emphasis on information from which social judgements are made. These differential weightings of the same information require explanation and it is here that vividness is advanced.

Interesting or concrete information is given increased weight in such judgements, and in contrast dull, abstract information is undervalued. Factors identified that add to the vividness of information include the imageability and concreteness of the information as well as the emotional interest. Although the basis for this notion, is disputed by those who have studied the salience of information (e.g. Taylor & Thompson, 1982) the basis of the conclusions and the data behind them will be explored later in the review

1.1.3.4 Working Memory Capacity

Working memory capacity is more than likely to affect the processing ability of decision makers. Short Term Memory (STM) focusing on the information briefly held in the memory and lost unless consolidated by rehearsal and transferral into Long Term Memory (LTM), has been well explored by Cognitive Psychologists.

Focusing on the work that looks at the capacity of working memory, it is apparent that STM is more than just a buffer from which information is transferred to the LTM, it has a limited capacity that has subsequent effects on the processes that are responsible for reasoning.

Baddeley's (1986) revised model of the working memory theory proposed in 1974 by Baddeley and Hitch provides a detailed account of the workings of STM. The central executive is assumed to select and operate various control processes. Its own limited processing capacity is devoted primarily to the short-term storage of information and the remainder supplemented by the subsidiary slave systems onto which some of the workload is passed. Two of these sub-systems have been detailed in the models; the Articulatory Loop which maintains verbal material through sub-vocal rehearsal and the Visuo-Spatial Scratch Pad which performs a similar functions through the visualisation of spatial material. The

properties of the slave-systems have been quite comprehensively explored (See Baddeley, 1986 and Morris, 1986 for reviews)

What is important to note is that some evidence (Hitch & Baddeley), albeit disputed (Evans & Brooks, 1981, Brooks, 1984), suggests that the load on working memory can disrupt reasoning ability. Interestingly enough the disruption appears to be less convincing the greater the complexity of the problems.

Without needing to explore the exact details of working memory in decision making, it is clear that it might have a negative effect and that the likelihood of this affect increases as the complexity of the task and/or the quantity of the problem can cause disruption. Indeed in explorations of syllogistic reasoning and working memory (Johnson-Laird, 1983, Johnson-Laird & Bara, 1984) the data supports the assumption that the more complex the model to be constructed the greater the likelihood of error. Furthermore, their data also supports the principle of the first piece of information entering the STM will be the first piece lost when more information is required and the capacity has been reached (Peterson, 1966). This important finding will be addressed later, when discussing the flow and exchange of information within group decision making.

1.1.3.5 Conclusions about Selective Processing

From this, it can be seen that there are four main factors that influence, individual reasoning and therefore will effect (in some form) group decision making. These factors: (i) availability, (ii) relevance, (iii) vividness and (iv) working memory capacity, will be revisited in greater depth at a later stage, when their influences on the group will be explored.

1.1.4 Selective examples of biases in decision making

The extent of the literature researching biases in human reasoning, necessitates that the field be narrowed to a manageable level before expanded towards the known biases in group decision making. The next section of this chapter identifies several of the key biases in the literature and serves to lay the groundwork for the later section on groups. The biases discussed are well known and well studied and form the central body of literature within the area. They offer clear, replicable effects and demonstrate clear evidence of non-logical processes and yet are still of interest to researchers within the area. This interest is

maintained as theories of human reasoning stand or fall on their ability to explain the existence of these biases, for example matching bias (Evans, 1998).

1.1.4.1 Matching Bias

Heavily based on propositional reasoning, matching bias; a case of perceived relevance (see Evans, 1972a) relates to the massive influence of the names of cards within the rules relating to the selection task (Wason, 1966). In simple terms, participants select as solutions the cards that match those named in the phrasing of the problem, regardless of their actual relevance to arriving at the solution. As Pollard (1982) remarked, participants “appear to respond with the ‘available’ stimuli embedded in the task instructions” and although later evidence such as that by Brooks (1984) and Evans (1975) on truth table evaluation tasks and on the Wason Selection Task (Evans, Ball & Brooks, 1987) shows the effect exists beyond propositional reasoning, the phenomena is most robust when falsification is required (Evans, 1972b).

As Evans (1989) himself concludes, “Clearly the matching bias effect provides a good example of errors in reasoning arising from selective processing of the problem information.” The conclusion to draw from this literature is that biases can arise from attentive processes as much as any component within the reasoning itself.

1.1.4.2 Confirmation Bias

Possibly the most classical of all reasoning biases yet identified, confirmation bias holds that decision makers, and indeed human beings as a whole, actively seek information that reinforces their current beliefs. This is to say that once a theory is formed, or a hypothesis formulated, people avoid potential sources of information that suggests a counter position, preferring instead information consistent with their current stance.

Two explanations are advanced by the researchers in the field, the prevailing view is that this reflects a motivational bias. That the decision maker is, for whatever reason, attempting to authenticate their beliefs. A second, less fashionable stance, is that the bias occurs through a selective processing failure, where decision makers consider positive rather than negative information, termed a ‘positivity bias’ (Evans, 1989: 42).

Cognitive psychologists looking at the nature of biases have devoted considerable effort to explaining the process that leads to confirmation bias (See for example Baron, 1985; Klayman

& Ha, 1987; Evans, 1989). The conclusion from this work is that it is likely that participants are simply unable to test their thoughts in a manner that would lead to falsification, rather than to actively seek confirmation, the end result is the same - the exhibition of a confirmation bias.

The question that is more important to the work being undertaken in this thesis relates to the existence of confirmation biases in groups and the effectiveness of the various attempts to remove this bias from the decision process. As will become apparent in the third section of this chapter which reviews group decision making, confirmation biases, one of the most traditional cognitive areas has received considerable attention from social psychologists.

1.1.4.3 Overcoming Confirmation Bias

In the search for a debiasing strategy several methods have been employed, these range from subtle manipulations of the display of problems in an attempt to deliberately induce falsification strategies (Mynatt, Doherty & Tweney, 1977) to instructional manipulations such as those employed by Mynatt, Doherty and Tweney (1978), Tweney, Doherty, Warner and Pliske, (1980) or Gorman and Gorman (1984).

It is not currently the intention to focus extensively upon this research, as it is afforded greater attention when considering groups. For now it is sufficient to note that the most successful approaches of overcoming confirmation bias involve manipulations of the task such that it becomes important for the decision makers falsify their hypotheses. These manipulations are in effect an implicit instruction to falsify.

1.1.5 Conclusions from Review of Individual Decision Making

The review of individual decision making has been intentionally brief, the purpose being not to provide a detailed and comprehensive account of field, but rather to highlight some of the concepts that will be revisited in the review of the (predominantly social) psychological literature on group decision making. This is not to deny the importance of individual decision making processes within the wider group context, but rather to encourage the examination of the processes at the group, rather than individual level. The key conclusion to be drawn from this literature is that a number of biases have been identified which hinder the decision making process in the individual and that attempts to overcome or remove these biases have been met with varied success.

1.2 The Group and Group Problem Solving

1.2.1 Overview

The purpose of this section of the review is to build upon the findings and theories from the research into individual decision making and compare these findings and effects to those reported in the literature regarding the processes and performances of groups.

1.2.1.1 Individual to Group Comparison

The central themes from research into the processes and performances of individuals have often been extrapolated directly to group-level phenomena. This generalisation of findings *per se* does not present too many problems, however, there is often a failure to recognise the differences between the two systems: individual and collective, and this can lead to problems regarding the validity of the inferences. Prior to any discussion of the effects upon performance of operating within a group and the key factors that determine group processes and performance, it is important to first define the term “group”.

Theories of group behaviour (See Mullen & Goethals for a review, 1987) make little attempt to explain the group as an entire entity. This lack of explanation, is more sensible than it at first may appear, for regardless of the restraints that psychologists might impose upon individuals or indeed the restraints and conventions that the community places on individuals, the operation of a group is a complex process. The complexity of the group and the nature of the actions within it have restricted theorists to explanations of processes and interactions. Attempts to explain the phenomena at any greater level are both time consuming and complex, a problem which the literature has attempted to grasp by accepting theories that often explain only a fraction of the activity within the group.

1.2.1.2 The Group Defined

Many definitions of groups have been proposed, for the studies presented within this thesis the definition of Kerr and Hiltz (1982: 121) is employed, who consider “groups [to] consist of sets of individuals who share some unifying relationship.” It is important to note that the key to this definition lies in the *unifying relationship* rather than upon any notion of size of membership or physical locality. The group is bound by common standards or interests and can be considered to be a collective unit. Although lay interpretations of what constitutes a group might try to draw upon a numerical definition, it is perhaps worth noting

that other sciences, for example Chemistry and Geology impose no such numerical criteria. A chemical group is two or more atoms bound together in a molecule and behaving as a single unit, whilst a geological group is two or more formations (stratigraphical units). Both these definitions use numerical criteria in a way that eliminates the possibility of single units, rather than necessitating a required number to be considered a group. A definition similar to that of Kerr and Hiltz permits a continued examination of the group and its' role in social psychology.

1.2.1.3 The Group and this Review

One of the guiding principles behind this review is that the outcomes of group processes are often inescapable consequences of the interaction between the members of the group. A number of the findings are quite predictable, however, as Davis (1992) comments “group level phenomena are often counterintuitive.”

Despite the long history of psychological research examining groups the area has become sadly impoverished over the last two decades. Although some resurrection of interest has occurred as a result of the emergence of Computer-Supported Co-operative Work (CSCW: the next major section of this review) the touted revival of the group in social psychology (Steiner, 1972, 1983) has never quite arrived.

Steiner observed the move away from group to monadic social psychology and identified four likely causes of this shift. No theory existed to bridge the gap between individual-centred and socio-centred approaches to the discipline, this lack of theory was termed a ‘theoretical malnutrition’ and this combined with the pragmatics of research to restrict research in the area. From Steiner’s perspective group research was identified as being not only time consuming but difficult to master. As such it is shunned by doctoral students inevitably slowing down the development of research in the area and leading to theoretical divides debating the nature of the group and the approaches of study most likely to identify differences (Warriner, 1956). This it is argued led not to a sudden jump from group to monadic social psychology but rather a gradual shift in paradigm, a shift mirrored by the cultural change brought about by rising affluence that promoted the study of the doctrine of the individual rather than promoting collectivism: as seen in times of conflict and hardship.

As such examining group performance has taken very much a monadic approach. Such an approach dictates that the group is seen as an independent variable with the social stimulus determining the actions (performance and productivity) of the individual. Given this quite clinical view of the group and the tendency to treat it as a collection of individuals rather than a collective unit with unique processes, it is understandable that the majority of studies concentrate upon examining groups formed solely for the purpose of being studied in experiments. If indeed the group is socially indifferentiated, in that it is an aggregate of interchangeable people without internal structure then this presents no difficulties. These *ad hoc* groups formed solely for the study of behaviour with no background to draw upon and no future beyond the end of the experimental task have resulted in a number of the theoretical developments being drawn from studies of *ad hoc* groups often examined in a social vacuum.

1.2.1.4 Ad Hoc Groups

The approach of using groups that are ahistorical has resulted in a considerable body of criticism levelled at this area of the discipline. It is argued that the groups studied in the majority of group decision making studies do not correspond to *real life* groups. *Ad Hoc* groups have weak normative structure and operate in a situation of decontextualisation; they avoid the external constraints or pressures that act upon existing groups. As such they are possibly unrepresentative of occasional and meaningful collective behaviours.

Indeed, it is argued that the experimental procedures employed in typical decision making studies suppress the true processes of a group, where a richer, more involving group activity would probably diminish the social loafing and related effects that are so frequently reported. The argument for using real groups, prominent in a number of areas, is based heavily upon the perceived value of the findings of studies of real groups. However, the value of these studies is inflated by an overemphasis upon the *possible unrepresentative* nature of *ad hoc* groups.

Initially it is useful to concentrate upon *ad hoc* groups due to the inherent expense in terms of time, money and/or difficulty of studying real groups. For example, legal restrictions in the United Kingdom ensure that the study of jury decision making is conducted on mock juries, yet a number of important theoretical advances in the study of groups have come from such studies (See for example, Davis, Bray & Holt, 1977)

To devalue an entire body of research on the basis of *possible differences* in group processes due to external pressures, historical precedent etc. whilst simultaneously inflating the value of studies inevitably conducted *without* the experimental control of the laboratory is to risk distorting an entire field. Inevitably both approaches will be criticised by proponents of the other methodology, yet the discipline should remain open to the existence of both. It is not so much the confirmation of findings from one approach to the other that provides the areas of interest, but where they offer conflicting perspectives. Clearly the argument is far from being resolved however laying aside the objections and arguments enables an examination of the key advances within the area.

1.2.2 Group Productivity

1.2.2.1 Defining Group Productivity

A useful starting point to consider the reported effects of group decision making is to contemplate the nature of group productivity. What is it that a group produces? and how is this product determined? In 1972 Steiner advanced a theory of group productivity, productivity in his view has three determinants: task demands, group resources and group processes. Task demands determine the quality and relevance of resources available to the group. Resources are distributed between members with potential group productivity equalling the group resources less the task demands. Group processes are the steps taken by the group to complete the task and all activity that transforms resources into a product. Given this, actual group productivity is the sum of the potential group productivity less the losses due to faulty processes. It follows that if demands and group resources can be quantified then it is possible to estimate the losses, and that these losses are due to faulty group processes. This itself can be quantified as being equivalent to the potential group productivity less the actual group productivity. Once more the definitions provided focus upon the processes involved and it is noticeable that this approach forms a common thread throughout the literature.

The assumption that task-oriented groups are creatively stimulating to their members has a long and diverse history anchored not just in psychology but also in other disciplines. This assumption and the resulting studies can be viewed from several perspectives (See Davis; 1969, 1982, for an historical perspective or Hastie; 1986, for a review of group accuracy). It is assumed that the members of a group can identify and correct errors, offer a

balance to the biases provided by other members and generally achieve greater productivity and deliver improved outcomes than individuals.

The conclusion that group performance was superior to individual performance (e.g. Shaw, 1932) arose from a number of studies demonstrating the improved performance of groups in the rejection of incorrect solutions and error correction. A brief examination of the literature pertaining to group brainstorming emphasises these effects. The deferral of judgement upon potential solutions and the suggestion that an increase in quantity leads ultimately to an increase in quality were initially advanced as the causes of the advantage of the group (Stein, 1975).

1.2.2.2 The advantage of groups over individuals: Are two heads better than one?

Although on the surface the assumption that groups are superior in many ways to individuals is acceptable, a closer examination of the reasons behind the superior performance reveals some methodological problems in the comparisons. Some of the apparent superiority in group performance that is observed amongst many tasks can be attributed to any of a number of factors. The effects are considered to be either true- or pseudo- group effects.

Pseudo group effects result from aggregating performances of individuals and can be explained either by pooling or sampling. Pooling effects are the statistical effect of increasing the resources available to a group through increasing the number of members in the group. In contrast to this sampling effects result from the increased probability of sampling a specific resource or skill that occurs as the number of individuals in a group increases.

True-group effects result from the social processes that occur through group interaction. These can either be *qualitative performance changes*; in the behaviour of an individual resulting from the presence of the group or *social combination processes* ensuing from individuals contributing differently to the collective productivity of the group. Here it is apparent that the group is having a genuine effect on the performance of individuals, where pseudo-group effects are not attributed to the group itself, but the additional characteristics of a group in relation to an individual.

Osborn (1957) predicted a group superiority due to true-group effects of qualitative changes in performance. However, it is a misconception to believe that all true-group effects

are positive as Lamm & Trommsdorf (1973) discovered group inferiority due to true-group effects of differential social combination.

1.2.2.3 Isolating true- and pseudo-group effects

It is, however, possible to isolate the true- and pseudo-group effects, as Hill (1982) and Ingham, Levinger, Graves and Peckham (1974) demonstrate. Comparing a co-acting group with an individual working in isolation demonstrates a group superiority effect, an effect attributable to the pseudo effects of pooling and sampling. Comparing a group with the best individual; drawn from a statistical aggregate of equal size isolates the pseudo-group superiority through sampling effects as a baseline. In these cases, results vary through different tasks, for example, the group demonstrates a superiority in tasks that permit dividing the task into individual performed actions and pooling the results. However, in tasks that might be considered complex and not easily divisible the additional group members can hinder the group performance. Interestingly enough for tasks depending on knowledge or skill there is no difference in performance.

The superiority of a group can be isolated through the use of a nominal group, a group created from the pooled performances of individuals. The nominal group exists as a group only from the perspective of the researcher, the group members operate as individuals without interaction with, or knowledge of one another, however, their output is pooled and considered as if the product of an interacting group for the sake of analysis. The pseudo group can then be treated as a baseline and an analysis without the confounding effects of sampling and pooling can be undertaken. The findings then demonstrate no difference where tasks are not indivisible, and group inferiority where non-divisible tasks result in the group being hindered by less able measures.

Finally a mathematical model of group performance permits the comparison of actual and expected performance to be undertaken. Here resource models enable predictions of group performance to be made based upon the resources available to the group. Any differences between the model and the observed data can be attributed to the group process, with efficient or inefficient resource usage being advanced as an account for the differences.

If the earlier appearance of group superiority is re-examined utilising these perspectives and methodologies then rather than revealing a vast improvement in performance as a result

of the group, what is actually revealed is a performance detriment. This performance detriment can be seen as groups failing to maximise their potential and the previously assumed group superiority can be re-evaluated as group inefficiency (Davis, 1969; McGrath, 1984; Brown, 1988; and Hastie, 1986).

The direct comparison of the group to the individual will usually show that the group is faster to reach a solution, that they can generate a greater number of solutions etc. however it is the low rate of return relative to the individual effort that suggests some decrement in the process, a decrement identifiable between actual and group performance.

1.2.2.4 The Importance of the Task Being Studied

It is apparent from this discussion that the group task is important. The importance of the task lies in that the activities undertaken are a strong determinant of the processes involving in deriving a solution, the route from starting point to the final goal will differ from task to task, and as such the demands of the task clearly need to be identified. It is worth digressing slightly to consider the effects of task, before examining group inefficiency in detail.

Steiner's (1972) typology of tasks presents three distinctions. Firstly, tasks are either unitary or divisible; some tasks require coherent activity from the group and cannot be split into a series of subtasks whilst other tasks can be subdivided into a series of subtasks which can be handled individually. Given this distinction it is obvious that an examination of process will yield different results in unitary compared to divisible problems.

In addition to this distinction tasks are classified as either maximising or optimising. A maximising task is one where the success of the group is dependent upon the co-ordinated output produced by the group (for example a tug-of-war event), in contrast to this, when the success is dependent upon the closeness of the group towards a goal (forecasting business) then the task is said to one of optimisation. The interesting contrast here is that the different tasks present different opportunities for process losses to occur and hence effect productivity in different ways.

The third and final distinction is that tasks can be summarised as being of one of three methods: disjunctive, conjunctive or additive. Disjunctive tasks require the group to accept one solution over and above all others, thus a successful outcome depends upon the group accurately determining the abilities of it's members and being guided by the most competent.

Conjunctive tasks are those where the group members are all required to perform the same task, such as a jury situation and the agreed output is taken as the group outcome. In additive tasks the output of the group is summed or averaged and this is taken as the group product. Again, the classification of task type employed will greatly effect the processes of the group that are observed.

Kerr & Bruno (1983) demonstrate that additive tasks are insensitive to relative abilities but conjunctive and disjunctive task demands emphasise relative abilities to contribute. In conjunctive tasks, the least able member of the group determines the group performance whilst in disjunctive tasks it is the most able member who determines the group performance. Although all combinations of the three task types provide interesting group activities, those that combine unitary, maximising tasks are potentially most interesting. These tasks, whether they are disjunctive, conjunctive or additive require co-ordinated effort from all group members.

The key concept to take from this discussion is that there are identifiable sources of productivity loss within the group process, that the group does not necessarily equate to the sum of its parts. It is the failure to fulfil potential and the process losses that occur within a group that reveal a number of interesting factors about the operation of the group. It is to the processes and process losses that attention now turns.

1.2.2.5 Group Processes and Process Losses

Considerable attention has been given to group processes and group process losses. This section is not intended to comprehensively review the entire field, but to provide sufficient insight to enable a more detailed understanding of the computer-mediated communication literature. To this aim the focus of this section will be on several different areas: Motivation losses and gains, process losses and gains, the formation of group consensus and information sampling.

1.2.2.6 Group Communication

At this point it is perhaps convenient to draw a distinction between group communication and group dynamics. The former concentrates upon understanding group communication processes, the prediction of outcomes and methods of improving the performance in group processes. Group dynamics is concerned with a more general approach to the group,

considering more than just the aspects of the communication process and paying specific attention to such aspects as group climate: warm or cold, friendly or hostile, the sense of belonging to a group, group leadership: encouraging, discouraging coalitions, factions etc. or group membership: specific roles, control over interactions etc. (See for example, Benjamin, 1978; Goldberg & Larson, 1978 and Shaw, 1976).

This distinction is drawn not to remove the possibility of considering the dynamics of group interaction during this thesis, but to focus attention upon the study of communication processes which forms the central theme of this work, and therefore receives considerable attention in this review.

1.2.2.7 Group Losses and Gains

Gains and losses within the group can be categorised as occurring from one of two sources, either they result from the motivation of the group and its members or from the processes themselves. Process losses occur through such phenomena as polarisation of decisions, the levels of participation of group members, the failure to efficiently co-ordinate the activities of the group members and through biases such as confirmation bias. Losses that are attributable to motivation occur through well documented behaviours such as conformity (Jahoda, 1959), social loafing (Ingham, Levinger, Graves & Peckham, 1974; Jackson & Williams, 1985), free-riding (Olson, 1968; Sweeney, 1973), or processes such as Groupthink (Janis, 1982).

The group does, however, gain from the combination of members and their abilities through the advantages of knowledge pooling, sampling ability, the correction of errors and group synergy. In addition to these process gains, groups also exhibit gains attributable to motivation such as social facilitation, commitment and loyalty to the group.

These processes both individual and in combination effect the process and output of a group and are therefore considered in the section that follows.

1.2.2.8 Motivation Losses: Social Loafing & Free-Riding

Losses that arise from a failure to utilise the resources available to a group by an individual member are deemed to be motivation losses. As group size increases the individual group members have less control over the final group output, and as such they have less accountability for the output itself. This distancing from the final group product results

in individual levels of effort being less visible, as individual effort becomes increasingly hidden as the size of the group increases. As such the satisfaction of participation declines and any group rewards are spread thinner amongst the group members (Ingham *et al*, 1974, Jackson & Williams, 1985).

Harkness *et al* (1980) suggest that the motivational strategy of individuals underlies observed occurrences of social loafing: the process whereby people exert less effort when they work collectively in comparison to the effort exerted if working alone. If people work as hard as they can overall, but conserve their strength for individual trials where work is of a personal benefit then this can be termed an optimistic allocation strategy. Alternatively, individuals may employ a minimising strategy whereby they decide to get by with minimum effort. Social loafing is likely to occur only when the reward an individual stands to gain competes with the collective interest of the group (Jackson & Williams, 1985). Although explanations of the effects observed vary from explanations employing social dilemma theories (Kerr, 1983) to the result of methodological errors (Kerr & Bruun, 1981, Latané, Williams & Harkins, 1979) the end effect is the same, that given certain conditions group members may perform at levels below their own potential.

Of a related nature is the concept of free-riding (Olson, 1968) where the benefit to an individual (or the cost of inaction) is met by the group as a whole. Here no single individual bears the cost, rather it is shared amongst all group members with no tangible effect. Again the end result is that the individual contribution towards the collective product or output of the group to which they are a member, is reduced. This in turn results in a decrease in the group output. It is the perceived dispensability of individual effort that holds the key to the effects observed (Kerr & Bruun, 1983) and overcoming this perception can overcome the presence of the effect (Orbell & Dawes, 1981).

Although both have been studied in relation to the Ringelmann effect (Ringelmann, 1913, see also Kravitz & Martin, 1986), the effects have been observed in other domains, however, it is a misconception to think of all motivational losses as being a result of group members hiding their own effort amongst the collective output. The effects of conformity are also seen to greatly influence the group process.

1.2.2.9 Motivation Losses: Conformity & Groupthink

Conformity is a “change in behaviour (or belief) toward a group as a result of real or imagined group pressure” (Kiesler & Kiesler, 1979), where pressure is “a psychological force operating on a person to fulfil other’s expectations of him or her”. It is well known from the work of psychologists such as Asch (1951, 1955) Sherif (1935) and Festinger (1951, 1954, See also Moscovici, 1974) that in a group situation individual members will privately or publicly alter their opinion to match that of the group to which they belong. The impact of such motivationally based adjustments upon group consensus reaching behaviour can be catastrophic. Whether these changes result from uncertainty in ambiguous situations (Sherif), conflict in ambiguous situations (Asch) or the need to validate social reality (Festinger) the overall outcome is one of the group appearing to operate in unity and with members agreement when in reality there exists conflict between the members. The overall group process is disrupted as the motivation to voice opposing opinions declines. As a result the potential productivity of the group is reduced as the error checking and counter-opinion seeking offered by other group members is removed.

In its simplest form this effect can be viewed as an unwillingness to express dissent, this is a theme upon which Janis (1972, 1983) builds in his formulation of the Groupthink hypothesis. The theory holds that under conditions of high cohesiveness and amongst conforming groups that defective decision making processes can occur. These processes result from three main areas: Overestimations of the group in terms of its power and morality, closed-mindedness and pressures towards uniformity. Although originally formulated from a study of political decision making bodies, the behaviours typical of the phenomena have been observed elsewhere (Callaway & Esser, 1984; Manz & Sims, 1982).

There are potentially very severe consequences of the “symptoms of groupthink.” The most striking of these are the failure to fully consider alternative courses of action and to survey the objectives of the group. Groupthink also leads to a reduction in the consideration of the risks of a chosen strategy and the quick rejection of alternative courses of action or the consideration of contingency plans. Inherent in this approach is the poor sampling of information and the biased selection in the information considered to have a bearing on the decision outcome.

It is this biased selection of information that has the largest bearing on the work reported later in this thesis and as such this will be afforded greater attention later in the review. However, it is important to note that one of the key antecedents in the occurrence of groupthink are the motivational factors in maintaining the (illusion of) uniformity of opinion amongst group members. Direct pressure is applied upon those who express arguments against the preferred choices and this often results in the self-censorship of ideas or self-appointed mindguards who protect the group from 'deviant' opinions and information. The changes result from the motivation of group members rather than the process by which they operate. Having considered these and other motivational factors it is to losses through group process that attention is now drawn.

1.2.2.10 Process Losses: Polarisation

Classic Interpretations of the group polarisation phenomenon place great emphasis upon the interpersonal processes such as social comparison and informational influence (Myers & Lamm, 1976) or the repeated expression of attitudes (Brauer, Judd & Gliner, 1995). The process observed is that an individual's opinion tends to polarise given discussion with other people of a similar opinion. This move towards extremities is consistent across a number of paradigms and has several implications for the observation of groups. The shift towards a more extreme perspective than would be held by individual group members offers problems for maximising group potential (See Turner, 1991 for a review).

The explanations advanced for this effect tend to rely upon Social Comparison or Self-Categorisation. The former holds that people place a high value on extreme perspectives, during discussion those that hold a moderate position exchange opinions and views with those with a more extreme perspective. In the process of comparison, they feel compelled to move towards a more extreme position than initially held, and this is reflected in the group output (See for example Sanders & Baron, 1977).

Self-Categorisation Theory argues that conformity to a group norm is responsible for the observed effects (Turner, Hogg, Oakes, Reicher & Wetherell, 1987). The theory advanced is that in-comparison to an out-group a position that best represents the commonalities of the group is adopted and it is this that is reflected in the existence of polarisation. Although a compelling argument, and one which has a growing body of support (see also Postmes, Lea, Spears, Croft, van Dijk & van der Pligt, 1994) in the computer-mediated communication

(CMC) literature, it does not explain the existence of polarisation where no out-group is present.

The third perspective on the phenomenon, Persuasive Arguments Theory (Burnstein & Vinokur, 1977) suffers from no such criticism. It is held that the change in attitude occurs as a result of the exchange of information, that during discussion more novel arguments are advanced by group members and that these bolster the initial position. The sampling of arguments (c.f. the earlier confirmation bias discussion and the later discussion of information sampling) confirms the current position and the extremity/novelty of arguments leads to polarisation. The crux of the argument here is that people evaluate arguments and find more evidence to support the existing position, which strengthens their resolve in the validity of the position, effectively increasing the polarity of the existing arguments.

1.2.2.11 Process Losses: Co-ordination and Group Participation

One of the reasons advanced for the deficits between group potential and actual group production was the difficulty in co-ordinating efficient group output and participation. Particularly, though not exclusively, this has been observed in the study of brainstorming (e.g. Gallupe, Bastianutti & Cooper, 1991). Production blocking may reduce the effectiveness of groups as at a given time only one member of the group can speak. In nominal groups advanced as the comparison, this disadvantage of co-ordinating effort is not a problem, therefore the interaction of group members, and the effort of co-ordinating the efficient use of the groups resources can result in process losses (Diehl & Stroebe, 1987).

The likely participation of an individual in the group process can also account for some of the losses attributable to process. The potential influence of a person in a group has received considerable attention (See Kaplan, 1987 for a review) and methods have been advanced to attempt to predict the likelihood of participation (O'Brien & Gross, 1981). What remains clear from this work is that a number of status effects and perceived differences between members will influence their input to the processes observed and that these differences account for a number of deficits.

1.2.2.13 Motivation Gains: Social Facilitation, Loyalty and Commitment

So far, the focus has been on the disadvantages that occur as a result of the combination of individuals in a group situation, however, it is clear that there are a number of advantages

to be gained from operating as a group. Loyalty and commitment to a group and the group situation result in increases in motivation. The group member has a vested interest in the group and these loyalties reap later dividends. In addition, the presence of others in the group situation permits comparison between members and can enhance the motivation of individuals to contribute to the group output. Identifiable consequences and identifiable sources of input combine to reward participation and increase the likelihood of future participation.

1.2.2.14 Process Gains: Knowledge Pooling & Ability Sampling

The process of pooling knowledge from group members, and the ability of the group to select the members with the highest skill level to tackle individual tasks affords them an advantage over individuals. Assuming that the potential losses that would result from a misidentification of talents can be overcome, that is a group will be able to identify when it has wrongly identified a talent within an individual, then the group may maximise or will at least increase its abilities relative to the abilities of individual members. Namely, as talents are identified, they can be applied where they are likely to give a maximum return.

1.2.2.15 Process Gains: Error Correction & Group Synergy

One of the largest advantages the group has over the individual is the ability of group members to recognise and correct faults in the process that are not available when individuals make similar decisions. The presence of others, each involved in the decision making process increases the likelihood of errors being identified and corrected.

In addition, the mere presence of the group serves as a catalyst for ideas, with members bouncing ideas off one another and building upon earlier suggestions. The processes involved increase the advantage of the group over the individual.

1.2.3 Improving Group Performance

1.2.3.1 Improving Group Operating Procedures

Pavitt (1993) identifies the utility of altering group processes to maximise resources, avoid process losses and to enable the group to benefit from the additional skills present in the group members. This intervention occurs on the basis of process and not at the level of resources of decision outcomes.

These interventions can be classified as either conflict reducing procedures (nominal group techniques, Delphi) or conflict exploiting procedures (dialectic inquiry and devil's advocacy) and are intended to improve the decision process through altering the structure of the group communication.

The difficulty behind these procedures lies in the successful matching of the process of support to the requirements of the task being undertaken. There are clear effects of intervention in achieving better decisions for judgement tasks however the impact of these styles of procedures is less clear when exploring group problem solving.

1.2.3.2 Increasing Conflict in Groups

Devil's advocacy and dialectic inquiry (Schwenk, 1990) tend to focus upon the individual rather than the group and it can be argued that the approaches operate at an individual level altering the process by which a group member, rather than the group itself operates. Although related in their approach, devil's advocacy requires a group member to criticise the current preference in a systematic manner, thus stimulating a defence by other group members and attempting to ensure that the approach is suitable and defensible. Dialectic enquiry takes the approach further by providing an alternative plan of action, as opposed to merely presenting a critique, and not only offers a different course for the group to take but offers differing assumptions as a starting point.

The applicability of the two approaches and the extent of their application in a given domain varies (Hornsby, Smith & Gupta, 1994; Schwenk & Valacich, 1994; Tung & Heinger, 1993). The presentation of opposing outcomes increases the degree of debate amongst group members, reducing the impact of conformity effects *and* dominance by members of the panels with higher status who are likely to greatly influence the outcome. The difficulty lies in that although dialectic inquiry is an effective method for increasing conflict within groups it is a harder approach to implement than devil's advocacy. In groups, devil's advocacy leads to a questioning of the assumptions that underpin the preferred group outcome. This promotes a re-examination of the evidence and information available, that is not apparent in dialectic inquiry where the process encourages choice between alternatives.

1.2.3.3 Reducing Conflict in Groups

Nominal Group Techniques and the Delphi method both offer a contrasting perspective on the improvement of the group decision making process by reducing conflict between members of the decision panel (Delbecq, van der Ven & Gustafson, 1975). These approaches remove conflict by narrowing down the decision to a single choice, however, although they share common themes, the route they employ to achieve this goal differs.

The comparable features are that both methods separate the generation of ideas and their evaluation into different phases of the decision making process. They also both build the advantages of anonymity (as per the conflict increasing methods) and aim to equalise participation across group members.

As with earlier discussions the effectiveness of the methods varies with the type of task being tackled (Arunachalam & Dilla, 1995; Hornsby *et al*, 1994). Generally, both procedures increase the performance levels of groups in comparison to unstructured groups, although it is worth noting that the satisfaction levels of group members varies in relation to the two techniques (Delbecq *et al*, 1975; Roth, 1994).

1.2.3.4 Conclusions from Conflicting Increasing/Decreasing Procedures

Three common themes can be identified running through the two approaches (conflict increase and conflict reduction), the first is the difference in the success of the approach varies in direct respect of the task being tackled. The second is that the effectiveness of the process is viewed in terms of the alterations in procedure rather than changes in outcome measures. Finally, the different processes have differing impacts on the satisfaction levels of the group members.

1.2.4 Influence and Information in Groups

1.2.4.1 A Return to Groupthink

Janis (1972, 1982) identified key deficits in the process of group decision making from an extensive review of policy decision making by a number of governmental and military decision making groups. The deficits can primarily be classified as a deterioration of mental efficiency that leads to a reduction in moral judgement and testing of assumptions made by group members. That is, a failure to test against the reality of what they know about the world in which their decisions will be implemented.

Although advanced from a study of primarily American political decision making bodies, the findings are typical of groups that operate under conditions of high cohesiveness, insulated membership, stress and with a directive chair. Placing aside the concerns that the materials needed to confirm the model in the strictest sense are beyond researchers and that this creates difficulties in falsifying the predictions made by the model, the process of groupthink still operationalises a number of interesting processes.

Perhaps the easiest way to present the findings of the groupthink literature is through an examination of the methods advanced to prevent groupthink (Bottger & Yetton, 1987; Janis, 1982; Miranda, 1994 and Neck & Manz, 1994). Unlike the process for increasing or decreasing conflict presented earlier, these methods proposed to remove the threat of groupthink take place at a group process level, rather than altering the processes employed by individual members of the group.

Proposals to remove the effects of directive leadership through the use of devil's advocacy and even rotating the chair around group members were advanced by Janis himself. The rotation of the chair concept is taken even further with the suggestion of varying or rotating group membership to help prevent the group becoming isolated from the world in which their decisions will be placed into practice.

These are not the only methods that can be employed to reduce groupthink, modifying the contributions of individual members to the discussion can also help (Bottget and Yetton, 1987; Neck & Manz, 1994). Such interventions can occur either through training in the case of the Bottget and Yetton or through the application of "thought self-leadership" in the later study.

1.2.4.2 Normative and Informational Influence in Groups

Before proceeding to an examination of the effects of computer-mediation upon group processes it is necessary to consider one final area, that of influence and how a group reaches a decision.

In any given discussion by a group, there are a number of group members, each of whom enters the discussion not from a social vacuum but from a social environment. Such an environment is likely to result in their adoption of a decision preference prior to discussion, an initially favoured position.

Normative influence holds that shifts in preference will result from the exposure to other opinions, this exposure leading to later conformity to the norms underlying these opinions. In contrast, informational influence predicts that rather than changes resulting from exposure to expressions of preference for a position, that the evidence advanced during the course of a discussion will lead to the incorporation of this information into the representation of the problem. Once combined, the new information and the existing information suggests an outcome different to that previously considered preferable. This new outcome is then favoured by the group and adopted as the preferred outcome.

This is not the only difference between informational and normative influence. Where informational influence maintains that the decision is based around the available information, normative influence suggests that a decision can be reached in order to increase social standing in a group or maintain self-image (Pruitt, 1971; Sanders & Barron, 1977).

The resolution of which of the two forms of influence holds greater sway in discussion has been examined through a series of studies that make specific predictions under experimental conditions that will lead to the prevalence of one approach or the other. The dominant approach, when viewed in terms of a simple count of findings indicating either normative or informational influence is the latter (Kaplan, 1987). This does not, however, lead to the conclusion that normative influence is of less importance. Even if not the dominant factor in the decision making process, the effects of pressure to conform with the preferences of others is still high. As such, the likely conclusion is that the two approaches operate simultaneously with each moderating the influence of the other (Burnstein & Vinokur, 1975, Lamm & Myers, 1978).

Kaplan distinguishes between the two forms of influence suggesting that normative influence predominates when the emphasis is on the group and the position of the individual member within that group. Informational influence is more concerned with the accuracy of the decision and the information that underpins it. Developing this point further the distinction is between task demands and group demands. If the task demands are high then informational influence should prevail, if the needs are to maintain the group then normative influence will dominate. The key here is prevail and dominate, neither of which remove the possibility of the other form of influence occurring, it is a case of assessing the relative contributions of the two forms of influence.

1.2.4.3 Information Sampling in Groups

Given, the distinction between informational and normative influence and the arguments advanced for the predominance of evidence based discussion, it is evidently important to consider the process whereby group members sample and discuss the information available to them.

Stasser and colleagues (Stasser & Titus, 1985, 1987; Stasser, Taylor & Hanna, 1989; Stasser, Kerr & Davis, 1989) have devoted considerable time and effort to addressing just this question. It is assumed that at least some of the group members bring unique information to the discussion, and that this information is only of benefit if the information is brought to bear on the discussion. Although explanations for the exclusion of this information have been interpreted by some as promoting the concept that “groups are bad” (Anderson, 1978; Buys, 1978), the idea of a bias in the discussion of material is a more appealing interpretation.

Stasser *et al* employed a technique referred to as ‘hidden profiles’ to explore the pooling of information in small groups. This technique conceals the superiority of one decision alternative over the other alternatives is by the distribution of the information amongst group members, such that only through efficient pooling of information can reveal the true “best” alternative.

For example in a three person group, the information is distributed such that each member has two pieces of information supporting the first outcome, and three supporting the second alternative. The three pieces of information advocating the second alternative are the same for each group member, however the two pieces of information supporting option one consist of one piece of information shared by all three group members, and one unique piece of evidence. If a straw poll were held they would individually vote for option two, on the basis of their own weight of evidence being three-two in favour of this outcome. If, however, they effectively pool the information, then the information that is available to the group becomes apparent and the outcome would be four-to-three in favour of the first option.

The series of studies revealed a clear tendency amongst group members to discuss information that was shared between all members, thus they discussed at length shared information and paid relatively little attention to information that suggested alternative courses of action. This finding is taken as being indicative of a process loss. If, other things

being equal, shared information has a greater likelihood of discussion than unshared information (Stasser & Titus, 1985, 1987) then this reveals a potential weakness in the group, as one of the inherent advantages of groups over individuals is the uniqueness of information that they may bring to bear on the discussion.

This biased sampling of information does not present a problem *per se*. If the sample of information that is shared and unshared suggests the same decision then the group will reach that decision regardless of the process of their deliberations. The difficulty arises when members' shared information is in direct conflict to the unique information, it is the distribution of information in the hidden profile that raises concerns regarding the group process.

Given the dominance of shared information in the discussion processes of groups, two explanations can be advanced. The first, derived from a sampling approach to the problem, is that group discussions may be dominated by shared information, and that this itself interferes with the discovery of the decision alternative. The other interpretation is that the group members adopt the approach of supplying information for discussion that advocates their own preferred outcome. Such an approach would lead to the discussion of shared information. Within the laboratory the manipulation of data to create hidden profiles is relatively easy, and reveals a process loss in the pooling of information. The problem lies in that this is clearly not the case in the "real world". By their nature hidden profiles remain hidden and their rate of occurrence is impossible to detect, so determining occurrence rates is impossible.

Clark & Stephenson (1989) offer some further insight into the problem, it has been shown that by manipulating the salience of unshared information it can be brought to bear on the discussion. However, once recalled if no corroboration of the material can be given by other panel members, then the information is frequently disregarded. In practice, the ability to create profiles of information that indicate a given outcome as favourable over and above other approaches is beneficial to the experimenter, and can be manipulated to assist the study of the group process. Further, the approach bears similarities to the earlier discussion of confirmation bias, and shows how some of the findings of the individual decision making literature are reflected in the study of groups.

1.2.4.4 Intellectual and Judgmental Tasks

Before moving on to a discussion of the effects of distributing group members around a variety of locations and examining the effects on their communication process of computer-mediated communication, it is valuable to consider on final dichotomy: intellectual and judgmental tasks.

Laughlin and Ellis (1986) present a distinction between the nature of tasks being tackled by groups. Intellectual tasks *have* demonstrably correct answers, judgmental tasks *do not*. This presents a continuum from one to the other, where the degree of existence of a correct solution decreases as we move from intellectual to judgmental problems. Although the distinction is invaluable in the study of groups, and mirrors some distinctions made between the tasks studied in relation to individual decision making, from a group members' perspective all problems appear to have a correct (or at least best) solution. In intellectual tasks, the task might therefore be considered to be one of identifying the critical information that leads to the identity of this solution. However, in a judgmental task, one could consider all alternatives as appropriate and merely identify the task as the selection of an alternative and the identification of the supporting evidence. The argument that Stasser presents is that members might be aware of unshared information but consider the discussion of this to be unnecessary as the shared information points to a more compelling outcome.

The final consideration is that although there is little evidence to (thus far) suggest the effect of the revelation of unshared information, the discussion of such data enriches the discussion process and is ultimately desirable, regardless of the final impact on the group outcome.

1.3 Computer-Mediated Communication (CMC) and Computer-Supported Cooperative Work (CSCW)

1.3.1 Overview

The effects of telecommunications upon communication and decision making has a tradition that can be traced back to the early 1970s. With increasing access to computers and the communication channels that computers can offer, the move from studying human-computer interaction towards detailed examinations of human-human interaction via computers was inevitable. The birth of the field of Computer-Support Cooperative Work

(CSCW) in the late 1980s drew together the diverse talents of engineers, sociologists, anthropologists, computer scientists and psychologists with a common goal: the understanding and supporting computer-based interactions.

This section of the chapter examines the origins of the study of Computer-Mediated Communication (CMC) and then identifies the core themes of Computer-Supported Cooperative Work (CSCW). Through these two related areas the background to the thesis is presented, identifying the areas of interest and equally as importantly drawing boundaries to contain the work.

1.3.1.1 A short note on CSCW and CMC

The concept of exactly what is CSCW is somewhat blurred, indeed both Bannon (1992) and Wilson (1991) draw attention to the absence of a clearly accepted definition within the field. Rather they consider the area to consist of researchers from a number of different disciplines with partially overlapping concerns and interested in supporting the activities of people via computers. The lack of coherence (Hughes, Randall, & Shapiro, 1991, 1993; Suchman, 1989) has not hindered development within the field, however, it is important to place the field in a context, and in this case, CSCW emphasises the need for understanding of the co-operative and collaborative processes of people and more centrally the design issues surrounding the supporting of these activities with computer based technology.

Computer-mediated communication (CMC) is frequently considered to consist of research that looks at human-human interaction via computers. This is a move away from Human-Computer Interaction (HCI) towards what might be termed Human-Computer-Human-Interaction or HCHI (Bannon, 1992). To some extent this might be considered a blurred distinction, however there is a subtle difference in the overall perspectives of the two fields. In contrast to CSCW, CMC research often focuses more upon the communication possibilities and effects of communicating via a computer and has been accused of concentrating less upon the content of discussions. More importantly it often fails to consider the social factors and pressures that will determine the uptake of the technology.

For the purpose of the research described here, the main difference between CMC research and work within the CSCW field is that the former concentrates more upon the evaluation of the effects of differing computer technologies whilst the latter is considered to be more with

the collection of information that might be used to design (or re-design existing) supporting technologies.

1.3.2 The Study of Computer-Mediation upon Communication.

1.3.2.1 Overview

To enable an understanding of the extent of the study of computer-mediated communication (CMC) this section of the literature review presents a brief historical background to the study of CMC. From this point the use of computers by groups is examined through a review of the common findings and by way of evaluating the theories advanced to explain the effects.

1.3.2.2 Origins of Computer-Mediated Communication

The seminal text on Computer-Mediated Communication is the 1978 work of Starr Roxanne Hiltz and Murray Turoff: *The Network Nation*. Although the origins of the discipline can be traced back prior to this date, Hiltz and Turoff's (1978) book was really the first work of note to pull together the common themes of the emerging discipline. The authors, already experts in the field, not only outlined the current state of the discipline but laid out their vision for the future. Fourteen key predictions ranging from the impact of computers in the home through to changes in the workplace were presented.

The interest in the study of CMC was firmly cemented into the minds of researchers. The growth and popularity of the personal computer in the late 1970's ensured that the study of computer bulletin boards; an electronic version of the "mundane cork bulletin board covered with thumb-tacked three-by-five cards" (Rapaport, 1991), the development of systems such as the EIES conferencing system (by Turoff himself) began an interest in human-computer interaction (HCI) and computerised human-human interaction that can be traced through to modern day interests. The focus of research has shifted somewhat, with academics now concentrating more on Internet Relay Chat (IRC), Electronic Mail (e-mail) and the use of Video-conferencing. Although the technologies being examined may have changed, the questions of how are the technologies used? When do they succeed? When do they fail? What tasks can they support? are still the of central concern.

By no means have all of the predictions of the *Network Nation* been met. This mirrors somewhat the predictions of Steiner (1974, 1983; for the future of group research), in being

over-optimistic about the speed of uptake of the approaches advocated. In the preface to the revised (1993) edition of *The Network Nation* they acknowledged this error:

“At the time we so readily perceived and experienced the benefits of the technology that we seriously underestimated the time it would take for it to spread.”

(Hiltz & Turoff, 1993: xxxix)

However, the foundations for the discipline lie back in the seventies when the technology now available was a pipe dream. What follows now, is a detailed examination of the effects of these systems.

1.3.2.3 Traditions in CMC Research

Two major areas of CMC design exist, the user or human-machine interface and the communication structure. The latter of these two has been studied much less than the former, the social interface is the determinant of the way in which groups work together within the electronic medium. Without the group working together to a common goal there seems little purpose in the group rather than the individual tackling the task.

1.3.2.4 Group Brainstorming Revisited: An example of common computer-mediated studies and effects.

One of the key areas studied in the support of group tasks by computer systems is that of group brainstorming (Aiken, Krosp, Shirani & Martin, 1994). Returning to the issues raised in relation to the study of group brainstorming reveals the effects partially accountable in terms of pseudo-effects, however, the study of real groups reveals real group deficits: The generation of ideas by group members can result in production blocking and the existence of a reluctance to evaluate ideas during later stages. On the positive side, the real group does have notable advantages over nominal groups through a mutual cognitive stimulation by group members building ideas upon those advanced by colleagues (Dennis & Valacich, 1993).

These process effects resulted in considerable attention devoted to the study of electronic brainstorming (Gallupe, Cooper, Grise & Bastianutti, 1994; Petrovic & Kricki, 1994; Valacich, Dennis & Connolly, 1994). These studies commonly employ the number of non-redundant ideas as the main measure and reveal that an increase in ideas occurs as the production of ideas electronically removes the blocking effect of speech in face-to-face examinations of groups. The quality of the ideas remains the same, that is there is an absence of outcome

effects in the main measures, however, the quantity of ideas is increased and this is attributed to the effects of cognitive inter-stimulation.

These findings serve to emphasise the tradition within the area, the examination of groups in face-to-face situations and their comparison with computer-mediated panels that operate either with the assistance of some form of computer support or who operate remotely. It will also become apparent that the absence of outcome effects, and the decrease in satisfaction often reported by members of electronically communicating groups are common findings.

1.3.2.5 Removing Groupthink Electronically

Recall the earlier discussion of groupthink (Janis, 1972; 1982) where group decisions can be considered increasingly faulty as a result of the process by which they are derived. The proposals for countering these effects consisted of the employment of procedures at either an individual or group level of intervention to alter the process by which the decision was reached.

The same outcome, an alteration in process, can be achieved through the employment of a support-system (Miranda, 1994). Through employing a group support system (GSS) to structure the group process the effects witnessed in groupthink affected groups can be overcome.

1.3.2.6 Group Support Systems

The underlying principles behind the provision of group support systems (GSS) and their variants group decision support systems (GDSS) and group communication support systems (GCSS) that focus respectively on the decision and communication of the groups, is that group decisions can be improved. This improvement commonly occurs through one of two forms, by overcoming the constraints of time and space or by increasing the information available (McGrath & Hollingshead, 1994).

The definition of group support provided by McGrath and Hollingshead is of a broad nature encompassing communication (GCSS), information (GISS) and performance support (GPSS), and expands upon the narrower focus offered in earlier papers. These earlier papers (for example DeSanctis & Gallupe, 1987) aimed to remove the barriers to communication and provide greater structure to the discussion, however, it is the later papers (Kraemer &

Pinsonneault, 1990; McLeod, 1992, Sambamurthy, Poole & Kelly, 1993) that have shaped the distinctions made.

Both decision and communication support attempt to increase the focus of the group on the task before them and the participation and effort of group members. They also both attempt to decrease the dominance of the discussion and outcome by individual group members and improve the overall decision quality. The distinction between the two approaches lies in several areas. Communication support decreases consensus and decreases satisfaction whilst decision support increases consensus. In contrast, communication support increases the time taken to reach a decision, with little increase observed in groups operating with decision support systems.

These findings are however debatable, the studies included in the reviews (Kraemer & Pinsonneault, 1990; McLeod, 1992) might be considered to be selective, leading to reservations regarding their conclusions. The nature of the work restricts the degree of systematic control of variables resulting in the comparison of very different systems across very different populations.

The standard comparison made in this literature is between supported and unsupported groups, and although the trend for this style of study is decreasing as the effects of existing technologies become known, there continues the need for new studies examining the effects of future technology.

1.3.2.7 Effectiveness of Support Systems

The extent to which support systems achieve their goals are debatable. Although the early work confirms the success of the approaches and established a number of consistent effects some difficulties remain. Recent studies (Benbasat & Lim, 1993; Sambamurthy, Poole & Kelly, 1993) have moved towards a study of the effects of support on different forms of groups (FTF, CM) and reveal differences in a number of outcome measures (satisfaction, completion time) and complexity of problem. The positive effects of greater insight into the process, connectivity of ideas and formal methods of evaluation are well documented (Sambamurthy *et al*, 1993). There is little clear evidence of the better organisation of the decision process as a result of support or an increase in the group members focus. Additionally, there remains a suggestion that the effectiveness is limited to problems of a low

complexity in less organised groups. That is, a group with a firmly established hierarchy is less susceptible to the positive effects of support. They have in place an established system of status of individual group members that presents a barrier to the support system that is difficult to overcome.

1.3.2.8 Establishing a gold standard: Face-to-Face versus Computer-Mediated Groups

The move away from comparing supported and unsupported groups to comparing the effects of different configurations and forms of support has established the need for a gold standard against which the processes can be compared. The standard that has emerged, despite (or perhaps because of) the documented problems associated with it is that of the face-to-face group.

Chapanis (1975) established a number of effects that are still utilised in the recent literature. Having explored progressive steps of mediation through a systematic manipulation of the channels available the consistent finding is that the loss of verbal communication is of greater importance than the removal of visual links. The comparison of computer-mediated communication (CMC) with face-to-face (FTF) has established that communicating via a computer takes approximately two and a half times longer than the same discussion in a FTF situation. FTF or communication via other verbal channels is richer when judged in terms of the number of words or the variety of words employed. There is also evidence for compensation of the removal of non-verbal cues (Williams, 1977; Wilson & Williams, 1977) by people communicating via channels where this form of communication is filtered out or prevented by the medium.

These findings are perhaps to be expected, however, there are a number of other key effects of computer-mediation (CM) upon communication. The medium employed to communicate influences the dynamics of the group and also influences the impressions of the process formed by the group members (See Williams, 1977 for a full review).

In assessing the effects of CMC it is as valuable to consider the effects that *are not* observed as much as those that *are* revealed by the literature. The absence of any large effect of the removal of non-verbal cues might imply that their role in the communication process, for so long assumed in the literature has been overplayed (Beattie, 1983; Kendon, 1981; Rutter & Stephenson, 1977). It is equally feasible to interpret these data as an indication that

people communicating via computer-mediated channels adapt to the removal of these cues. Furthermore, the existence of variable task effects is best explained by the lack of social presence conveyed via computer-mediated systems (see also Williams, 1978).

1.3.2.9 Use of Electronic Mail (e-mail)

Although studies of media have examined a vast degree of issues including video (Heath & Luff, 1992; Tang & Isaacs, 1993), voice mail (Adams, Todd & Nelson, 1993, Rice & Shook, 1990) and teleconferencing (Christie & Holloway, 1975; Johnsen & Bullen, 1984; Trevino, Lengel & Daft, 1987) it is the study of electronic mail (e-mail) that has generated greatest interest.

A number of these studies have focused upon predicting the use of e-mail by a variety of users, mostly but not exclusively within businesses (Sproull & Kiesler, 1986, Trevino & Webster, 1992). The general findings of these studies are invaluable to the study of e-mail use and support system development. E-mail is a text-based, fast, asynchronous mode of communicating but can be considered to be lacking in the social context cues found in other forms of communication. The use of e-mail reveals a lack of status effects in communication with additional less inhibited or conformist communication than present via other communication media. The distinction between real time (synchronous) and non-real time (asynchronous) communication is often made in the literature with little acknowledgement that e-mail can be employed for synchronous communication, and that the distinction for e-mail is rather more blurred than for other forms of communication, for example chat-programs.

1.3.3 Theories of Computer-Mediated Communication

A number of theories have been advanced to explain the key observations drawn from studies of CMC. These theories are still evolving, gaining and losing popularity and leading to the generation of new theories. In reviewing the issues surrounding the support of group processes it is beneficial to explore the support in relation to these theories.

1.3.3.1 Reduced Social Cues

Originating from the Carnegie-Mellon University, this model was developed in the late 1980s and revised in the 1990s from a comprehensive series of experiments (for example Kiesler & Sproull, 1992; Siegel, Dubrovsky, Kiesler, & McGuire, 1986). The central focus of

this approach is real-time communication although it does encompass some studies of asynchronous communication. Through a comprehensive examination of the effects of mediation upon (frequently) judgement tasks the process of the group decision process was studied, concentrating upon communication rates, content and duration and employing a number of outcome measures.

The theory draws heavily upon the ideas of deindividuation, and proposes that CMC lacks the social cues apparent in FTF communication that regulate turn-taking behaviour, and convey both the status and emotion of the group members. It is the lack of cues that results in deindividuation through increased self-absorption or a reduction in the level of social evaluation.

These two processes, interestingly an increase and a decrease, lead to disinhibition which manifests itself in flaming; uninhibited and regulated behaviour (Lea, O'Shea, Fung & Spears, 1992; Spears & Lea, 1992) and reduced normative influence; that is a reduction in the appeals to societal and personal values of right and wrong, and expressions of personal and societal preference. A second effect is deregulatory, the medium (computer-mediated communication) promotes the conveying of extreme ideas and anti-normative or anti-social behaviours.

Siegel *et al* (1986) reported a major experimental examination of the ideas inherent in the reduced social cues model and revealed several effects that have become well established within the literature. In comparison to FTF groups, those mediated via computer (CMC) took longer to reach a decision and produced lower levels of communication. They also concentrated more on the generation of proposals for outcome and were contributing in a more equalised manner. They also revealed large shifts in decision outcome mirroring the polarisation effects of social psychology and exhibited greater levels of anti-social/normative behaviours (flaming).

In an extensive review Kiesler & Sproull (1992) revealed the effects of CMC upon organisations and confirm a number of the experimental effects reported by earlier ventures in the field. Their conclusions, that CMC is good for idea generation, widespread participation, the sharing of information and the checking of errors have since been further validated. As

have the areas in which they identified problematic usage of CMC: complex, sensitive and ill-defined problems that focus upon person-centred decisions.

1.3.3.2 Task Effects

The focus of the Carnegie-Mellon group is very much upon tasks that have no correct outcome. These tasks involve the pooling of ideas and the reaching of a consensus, but in a situation of relatively low conflict. The combination of both the lack of a correct outcome and the absence of conflict leave the conclusions drawn from this work susceptible to the claim that they are task dependent. An examination of this claims confirms that this might be the case.

Studies of tasks (Daly, 1993) where there is a single, optimal solution that can (and should) be deduced from the available data reveal a slightly different set of results. Differences were found between the ability of CM and FTF decision groups to eliminate implausible arguments and hypotheses. CM groups used fewer turns and encountered greater difficulty in reaching agreement and in conclusion the authors argued that CMC are less able to detect and correct errors which contrasts to Kiesler's own claims that CMC is an effective medium for error correction. Indeed, Daly builds beyond the simple study of CMC and suggests the inclusion of a number of features, including devil's advocacy into the e-mail system to improve the decision process.

Further task effects are revealed by Strauss and McGrath (1994) in the extent to which group members are interdependent upon one another. The identification of this independence is reliant upon social cues and the reduction in these cues as caused by CMC. This creates increased difficulty in the management of the dependency upon other panel members. Collaborative tasks such as the generation of ideas have a low requirement of interdependence and therefore suffer little of the negative effects of CMC. Co-ordination tasks that involve the identification and selection of the "best" solution make moderate demands upon interdependence and are therefore susceptible to impairment when conducted via CM technologies. Worst effected of all are tasks that require large degrees of dependence between group members, judgement tasks and opinion based discussion which can be severely disrupted via CM channels of communication.

Additionally, this work (Strauss & McGrath, 1994) revealed no effects of decision quality -- itself becoming a recurrent theme -- on any task and a productivity deficit for all tasks. Although on both judgmental and intellectual tasks users reported increased dissatisfaction with the process, the effectiveness was only reduced on the judgmental tasks. In contrast to Kiesler and colleagues own claims about CMC, Strauss and McGrath conclude that although CMC is ideal for the generation of ideas and acceptable if somewhat slow for intellectual tasks, however, it greatly hinders groups solving judgmental problems.

1.3.3.3 The backlash against Reduced Social Cues

This work and that of Daly (1993) discussed earlier are not the only papers to offer counter-evidence to the model proposed and supported by Kiesler and colleagues. Walter (1992) also questions the validity of the conclusions and support for the model on the basis of the relatively small sample and dataset upon which the theory has been developed. These concerns are further emphasised by studies of asynchronous e-mail (Bikson & Eveland, 1990; Weedman, 1991).

Some of the criticism has arisen from comparisons between the study of laboratory-based and field-based experiments. It is possible that the cause of some of the discrepancies between laboratory-based and field-based studies is the insufficient time in which lab-based groups are allowed to establish themselves as groups, a criticism already covered in the discussion of *ad hoc* groups earlier in the chapter. Some of these problems can be overcome by allowing CM groups to communicate at their own rates -- thus overcoming some of the effects inherent in the medium -- and by developing their own methods of compensation for the filtering out of the cues by employing electronic forms of non-verbal cues such as, text based E M P H A S I S, emoticons (e.g. smileys) or ASCII art.

1.3.3.4 Social Identity and Deindividuation (SIDE)

The emerging Manchester-Amsterdam school of CMC are amongst the most vocal opponents of the reduced social cues approach, Spears and Lea (1992) criticising the general approach of social cues to computer-mediated communication. Their excellent critique of the approach also addresses issues raised by Short *et al's* social presence model, the cuelessness model of Rutter and Daft and also Lengels classification of forms of mediated communication on the basis of the richness of the media that they present.

Three main objections are raised to these models. Firstly, the approaches equate 'interpersonal' and 'social', employing a comparison of not only verbal cues but also non-verbal cues. Secondly, they fail to incorporate the important subjective representations of social categories and structures and finally they define CMC on the basis of what it will and won't permit to be conveyed from group member to group member.

Drawing heavily on the concept of anonymity (Reicher, 1984) the SIDE model assumes that anonymity can enhance a users social identity and lead to an increase in normative behaviour. This argues that it is a misconception to believe anonymity deindividuates people and leads to reductions in normative behaviour.

The proposal advanced by the SIDE model is that the isolated nature of CMC and the anonymous method of communicating combine with a strong sense of group (social) identity to increase the adherence of group members to the norms held by the group. It also holds that under similar conditions if personal identity is salient, perhaps even dominant, then an increased adherence to personal norms and values should be observed.

Experiments that vary the salience of the group identity form the basis of the support for the SIDE theory. Communication via CMC in physically close (co-located) or spatially divided terminals (isolated) removes the effects of medium of communication inherent in the FTF-CMC comparison and enables the authors to isolate identity. In comparison with either isolated groups without a salient group identity or co-located groups with a salient group identity, groups of a known disposition towards a solution who were isolated and had a salient social (group) identity polarised towards the pre-established group norm. In the process of which they produced fewer task-oriented utterances and a greater number of socially-oriented remarks. These findings run contrary to the predictions of the reduced social cues approach which despite predicting polarisation (albeit in any direction) would predict reduced social orientation and greater anti-normative behaviour.

The conclusion to be drawn from these studies is that subjective responses to CMC systems and the contexts in which they are used are of great importance to the field. Additionally, the subjective meaning of the information that members of CMC groups choose to communicate to one another is not solely information about the decision but also information that expresses emotion, turn-taking and group membership.

1.3.3.5 Status Effects and CMC

It is apparent from the preceding discussion of the effects of CMC that the inter-relationships of group members may alter as a direct result of the communication medium. Dubrovsky, Kiesler and Sethna (1991) from a position of the reduced social cues model argued that CMC removes both the static and dynamic cues which mediate the effects of social status upon influence and rates of participation in discussions. The large majority of their findings mirror the earlier work of this tradition that CMC panels (i) take longer to reach decisions, (ii) advance a greater number of decision proposals and (iii) show an increase in disinhibited behaviour.

The main finding of interest from this study was something relatively new, that the low status members of CM groups overcame the disadvantage of their low status and were increasingly likely to influence the decision process. Despite the continuation of this equalisation, even at the expense of expert influence no longer holding greater sway than the influence of inexperienced group members, this was interpreted as a major advantage of CMC over some other forms of communication. This is perhaps to over emphasise the nature of the material, as the equalisation is advantageous only in certain areas of group activity and that all equalisation cannot be viewed equally or as having equal benefits.

Similar findings are reported from the field by Bikson & Eveland (1991) with CMC groups showing less centralisation, hierarchical differentiation and broader participation than FTF panels. CMC groups also demonstrate a more flexible approach to leadership than FTF panels. Other studies (Kiesler & Sproull, 1991) show similar beneficial effects of CMC for large (organisational groups) however in an excellent paper on the democratisation of organisations by e-mail, Mantovani (1991) argues that the effects may be overplayed. CMC, although serving to equalise participation amongst discussants, is not equally accessible to all and therefore maintains some differential status effects. Additionally, the link between the status of the sender and the status of the receiver goes some way to determining the likelihood of the messages being sufficiently attended to. High status receivers are less likely to give sufficient attention to messages from low status senders, than to similar messages from high status members.

Mantovani also revisits the issue of flaming and identifies the possibility of inappropriate negative interpretations being placed upon flaming, however, as Spears and Lea (1992)

counter this might not be an effect of disinhibition but rather a manifestation of normative behaviour. It also fails to acknowledge the role of flaming when used in a playful manner by some teachers (Weedman, 1991) and the positive benefits that this may entail.

Turning to one final study in this area, that of Spears and Lea (1994), identifies the importance of status and power within CMC. This demonstrates the potentially repressive rather than liberating nature of CMC. There is no concentrate evidence for the decreased awareness of status differences in CMC groups, rather the equalisation of participation has been taken as an indicative measure of status. The possibility remains that participant involvement in discussion is reduced to similar levels, and that what is reflected by the data is not the removal of status but the suppression of all communication down to a fixed rate.

The *ad hoc* nature of the laboratory based groups also presents difficulties for the simulation of true status differences. Indeed, neither power nor status are the interchangeable concepts they are sometimes presented as. Influence may or may not be determined by status which itself is a characteristic of individuals. Power on the other hand is internalised, and by its nature accepts the influence relationship with the related potentially long term nature of the influence and relationship. Given the ingrained nature of a hierarchical society it is perhaps naive to assume that the application of a relatively simple technology will overcome a number of status effects.

The SIDE model predicts that far from suppressing any status differences, that these differences will be enhanced when communicating via CM systems *if* CMC occurs in isolation. Crudely speaking the argument is that as CM technology serves to enable people to work in isolation, it reduces the occurrence of collective responses. Self-Categorisation provides a ready representation of the power relationships and this combines with the self-presentation of individuals to provide conditions under which normative behaviour is exhibited. It is therefore in the interests of users, groups and organisations to maintain an identity encompassing computer-based working to ensure the conditions do not exist for the enhancement of status differences.

1.3.4 Computer-Supported Co-operative Work (CSCW)

The origin of the term CSCW has be traced back to Irene Grief in 1984, by Schmidt and Bannon (1992) and was encapsulated in their own definition as:

“an endeavour to understand the nature and requirements of co-operative work with the objective of designing computer-based technologies for co-operative work arrangements.”

The emphasis of the field is upon the supporting of activities rather than passive forms of co-operation (Hughes, Randall & Shapiro, 1991), viewing work as social in character and dependent upon the activities of other people. The assumption underpinning this work is that co-operation requires an articulation of the activities being undertaken. Articulation is solved by mechanisms of interaction--formal/informal roles, plans/schedules, standard operating procedures, etc.

As such co-operative work can bring individuals together to utilise their specialised contributions to the group, in doing so it might enhance an individuals capacity to contribute thus helping reduce the discrepancy between potential and actual group productivity. CSCW software can also provide a method for the correction of known process defects thereby enabling the group to overcome some of the individual biases and errors that are known from the study of both individual and group decision making.

Two main problems prevent the full achievement of the aims of the field of CSCW, the first (Suchman, 1991) is that the rules that govern a group, the operating procedures it employs are a product of the articulation and not as might be thought the cause. As such attempts to apply rigid structures to the group process are likely to fail due to the inherent difficulties in matching the process to the procedures of the system. The almost classical example of this is the development of COORDINATOR (Winograd, 1988a, 1988b, Winograd and Flores 1986). The requirement of users to classify their own communications on the basis of an application of speech act theory prevented the primary act of communication occurring, leading ultimately to the failure of the system.

The second problem is the difficulty in managing shared spaces and resource between group members. The study of COLAB (Foster 1986; Stefik 1987a & 1987b; Tatar 1991) and also the examination of the failure of electronic meeting systems (EMSs) by Poole, Holmes, Watson, and DeSanctis (1993) revealed that although EMSs were intended to reduce or eliminate the process loss in group interaction therefore increasing productivity, the difficulties in entering information, and maintaining operational systems causes many difficulties for both the system designer and researcher.

Rodden's (1991) presentation of a model of classification of CSCW systems into a two-dimensional space has become accepted as the common classification scheme. The model works by defining whether people are working at the same or different times and in the same or different places, with the basic issue being the degree of prescriptiveness embodied in systems.

1.3.4.1. Developing the concept of CSCW

The emphasis within CSCW is the temporal structure of group activity (McGrath, 1990). The discipline seeks to integrate the functions of a group that are often left neglected such as support for, and integration of group members. Inherent in this approach is the often neglected recognition that groups are multifunctional and more than just a collection of individuals.

Expanding on this theme, the field of CSCW has rightly recognised the importance of the multi-staged process of defining goals, deriving problem solving, resolving conflicts between members and putting achieved goals into practice. It has also recognised the cyclic tendencies of the group to reiterate through these phases and vary the sequences in which they are tackled, often in accordance to external pressures such as time constraints and deadlines.

In supporting groups, CSCW ultimately alters the group process, maximising the benefits and minimising the negative aspects. One method employed is the removal of co-ordinating cues which can disrupt turn-taking. Again the attempt here is to reduce the process losses and therefore increase productivity. However, asynchronous CSCW can alter the time scale of tasks, making coordination difficult to achieve. It can also hinder or remove affective processes that result in group integration and makes member support being difficult to achieve.

Given the nature of the field it is perhaps inevitable that to a large extent the work is driven by applied studies and organisational requirements which have lead to a call to understand CSCW in an organisational context (Jirotko *et al*, 1992). However, perhaps the most interesting advance comes from the challenge issued by Grudin in 1994. Having participated in the development of the field during the late 1980s and early 1990s Grudin was well placed to identify the needs of the CSCW community, not necessarily from the

perspective of a designer or researcher but from the end users - a theme that now runs consistently through the discipline.

According to Grudin, there are a number of pay-offs to be tackled, the first of which is to ensure that the benefit to the user of the system is greater than the workload demanded by the system to be operated. A related theme here is that the benefits of the system should be gained by those incurring the costs of operation, and that, for example the line-managers should not stand to gain more than those completing the tasks as is frequently the case with calendar software.

Systems require sufficient appeal to gain what is termed a critical mass, that will ensure the use of the system once installed and that any new system should be integrated into existing work practices. This goes some way to avoiding the enforcement of standardised procedures as required by the likes of COORDINATOR, and does not lead to the development of "Fascist software" doomed to fail due to the conflict between user operating procedures and those required by the system (see again Suchman and also Patel's, 1993 analysis of the London Ambulance Call Out Service) or preventing intuition from decision makers. Finally, there is the need to evaluate the system design to ensure that it operates in the expected fashion and that attempts to generalise beyond the initial context of the system are not made.

1.3.4.2 Selected Examples of CSCW Systems

The final section of this review examines the success and failure of some CSCW systems drawing upon the lessons learnt to provide a guide for the remainder of this thesis.

Considerable attention has been devoted to the study of the success and failure of CSCW systems. The common format is to describe both the development and implementation processes and then, where applicable, to document the widespread failure of the system within a given context along with the presentation of recommendations for future development.

From the COSMOS project (Bowers & Churcher, 1989) to COGNOTER (Tatar, Foster & Bobrow, 1991) via COLAB (Foster, 1986, Foster & Stefik, 1986) the practice of modelling communication structures and supporting this behaviour has been well established. COLAB, an admirable attempt to support group work (by design teams) in a specialised facility, held a

complex model of the meeting process around which support was based. However, analyses of the use of the system identified a number of communication breakdowns between users. Modifications to the system to attempt to overcome these difficulties led to the development of COGNOTER. However, even this somewhat enhanced configuration of the system resulted in failure due to the difficulty experienced in maintaining the flow of communication and enabling users to determine shared resources.

One common theme that can be extracted from the studies of CSCW systems is the importance of matching the models held by the system to the models employed by the end-users. This is apparent from both the literature pertaining to the development of support systems (e.g. Bennett, 1983) and surveys of the failure of implemented applications (Grudin, 1988a, 1988b). Indeed, the failure of groupware is attributed by Grudin not to the fact that the products are dull or unoriginal or poorly run companies but to the fact that the products attempted to change the way in which people interact in a work environment. The crux of this argument is that to succeed the systems must match the work patterns of the users and not that users should be required to dramatically alter their established work practices.

Applications fail if there is a discrepancy between the person required to exert effort in implementing the system and the person gaining a return from this effort. Thus, successful systems maintain a collective benefit whilst minimising the behavioural cost of implementation. Applications also fail if they violate existing working practices and (organisational) structures (see also Patel, 1993) or present inherently restrictive procedures for communication (Winograd, 1988a).

Group decision support suffers from the difficulties common in the development of CSCW systems (Poole, Holmes, Watson & De Sanctis, 1993). The advantages of, and desire to improve both the effectiveness and efficiency of the decision making process is clear from the earlier review. That decision-making process is both complex and frequently subtle, with participants holding partially hidden agendas, relying on the knowledge of personalities of the others involved, and so forth (Grudin, 1988b) creates difficulties in accurately representing the process.

Long periods of learning to use a system decrease the likelihood of its success. It is noticeable that the computer technology that has experienced the greatest uptake and development is that of electronic mail. One of the reasons behind this success is the ease

with which the operation of e-mail matches to existing representations of communication structure. The system incorporates the knowledge and behaviours of the user into the system design. Too many systems have been driven by technological developments rather than through the study of groups and their needs. Encouragingly the emergence of ethnography as an increasing dominant field within CSCW has helped to draw developers' focus back to the needs of the user. There is, however, still room for increasing the degree of consideration given to this topic (see for example, Hughes, Randall & Shapiro, 1993, Sommerville, Rodden, Sawyer & Benley, 1992).

This argument does in essence share similarities with the "Scandinavian" approach to Computer-Supported Cooperative Work (See Bodker, Ehn, Knudsen, Kyng & Madsen; 1988, for a historical perspective on the view). Kyng (1988) in an excellent review of the methodology behind this perspective reviews several tools and techniques which: i) establish possibilities of alternative forms of work within the workplace; ii) evolve the local work situation through a cycle involving situation analysis, goal discussion, and investigation of possible courses of actions; iii) create a vision of new and different uses of technology; and iv) view the design through mock-up simulations.

Bermann & Thorenson (1988) argue for a collaborative approach between developers and end-users. The conventional designer led perspective on software/application development contains many challenges and inherent to the process are a number of conflicts and contradictions. The greater inclusion of end-users encompassed in the Scandinavian approach to system design enables systems to incorporate those surprising work habits revealed by studies such as Bjerknes and Bratteig (1988).

This approach encompasses the concept of groupware advanced by Kerr and Hiltz (1982b):

"A system for human communication is more than just a collection of software capabilities; ideally, it is 'groupware,' an integrated set of group processes and software capabilities melded to support the specific goals or tasks of a particular user group."

To ensure that potential productivity is realised in a group it is important that any electronic medium supporting or facilitating the processes both allows and supports explicit and intentional procedures and processes, this is the goal behind groupware.

Indeed, the approach to incorporating user opinions and working practices within the field is now well established, and encapsulated in the challenges issued by Grudin (1991b) to CSCW designers and the improvements in processes reported by Greenbaum (1988).

1.3.4.3 Closing Comments on CSCW

In the short period since the conception of CSCW as a discipline, the study of computer-based behaviours and the support of these behaviours has revealed a number of interesting phenomena and advanced a number of (ever evolving) theories to explain these behaviours. Before reporting the experiment phase of this work, this chapter reviews one final area of literature that of the effects of feedback upon behaviour and communication.

1.4 Understanding Feedback

1.4.1 Overview

The purpose of this, the final section, of the literature review is to consider the effects of group level feedback upon performance. In doing so, the key factors that influence the effectiveness and utility of feedback are identified and the recurring problems with the field discussed. The literature related to this area is presented in three sections that concentrate on the feedback itself, effects attributable to the group processes and finally, feedback and communication.

1.4.2 Feedback

1.4.2.1 Individual and Group Feedback

Whilst much is known about the effects of feedback upon individuals, there is relatively little known regarding the effects of feedback upon groups. What little research there was declined during the 1970's as the general levels of interest in the psychology of the group and group level effects declined (Steiner, 1972, 1974). It would, however, be incorrect to assume that there is no interest in addressing the issues of group feedback, indeed Conlon and Barr (1988) argued that the lack of research on the effects of group feedback was the single largest factor blocking progress in the study of organisational change.

Knowledge of results, or performance feedback has often been championed as the most effect method available for modifying or shaping behaviour in a group situation (Friedlander & Brown, 1974; Larson, 1984; Nadler, 1976, 1977). The principal functions of knowledge of

results are threefold, firstly it serves to provide *reinforcement* for the behaviour exhibited, in purely behavioural terms it increases the likelihood of the exhibited behaviour occurring again. Secondly, it can be seen to serve as an incentive for the recipient of the feedback, the provision of information making it a desirable state to seek. Finally, it exists as a form of information provision such that the person or persons involved receive information that relates to the outcome of their actions, communication, decisions.

When people work alone, performance feedback has been shown to effectively motivate and direct individual behaviour (Annett, 1969, Fisher, 1979; Greller & Herold, 1975). Feedback confirms expectations about positive outcomes or rewards believed to be associated with behaviour and tends to increase the further likelihood of such behaviour, in contrast disconfirming feedback tends to decrease the behaviour. Taking the effects of feedback together, they can be seen to shape current and future behaviour, dependent upon the timing of the feedback.

These general findings are robust when considered in relation to the individual. However, the domain typically employed in these studies is one in which a person receives feedback in a state of social isolation. The experimenter often exerts such a degree of control over the environment that the person might be considered to be operating almost in a social vacuum. When feedback is considered in an environment that is socially richer, the effects previously observed are revealed to be less dependable and robust (Conlan & Barr, 1988).

1.4.1.2 Feedback in Social Contexts

A distinction can be made between feedback that occurs in social and non-social contexts. A social context being one in which individuals interact with others and have the opportunity for social comparison. It is a richer environment in which to interact than a non-social context, which allows an individual to operate with an independency of action and without the possibility for comparison with others.

Naturally, social contexts are the focus of research concerning group level feedback. Here the focus lies with the aggregation of feedback and the structure of the group task (Nadler, 1979). To these two factors has been added a third, that of social processes (Conlan & Barr, 1988) which mediate performance feedback in social settings. It is to these social processes that attention now turns.

1.4.1.3 Aggregation of Feedback

The individual level of aggregation is information provided that directly relates to the individuals performance. There are two possible ways to expand this information when provided in a group context. The first is to provide information about the performance of an individual within a group in such a way that the information is available not only to the individual but also to other group members. Such a method of provision serves not only to provide feedback on the group performance but clearly identifies the contribution of the individual to the group task. The second form that the feedback might take is one which might be considered to be feedback at a true group level. Here the group is considered to be the main topic of interest and feedback is provided on the results of the joint performance of the group, in doing so the ability to identify individual contributions to the group output is removed.

It is true to say that studies of feedback aggregation have focused upon the effects of feedback containing data regarding individual performances rather than group performance feedback. This research has revealed that individuals provided with aggregated feedback often attribute the aggregate effect to the actions of individuals, rather than to the group as a whole i.e. the current performance, especially in the case of poor performance is attributed to an individual rather than the collective action of the group. Such provision of feedback might be considered a confounding of the measurement, as the individual level results detract from the effectiveness of aggregated feedback by focusing the attention upon the performance of individuals rather than on the combined nature of the group. The resulting effect is to divert attention away from the need to maximise potential group productivity and the need to minimise process losses and focus upon individual activities.

It is a misconception to believe this to be the only factor that might be influencing the effectiveness of aggregated feedback. Given that it has long been established that task effects the group productivity, one might expect that the task structure will influence the effectiveness of feedback.

1.4.2 Group Processes and Feedback

1.4.2.1 Task Structure

Researchers considering the effects of performance feedback given to groups have not systematically examined the effects of task structure. This is despite the expectation that as with the examination of the effects of CMC and the study of FTF processes, that performance in part depends upon the form of the task. It is therefore important to consider the effects of different task structures upon feedback.

If a task is divisible, that is it can be accomplished via the dividing of the effort of individuals to concentrate on sub-tasks to be completed simultaneously, then the effects of the feedback should vary according to the form that the feedback takes. In this situation, feedback that permits the identification of individual contributions will be more effective in achieving the desired goals than feedback offered at a group level that enables individual contributions to remain concealed. In contrast, group feedback operating at a true group level and concealing individual contributions should be effective in influencing the successful completion of non-divisible tasks.

Although Nadler's (1979) review convincingly demonstrates the importance of understanding feedback in relation to the group task, this remains largely unexamined. As Conlan and Barr (1988) conclude, "there are many theoretically justifiable reasons but only limited data on which to base predictions that aggregate and individual level feedback produce different effects, depending on the structure of group tasks". Thus without a substantial body of data on which to base predictions attention must turn to other factors that might influence the effectiveness of feedback at a group level, such as social processes.

1.4.2.2 The Effects of Group Structure

One key area that has been identified as a factor in the adherence to feedback and subsequent learning within groups is the group's communication structure. Results reviewed in 1993 by Argote suggest that "centralised structures were more efficient and made fewer errors than decentralised structures for simple tasks (Guerzkow & Simon, 1955; Leavitt, 1951). For complex and uncertain tasks, however, decentralised structures were more efficient and made fewer errors (Heise & Miller 1951; Hutte, 1965; Macy *et al*, 1953; Shaw 1954)."

Argote (1993) attempts to shed light on the area of group level feedback through an investigation of organisational learning curves and comparing these with theories drawn from social psychological literature. Laughton & Sweeney's work (1977) suggests that there is little or no transfer of skills acquired at the individual level to group tasks, nor is there a group-to-individual transfer. Indeed, "previous individual experience did not influence subsequent group performance, and previous group experience did not transfer to subsequent individual performance" (Argote 1993). It would appear that the group must learn within the group context, the experience of an individual has little consequence for the experience of the group.

1.4.2.3 Social Processes

At an individual level feedback is often equated with reinforcement, it contributes to the behaviour of the individual by motivating or directing future behaviours. This direction might be to increase or decrease future occurrences of the target behaviour, but it can almost be reduced to the behavioural concept of reinforcement. Within groups other factors might be seen to be influential and as such theories concerning groups often focus on how the process of social comparison occurs. That is an individual making direct links between the actions of themselves and the actions of others. It would therefore be prudent to assume that feedback to members of a group would be evaluated in direct comparison to the feedback received by other members of that group, especially if the feedback permits the identification of individual contributions. Social comparisons might be expected to occur not only at this intra-group level, but also inter-groups. Group members can also be expected to compare their own performance as a group to that of other identifiable groups tackling the same or related tasks.

Again the lack of published studies within the area of interest results in the exact understanding of the effects of feedback given to groups to be limited. Nadler (1979) suggested that future research should address the process of the utilisation of feedback through the development of theoretical models, models that examine how groups and individuals process the feedback they receive. To date this challenge has, however, remained largely unmet.

1.4.2.4 Consolidating the Issues Surrounding Feedback

As a result of the lack of theoretical development with this domain, several problems exist surrounding the issue of group feedback. These may be summarised as concerning four main

issues; confounding feedback, social loafing, problems of cooperation and social influence, each of these is now addressed in turn.

The first of these is the confounding of information between group level feedback and feedback provided to individuals within a group context. Here the individual level feedback permits inferences to be drawn regarding the group, but group level feedback does not permit the identification of the contribution of the individual. As has previously been discussed, this results in great difficulty in determining the true effects of the feedback and whether these effects occur at a group or individual level.

A second issue concerns the existence of conditions that permit social loafing. If the environment in which feedback is received is one in which an individual can reduce their own input to the group product and require other group members to increase their own workload to compensate, that is to say an environment in which social loafing is possible, then the effectiveness of feedback will be reduced. The process losses that occur as a result of social loafing will reduce the effectiveness of the feedback, this occurs as a result of the inability to identify individual contributions to the group product.

Similarly, problems in establishing cooperative techniques on divisible tasks such as a prioritised list of actions that are required to complete the task and also reductions in the social influence exerted by individuals, will both contribute to difficulties in establishing the true effectiveness of feedback. In these cases it becomes increasingly difficult to establish a technique by which the group can collectively respond to the feedback being received. A levelling of status might reduce the leadership and as a result individual contributions to the group product might become less effective. It might, however, enable a greater contribution from other group members (cf. the earlier discussion of the equalising effects of CMC). Evidently, the inability to establish a collective approach to the task, or a collective response to the feedback can be seen to decrease the effectiveness of the feedback.

It is difficult to create an environment in which all of the potential problems can be removed, yet there is little doubt that the number of problems can be reduced. Conlan & Barr (1988) make several proposals regarding the effects of feedback. A high level of task interdependency with group level feedback but no individual level feedback should remove the problems of confounding, cooperative problems and social influence. In this situation, the potential for confounding of feedback is removed by providing feedback that does not permit

individual contributions to be identified, ensuring that the effects are due to group feedback. Furthermore, the ability to divide a task into several smaller components, or task interdependency, where each component is tackled by an individual is associated with difficulties in co-ordinating activities. Such sub-division of the task creates possibilities for the goals of individual group members to conflict and increase the likelihood of communication failure. In contrast, these problems are absent in tasks that have no interdependency. Finally, the absence of any individual level feedback, removes the possibility for social comparison and decreases the social influence of group members. It is, however, this absence of individual level feedback that permits social loafing to occur and presents a potential problem.

One alternative, is to remove the high levels of task interdependency and provide group feedback in conjunction with publicly available individual feedback. In this situation, the possibility of social loafing is removed, the ability to identify individual contributions to the group process prevents individuals decreasing their own activity without their colleagues being aware of the reduction in their effort. As with the first example, the possibility of confounding individual and group level feedback is removed, although in this case, rather than being due to an absence of individual feedback, here it results from the individual level feedback being clearly identifiable. The provision of feedback on individual performances, helps reduce the cooperation difficulties as each group member is able to see the activities of the other, it is unlikely, however, to fully remove the problems of cooperation as Conlan and Barr claim. However, in enabling individual contributions to be identified social influence, and status effects might become a problem.

Unfortunately no complete solution exists, the phenomena that have been identified as potentially causing problems cannot all be removed at the same time. However, the known problems with each approach can be identified and incorporated into the interpretation of data when the effectiveness of the feedback is being evaluated. Before considering the effects of feedback upon the communication process of the group, one final area might offer greater understanding of the potential effects, the area of motor skills acquisition.

1.4.3 Feedback and Communication

1.4.3.1 Feedback and Motor Skills Acquisition

Much of the literature incorporating or directly examining knowledge of results concerns the effects of feedback upon the acquisition of motor skills (e.g. Glencross, 1992; Lee, White & Carnahan, 1990; Young & Schmidt, 1992). Motor skills are usually considered to be “those skills in which both the movement and the outcome of action are emphasised” (Newell, 1991). At present, the distinction between motor skills and other forms of skills acquisition; perceptual, cognitive or communication is more a matter of conceptual convenience rather than any underlying theoretical necessity.

The field has undergone many changes as theories of learning become popular and then fall from favour. The underlying theme that remains is that skill learning is a continuous process, and that learning continues even once a skill has been acquired, with improved performance developing over time. The difficulty with applying the lessons of this field to the area of investigation in this thesis arises from the tendency, as identified by Newell (1991), of the dominant information processing approach focusing upon *how* information is processed rather than examining *what* information is central to skill acquisition.

Examining cognitive skills acquisition enables a few clearer conclusions to be drawn. Van Lehn (1996) presents a comprehensive overview of the field from the perspective of problem solving, the focus of this body of research has shifted from tasks requiring little background knowledge (1950s & 1960s) to knowledge rich domains and the modelling of processes dominant in the 1970s to the current vogue of examining the acquisition of expertise. This has led to a revival of interest in traditional topics in skills acquisition, such as practice effects and transfer.

The constant change of focus within the field, and the continual transitional phases have resulted in the absence of a clear and coherent theory of problem solving and skills acquisition (Van Lehn, 1996). However, what may be drawn from this field are the importance of the traditional areas of focus practice and transfer (See Van Lehn for a review). Skills acquisition is often domain specific, with complex effects sometimes making prediction of transfer to other domains difficult, however, with practice solution times decrease and the reiteration of rules and process requirements decrease (Anderson, 1982; Simon & Simon, 1978).

1.4.3.2 Effects of Feedback on Communication

Having considered the general effects of feedback, attention now turns to the known effects of feedback upon communication. Unfortunately, little if any published research exists on these effects, however, from the literature that addresses other feedback settings it is possible to draw several inferences about the likely outcomes and influences.

Investigations incorporating feedback (Chapanis, 1964; Jacoby, Troutman, Mazursky & Kuss, 1984) have largely concluded that it improves performance. The exact process through which this is achieved is unclear, although it is thought that several factors influence the impact of feedback amongst which the role of motivation is central. The greater the motivation levels of the individual in relation to the task, the greater the likelihood that they will respond positively to the feedback and try to utilise any information it provides. Predicting an individual's response to feedback is indeed a complicated matter, however, learning and motivation offer insights that allow the anticipation of an individual's reaction and subsequently those of a group to the feedback available.

Indeed, when subjects work alone "performance feedback has been shown to effectively motivate and direct individual behaviour (Annett, 1969, Fisher, 1979; Greller & Herold, 1975). Crudely speaking, the results show that feedback confirms expectations about positive outcomes or rewards believed to be associated with behaviour and tends to increase the further likelihood of such behaviour. On the other hand disconfirming feedback tends to decrease the behaviour" (Conlon & Barr, 1988: 28). As Earley, Northcraft, Lee and Lituchy (1990) comment,

"Feedback can provide information about the correctness, accuracy, and adequacy of work behaviours. Motivationally, feedback may be necessary for instilling a sense of competence, accomplishment, and control in workers (Bandura, 1977; Hackman & Oldham, 1976)."

Although outcome feedback can identify the need to adjust action, it often does not provide specific information concerning how to adjust, that is information on the direction of behaviour (Earley *et al* 1990). Such adjustment information becomes particularly important for performing complex or unstructured tasks in which the relation of behaviours to performance outcomes may be uncertain (Campbell, 1988). As a result, an individual who receives feedback while performing an unstructured or complex task may make inappropriate

adjustments. The directive, strategy-shaping effect of feedback can occur much more directly and accurately when feedback focuses on the behavioural processes that generate outcomes.” Such feedback concerns the process of performing a task, as opposed to the outcomes of the performance or an individual’s task strategy.

1.4.3.3 Sources of Feedback

Before drawing the review of the feedback literature to a close it is necessary to address one final area, that of feedback seeking and the effects of different sources of feedback. Although it has long been recognised that feedback is important in maintaining and improving performance, the traditional stance has been to view this process as being a passive experience on the part of the receiver. Increasingly, researchers have recognised that this is not always the case and are becoming increasingly concerned with those who actively seek feedback (Robinson & Weldon 1993). The majority of this work has little direct bearing upon the experimental work undertaken here, however, it does reveal relevant effects concerning the sources of the feedback.

1.4.3.4 Receiving feedback from a machine

As seekers of feedback require accurate feedback Robinson & Weldon (1993) argue that, “the need for self-assessment encourages feedback seeking from non-social rather than social sources because feedback seekers want accurate information about the self (Festinger, 1954)”. This can be taken as an indication that the development of CSCW systems should prove a productive research direction.

The conventional framework for decision support (CFDS) supplied by Angehrn (1993) offers a theoretical basis which, “transforms a DSS [Decision Support System] into a decision-making arena in which users define and explore their problems under the continuous stimulus of electronic agents.” This is advanced as an alternative approach to the area of human-computer interaction (HCI), which although is aimed primarily at advancing the cause of this new form of decision support system, offers an insight into the reaction of computer users when receiving information that often amounts to criticism from the computer itself.

Clearly examining the complete nature of decision support systems is somewhat problematic.

“Current approaches to the problem are, on the whole, centred around the approaches of Bonczek, Holsapple & Whinston (1981) and Sprague & Carlson (1982). Two distinct types of DSS are identifiable, *vehicle DSS* and

toolbox DSS. The former assumes that “the task of recognising a decision-makers needs can be delegated to an expert.” As such the system is operated as a flexible *vehicle* for conveying the strategy to the decision maker. The latter, the *toolbox*, has no basis in ‘normative models of decision making’, no structure is imposed nor are techniques to solve problems provided.”

Angehrn (1993)

Although the approach offered by Angehrn differs in several respects to the approach that will be advanced in Chapter Two, the ‘arena solution’ is based upon the assumption that decision support can be provided by “facilitating and stimulating reflective learning,” a process quite close to that under exploration.

1.4.3.5 Passive versus Active support systems

As explored in greater depth elsewhere the distinction between a passive and an active system is a clear one. Systems denoted passive merely provide the facilities for the decision making group to reach their decision, an active system is much more than just a silent agent in the decision making process. Active systems intervene in the decision making process, they perform three crucial functions; intervention, prompting and criticising. On the basis of either a pre-determined model or a set of decision making and conflict rules, active support systems, prompt, push, edge and even bully the decision maker down an appropriate path to the final decision.

As such active systems must be capable of assessing the suitability of taking the initiative and interrupting the ongoing, user driven process and capable of intervening in the decision making arena to provide - depending on their specific knowledge - new facts, perspectives, problem representations, alternative strategies. (Angehrn, 1993)

1.4.3.6 Goal Setting and Feedback

One final area might provide further insight into the nature of the feedback provided by a support system, the area of goal setting. This involves the active creation of a target behaviour or in this case communication pattern to which the group aspires. The simplest way to provide a target or goal is for people to actively be aware of the model to which they are being compared, either with a constant comparison provided or with provision of the target behaviour prior to the task.

There is a documented interaction between the effects of goal setting and the provision of feedback, which perhaps provides a greater insight to the impact of goal setting on behaviour. As Earley *et al* (1990) comment, “The key to the interaction between feedback and goal setting is the clarity of the feedback, not its mere presence.” Indeed, “the presence or absence of specific outcome feedback should determine the effects of goal setting on self-confidence and effort, and the presence or absence of specific process feedback should determine goal settings effects on the strategy an individual implements” (Earley *et al* , 1990).

The data from this study (Earley *et al* 1990) suggests that the most effective combination of feedback and goal setting for individuals is the provision of a challenging goal and specific outcome feedback. Additionally performance of individuals can be enhanced by supplying a specific goal combined with specific process feedback.

The results from this study, “reinforce the thesis that feedback moderates goal setting’s relation to performance and that both outcome and process feedback are important contributors to goal-setting effects,” (Earley *et al* 1990). Taken together this suggests that the provision in some form of the target model of communication would be desirable.

1.4.4 Conclusions from Feedback Review

The literature concerning feedback offers many questions few of which have satisfactorily answered. It remains the case that predictions within the area are more likely to result from the development of a theoretical position into an experimental study rather than being able to base predictions upon a large body of data in published studies. As such many of the decisions made over the course of the experimental studies presented within this thesis are the result of pragmatic decisions, rather than confident predictions made from the conclusions of previous work.

1.5 General Overview of Thesis

It has been established that the use of electronic conferencing systems has behavioural effects (Hiltz & Turoff, 1985; Kiesler & Sproull, 1992), which are only partially explained by the theories advanced to account for them (Burnstein & Vinokur, 1977; Spears and Lea, 1992 for a review; Turner *et al*, 1987). A considerable body of literature reveals communication deficits in computer-mediated decision making groups compared to their face-to-face

counterparts, the research presented in this thesis attempts to develop a system to overcome the often negative effects that computer-conferencing has upon communication.

It is argued that such differences in communication represent a decrease in the richness of the decision making process of CM in relation to their FTF counterparts. It is believed that the tendency of computer-mediated groups to be “decision-driven” can be overcome by shaping their communication behaviour to be more like that of face-to-face groups. This would require computer-mediated groups to suppress their tendency to concentrate on decision outcomes, and to enrich their conversation with more reference to factual information and reasoned argument. Rather than develop a fully operational system for overcoming these deficits in communication the feasibility of such an approach is examined as “in any period of rapid technological growth and innovation, the first priority is to demonstrate that an idea is feasible at all” (McCarthy & Monk, 1994).

It is apparent from the review of literature presented in this chapter that there are a variety of forms that interventions might take, each based upon the communication process of group members. It is also apparent that the form of this feedback might vary greatly in both the frequency and content. Consequently it is important to define the boundaries of this research. Johansen (1984) presents a matrix that varied along two dimensions; time and space. The work that follows is concerned with groups operating in different locations, but at the same time and is interested in the effects of computerised rather than manual procedures upon group performance. Therefore the remit of the experiments that follow can be summarised as the modification of the communication of computer-mediated decision making groups through the provision of feedback concerning the communication style of the group. This approach of modifying the communication of computer-mediated groups to resemble face-to-face groups assumes that, up to a certain point, the greater the level of factual information exchanged by group members, the richer the process and the better the resulting decision. A theoretical point of information saturation exists where the additional information is no longer enriching and might hinder the decision making process. However, on the basis of the studies already considered it is unlikely that within decisions of short duration, made under time pressure, this point of saturation will not be reached.

As has been discussed previous attempts to overcome the difficulties presented by computer conferencing have been restricted by the practical constraints of being unable to

develop software capable of understanding unconstrained language. The use of templates for message composition or the completion of 'tick boxes' to aid the computer coding of communication (Malone, Grant, Lai & Rosenblitt; 1987) has led to inoperable and over-restrictive communication systems. The nature of the problem requires the development of a new paradigm that can overcome the constraints posed by the difficulties inherent in computer understanding of natural language. It is to the development of such a paradigm that attention now turns in Chapter Two, a development that is guided by the following hypotheses:

- i) The communication content of decision making groups will vary according to the medium used to arrive at that decision.
- ii) As a result of alterations in communication content, induced by communication medium, decisions made using computer conferencing systems differ in outcome to those made by face-to-face groups.
- iii) The quality of decisions made by computer-mediated groups can be improved through the provision of an intelligent support system prompting users to communicate in accordance with external criteria.

Chapter Two - Coding of Communication and the development of a paradigm for establishing the impact of communication support systems

2.1 Overview

2.1.1 *Statement of Intention*

At the end of the preceding chapter it was established that the intention of this research is to explore the possibilities for a Group Communication Support System (GCSS) that encourages computer-mediated groups to communicate as if meeting face-to-face. Given this stated aim two main directions exist for the research. The first is to explore the development possibilities from a computing perspective and to develop an automated system capable of processing natural language and providing communication support. The second approach would be to conduct a series of studies emphasising the impact of various possible system configurations to assess the psychological and behavioural impacts of such a system.

Although the development of a system capable of processing language has widespread appeal, at present this approach is considered unattractive. Much research has focused on the abilities of computer systems to encode and understand unconstrained communication. Although some success has been achieved in developing systems that can interpret some of the structure and some of the content of natural language, the approach has, on the whole, failed to fulfil its full potential.

Given the effort already expended in the development of such systems, the possibility of failure in any given research project is greater than the likelihood of a success. Furthermore, assuming that even if the development of such a system is possible and that this research program is successful, one major question would still remain unanswered: That of the behavioural and psychological effects of the system being proposed. Indeed, the review of CSCW (Chapter One) established that one of the key factors in the failure to utilise a system is the assessment of the users, it would seem prudent to devote attention to this issue.

Returning to the main premise of this thesis; that the process deficits of computer-mediated (CM) decision making groups seen in comparison to their face-to-face (FTF) counterparts can be overcome, this research requires (i) the development of a method for establishing the communication content of decision making groups (ii) the identification of the

styles of communication typically employed by decision makers in both CM and FTF decision making environments and (iii) a paradigm that permits real-time feedback to be given to decision makers concerning the content of their communication.

It is necessary to deviate from the main objectives of the research to address the methodological issues that require a successful resolution prior if these goals are to be met. To this aim the first section of this chapter concerns the selection of a decision task and a method for communicating via computer that will be employed in the experimental chapters of this thesis. Having selected both a task and a communication medium attention turns to the methods of analysing the style of communication employed by the decision makers. Finally, the later proportion of the chapter considers the development of a paradigm that permits real-time intervention in the communication processes.

2.2 The selection of a decision task

2.2.1 A Consideration of Task Effects

Chapter One identified a number of outcomes that arise as a direct results of the task being studied. The discussion of task effects revolved around Steiner's (1972) typology of tasks which provides a general framework exploring the processes and division of labour required by the group to successfully achieve their goals. The theme of task effects was again considered when examining the effects of CMC where it was concluded that the productivity of a CM group is in part dependent upon the nature of the task being tackled. Computer mediation typically helps idea generation and sharing, but hinders groups performing tasks requiring agreement on judgement matters (Strauss & McGrath, 1994; Valacich, Dennis & Connolly, 1994).

There is one other consideration yet to be addressed, that of the complexity of the task. Simple tasks often require little exchange of ideas and information and fail to require participants to fully engage in the decision process. In simple tasks, solutions are often derived by drawing upon previous experience of similar situations. If experiences are shared between group members then the possibility to draw on shared knowledge of shared experience may result in a solution being reached without objective measures of the process being possible. For instance, people who have tackled a related task may refer to that task for the solution. This removes any necessity for discussion beyond a reference to the previous

experience. Although not a vast problem it restricts the communication used by the group, decreases the generalisability of the communication employed, and suggests that a new and novel task should be used to examine decision makers communication.

Complex tasks have the added advantage of often being realistic, which in turn increases the extent to which results can be generalised. Although studies of decision processes in laboratories are often conducted to assess the validity of process models, studies avoid addressing the issue of realism, often using tasks such as the NASA Moon Survival Problem (Pfeiffer & Jones, 1969; Hall, 1971). Decision processes in the 'real world' involve the added pressure of external sources and the requirement to be responsible for a decision (see for example Janis, 1985). A lack of pressure to reach the correct decision, and a lack of accountability for the decision might result in decision makers in laboratory studies failing to use the same process, or failing to arrive at the same outcome as they would, were the situation 'for real'. In these situations, the objections raised by opponents of *ad hoc* groups become increasingly difficult to counter.

This problem cannot be completely overcome in the laboratory, but one way of reducing the likelihood of such factors influencing the decision process is to increase the realism of the task. Carlsmith, Ellsworth and Aronson (1976) make an important distinction between Experimental Realism and Mundane Realism. The former is the extent to which a participant believes in the experiment, the degree to which they attend to the experimental task and treat it seriously. Whilst the latter is the extent to which the task bears a similarity to the 'real world' i.e. the environment outside of the laboratory.

"The situation encountered by subjects in an experiment must be so striking and so believable that its effects will transcend the influence of their knowledge that they are in an experiment; that is, the situation must have experimental realism."

(Carlsmith *et al*, 1976)

They argue that if acquiescence, experimental demands and/or evaluation apprehension are minimised then mundane realism is no longer required as the level of experimental realism will suffice. Three factors can be seen to influence experimental realism: i) the extent of the data available, ii) the type of decision required and iii) the sensitivity of the issue. All three of these issues are interrelated, a satisfactory solution to one often results in the

satisfactory solution of the others, in much the same way that experimental realism can on occasions ensure the mundane realism of a task. The greater the availability of data on which to base the decision, the more likely that the task will be treated seriously (cf. Simon's 1963 discussion of satisficing). This does not necessarily guide the selection of a task, but it provides a framework within which to evaluate the likely effects of the task upon the decision process.

2.2.2 The Selection of a Decision Task

The primary task is the examination of group communication and the process of supporting this communication. As the development of experimental materials is a complex and time consuming process it is prudent to utilise existing experimental materials rather than developing new ones. To this end those developed by Reid, Ball, Morley and Evans in 1991 (see for example Reid, Ball, Morley & Evans, 1998) were employed.

Based upon a case of non-accidental injury to three children by a single mother the materials (Appendix B1) detail evidence from a case conference called as a result of the increased frequency of injuries experienced by the children, and in particular the youngest child. The case reported contained numerous arguments, evenly balanced both for and against the keeping of the family unit of mother and children intact.

The information was selected from the reports prepared by the panel of inquiry (Douet, Graham & Smart, 1982; Mildon, 1982) and divided into a series of statements, varying in length from 50 to 200 words. Reid *et al* report consistent interpretations of these statements by two independent judges as to which of three decision outcomes were advocated by each statement with rs. of between .64 and .69.

Further simulating the processes of a genuine case conference, this information had previously been divided between decision makers and presented as if from four agencies involved in the welfare of the family. Piloting of the information (Ball, 1990) ensured that the information could be distributed amongst the participants so as to give each panel member a distinct perspective, akin to the distribution of data across hidden profiles (Stasser *et al*, 1985, 1989).

An immediate advantage of these materials were that they contained a high degree of realism and complexity. In addition, the seriousness of the task material and the emotive

responses that cases of potential child abuse evoke might help increase the realism. In short, the demand characteristics of the task are such that they might encourage the participants to tackle the task in a nature above and beyond the requirements of the laboratory. That is that the participant will wish to be seen to act in the correct manner, reaching the correct decision, and conducting themselves in an appropriate way. The social pressures to act and behave in a responsible way are immense and the laboratory is no barrier to these pressures. No devolution of responsibility for the decision can be permissible in such a task, whether this be to authority (Milgram, 1963, 1974) or to other members of the decision making panel (cf. social loafing & free riding discussion in Chapter One). One final advantage of this task is that it is typical, if not in content then in form, of the type often performed via CMC, in that it involves representatives of several different agencies each with their own perspective upon the decision and with goals that might be conflicting.

2.2.3 Presentation of Decision Materials

The nature of the task is such that common experiences of decision makers are insufficient to satisfactorily resolve the problem, the nature of the decision materials is complex, and requires cross referencing. To present this data as a paper and pencil task would increase not only the decision time required by each group, but also the strain on the decision makers themselves.

Case conferences of this nature commonly occur under face-to-face conditions, with briefing folders at hand and occasionally administrative support available to locate sources of information. The decision makers themselves are familiar with the case before them, having often been involved with the family over a period of months if not years. As such they are aware of the chronology of events and the location in their files of specific incidents that may have direct bearing on the case. Replicating similar conferences in the controlled environment of the laboratory presents several problems, most notably equipping the decision makers with the knowledge required to adequately judge the case.

The ability to manipulate the content and order of information for both storage and retrieval is eased when contained in computer databases. Kiesler & Sproull (1992) show that the provision of computer technology decreases the effort required to locate specific pieces of information for distribution to other members of a decision making group. It was therefore

deemed appropriate to store the required case notes in a computerised database. A purpose written database using Apple Macintosh's HyperCard® Version 2.02 had previously been developed by Reid and reported in 1997 (Reid *et al*). Rather than developing a new system for presenting the data, the existing system was modified to meet the purpose of these experiments.

2.2.4 Computer Presentation of Decision Making Materials

Hypercard is an computerised version of the traditional 'six by four' file index storage cards. Information is stored in *stacks* of cards through which the user may browse. The advantage of Hypercard over the traditional box of six by fours is that electronic links between the information enables quick and accurate searching for the information.

The system developed for the presentation of the data reported here divided the data into two files. The first file was a reference file, common to all decision makers and presented to them as a summary of the major events in the case before. The second file was a case file unique to each panel member, containing information known to the agency represented by the participant, and unknown by other members of the decision making group. These two information files were supplemented by a help file, that gave on-line assistance in the operation of the database themselves.

The data contained in each file was chronologically ordered and presented as per Figure 2.1 (overleaf). The left hand side of the database, which filled the computer screen, contained the information for the subjects to read contained in a scrollable field. These fields (21 in the Case Notes, 50 in the reference file) varied between 50 and 200 words in length, and each ended with information regarding the source of this information.

The first two buttons provided links to the two databases not currently being viewed, the third (in the top right hand corner) opened a computer based notebook; in this instance the standard Apple Macintosh® notebook distributed as part of the Apple Operating System. This notebook enabled the participants to record their thoughts, make note of information, and if they wished compose messages to send through the electronic mail.

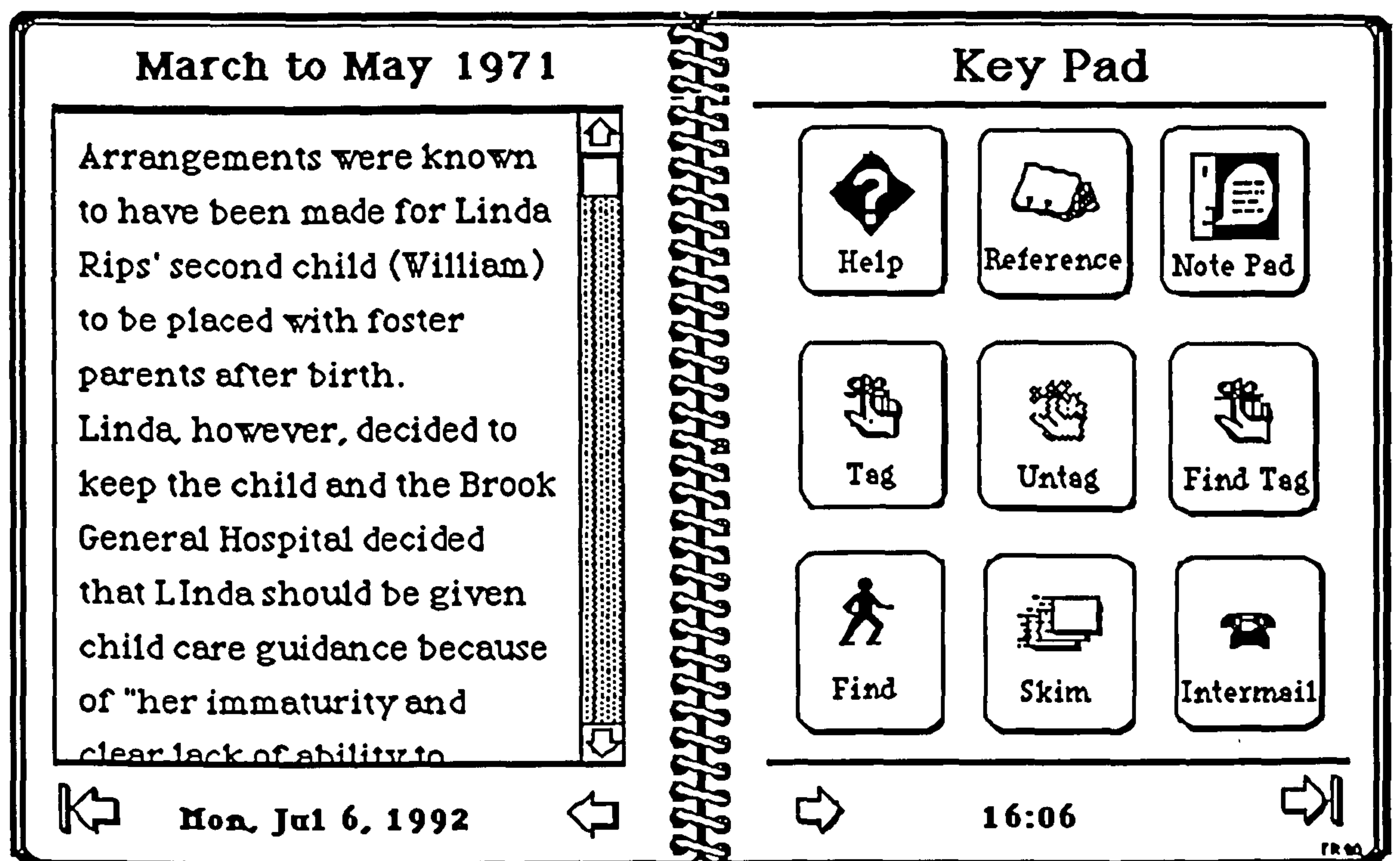


Figure 2.1: The database interface as viewed by the members of the decision making panel.

The middle row of buttons, provided a bookmarking system, the first marked the page, and signified doing so by placing a small pen icon in the top right hand corner of the screen. The middle button served to remove this bookmark whilst the third, the 'Find Tag' button searched sequentially through the database until either finding a marked page to which it would take the decision maker, or remaining on the current page if no bookmark was to be found.

The final row of buttons offered the user a search facility. 'Find' brought up a dialogue box into which the decision maker could type the words that they wished to search the current database for. This facility enabled users to seek a letter string and stop on any page of information that provided a match. 'Skim' turned every page with a short delay until returning to the page at which the 'Skim' button was pressed, enabling users to determine their location in relation to the beginning of the file. Additionally, whilst the system was 'skimming' through the database a click of the mouse button would end the 'skimming' and enable the user to read the card viewed when the mouse button was pressed. In this way a user could quickly locate information that they had seen earlier, or stop and read a piece of information that caught their eye. The final button provided a link to the electronic mail system (detailed below) to enable written communication between the groups.

Through this system users were able to read, store and retrieve information more easily than they would be using the traditional pencil and paper presentation of case materials. The facilities available in the database reduced the difficulties, and resultant increase in decision time that were expected to result from a lack of knowledge of the case materials.

2.3 The Communication Medium for CMC Groups

Of the several methods available to enable the computer-mediated groups to communicate (e-mail, chat programmes, conferencing software) the most readily available was e-mail. The e-mail system chosen for the task was Interactive Network Technologies Intermail™ Version 1.0, at it's time “the most advanced desktop communications system available for the Macintosh” (Ullman & Holt, 1986: 1). Compared to e-mail systems developed since, Intermail offers nothing more than the standard functions found in all applications, however the system has survived the test of time and was retained for use in each of the experimental chapters of this thesis. Intermail (Appendix A5) offered a good combination of speed, power and reliability but most importantly was easy to use, enabling new users to be quickly taught how to operate the system.

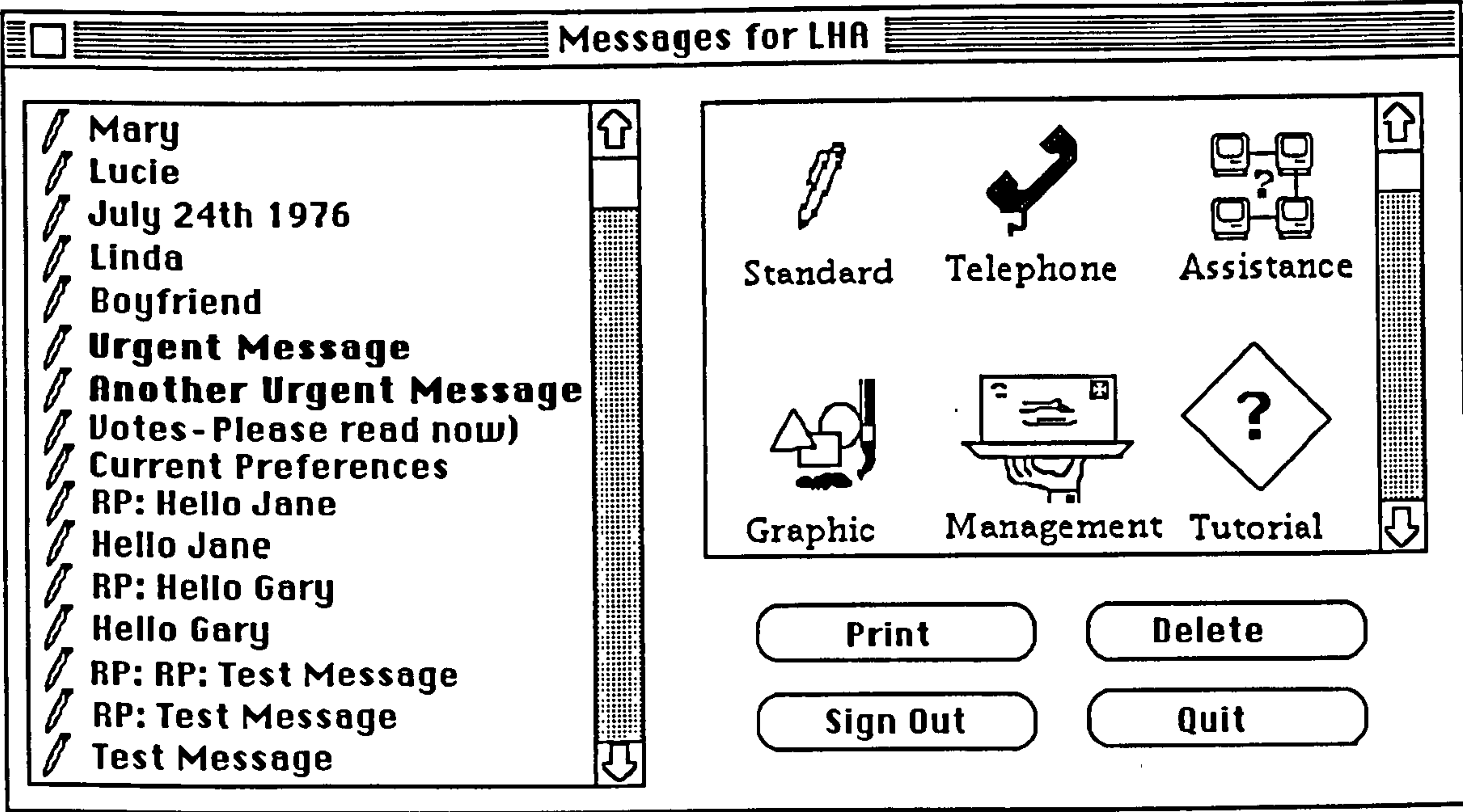


Figure 2.2: The e-mail message centre displaying after clicking the Intermail button on any of the databases.

To send a message users double clicked on the *standard* icon (Figure 2.2), this permitted the user to send a message to any user or group of users on the network. Having opened the *standard* mail message component of the application, a new (blank) *send message* window

(Figure 2.3) opened. The top left hand corner of the window displayed the complete list of possible destinations for the mail in alphabetical order.

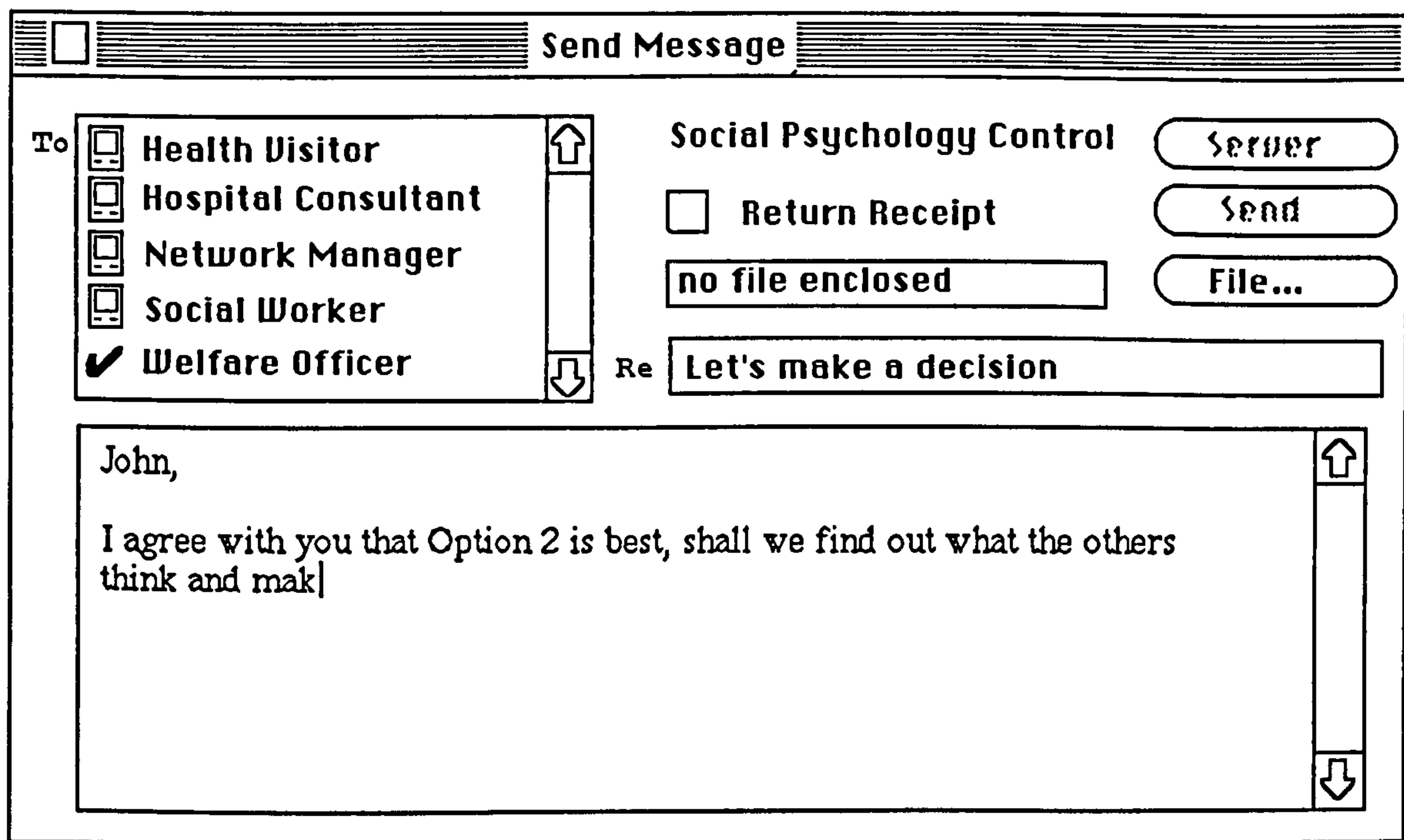


Figure 2.3: The send message window, containing a part-constructed message to the Welfare Officer, with the message header 'Let's make a decision'

The user selected a recipient for the message by clicking on the name, or names at which point the Macintosh icon was replaced by a 'tick' indicating that the named user had been selected to receive the current message. A message header (subject line, or title) was then entered to inform the receivers of the approximate nature of the message, and having pressed either *tab* or *return* to move to the main body of the message, the user typed the message itself. If the visible area for entering the message was filled, then the scroll bar became active and the user could continue to enter their message up to a limit of 32,000 characters. Finally when users were happy with their composition clicking the *send* button on the right hand side of the screen delivered the message to the intended user(s).

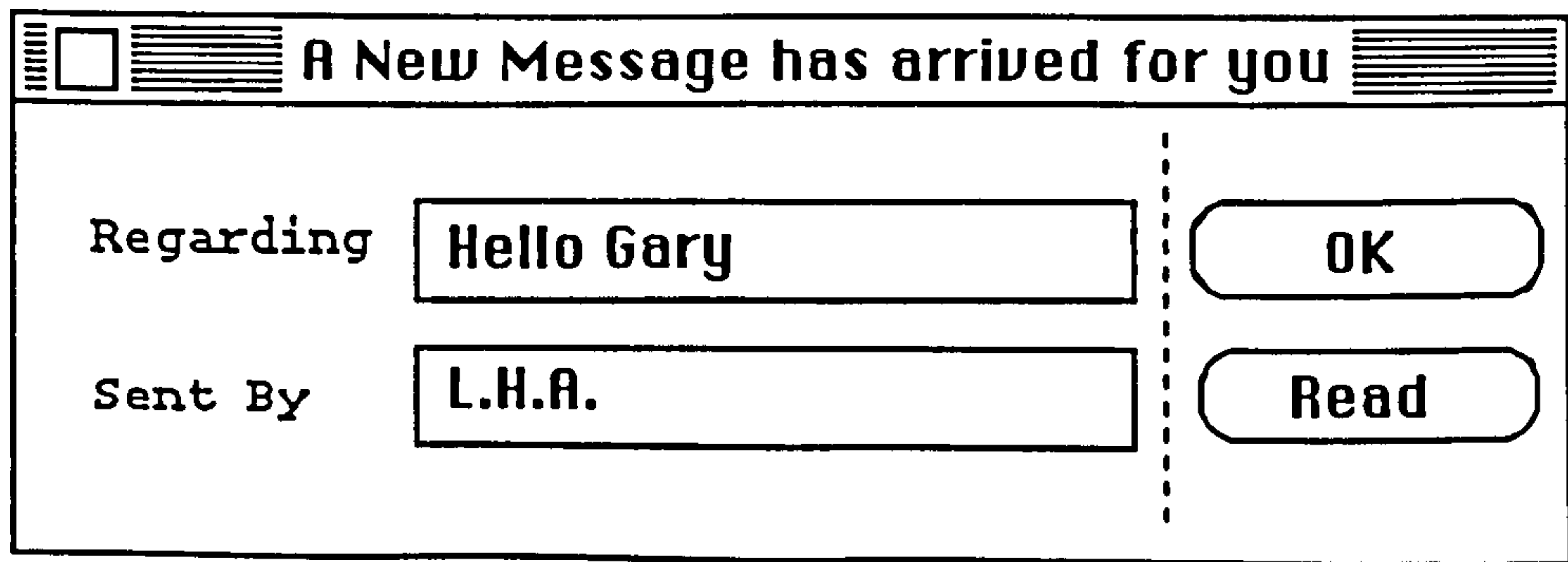


Figure 2.4: The computer display alerting a panel member to the arrival of a new message.

Upon arrival the alert box shown in Figure 2.4 was displayed and a double ring, as if a telephone, sounded on the receivers computer. The user could then either click the *OK* button to hold the message to read later or click the *Read* button to access the message immediately. Upon accessing the message a return receipt (Figure 2.5) was sent back to the sender of the message.

Return Receipt

Your Message

Lucie & Mary

Was Read By

Social Worker

At

10:59 AM

On

Tues, Dec 21, 1992

Save As...

Print

Delete

Figure 2.5: The return receipt sent to the sender of a message to inform them that the message had been read by the receiver.

Once a message was opened either through the *Read* button (Figure 2.4) or by double clicking on the title of the message from the message centre (Figure 2.2) the e-mail system presented the user with the window shown in Figure 2.6. This window displayed not only the content of the message but the message header, the name of the sender of the message and the time at which it was sent.

Read Message

From

Welfare Officer

At

9:45 am

On

Mon, Feb 01 1997

Re

Case Notes

No file enclosed

File...

I've finished reading the reference file, and I'm going to move on to the case notes. How far through are you?

Reply

Forward

Print

Save As...

Delete

Figure 2.6: The standard Read message window

Having read a message the user could either (i) close the message by clicking in the box in the top left corner of the screen and return to the database by clicking the close window box in

the top left of the message centre, or (ii) close the message and send a new message to either the sender of the last read message, or any of the panel members, or (iii) reply to the sender of the current open message. In doing this a window as per the *Send* message window of Figure 2.3 was displayed with the following alterations (a) the intended recipient of the message was preselected by default as the source of the message being replied to and (b) the message header window was filled with the header from the message being responded to, with the addition of the prefix 'RP:' to inform those receiving the message that it was a reply to the original message.

2.4 Measuring Communication in Decision Making Groups

2.4.1 Methods of Coding Communication

One of the driving forces behind this work is that the belief that the restrictions imposed by CMC on group discussion interact with other task conditions, such as demonstrability and time scarcity, to predispose computer-mediated groups to adopt a style of discussion that emphasises the goal of consensus. This might be considered to be a normative style of discussion as it consists of two discernible elements of normative influence. Firstly, the restriction on explaining and defending proposed solutions is likely to discourage complex arguments and increase the direct pressure for consensus within the group. Secondly, groups are likely to seek a basis for consensus through appeals to societal and individual concepts of right and wrong. That is, they will appeal to norms and values which function within this context as shared rules for evaluating the validity of assertions and thus permit a form of argument to be employed, that might be considered quite simple in outlook.

To enable this assertion to be examined it is necessary to consider some of the potential methodologies for exploring the content of the communication of decision panel members. Little consideration was given to the use of schemes that also account for non-verbal communication as these only serve to further emphasise the deficits inherent in CMC.

2.4.2 Schemes for coding the content of communication

The natural observation and coding of information is well established within the field. Many authors suggest that most mathematically sound methods of observational research

involve the application of some form of a systematic coding scheme (Hollenbeck, 1978). It is worth digressing slightly to consider observational techniques in general.

Three key distinctions can be drawn between natural observation and “naive naturalism” (i) reactivity, (ii) selectivity and (iii) interpretation. Natural observation acknowledges the prominence that each of these three areas plays in any observation. It is possible that the presence of the observer or the tools of the observer might lead to changes in the behaviours of interest, that is some reaction to the presence may influence the observations made. Furthermore, it is necessary to be selective about what is observed, it is not possible to account for all of the antecedents, behaviours and consequences that might occur before the observer, therefore it is important to be selective about the areas of interest. Finally, the events that are observed are only meaningful once they have been placed in a framework of interpretation.

It is essential to ensure that the observations are repeatable and that observer reliability is established. The ultimate goal of establishing both factors is to use standardised behavioural codes and for observers to be able to independently produce identical interpretations from the same observations. Reliability can be assisted through the use of operational and ostensive definitions of behaviour and through the training of the observers.

To aid the reliability of the application of a coding scheme, codes exist in a state of mutual exclusivity and are exhaustive in that all behaviours can be coded. In essence, a single code is associated with any given behaviour and every behaviour has a code. The definitions of the behaviours to be coded, which are operational definitions of the theoretical constructs that underpin the observations, specify the decision steps that are taken by the observer in their coding of the behaviour. Examples of the behaviours encourage the correct interpretation and classification of the observations with guidance rules for cases that may sit upon the boundaries of two categories.

2.4.2.1 Sources of Error in the Application of the Coding Scheme

As with any measure, true score theory predicts that the measure consists of a true measure plus error. Thus, any observed event consists of the observation of the true event plus error, where the error can be interpreted as consisting of random error and systematic error. The reliability of the observations or the precision of the observation can be effected by

a number of factors. Observer fatigue, observer boredom and work overload can all be considered to add random error to the observations and thus decrease reliability.

The validity of the observations may also be influenced by error. Systematic error in the observations or decreases in the accuracy of the observations influence the validity of the coding scheme. The extent to which observations retain their original definitions influences the validity of the coding scheme. Systematic error in the application of a coding scheme can be attributed to two main sources; observer drift and consensual drift. The former is where a gradual cognitive shift occurs, that is the initial definitions of categories becomes blurred with assimilation occurring. The latter can be seen where multiple observers drift in unison from the predetermined definitions and continue to show consensus with one another but have lost sight of the original definitions. The argument here is that observer agreement could be an indication of a systematic misapplication of a coding scheme, i.e. both observers making the same mistakes.

2.4.2.2 Reducing the effects of Error

Clearly either or both of these sources of error leads to questions regarding the nature of the data collected. However, it is possible to introduce techniques to reduce the likelihood of the sources of error occurring. A number of checks can be applied to control the influence of systematic errors and thus maintain the validity of the data. Protocols for the application of the scheme can be derived and observers trained in the application of the coding scheme to be used. Checks on the application of codes, via the blind coding of observations can be used to maintain the calibration between observers and the definitions. Repeated and regular checks of the application of the scheme can be used to identify the sources of error, and the scheme can be reapplied where required to maintain validity. The reliability of the application of the scheme can be checked via two sources, inter- and intra-observer reliability. Cross-checking of the consistency of application between observers reveals the extent to which a coding scheme is applied consistently over time. Whilst the similarity of the application of the coding scheme by two or more observers enables an assessment of the between-observer reliability to occur. Overcoming the problem of the systematic misapplication of a coding scheme requires a comparison with a previously established standard.

Statistical assessments of the application of coding schemes can be undertaken to quantify the reliability of observation. Simple agreement calculations that consider the percentage agreement of two (or more) observers are flawed (Hollenbeck, 1978) in that as the likelihood of a behaviour increases so does the probability of it being similarly coded by a second application of the coding scheme. The key source of error in such an assessment is that it fails to take into account the underlying rate of chance that two observations might apply the same code. Such an error may be overcome via the application of Cohen's kappa, an index of concordance that measures the accuracy of two (or more) observers in relation to the chance levels of agreement.

$$\text{Kappa} = \frac{\text{Simple Agreement} - \text{Chance Agreement}}{1 - \text{Chance Agreement}}$$

Equation 2.1: Cohen's Kappa (Index of Concordance)

2.4.3 Existing Schemes

There is little reason to suggest any deviation from this accepted mode of practice, i.e. the application of a coding scheme. Indeed, initially it is useful to concentrate upon the selection and application of a coding scheme to enable the interpretation and analysis of communication. A consideration of alternative methodologies and their potential influence upon the data will be made during the general discussion (Chapter 8).

By way of example, the Conference Process Analysis coding scheme (Morley & Stephenson, 1977) provides a set of rules for breaking down communication into a series of 'acts', where each act conveys a single point within the discussion and is categorised on three dimensions: Mode, Resource and Referent. *Resources* consider the procedure through which the discussion is being held, information, irrelevant information, acknowledgement of another's contribution, whether positive (praise) or negative (criticism) and outcomes which reflect any settlements or agreements reached. The *mode* dimension of the scale reveals whether the communicator is offering, seeking, accepting or rejecting a resource. Finally, the *referent* dimension considers the person being referred to by the act, whether it is the speaker, someone else who is present, a third party or no-one. In addition to permitting an analysis of the communication within a category, the analysis may occur across combinations of the categories both within

and across the three dimensions. Such an approach has been shown to be both reliable and valuable in a variety of settings.

Other indices of the style of communication, for example, Rutter and Stephenson (1977) or Rutter, Stephenson and Dewey (1981), have employed a variety of measures including the number and length of utterances, total words spoken, number of turn changes, the ratio of nouns to verbs, number of questions asked, requests for attention and speech disturbance ratios.

Another approach is to apply what might be considered transitional schemes. These schemes examine the occurrences of given behaviours at time n and time $n + 1$ have been employed to explore the sequences of events, for example Olson *et al* (1992) where the coding of design group meetings was represented as a series of simple probability in conjunction with transitional probabilities. Elsewhere, where it has been deemed necessary to consider more complex sequences of behaviour, lag sequential analysis (see for example Bakeman & Gottman, 1997) has been employed to consider the transition of acts beyond a simple, step-by-step approach over two immediately adjacent times.

Alternatively, analyses can concentrate on the conversational component of the discussion, indeed, such approaches may be considered to be dialogue analyses. Conversation games analysis (Kowtko, Isard & Doherty-Sneddon, 1991) was developed to explore the pragmatic inference in map task dialogues which each accomplish speaker's goals and subgoals. The perceived function within the conversation of the speakers' utterance determines its' categorisation, a categorisation which accounts for factors such as the semantic content of the utterance, the intonation of the utterance and the location of the utterance within the overall dialogue.

There are many benefits to be gained from the adoption of any of these approaches, however, the adoption of an approach to the coding of the communication is guided by the assumptions underpinning this work. There is an assumption underlying the drive behind this thesis that normative and information influence will co-occur and will interact in a fashion that is often both complex and subtle. A single remark could simultaneously convey not only a preferred position (normative) but also factual evidence (informational influence), as such classifying the remarks on the basis of their dominant influence, as per Kaplan and

Miller (1987), enables utterance units to be classified *either* as being primarily normative if they express specific decision preferences or reflect norms and values *or* informational if they refer to inferences drawn from the information available or directly quote this material

2.4.4 Developing the coding scheme

2.4.4.1 The development of and rationale behind coding communication

The scheme was developed by the author in conjunction with the external consultant, Dr. Linden Ball at the University of Derby. The development occurred over a period of time using transcripts and details from existing experiments that are not included within the chapters of this thesis. This development involving the double coding of communication and the identification of areas where problems occurred in the application of the codes with different approaches to the resolution of conflict tested to enable the final version of the scheme that is used in the course of this research. It has been used elsewhere for similar experiments (Reid, Ball, Morley & Evans, 1997) and involves identifying the smallest component of a sentence that conveyed meaning, referred to as an utterance unit.

All statements within the transcripts are parsed into "utterance units" during the actual encoding process. An utterance unit is defined as the smallest statement that meaningfully conveys some influence of a normative, informational or non-specific nature. Such utterance units often exist at the sentence level. It is possible, however, for utterance units to exist as subparts of sentences - but only when they could exist at the sentence level and retain the same essential meaning by the deletion of a one-or two-word connective or relation such as: "and", "or" "but", "because", "although", "and thus", "and so", "since", "however", "therefore" and/or the addition of an appropriate noun or anaphoric pronoun.

The only cases in which these latter criteria do not apply is for conditional statements, that is utterances involving constructions such as "if then", ".... if", "if and only if then" and ".... only if" or statements expressing other dependencies such as "either or" constructions.

It should be noted that these parsing criteria are only presented as a means to ensure reliable encoding and it is appreciated that in reality the omission of linguistic relations alters

certain important semantic aspects of a statement. It is believed, however, that the normative or informational aspect of the utterance remains unchanged through such deletions.

Once broken down into utterance units all communication, whether verbal or written was classified as one of nine high level communication categories. These consisted of two informational, two normative and the five of categories and a list of utterances that should be left uncoded by the scheme.

2.4.4.2 Introduction to the coding scheme

The coding scheme used is based upon a scheme reported in brief by Kaplan and Miller (1987; see also Kaplan, 1987) which was used to categorise communications arising from decision-making groups discussing issues of a moral and judgmental nature. The main similarity between this new scheme and that devised by Kaplan and Miller lies in the fact that the present one pivots crucially around their high-level distinction between informational and normative utterances (see below for definitions) and encompasses in many essential respects their full set of intermediate-level coding categories.

Informational influence "is based on the acceptance of information from others as evidence about reality. Shifts are attributed to the sharing of relevant arguments and factual information about the judged issue". Whilst normative influence "is based on the desire to conform to the expectations of others. Judgement shifts are assumed to result from exposure to others' choice preferences and from subsequent conformity to the norms that are explicit or implicit in these preferences". Utterances that are neither informational nor normative are non-specific in nature. The informational/normative distinction stands as an attempt to capture the different modes of influence which group members use during discussion and follows from Kaplan and Millers attempt to categorise all communication. In addition to the categories directly developed from Kaplan and Miller's categories a number of intermediate-level categories are included in this scheme in order to enable the categorisation of utterances that appear to have arisen because of the task-specific characteristics of the case conference set-up, namely the computerised database, audio monitoring equipment, e-mail facilities etc.

A final point that is important to stress is that the limited amount of detail that is obtainable on Kaplan and Miller's scheme has meant that this scheme, whilst employing similar coding categories, may well be different in terms of the criteria that have been adopted

for placing utterances in one category or another. In an attempt to maximise the reliable application of the coding scheme strict criteria are applied to the categorisation of utterances - including ambiguous cases (See Appendix A3) for the full coding scheme).

2.4.4.3 Informational Influence

Developing this distinction between informational and normative influence, each category can be sub-divided into two further categories. Informational influence is further considered to be either a Citation of Case Fact or Inferences from the Case Information. Citations of Case Fact (CIT) include statements directly citing factual information that is provided in the case material for example "the flat was found in a filthy state" or a dead mouse was found in the kitchen". Such utterances are easily spotted since they arise when the participant, in the FTF condition, directly reading out sections of case material or types it into an e-mail in the CMC condition. Also categorised as CIT are statements indirectly citing factual information that is provided in the case material (e.g. "She was also, uhm, charged with, uhm, possession of a prohibited drug, this girl"). Such statements arise when the subject recalls previously read case information. For such utterances to be coded as CIT they must be accurate renditions of case facts - though it is permissible for such facts to be conveyed in a slightly more abstract and schematised form that contained in the case book (e.g. " Linda was not very keen to have a stranger in to help with the cleaning").

Also conveying informational influence is communication considered to be an Inference from Case Information (INF). These consisted of statements expressing facts not given in the case material but inferred from those given, regardless of whether the inference was accurate or inaccurate, for example, "...but then she has been given a chance before") or descriptions that convey the general nature of a number of case entries such as, "Yeah mine's all about like sort of the injuries.

Also included as INF were statements expressing personal views and opinions (apart from those defined within the VAL and PREF categories) even when such statements appear to be accurately based upon case information. It is more often the case, however, that such statements over-generalise the true nature of case facts ("It's like she doesn't care"). Finally, statements that convey inaccurate or fabricated case information. Such statements might be uttered with sincerity and possibly reflect the operation of unconscious processes aimed

toward maintaining prior beliefs and attitudes. Appendix A3.3 provides further examples of the forms of communication included in each category along with notes on the more detailed constraints of their application.

2.4.4.4 Normative Communication

The other main category within the coding scheme concerns normative influence. The first of these categories (VAL) includes all statements directly conveying personal values of right or wrong in actions, outcomes, circumstances or attitudes or directly conveying or indirectly making an appeal to societal norms of right or wrong in actions, outcomes, circumstances or attitudes.

Examples of VAL would be utterances such as, "I mean parents do slap their children" or "lots of children get dirty". Kaplan & Miller (1987) state that "social norms represent the shared expectations about what someone, self or other, ought to believe, feel, or do in various circumstances ... exerting pressure to conform to such norms is one means of attaining consensus and establishing social reality, about what is ethically, behaviourally or aesthetically appropriate, given the lack of a demonstrably correct answer". The VAL category endeavours to capture the communication that conveys these beliefs.

Additionally communication that strongly alludes to or explicitly declares one's preference for one or more of the available options or strongly alludes to or explicitly declares one's preference for some option that is not even available. PREF also includes utterances that explicitly state a lack of any particular preference, "From reading my notes I think that they all ought to be taken into care".

Furthermore, statements directly requesting the current preference of one or more of the other conference members or requesting their opinion about any option, regardless of their availability as a group decision. For example: "What are your views at the moment?" or "So do you think it's a good idea to take away the youngest child?". Finally, also included in this category are statements applying normative pressure to reach a specific verdict (e.g. "do what the majority thinks is right").

These four categories, two conveying informational communication (CIT & INF) and two normative influence (VAL & PREF) encapsulate the majority of communication. All other communication is coded into one of five remaining categories.

2.4.4.5 Miscellaneous Communication

Statements that apply pressure upon the group or an individual to perform certain actions or reach a decisions, but not any particular decision or outcome such as "if we can get this done we can go home" or "Who are we waiting for?" are categorised as conveying non-specific pressure (PRESS).

Communication that refers to the rules, procedures and requirements that have to be followed by the group as stipulated in the experimental instructions, "should we make a decision now?", or statements referring to procedural aspects of the task that are instigated by members of the case conference are considered as Procedural Communication (PROC). These utterances occur at the level of two or more individuals, for example "So I guess what we ought to do now is to keep going all through our notes". This category is aimed at encoding utterances that coordinate activities at a group level. These are different to statements conveying personal intentions to engage in some action or procedure (e.g. "I'll send more details soon") or those that convey an instruction to another person to pursue some action or procedure (e.g. "Could you please repeat your last message"), these are coded as MAT. The Materials, Context, Computer (MAT) category also includes all communication that refers to the experimental set-up, laboratory context and materials, such as "see you've got different case notes, haven't you".

Additionally, MAT statements express knowledge or opinions about the computer itself, it's operation or one's interaction with the database, the e-mail system or the Notepad or utterances that locate a participant in relation to the database (e.g. "I'm reading notes from March 1974"). Similarly, MAT statements include those that temporally locate the occurrence of some event either in general terms (e.g. "Here's something that was written after the children were taken away" or "that was before the first child was born"). Finally, communication that refers to the original reporter of some event or opinion, "this is from the second health visitor", are also encoded as MAT.

Given the nature of the case materials, participants may call to some extent on the legal information (LEG) that is contained in the reference files, any information pertaining to the legal issues surrounding child welfare, care orders or the fostering of children is coded as a LEG.

The final category includes all comments such as "What lecture have we got this afternoon?" that are essentially irrelevant to the task, or at best unrelated. These statements may serve essential social functions relating to group cohesion or tension release that are interesting in terms of the establishment and operation of the group but are essentially unrelated to the task. These utterances, and those that are either nonsensical or statements that do not fit into any other category are categorised as Other Communications (OTH). It is important to note that this is not a 'catch-all' category as there are a number of utterances that remain uncoded (See full coding scheme in Appendix A3). The rationale behind leaving some utterances uncoded is that they are frequently ambiguous and therefore reliably determining their membership of an informational, normative or non-specific category is problematic. It should be noted that an analysis of case conference utterances using Bayles' scheme or at the level of speech acts (see, for example, Searle, 1969) might be more appropriate for picking up details of the illocutionary intent of speakers when they use such utterances as above. It is argued here, however, that the present analysis which omits classification of such utterances is still entirely legitimate as a means of providing a very good estimate of the relative amounts of normative and informational influence arising in case conference communication.

In addition, to the high level categories described above all communication is also classified at a low level according to whether it is a direct assertion (da), a question to one or more conference members (q), or provides an answer to a question posed by another person, (a).

It might appear from the presentation of the scheme that all utterances can easily be coded within one of the communication categories. However, within the face-to-face conditions it is possible due to interruptions or simply where a speaker trails off for utterances to remain incomplete or be interrupted. Statements which are fragmentary in the transcript because of sound distortion on the original tape recording are left uncoded unless the gist of the missing

verbalisation can be inferred from its context with a high degree of confidence by the coder. The same strategy is adopted when a speaker has been interrupted in mid flow by another speaker. If, however, the interrupted speaker subsequently completes the utterance then only a single coding is applied to the two fragments of the broken utterance unit. Other statements may be incomplete because the speaker simply tailed off and failed to complete them. Further details of the coding of problematic utterances, such as rhetorical questions are provided in Appendix A3.9.

2.4.4.6 Examples of Coding

To aid the interpretation and understanding of the application of the coding scheme it is prudent to consider some examples of the parsing of statements into utterance units. These are presented below, along with, where appropriate, notes explaining the encodings.

Yeah, [uncoded] I don't think that she'd actually harm her children (INF.-da) / because she's, she's very passive toward them. (INF.-da)

Example 2.1

In example 2.1, the information contained in the utterance conveys information from the databases but without directly quoting the materials. The information is inferred from the case notes, as is coded as such. The longer example 2.2 includes some utterances that are left uncoded.

Yeah, [uncoded] I've got one here from January to May 1978. (MAT-da) / It says that [uncoded] Miss Rips' personal hygiene leaves much to be desired (CIT.-da) / but she is keeping her flat tidier at the moment with the help of the home help. (CIT.-da) / She has also made friends in the area at the moment, (CIT.-da) / er, which are exerting a positive... (speech interrupted briefly by other speaker but then continues) ...influence on her life. (CIT.-da)

Example 2.2

In addition to the non-coding of some utterances, a number of the parsed units can be directly tracked to entries from the case materials and are direct quotes (CIT). The other practice of note, is the continual coding of a single utterance which is interrupted. The same treatment of the utterance would have occurred had the speaker paused to relocate the

information they were reading, or paused for another reason such as answering an e-mail or sneezing.

2.5 Developing a paradigm for real time intervention in the decision making process of computer-mediated groups

The key focus of this research is the feasibility, rather than development of a support system to assist computer-mediated decision makers communicate in an efficient manner. Although one might consider the development of an approach to be the key area, “in any period of rapid technological growth and innovation, the first priority is to demonstrate that an idea is feasible at all”, (McCarthy & Monk, 1994) therefore it is the possibilities for, rather than the actual development of, support which forms the central focus of this work.

The development of a fully operational system and concentrating upon language processing would leave the key question of impact that it has upon the end users unanswered. The focus of attention must therefore turn to the development of the system and the measurement of the effect upon decision makers. This does, however, raise an important question, how can the assessment of a Group Communication Support System reliant upon natural language processing take place without first establishing an operational language processing system? The answer to this is twofold, the first issue is the merit of developing a system without fully understanding its benefits (or otherwise) to the potential user(s) of the system. The second part of the answer relates to the increasing use of such an approach.

An increasing number of systems have been developed from the perspective of the computer software engineer, examining the technical capabilities of the system and placing this as the foremost concern of the development team. Increasingly this approach has been seen to neglect the final and most important component in the system, that of the end user. Although several systems have been developed that demonstrate considerable theoretical benefits to the user(s) of a system, the implementation of the system will falter if i) the end user perceives the system to have little or no utility, ii) the system requires operating in a way that is either alien to the user or counter-intuitive, or iii) requires great complexity in its operation.

Examples of systems that have faltered in their implementation as a result of one or all of these issues are manifold (cf. COLAB and COGNOTER, Stetik, Foster, Bobrow, Kahn,

Lanning & Suchman, 1987; COORDINATOR Winograd and Flores, (1988) and the failure of the London Ambulance Service Callout System: Patel, 1993)

Two possible approaches can be adopted to decrease the likelihood of such abject failure of a developed system. The first approach is to incorporate the opinions, operating practices and experiences of the end user earlier in the designing of the software (cf. the 'Scandinavian approach' to CSCW development Chapter One). Such an approach has already seen a surge in popularity (Eason, 1994) which has coincided with the inclusion of psychologists and other social scientists in design teams. The second approach is to adopt greater iterative testing of the system, earlier in the development of the overall package. The approach advocated here is more than just beta testing of equipment, it involves bringing the end users into the laboratory during the development of the computer system, to enable various system configurations to be explored *before* the commitment to a particular line of development is made. Although this requires an early identification of potential end users, this reduces the commitment in terms of finance and time spent on a product before the critical decision to terminate or proceed with a line of enquiry is made. Theoretically this decreased commitment to the development of a particular product, should enable greater objective assessment to be made and decrease the pressure to continue due to the already committed resources. (cf. Janis' discussion of the escalation of the Vietnam War, 1982: 102, 105, 112)

The earlier testing of systems requires methodological issues to be addressed. Notably, how to test a computer system that has not yet been written? The answer to this question, is to develop partially automated systems that can then be supplemented through manually operated components. Taking the analogy of structured programming a stage beyond its usual visualisation, rather than writing each 'procedure' and 'sub-routine' for incorporation in an overall software package, the approach here developed only those 'units' of the software that were essential to the system and/or easy to implement. Any remaining components can be simulated using a mixture of manual inputs and external supported units.

2.5.2 The Oz paradigm for Human-Machine Interaction

The approach advocated here is not entirely new, in 1984 Kelley demonstrated the practical benefits of the adoption of such an approach in developing a Calendar Access Language (CAL). The paradigm, referred to as the OZ paradigm, involves a partially automated system supplemented by the experimenter or 'Wizard' performing as a unit within the system. The functions of the 'Wizard' are those components not yet developed within the CAL system, in this case natural language processing. This enabled early testing of the computer system, without the investment required to develop a fully operational system. In this case, the 'Wizard' acts as part of the computer system, a computer system with which the user is themselves interacting. To some extent this is almost a Turing test (Turing, 1950) in reverse. In Turing's original test, computers were assessed on their ability to convince a human user, asking questions of the system, that they were interacting with another human. Here the system actually contains a human component acting to all intents and purposes as a computer, the traditional approach of designing computers to behave as if human has been reversed and here the human responds as if a computer. In doing so the system gains the high level processing capabilities required without the investment costs traditionally associated with such a development.

2.5.3 MIMICS

Kelley later developed a fully automated version of the CAL system, but only having first determined the effectiveness of the system through the use of the OZ paradigm. In developing a GCSS to support communication between members of a distributed decision making group, the demands placed on the system are slightly different to those required by Kelley. The users of CAL communicated not with each other, but directly with the computer (albeit supplemented by the Wizard) addressing questions to the system itself. The requirements of this research are a system which is not addressed by the users but offers unsolicited advice as to how best to proceed in their communication. The system must therefore monitor all communications, encode the utterances, draw comparisons between the current state of the communication process and a desired 'target' state of communications and relay these differences to the users in an effective manner. The coding of communication and the

intervention on the basis of the analysis of the communication must all occur within real time. It is to the implementation of such a system that is now addressed.

2.5.4 Implementing the methodology

Three main barriers needed to be overcome for such an approach is to be successfully implemented. Firstly, the system had to surreptitiously intercept any e-mail sent by one decision maker to another thereby avoiding distracting the decision makers from the task at hand. Secondly, the interception and encoding of the communication had to occur without delaying the communication between the decision makers. Thirdly, as the language processing is not automated but performed by a human component in the system, the resultant effects of any excessive experimenter workload upon the reliability of communication interpretation has to be addressed.

The first of these requirements was easily met, given that the computers required networking to enable electronic mail to be sent and received, the addition of an extra machine to the network presented no problem. The concept of mail servers is long established, as such diverting all the mail via the support machine easily accomplished. Users with low level knowledge of a computer network might be expected to hold an impression of the network like that provided in Figure 2.7

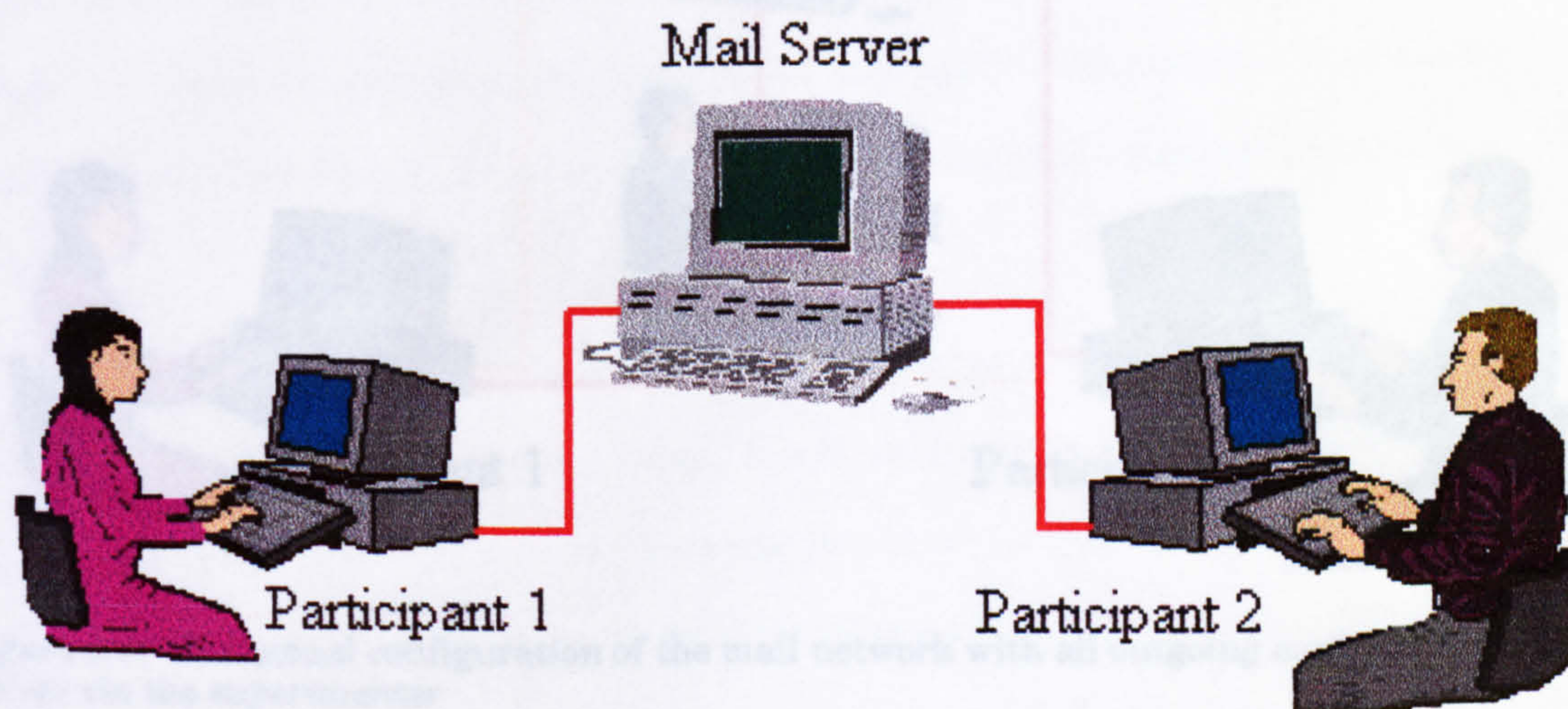


Figure 2.7: The perceived network as envisaged by the decision makers.

Here the communication between the two users within the network is maintained by the mail server that sits, unseen, between their machines. The standard procedure behind the composition and sending of e-mail requires the 'sender' to determine a receiver or destination

for the message, to compose the message and to define a header or subject line that informs the 'receiver' of the message content.

The defining of a destination often takes the form of selection from a list of predetermined mail addresses already entered by the user. A user mailing to Jo.Doe@plymouth.ac.uk is unlikely to have to enter the full mail address and is likely to have configured the system to send to the user Jo. The alternative method is to have a list of destinations already configured, that are presented as a list and the required destination selected from the list of available destinations. The second form is common on local area networks (LANs) whilst the first is more prominent on systems connected to the Internet. By selecting a system commonly found on LANs, it was possible to add to the list of 'receivers' the computer system itself under an alias. This simple, though effective manipulation created no discernible difference between a user operating a traditional configuration of the e-mail system, and the user who was having all their mail intercepted (Figure 2.8)

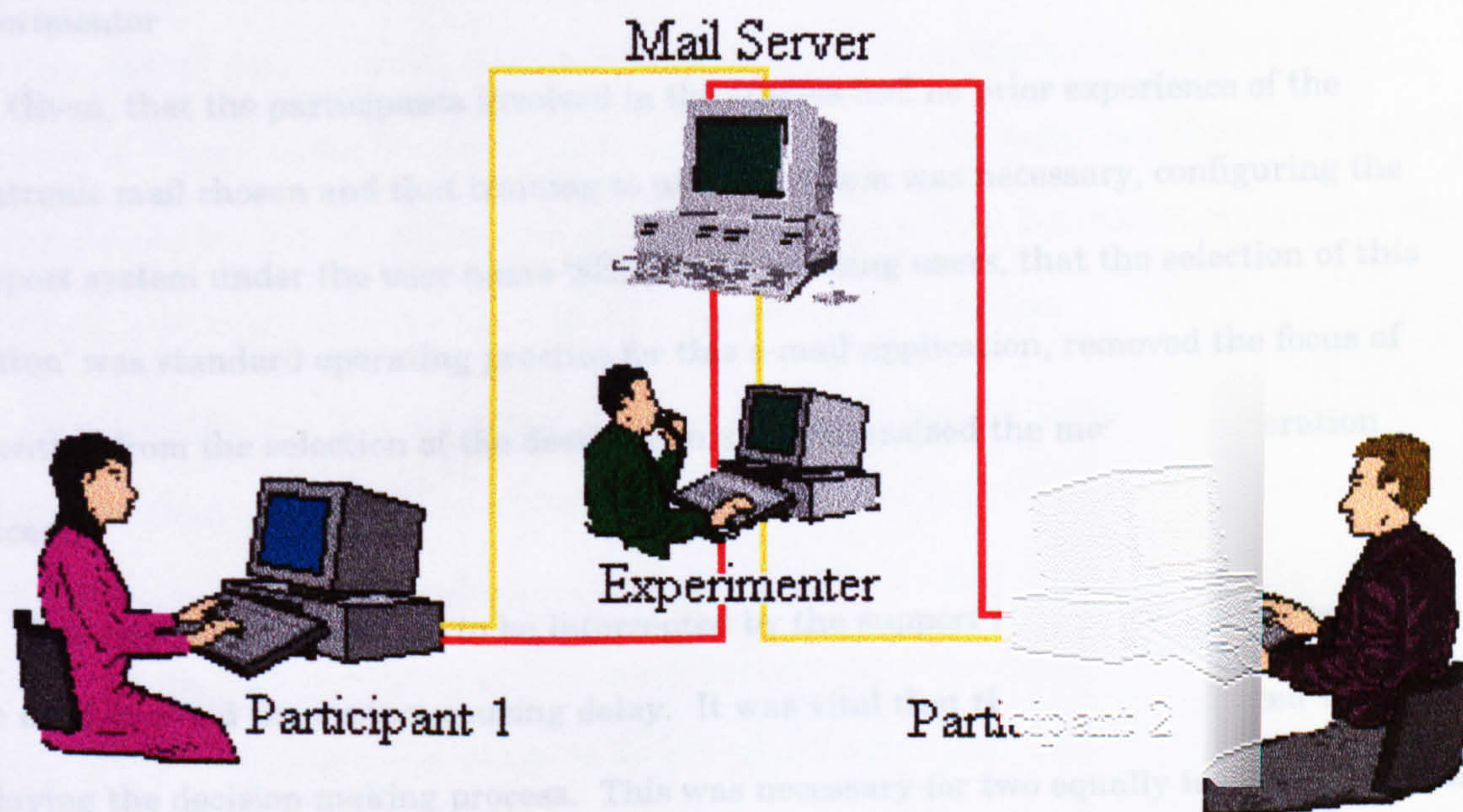


Figure 2.8: The actual configuration of the mail network with all outgoing mail reaching the server via the experimenter

Here, rather than all mail travelling direct to the mail server, each participants machine communicates with the experimenters, who forwards all mail on to the intended recipient via the mail server. Through this configuration of the messaging system, all messages were directed to the support system, and the system merely forwarded the mail on to the intended

destination, having first processed the required information. The e-mail window presented to subjects appeared (Figure 2.9) to all intensive purposes a standard e-mail window.

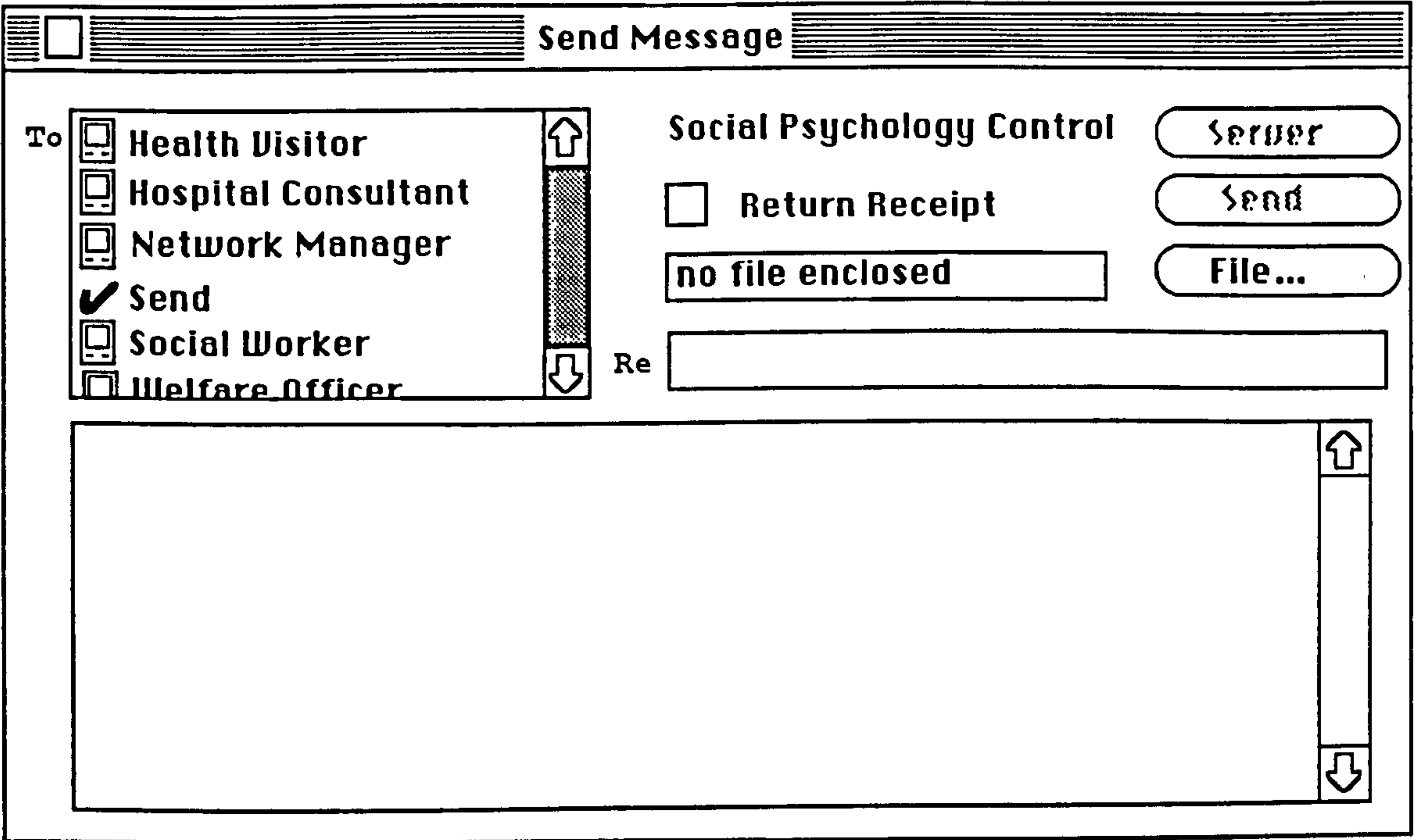


Figure 2.9: The e-mail *send* window modified to permit all mail to be diverted via the experimenter

Given, that the participants involved in the studies had no prior experience of the electronic mail chosen and that training to use the system was necessary, configuring the support system under the user name ‘SEND’ and teaching users, that the selection of this ‘button’ was standard operating practice for this e-mail application, removed the focus of attention from the selection of the destination and emphasised the message generation process.

This enabled the message to be intercepted by the support system. A related issue was the need to avoid the system causing delay. It was vital that the system operated without delaying the decision making process. This was necessary for two equally important reasons. Firstly, as has been shown by the analysis of the data corpus, decisions reached through computer-mediated communication (CMC) require considerably longer than those conducted face-to-face (FTF). Secondly, if the system was to benefit the decision makers, increasing the time taken to communicate between decision makers is unlikely to endear the system to the end users. Previous experiments examining this have shown that where a system hinders the decision making process, the users of the system are likely to either operate practices that circumnavigate the hindrance or stop using the system altogether.

Thus two critical issues effect the time taken to process the communication between decision makers i) 'real' delays as a result of the intervention and ii) 'perceived' delays as a result of intervention.

The nature of electronic mail is such that once an e-mail is sent a user has no control over the time at which the intended receiver reads the message. Although most systems provide a signal to alert the receiver to the presence of a new message, and some permit priorities or levels of importance (e.g. Urgent) to be assigned to each message, the 'receiver' has ultimate control over when they read the message and when, if ever, they respond. Although 'receipt confirmation' exists to enable the sender to be alerted that a message has been read, if a delay has occurred, there is no way of knowing whether to attribute the delay to the system or the receiver. As such delays in delivery of messages are more likely to be attributed to the receiver than the system, especially if the reliability and speed of the system can be demonstrated prior to the decision making task commencing.

Delays to the message as a result of the processing of the content of the communication are more problematic. Assuming that the time required to determine the content of a message is related to the length of a message, and that the messages sent through electronic mail are more likely to be short messages (one to ten lines) than long messages (greater than ten lines), processing time does not offer a large delay to the system.

An examination of the literature reveals that e-mail based discussions often contain some lengthy messages conveying considerable levels of information thus a method that avoids delays is desirable. Given that each message is sent to the intervention system, a simple solution exists, that of copying each message and storing it for content coding, whilst immediately delivering the message to its intended destination. This satisfactorily achieves the goal of both no 'real' delay as a result of the system and no 'perceived' delay resulting from intervention.

The last issue is perhaps the most important, although two independent raters have been shown to apply the coding system reliably, previous content coding was performed without the any time pressure on either coder. In the paradigm outlined coding of communication content must occur in real time, the detailed coding scheme can still be referred to, to resolve uncertainty, however, the added pressure of time might increase both assimilation and drift.

Evidently reducing group size from four to two reduced the messaging levels and ensured that the workload demands placed upon human component of the system were kept to a manageable level. Thus a paradigm is presented in which HuMan Imitates Machine in Computer Software (MIMICS) enabling real-time interventions in the decision panel communications to occur.

To summarise, all communications between the users were intercepted by the system and coded by the experimenter. The codes were then used to provide support to the users in the form of communication feedback. Of course, to evaluate the extent to which human error in the application of the coding scheme can be seen to influence the data, further checks of coding of communication content are presented prior to the results from each experiment. Ensuring the integrity of the application of the scheme is essential to the interpretation of the findings, and further discussion of the possible effects of the human component are discussed later (Chapter Eight).

2.3.5 Operation of MIMICS

Figure 2.10 summarises the main functions of the operation of the MIMICS paradigm giving a general overview of the main processes performed by the experimenter and by the automated components of the system.

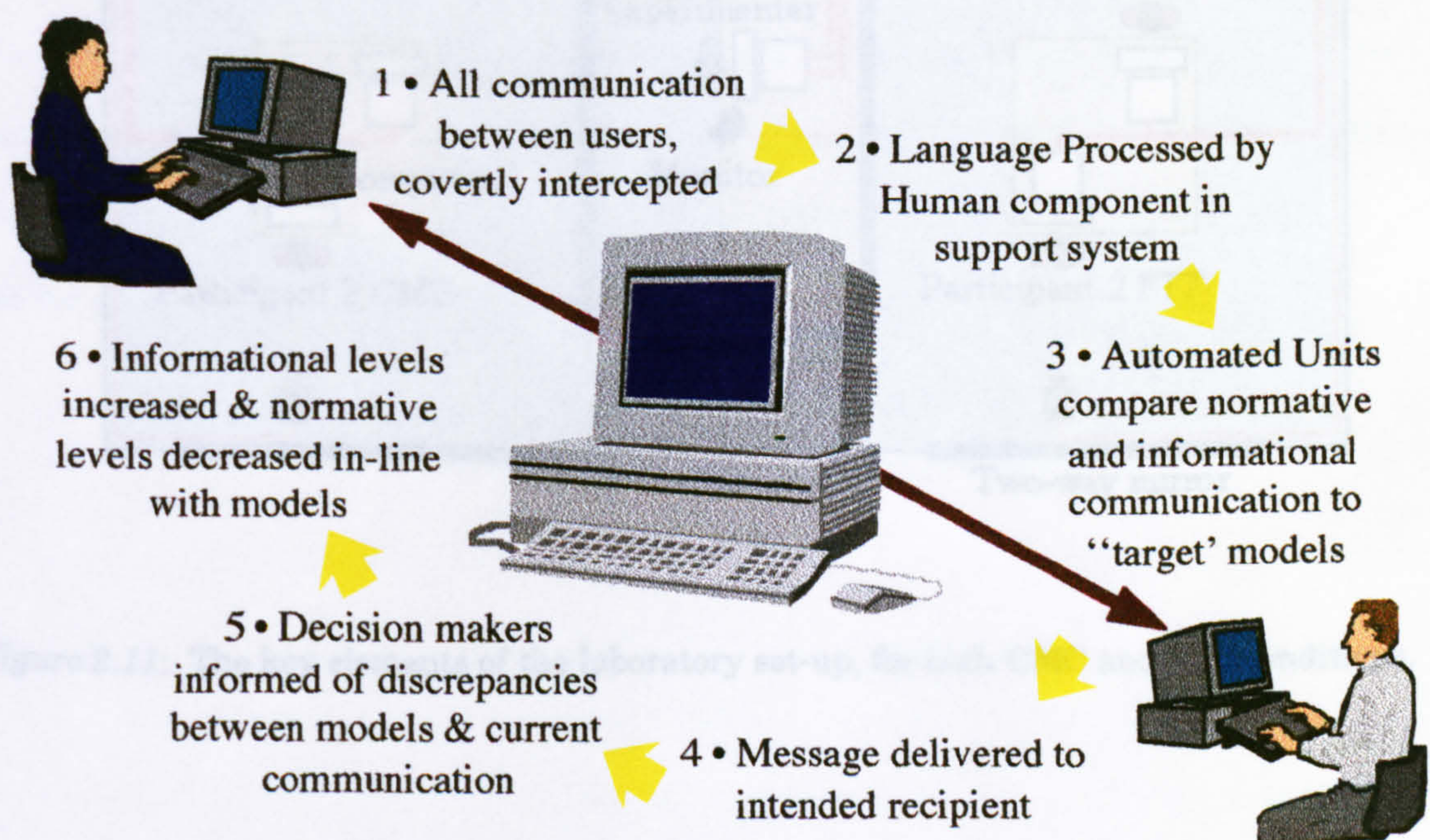


Figure 2.10: Summary of the general process of MIMICS

The MIMICS process is a six stage process involving the interception and subsequent delivery of the e-mail (1 and 4), the coding of the communication and comparison to target levels of communication with the support system (2 and 3) and the feedback and subsequent hypothesised changes in communication levels (5 and 6). For the sake of space the figure uses the term 'models' to describe the impression of the communication states held by system, however, at this stage of the development of support these are target levels of communication rather than any complex model of the communication process. Such a figure only permits a general impression of the nature of the paradigm to be understood. To fully understand the operation and operators at each stage of the process of intercepting, coding and intervention it is necessary to follow a single message through the paradigm examining the actions that occur at each stage.

Utilising what has become an almost standard laboratory set-up for these type of experiments (Figure 2.11) the experimenter sits isolated from the participants, able to observe the process of the decision via a series of cameras.

Figure 2.11: The control room layout and views of the experimenter

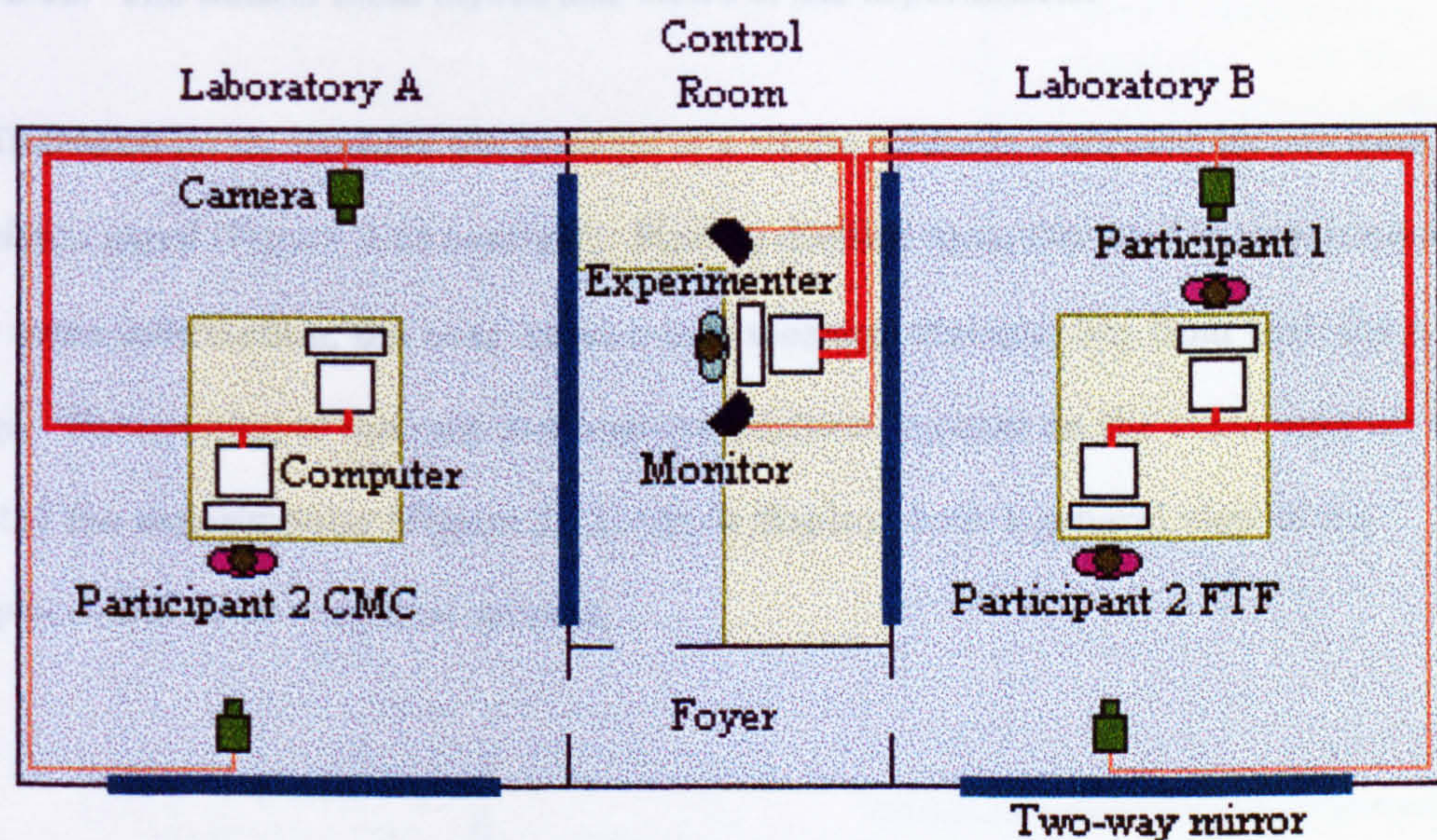


Figure 2.11: The key elements of the laboratory set-up, for both CMC and FTF conditions.

The laboratory can be set-up to enable the experimenter to observe the detail of the decision, down to the level of the current on-screen activity of individual participants in addition to monitoring the mail server and other computer based equipment (Figure 2.12).

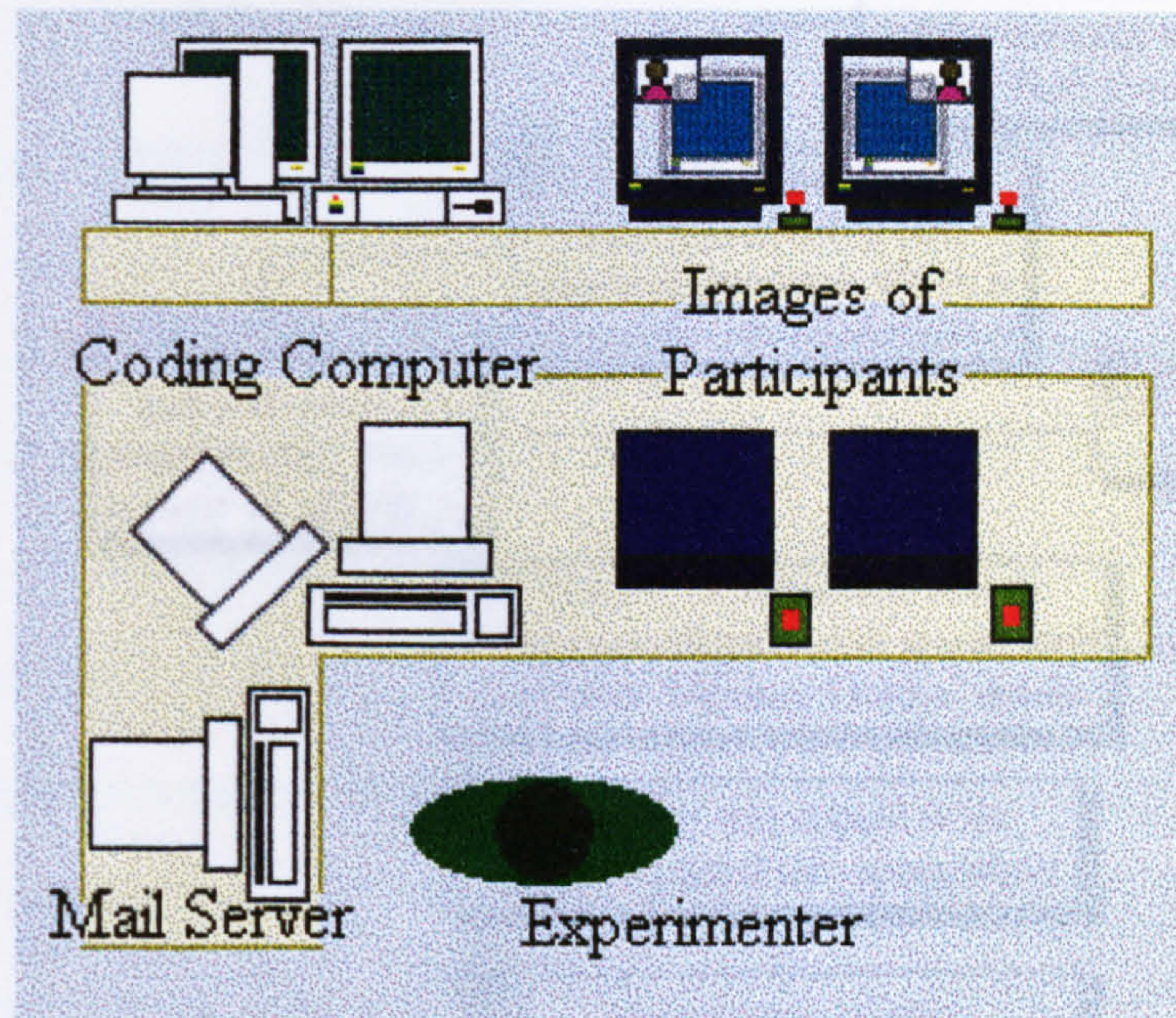


Figure 2.12: The control room layout and views of the experimenter

Therefore let us consider the passage of a single message composed by one member of the decision panel (Figure 2.13 overleaf). Having decided upon the need to communicate an idea or some information, the user opens a new message dialogue box from within the e-mail package. The opening of the new message composition appears on the video monitor situated in front of the experimenter (Figure 2.12) which displays both a general view of the participants and their computer screens.

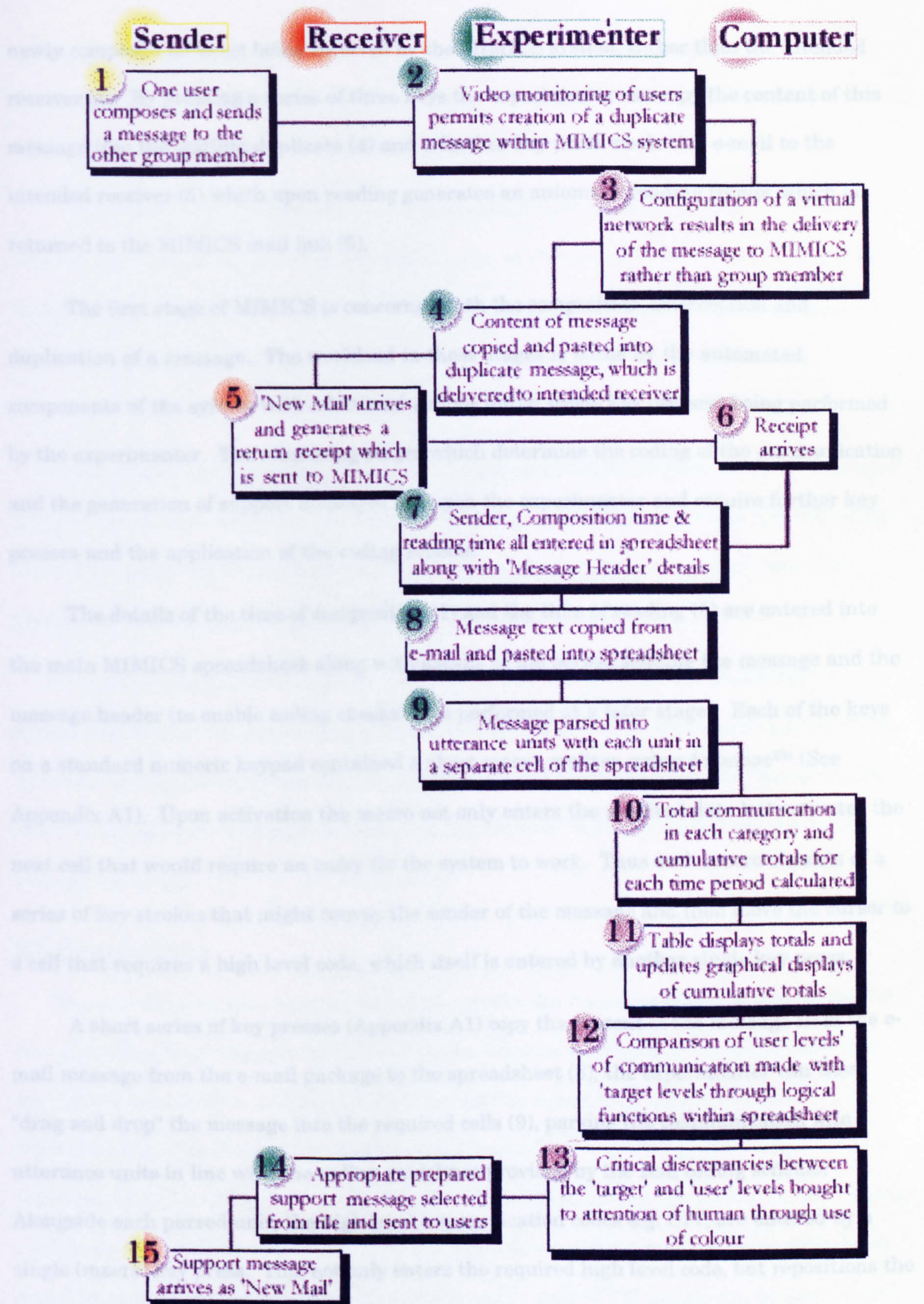


Figure 2.13: The stages and operators of the MIMICS paradigm.

At the press of a single button the experimenter is able to create a duplicate message within the MIMICS system with an identical message header and a similar creation time (2). The network having been configured as a virtual network (Figure 2.8 earlier) results in the

newly composed message being received by the MIMICS system, rather than the intended receiver (3). By pressing a series of three keys the experimenter can copy the content of this message into the waiting duplicate (4) and a further key press sends this e-mail to the intended receiver (5) which upon reading generates an automatic reading receipt which is returned to the MIMICS mail hub (6).

The first stage of MIMICS is concerned with the composition, interception and duplication of a message. The workload in these stages is borne by the automated components of the system with additional actions (often single key presses) being performed by the experimenter. The remaining stages which determine the coding of the communication and the generation of support messages fall upon the experimenter and require further key presses and the application of the coding scheme.

The details of the time of composition (1) and the time of reading (6) are entered into the main MIMICS spreadsheet along with details of the person sending the message and the message header (to enable coding checks to be performed at a later stage). Each of the keys on a standard numeric keypad contained a short macro, written using Automac™ (See Appendix A1). Upon activation the macro not only enters the required data but activates the next cell that would require an entry for the system to work. Thus each macro consists of a series of key strokes that might convey the sender of the message and then move the cursor to a cell that requires a high level code, which itself is entered by another single key press.

A short series of key presses (Appendix A1) copy the content of the message from the e-mail message from the e-mail package to the spreadsheet (8), the experimenter can then, "drag and drop" the message into the required cells (9), parsing the communication into utterance units in line with the coding guidelines provided by the Ball coding scheme. Alongside each parsed unit, the high level communication codes e.g. CIT, are entered by a single (macro) key press. This not only enters the required high level code, but repositions the cursor in readiness for the next code. The cumulative totals for each of the nine high level communication categories are automatically calculated by the spreadsheet and displayed at the bottom of the screen. Cumulative totals for each time period are stored by the pressing of an additional key by the experimenter at the predetermined time intervals (11), which results in the automatic production of the required charts displaying both the cumulative totals in

each of the target communication categories and the predetermined target levels of communication (11) Note: These levels will be determined by the identification of appropriate levels of communication through the first experiment.

The remaining steps perform the comparison between existing levels of communication and the target levels derived from the examination of FTF groups. The comparison of user levels with the target levels is performed by the logical function capabilities of the spreadsheet (12). Critical discrepancies between the levels of communication are identified, and highlighted (13) through the use of colour.

According to the discrepancy identified by the spreadsheet prepared 'support messages' can be selected from file by the experimenter and sent to the decision makers (14) informing them of the nature of their communication or the required changes depending upon the experimental conditions currently under examination (15).

In summary, of the twelve operations performed by the MIMICS system six are undertaken by the automated components of the system and six by the experimenter. Of the six performed by the experimenter, five are automated and require only a key press or a short series of key presses, with only the actual coding required anything more than a carefully selected key press.

2.6 Conclusions

The use of the semi-automated paradigm enables the real-time coding of communication. The next stage is to measure the levels of communication employed by computer-mediated and face-to-face decision making panels to permit the comparison and identification of the differences between them. From the levels of communication of FTF groups, target levels of communication for CM groups can be determined and then having established in this chapter a methodology for the real-time coding of communication, various configurations of feedback aimed at overcoming some of the expected changes in style of CM panels can be derived and tested. It is to establishing the styles and levels of communication in FTF and unsupported CM decision panels that attention now turns.

3.1 Introduction

3.1.1 Identifying the Differences Between CM and FTF Styles of Communication

It was established in Chapter One that the central premise of this thesis is that some of the deficits observed in computer-mediated (CM) decision making groups when compared to their face-to-face (FTF) counterparts, can be overcome through the provision of feedback concerning current communication levels from a support system. The central focus of the thesis is to assess the feasibility of developing intelligent support, intelligent support aimed at reducing the differences between the styles of communication employed by FTF and CM groups. The argument underlying this work is that the adaptation to the keyboard interface of a computer-mediated (CM) decision making group leads to differences in the style of communication when compared to that of a face-to-face (FTF) group. Such adaptation leads CM groups to adopt a normative style of discussion, concentrating upon achieving consensus within the group through appeals to personal and societal values of right and wrong rather than developing the often complex, information based arguments that are seen in FTF groups. The purpose of this chapter, the first of the experimental chapters, is to present the examination of a previously unanalysed data corpus to establish the styles of communication used by face-to-face and computer-mediated groups on the decision task being studied.

Chapter Two introduced a decision task consisting of a simulated panel of enquiry presented via computer databases and containing inconsistent and incomplete shared information. This task can only be resolved through collaboration between the group members, in the case of the FTF panels via speech and in the case of the CM groups via an electronic mail system. Thus, prior to testing the feasibility of the support system proposed, it is necessary to establish the 'typical' levels of communication that are employed by both CM and FTF groups.

3.1.2 The Aim of Experiment 1

The purpose of Experiment 1 is to identify the communication processes used by FTF and CM decision panels when faced with a problem solvable only through a co-ordinated effort by panel members. In addition to measuring the levels and content of the communication, the

perceptions of the decision making process by the decision makers themselves will be assessed. This will be undertaken due to the expectation that the levels of commitment to a decision outcome and the satisfaction with the decision process are determined in part by the style of communication employed by a group, and in part by the medium through which communication occurs

3.2 Method

3.2.1 Design

3.2.1.1 CM & FTF Decision Making Groups

The communication process of twenty groups of four participants were examined under two communication defined conditions. Half the groups were randomly assigned to a computer-mediated communication (CMC) condition in which each member of the group sat in a room isolated from the other group members and communicated only via the electronic mail system.

The remaining ten groups made their decision face-to-face (FTF) and sat in a single room with two members of the group on either side of a large table. In the FTF condition, care was taken to ensure that participants could not see the computer screens of the other group members. Thus, in addition to being able to use the mailing system available in the CM condition, participants in FTF condition were able to see and speak to each other as they worked on the decision task. Although certain similarities exist between the operation of the FTF panels and decision makers operating in electronic meeting rooms (EMRs - Johansen, Vallee & Spangler, 1979; Dennis, George, Jessup, Nunamaker & Vogel, 1988; Martz, Vogel & Nunamaker, 1992) it would be misrepresentative of the nature of the computer system and the functions it performs to attempt to portray this as such. The facilities available are merely in-line with those commonly found in open-plan offices, with individual desktop computers linked via an e-mail network to enable the sharing of information and discussion of ideas.

3.2.1.2 Roles within each group

Within each group, a different role was assigned to each group member. Each role reflected the position of a different agency involved in the case. Two were of a medical nature; A Hospital Consultant and a Health Visitor, the remaining two; A Social Worker and Welfare

Officer, provided the viewpoint of the social services perspective upon the case. Each role was clearly identified through the electronic mail and (in the FTF condition) supplemented by role labels on each computer.

The statements contained in the databases represented the different vantage points on the case and biased participants to either prefer to keep the family unit intact (in the case of the two social service files) or remove one or more of the children and place them into care (in both the medically based files). The intention here was to create initial differences in preferences between two attitudinally homogeneous subgroups that could only be resolved through a full and wide ranging discussion of the issue by all members of the decision making panel.

3.2.2 Participants

The twenty groups of four were formed from 80 participants who successfully completed a training phase consisting of instruction in using the synchronous electronic mail system and the use of a hypertext database system. Five participants failed to achieve satisfactory levels of operation of the system, they were asked to withdraw from the study and paid in full for their co-operation. These five were participants who failed to complete a short task summarising, to the participants own satisfaction, a short passage of text of approximately 350 words, and sending this via the e-mail to the other members of the group, or people who failed to grasp the sending, receiving and replying to of e-mail sent via the Intermail system described in Chapter Two. In return for participation each participant received a cash payment of £10. Participants were recruited by advertisement around the University of Plymouth and primarily consisted of undergraduates enrolled on either the B.Sc. (Hons) Psychology, or B.A. (Hons) Social and Political Administration degree programmes.

3.2.3 Materials

3.2.3.1 Choice Dilemma Questionnaire

To reinforce the biasing effect of the case files testimonies, a Choice-Dilemma Questionnaire (CDQ) was issued to each group member prior to their assignment to one of the roles within the group. The assignments were made on the basis of value orientations relevant to the case before the group. The choice dilemma (Appendix B3.2) described a married couple planning for a holiday which was intended to repair their faltering

relationship. The dilemma that faced them regarded difficulties in finding a qualified foster parent to temporarily care for their severely handicapped child. Participants rated the dilemma (presented amongst four distracter dilemmas) upon a ten points scale, where a score of ten indicated a preference for abandoning the holiday in favour of looking after their child, and a score of one suggested a desire to proceed with the holiday regardless of the child care arrangements. Those who responded with a tendency towards cancelling the holiday due to the absence of adequate child care arrangements were assigned to one of the two social-welfare roles.

3.2.3.2 Databases

Each participant was provided with a Networked Apple Macintosh SE computer equipped with the electronic mail and Hypercard databases as described in Chapter Two. Each machine contained a database representing each of the four public services involved in the conference containing 50 statements varying in length from 50 to 200 words. Statements were selected to suggest that a particular course of action was the most appropriate in these circumstances. The databases presented a unique, conference file for each participant and held the information from one of four agencies (Hospital Consultant, Health Visitor, Social Worker, Welfare Office) in the case. The division of information between the databases followed the algorithm described by Stasser & Titus (1985) and was such that the two medical roles were biased towards removing the children into care and the social services roles towards providing additional home help. These biases were included to ensure that the initial preferences of the group members differed and that a decision could only be reached through discussion.

3.2.3.3 Decision Options

Three decision options were presented to the group, the first of these enabled the group to provided *home help* for the family, the second option was to *remove the youngest child* and place her in care and the final option was to *remove all three children* and place them in care. The task of the decision panel was to select the option that they felt was most appropriate given the information that they had before them and to notify the experimenter of this decision, within a three hour time limit.

3.2.3.4 Post-Experimental Questionnaire

As demonstrated by the literature, the objective measurement of the user satisfaction and ability to cope with the constraints of computer system often fails to accurately convey the user's own perceptions of the system or task. Although self-report measures are often subject to systematic distortions and biases as a result of factors such as social desirability, personal values and preconceived ideas, there is little to suggest that participants in the study would experience any pressure (real or imaginary) to give a distorted impression of their experience and perceptions of the task. As such a post-experimental questionnaire (PEQ) was constructed to sample the opinions of the decision making panel once the task itself had been completed (Appendix B5.1).

3.2.4 Procedure

Participants were briefed as to the nature of the task and the case materials before them. Participants were informed that the task before them was to choose the best course of action from three options presented and that no other alternatives were available. In reaching their decision two criteria were to be met: (i) the decision must be a unanimous group decision and (ii) that they were each to read all the information contained in their databases. Although each participant had a database unique to their role and access to a shared, common reference file, they were made aware that some of the information held in the databases might overlap, and that they might each have information relating to the same incident (cf. the discussion of Stasser & Titus' (1985) "hidden profiles" in Chapter One)

Three hours were available in which to reach a decision, and each group was told to use as much of the time as necessary i.e. it was deemed acceptable to have reached a decision before the time limit was exceeded, if they had fulfilled all the criteria regarding the group decision. Warnings of the time remaining were given as the three hour time limit neared: with thirty, fifteen and five minutes remaining, but group members could contact the experimenter through the electronic mail at any time during the task. Finally, they were informed that refreshments would be brought to them during the course of the experiment and that when they settled upon a decision they should inform the experimenter via the electronic mail.

After completing the briefing, subjects were seated at their computers and instructed to begin. Video and Audio tape recordings of each FTF group were made and each e-mail message stored with a time stamp for both its sending and reading. Upon completion of the task, subjects individually completed a post-experimental questionnaire and once these were collected, a collective debriefing took place. Following this, any participants questions were answered, the participants paid and thanked for their time.

3.3 Results and Discussion

3.3.1 Overview of the Analysis of the Data Corpus

A number of analyses from the data corpus are presented. It is initially useful to concentrate on the main measures of decision outcome: the time taken to reach a decision & the decision itself. Having briefly examined these data the main question of interest, the communication of the decision makers is explored, before finally using the perceptions of the decision makers to place the whole process in a wider context.

3.3.2 Preliminary Measures of the Panel Decisions

3.3.2.1 Decision Outcome and the Time Taken to Reach a Decision

The two most obvious measures of group performance on the task are the time taken to reach a decision and the decision outcome itself. The time, to the nearest minute, taken to reach a decision was measured as the time elapsing between the instruction to begin reading the case files and the time registered on the e-mail message that logged the panels decision with the experimenter. All of the FTF and all of the CMC groups completed the task within the time limit and few decision groups in either condition required the full three hours. On average the face-to-face (FTF) groups (144 minutes) were around half an hour quicker than the computer-mediated (CM) groups (172 minutes: $t_{(18)}=8.681$; $p<.001$) and although FTF groups at first appear more uniform in the time they required to complete the task ($SD = 6.200$, $SD = 8.144$) they were not significantly so ($F_{(9,9)}=1.314$; $p>.05$).

Despite the differences in time spent reaching a decision by panels in different communication conditions, no differences were observed in the decision selected (Table 3.1) with only one FTF group selecting to provide home help and the modal choice being to remove all three children and place them into care (CM $N = 6$, FTF $N = 5$) and the remaining panels in each condition electing to place only the youngest child in care.

| | | Decision Outcome | | |
|---------------|-----|------------------|------------------------------|----------------------------|
| | | Home Help | Removal of Youngest Child | Removal of All Children |
| Mode of | CM | 0 | 4 | 6 |
| Communication | FTF | 1 | 4 | 5 |

Table 3.1: Decision outcomes examined for each condition in Experiment 1

Furthermore, a 2-way factorial analysis of variance of post decision preferences with communication modality as a between subject factor and decision option as w within subject factor showed that options did not vary between conditions in the average rank assigned ($F_{(2,36)} < 1$), nor did the options vary significantly amongst themselves (Home Help, $M = 2.24$, Remove Youngest Child $M = 1.84$, Remove All Three Children, $M = 1.92$; $F_{(2,36)} = 1.58$). This pattern of panel decisions and post-decision preference does, however, approximate to the weight of evidence contained within the case notes.

3.3.3 The Content of Communication

To enable a picture of the style of communication being employed by each of the decision making panels the coding scheme presented in Chapter Two was applied to all in-group communication i.e. that is all communication between the group members and one another, but excluding any communication directed at the experimenter.

The video and audio recordings of each FTF group were transcribed, with the two sources used as a source of verification of the accuracy of the transcript. Where confusion arose as to the exact nature of the statement being made, the opinion of a third party was sort and on the rare occasions where no clearly identifiable speech was apparent, the transcript recorded an inaudible utterance which was left uncoded. The e-mail messages of each group were compiled to form an equivalent transcript for each computer-mediated panel.

3.3.3.1 A Short Note on e-mail Latencies

Before examining at length the communication itself it is worth digressing slightly to consider the delay between the composition/sending and receipt/reading of the messages by CM groups. The nature of the task was such that the large majority of panel members read messages the instant they arrived, in this respect a large number of the users treated the medium more as a synchronous system rather than as the asynchronous system that e-mail is traditionally viewed. An inspection of the latency from the time of composition of a

message, to the time of reading suggests that the later into the decision process that a message was composed, the quicker it was read by the receiver. i.e. the difference between the time stamp on the composition of a message and the time marked on the receipt is greater at the beginning of the experiment than the difference between the composition and receipt times for messages sent at the end of the experiment. There is a danger that this might be interpreted as being indicative of panel members reading messages upon their arrival rather than storing them to read later, a behaviour that might be expected to result from the increased time pressure as the time remaining for a decision to be reached decreases. The finding is, however, more likely to reflect the nature of the messages themselves, as messages sent later in the decision making process are more likely to be short (four or five lines) rather than a long message (greater than ten lines). Furthermore, as the time stamp on a message indicates the moment at which the user began to compose the message, rather than the actual time at which the message was sent, few conclusions can be drawn regarding the behaviour of subjects in relation to their e-mail use.

3.3.3.2 The Application of the Coding Scheme

To assess the reliability of the application of the coding scheme two judges independently coded 1242 utterances from the total pool of 14,576 units. These utterance units were drawn from both the CM and FTF conditions and the second judge was unaware of the experimental hypothesis being tested. A highly significant Cohen's Kappa Agreement Coefficient (Siegel & Castellan, 1988; Winer, 1991) was obtained ($K = .94$). This represents acceptable levels of reliability in the inter-rater application of the scheme.

3.3.3.3 Total Levels of Communication

In total, all the FTF decision making groups produced approximately five times as many utterance units (12,725) as their CM counterparts (2,851). However, the significantly longer decision times of the CM panels suggest that utterance rates, that is the number of utterances produced per minute of discussion, rather than utterance frequencies would provide a comparable representation of the respective levels of communication in the two conditions (Table 3.2).

| | Total Utterances | | Utterance Rates | |
|-----|------------------|-------|-----------------|-------|
| | Mean | SD | Mean | SD |
| FTF | 1273 | 191.8 | 9.044 | 1.443 |
| CM | 285.1 | 100.6 | 1.713 | 0.585 |

Table 3.2: Mean Utterances and Utterance Rates for each Mode of Communication in Experiment 1

This measure further emphasises the communication advantage of FTF groups with over 9 utterances per minutes being more than six times the rate of CM panels. It should also be noted that although the e-mail system was available to the FTF groups no panels used the system prior to reaching a decision. The general pattern of communication employed by the two communication medium defined conditions can be seen in Figure 3.1.

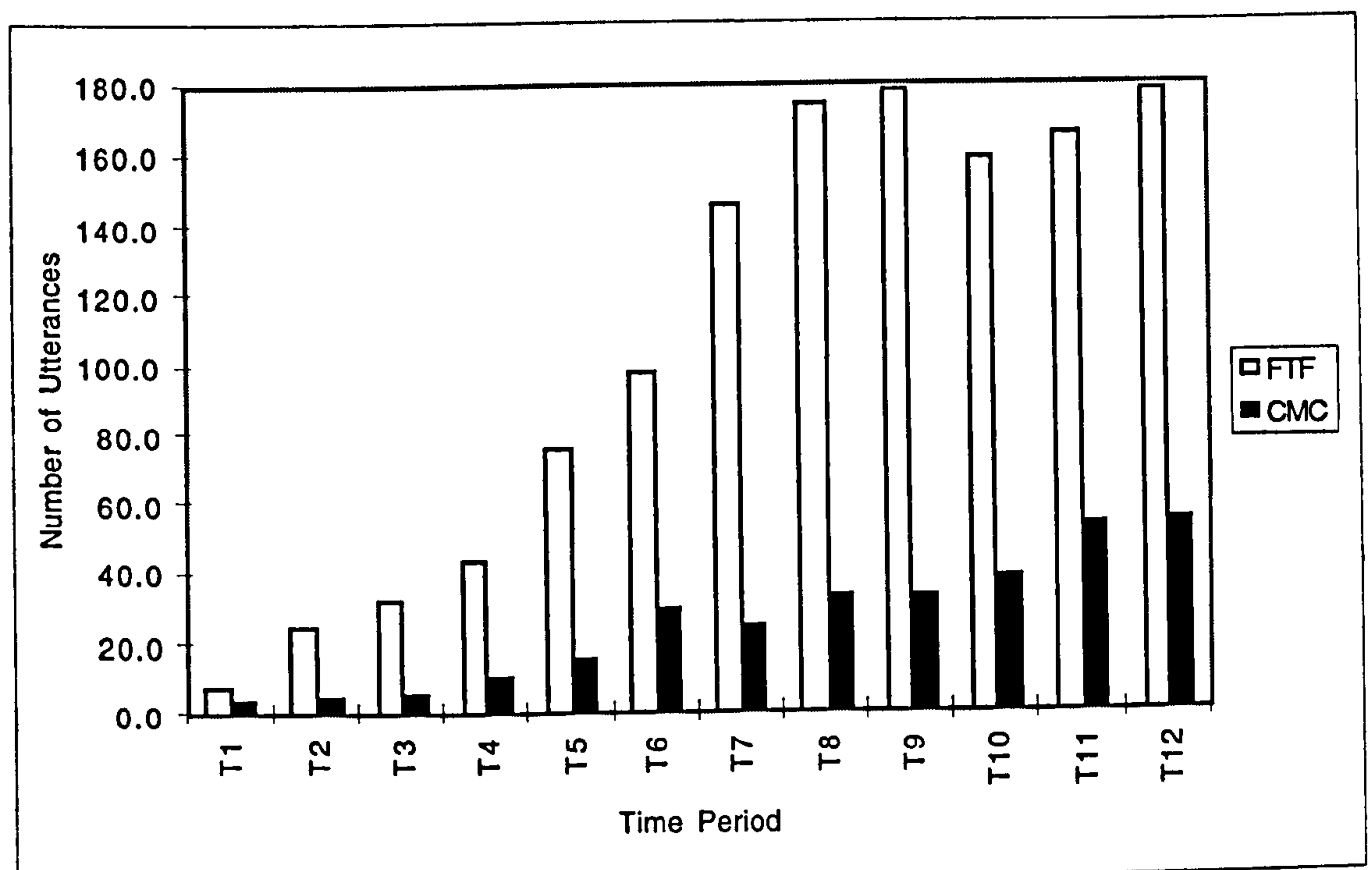


Figure 3.1: The number of utterances for Experiment 1 CM and FTF panels across the twelve time periods

The key factor to draw from this figure is not the large difference in the communication rates but rather that the FTF groups steadily increase their rate of communicating during the first seven time periods and reach a peak during period eight which is maintained for the remainder of the task. CM panels increase at a much slower rate and do not appear to reach a peak level of communication with small increases occurring from one time to the next.

Mindful of the already identified differences in utterance rates, it is perhaps more meaningful to consider the relative distribution of communication over time. That is, the

distribution of communication in any given time period as a proportion of the total communication of the group (Figure 3.2)

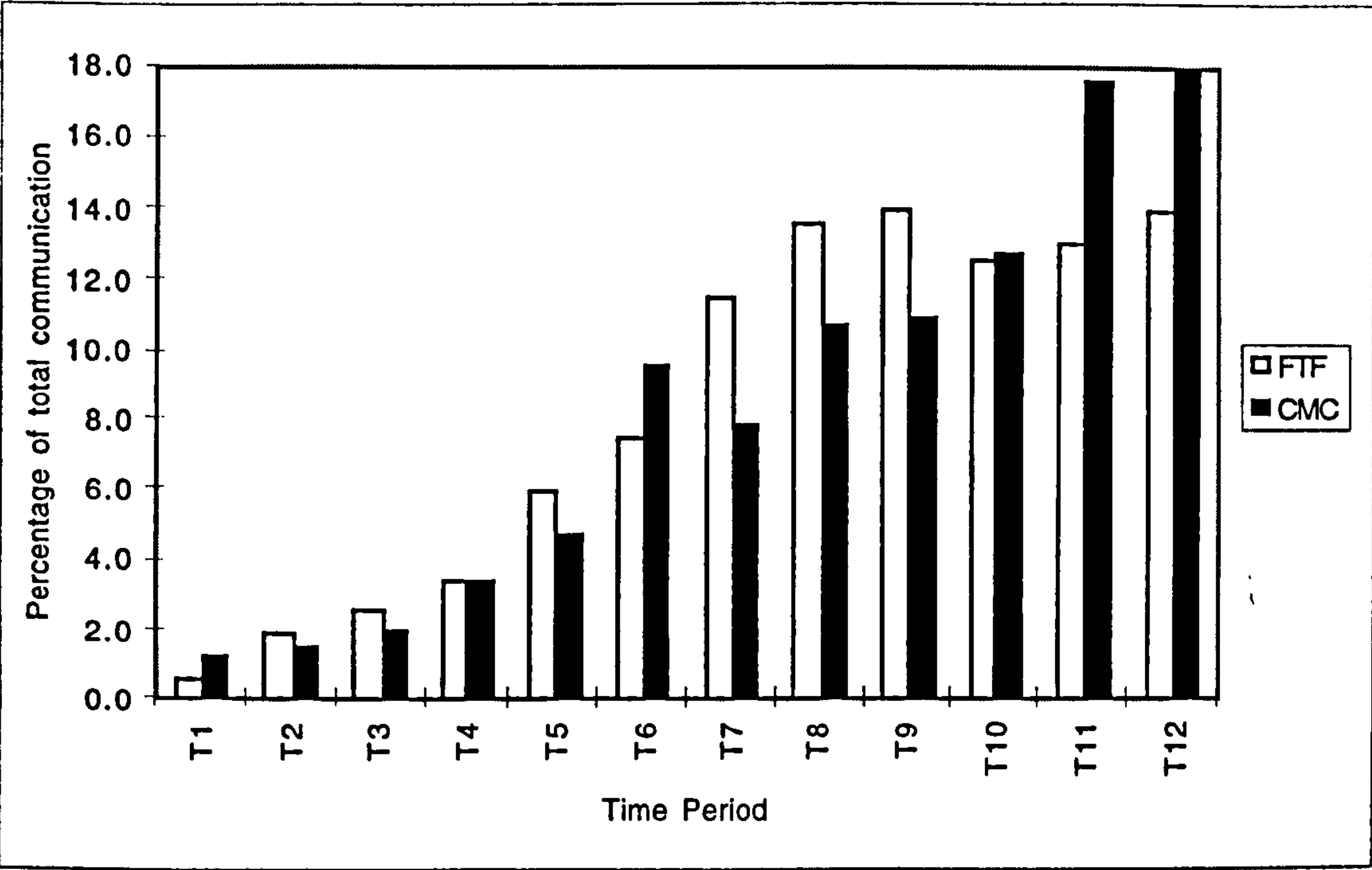


Figure 3.2: Communication in each time period as a proportion of total communication employed by Experiment 1 FTF and CM groups.

Examining the data in this fashion, reinforces the earlier impression of the patterns of communication employed by the two methods of communication defined conditions. FTF groups communicate almost the same level of utterances in each of the final five time periods as they do in the first five combined. It also suggests that the final five periods each contain around the same level of communication for FTF panels, but for CM groups that the number of utterances, that is the level of communication continues to increase as the end of the decision task approaches.

3.3.3.4 Treatment of the Data

The purpose of this analysis is to identity not just the levels of communication used by CM an FTF decision making groups but also to identify the distribution of these utterances over duration of the decision making task. Given the discrepancies in rates of communication and the need to identify relative levels of communication for the two communication defined conditions, the following data are presented not only in terms of the absolute levels of each form of utterance but also the proportion of total communication that is occurs in each of the nine categories in the scheme adapted from Kaplan and Miller (1987).

The other main decision that must be taken regards the nature of the coding scheme itself, whether to subject the nine communication categories to a single multivariate analysis or to conduct several univariate analyses. Although several sources discuss the mathematical process of the two techniques (Hair, Anderson, Tatham & Black, 1995; Winer, Brown, & Michels, 1991) comprehensive discussions of the merits of applying the two approaches in a psychological setting are rare. Huberty and Morris (1991), however, present an excellent analysis of just this dilemma. Although the dependent variables, may not be completely “conceptually independent” in the true sense of the definition provided by Biskin (1980: 70) there is no desire to identify the ‘trade offs’ between the nine communication categories. That is, the main interest lies in the identification of the levels of use of each category and not in identifying the relationships between the codes. This process would prove difficult due to the inherent complexity in trying to identify the inter-relationships between the nine coding categories employed, made all the more complication by the likelihood of an increase in one category being reflected in the decrease of two or more of the remaining communication codes. As such this points to multiple univariate analyses rather than a single multivariate analysis. Another criteria presented by Huberty and Morris, also suggests that univariate techniques be employed. They propose that where the conducted study is of an exploratory nature that rather than use a multivariate approach that repeated univariate analyses be applied.

Before embarking on the analysis, it is important to recognise the warning of Van de Geer “with separate analysis of variance for each variable, we never know how much the results are duplicating each other (Van de Geer, 1971: 71). That is, if a significant effect of one variable is revealed by the analysis, and this variable is highly correlated with a second variable, then when interpreting a significant difference in the second variable this might be revealed a new an interesting finding, or it might merely be reflecting the results of the first analysis. It is in these cases, that a degree of theoretical understanding regarding the categories needs to be applied. A finding of a significant difference in two normative categories (e.g. VAL and PREF) that are themselves correlated is likely to reflect such a duplication, yet a significant difference in one normative (VAL) and one informational influence (INF) category is of greater interest.

3.3.3.5 Total Informational Utterances

Given the large differences in absolute levels of communication identified in the analysis of communication totals, the analysis of the use of communication concentrates on the relative use of categories by examining the proportions of communication of a group within each category. The absolute levels are provided within the tables to enable the magnitude of communication to be placed in context.

Over half of all communication in the three hour task was devoted to information drawn either directly, indirectly or inferred from the databases (Table 3.3). Decision making panels in both conditions devoted just over a third of their communication to utterances coded as INF (FTF = 35.9%, CM = 36.2%: $t_{(18)} = .093$; $p > .05$, two-tailed).

| | Total Communication | | Proportional Communication | |
|-----|---------------------|-------------------|----------------------------|-------------------|
| | CIT | INF | CIT* | INF |
| | Mean (Std Dev) | Mean (Std Dev) | Mean (Std Dev) | Mean (Std Dev) |
| | 267.9 (52.4) | 456.3 (132.3) | .214 (.051) | .359 (.087) |
| FTF | 47.5 (23.6) | 100.4 (33.27) | .163 (.045) | .362 (.074) |
| CM | | | | |

Table 3.3: Total and proportional levels of Experiment 1 informational influence
Note: * denotes a significant difference, $p < .05$

However, direct quotations (CIT) drawn from the database accounted for 21.4% of the FTF groups communication and only 16.3% of the computer-mediated groups ($t_{(18)} = 2.41$; $p < .05$, two-tailed).

3.3.3.6 Total Normative Utterances

In contrast to the deficit in informative utterances exhibited by the CM groups in comparison to FTF panels, a comparison of the proportional communication reveals that they communicate considerably more normative information (Table 3.4 overleaf). Expressions of preference (PREF) and comments on personal/societal assessment of right and wrong (VAL) made up 18.4% and 9.7% respectively of CM groups communication. This indicates that CM groups communicate six times as many PREF (FTF 3.1%: $t_{(18)} = 8.6$; $p < .001$, two-tailed) and twice as many VAL (FTF 4.7%: $t_{(18)} = 2.85$; $p < .01$, two-tailed) as the face-to-face groups.

| | Total Communication | | Proportional Communication | |
|-----|---------------------|-------------------|----------------------------|-------------------|
| | PREF | VAL | PREF* | VAL* |
| | Mean (Std Dev) | Mean (Std Dev) | Mean (Std Dev) | Mean (Std Dev) |
| | 39.3 (27.75) | 58.3 (26.49) | .031 (.019) | .047 (.023) |
| FTF | | | | |
| | 51.2 (18.07) | 25.8 (13.04) | .184 (.053) | .097 (.051) |
| CM | | | | |

Table 3.4: Total and proportional levels of Experiment 1 normative utterances
Note: * denotes a significant difference, $p < .05$

3.3.3.7 Miscellaneous Categories of Communication

Again exploring the proportional levels of communication (Table 3.5) reveals that Face-to-Face groups devote over a fifth (20.2%) of their communication to the experimental materials/context/computers (MAT) compared to just 8.1% relating to the same in CM groups ($t_{(18)}=-4.6$; $p<.001$, two-tailed).

| | Total Communication | | | | |
|-----|---------------------|-------------------|-------------------|-------------------|-------------------|
| | LEG | MAT | OTH | PRESS | PROC |
| | Mean (Std Dev) | Mean (Std Dev) | Mean (Std Dev) | Mean (Std Dev) | Mean (Std Dev) |
| | 75.2 (31.04) | 259.2 (92.32) | 63.3 (48.03) | 10.7 (8.08) | 42.3 (20.94) |
| FTF | | | | | |
| | 12.5 (14.89) | 26 (28.13) | 12 (7.52) | 4 (7.32) | 5.7 (5.38) |
| CM | | | | | |

Table 3.5: Total levels of Experiment 1 miscellaneous communication categories.

| | Proportional Levels of Communication | | | | |
|-----|--------------------------------------|-------------------|-------------------|-------------------|-------------------|
| | LEG | MAT* | OTH | PRESS | PROC |
| | Mean (Std Dev) | Mean (Std Dev) | Mean (Std Dev) | Mean (Std Dev) | Mean (Std Dev) |
| | .059 (.023) | .202 (.059) | .047 (.033) | .008 (.006) | .032 (.013) |
| FTF | | | | | |
| | .036 (.036) | .081 (.059) | .044 (.026) | .012 (.021) | .027 (.018) |
| CM | | | | | |

Table 3.6: Proportional levels of Experiment 1 miscellaneous communication categories.
Note: * denotes $p < .05$

In neither condition (Table 3.5 & 3.6) do group members exert much pressure (PRESS) with both the FTF panels (0.8%) or the CM groups (1.2%) exhorting specific actions for the group members to follow ($t_{(18)}=.49$; $p>.1$, two-tailed).

Although the panels relied heavily upon CIT there is relatively little attention is paid to the legal issues (LEG) surrounding the case (FTF 5.9%, CM 3.6%: $t_{(18)}=-1.63$; $p>.1$, two-tailed). Nor is there a difference (FTF 4.7%, CM 4.4%) in the amount of communication that is essentially irrelevant (OTH) to the task before them ($t_{(18)}=-.248$; $p>.1$, two-tailed)

Finally, communication regarding the procedural approach to the task consisted of 3.2% of the face-to-face groups and only 2.7% of the CM groups ($t_{(18)}=-1.6$; $p>.1$, two-tailed).

3.3.3.8 A short note on the analysis of total communication

It should be noted that these analyses provide an initial impression of the distribution of communication across the nine coding scheme categories. It might be argued on the basis of the literature reported in Chapter One that one-tailed predictions could be made regarding a number of the categories, however, the data presented here is purely exploratory and making two-tailed predictions only increases the likelihood of a type II error. An inspection of the one-tailed tests (Appendices C1 & D1) suggests this not to be the case.

3.3.4 FTF and CM Communication over time

3.3.4.1 Identification of levels of communication

This initial analysis suggests that FTF decision making groups might adopt an informative approach to the task and that CM groups are much more normative in their approach to the same problem. This difference in communication style is most noticeable in the use of Citations of Case Fact (CIT) by the FTF groups, who draw heavily upon factual information taken directly from the case notes to reach their decisions. In contrast to this, CM panels rely less heavily upon the informational influence and make greater appeals to societal and personal values of right and wrong (VAL) and engage in greater exchange of Expression of Preferences (PREF). Additionally, FTF groups communicate to one another a greater degree of MAT style communication, which is concerned with the engaging of individual actions, orientation to the databases and statements regarding the computers and context of the study.

The key argument advanced earlier was that the restrictions imposed by CMC on group discussion interact with other task conditions to predispose CM groups to adopt a normative style of discussion, and that this contrasts with the informational approach adopted by FTF decision making groups. To this aim, rather than analyse in depth each of the nine communication categories, attention is focused upon CIT, as evidence of informational influence and PREF as evidence of a normative style of discussion. In addition, the attempts at coordinating the group effort (PROC) are also examined, as the successful coordinating of group effort is frequently related to outcome and satisfaction (Chapter One) and it has been established that CMC panels often report difficulty in this area. Indeed, the failure to maximise group potential in groups has often been attributed to the effects of blocking, which itself is linked to a lack of coordinated output. For example, the inability of all group members in a face-to-face situation to simultaneously communicate and still be understood. Computer-mediated communication often overcomes this blocking effect and yet CM groups still fail to achieve the potential group product, perhaps increasing the level of PROC in CM panels will help overcome this loss.

3.3.4.2 Comparison of Communication Style

The comparison of proportional communication has enabled the identification of a general difference in the communication content of FTF and CM groups: an informative approach compared to normative approach, and three specific changes, in CM groups, a decrease of citations of case fact (CIT), the suggested (although non-significant) of decrease in coordination of the task (PROC) and an increase in decision outcome orientated communication (PREF).

Although the absolute levels of communication vary with the medium (FTF or CM) it is likely that different forms of communication might be utilised at different times in the decision making process. The question to which attention is now turned is to what extent does the pattern of communication across time vary as a result of the mode of communication employed?

3.3.4.3 Reducing time and production rate effects

Having considered the overall levels of CIT communicated by FTF and CM decision making panels, it might be expected that the differences in the use of the communication will

lie not only in the proportional use of communication (and indeed the absolute levels) but in the distribution of this communication over time.

There are two ways to consider the distribution over time, the first would be to consider the communication in real-time, however, given the earlier finding that FTF groups complete the task around half an hour quicker than the CM counterparts such an analysis has inherent problems when drawing direct comparisons. A further difficulty is presented by the differences in absolute levels of communication, with FTF groups communicating at nine times the level of CM decision making panels.

To overcome these problems the data is considered at a proportional level (overcoming the absolute differences) and across twelve time periods, each of which is calculated on the basis of dividing the total time taken by any panel into twelve equal units. In segmenting the data in this fashion, the effects of different experimental durations are reduced, and effects such as reading speed or the rate of speech in the FTF condition and typing in the CM condition have less influence upon the data.

Furthermore, these data are presented in two ways, the first an analysis and description of the proportional utterances reveals the levels of communication within any given time period. The second provides no additional analysis, but provides a description of the cumulative record of the production of the communication style of interest. This is presented to enable a clearer impression of how the behaviour develops over time to be established.

3.3.4.4 Citations of Case Fact (CIT)

The first consideration of the use of CIT style communication by the panels operating under face-to-face or computer-mediated conditions is the distribution of the absolute levels of communication over time (Figure 3.3 overleaf). This reveals an almost inverted-U shape relationship between the use of CIT over time. The raw frequencies contained within Figure 3.3 reveal the large difference in actual utterance levels identified in the earlier analysis, encouragingly both modes of communication produce similar patterns of CIT style communication, this view is supported by Figure 3.4 (also overleaf), which shows that when CIT communication is examined as a percentage of overall communication that the FTF panels rely more heavily upon the citation of case fact for the majority of time periods.

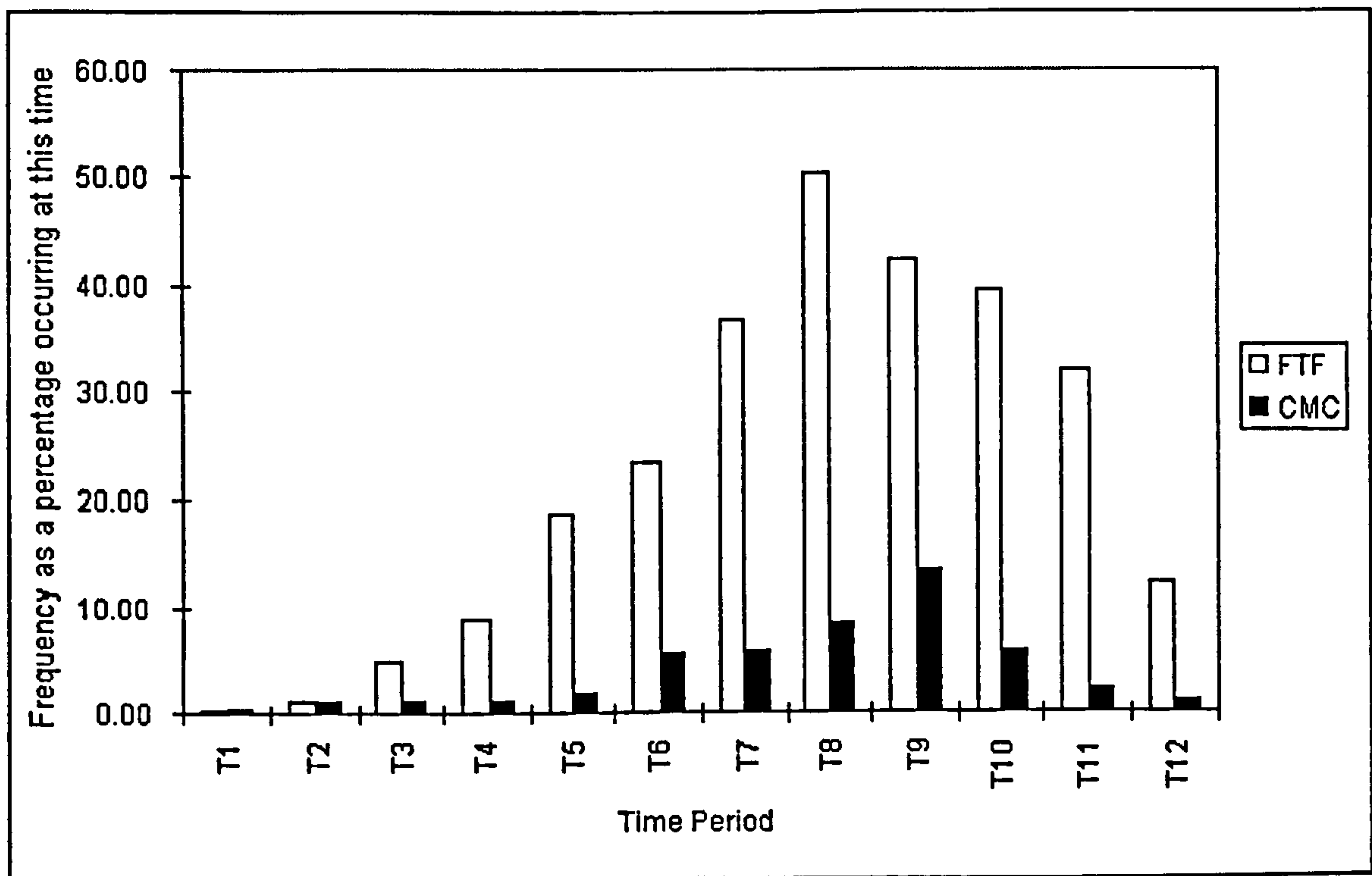


Figure 3.3: The distribution of Experiment 1 Citations of Case Fact (CIT) over time

It might also be considered that Figure 3.4 reveals that not only do CM panels communicate at a lower rate than their FTF counterparts but lag behind the FTF panels in the time at which they communicate CIT. The figure might be interpreted as showing that the use of CIT style communication increases through the early time periods, peaking at time period eight for FTF panels and time period nine for CM groups.

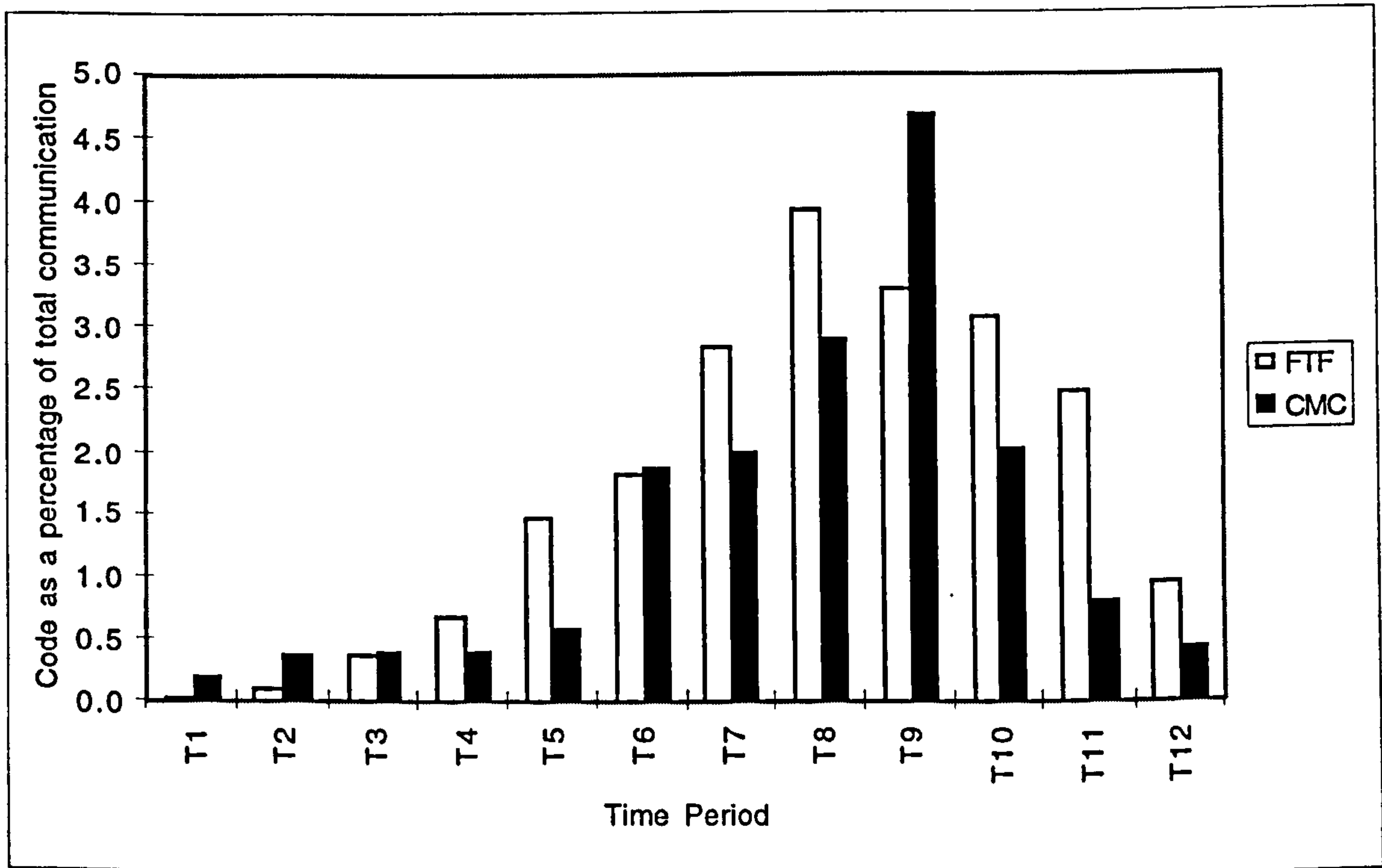


Figure 3.4: The distribution of Experiment 1 Citations of Case Fact (CIT) as a percentage of total communication over time

The final consideration of the use of CIT by groups communicating face-to-face and via computer is to consider the cumulative record of the behaviour over time of CIT as a percentage of total communication (Figure 3.5).

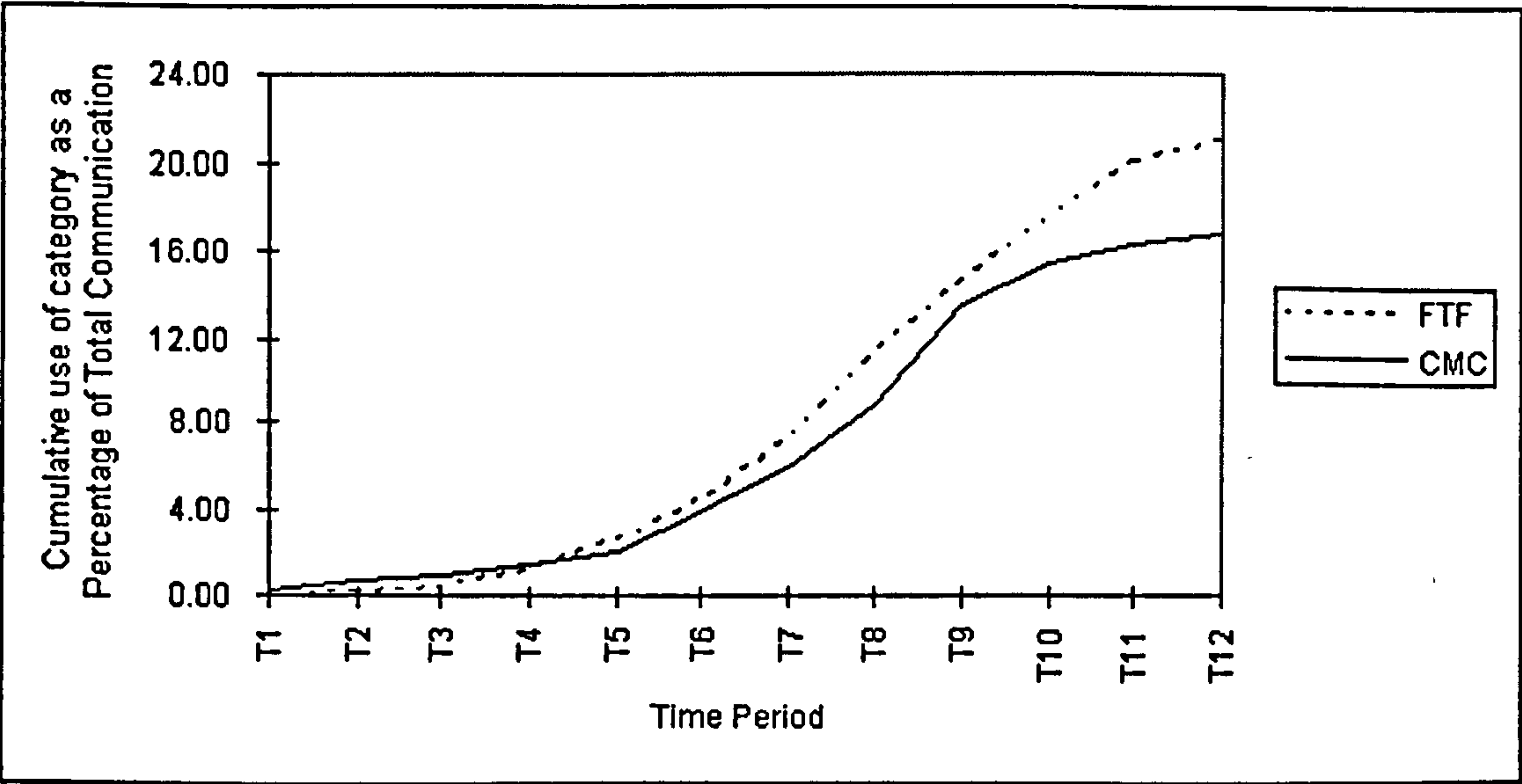


Figure 3.5: The cumulative record of Experiment 1 Citations of Case Fact (CIT) as a percentage of total CIT over time

Although the general pattern in the rate of communicating CIT is the similar it is noticeable that not only do CM panels communicate proportionally less CIT, but in the later stages of the decision process, time period 9 onwards, when the FTF groups are continuing to convey the information contained in their case notes to one another, the CM groups, decrease the rate at which these are included in the discussion process.

3.3.4.5 Expressions of Option Preference (PREF)

Turning attention to the normative communication style, that of the Expressions of Preference (PREF) for the decision options expressed by the different communication channel defined conditions supports the earlier assertion concerning greater use of PREF by the CM panels (Figure 3.6).

When PREF style communication is considered as a proportion of total utterances, it is noticeable that not only do CM panels convey a higher level of PREF earlier in the decision process (see for example time periods four to six) but that they communicate at proportionally higher rates throughout. In contrast to this, FTF panels maintain an almost constant proportion of their communication within this category from the first expressions of preference in the forth time period through to penultimate time period, T11.

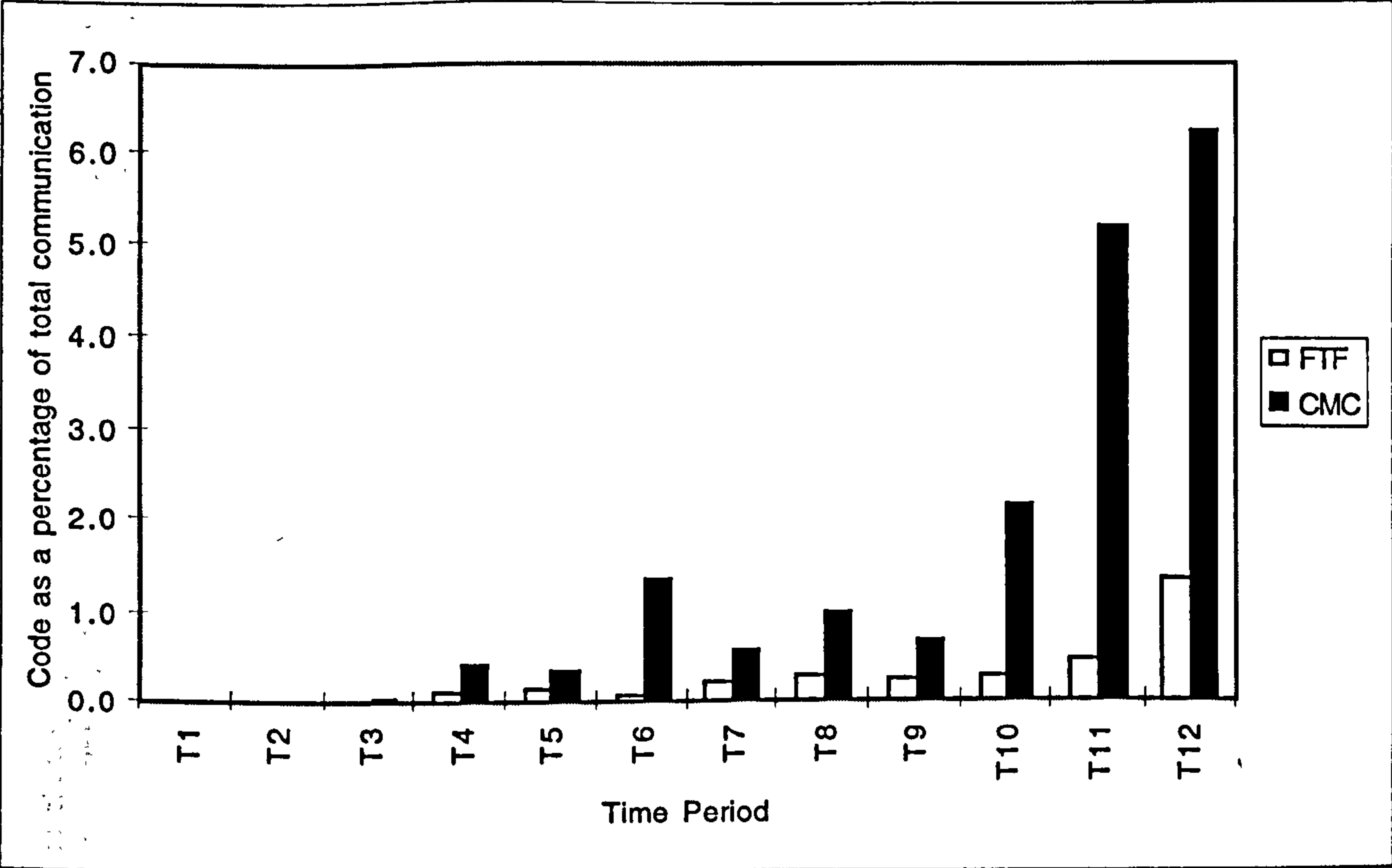


Figure 3.6: The distribution of Experiment 1 Expressions of Preference (PREF) as a percentage of total PREF over time

Indeed, this is not just a higher proportional level of communication, but is apparent when considered at the level of actual utterances (Figure 3.7) where the levels of PREF from the CM groups can be seen at least match and occasionally slightly exceed the levels of PREF utilised by FTF panels.

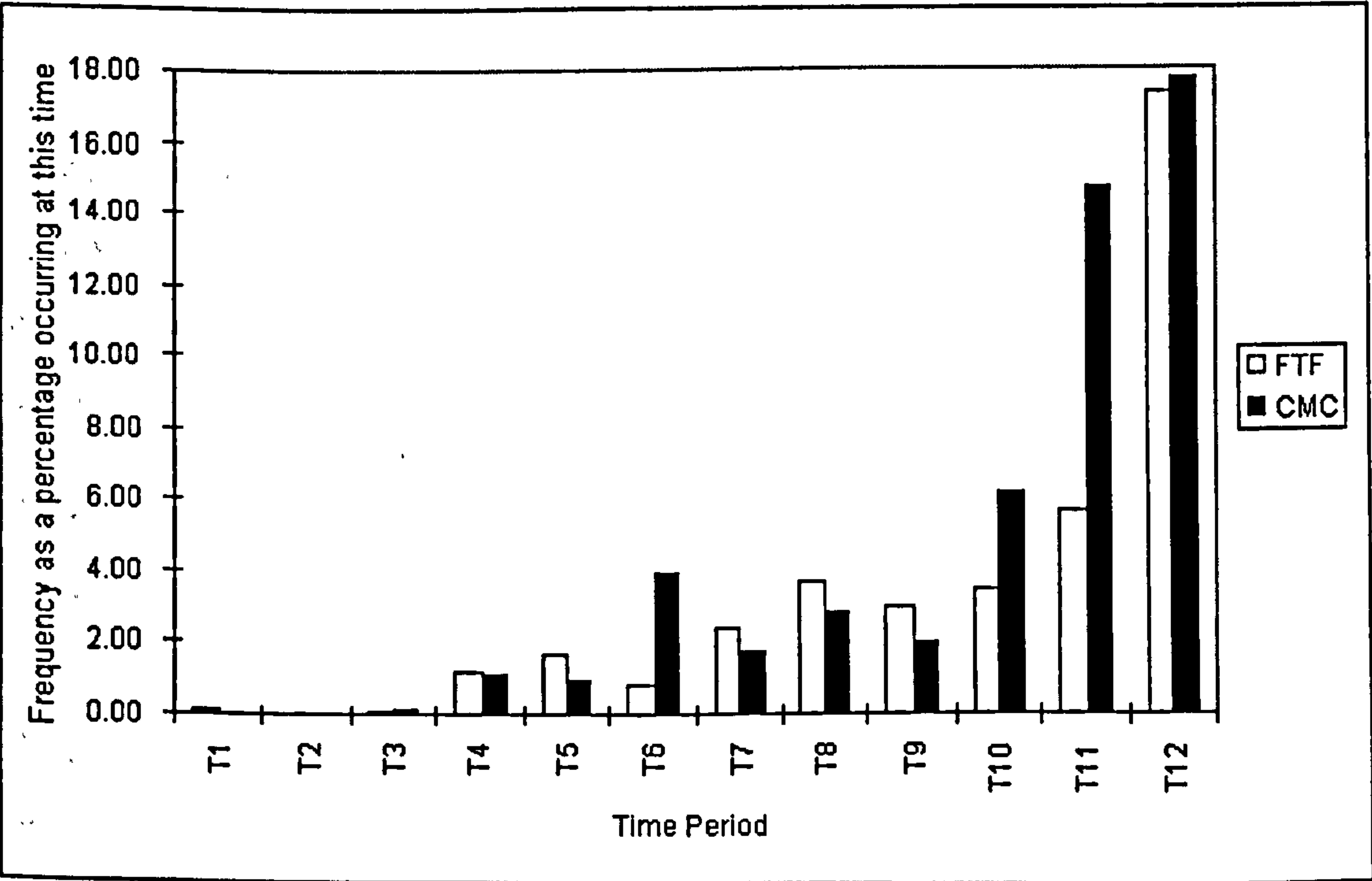


Figure 3.7: The distribution of Experiment 1 Expressions of Preference (PREF) over time.

The other interesting feature of Figure 3.7 is the relative lack of PREF style communication used by FTF groups until the final period of their deliberations, apparent in the large increase of PREF between time period eleven and twelve.

Finally, when considering expressions of preference it is also valuable to examine the cumulative record of the production of PREF in relation to the total communication of the groups (Figure 3.8).

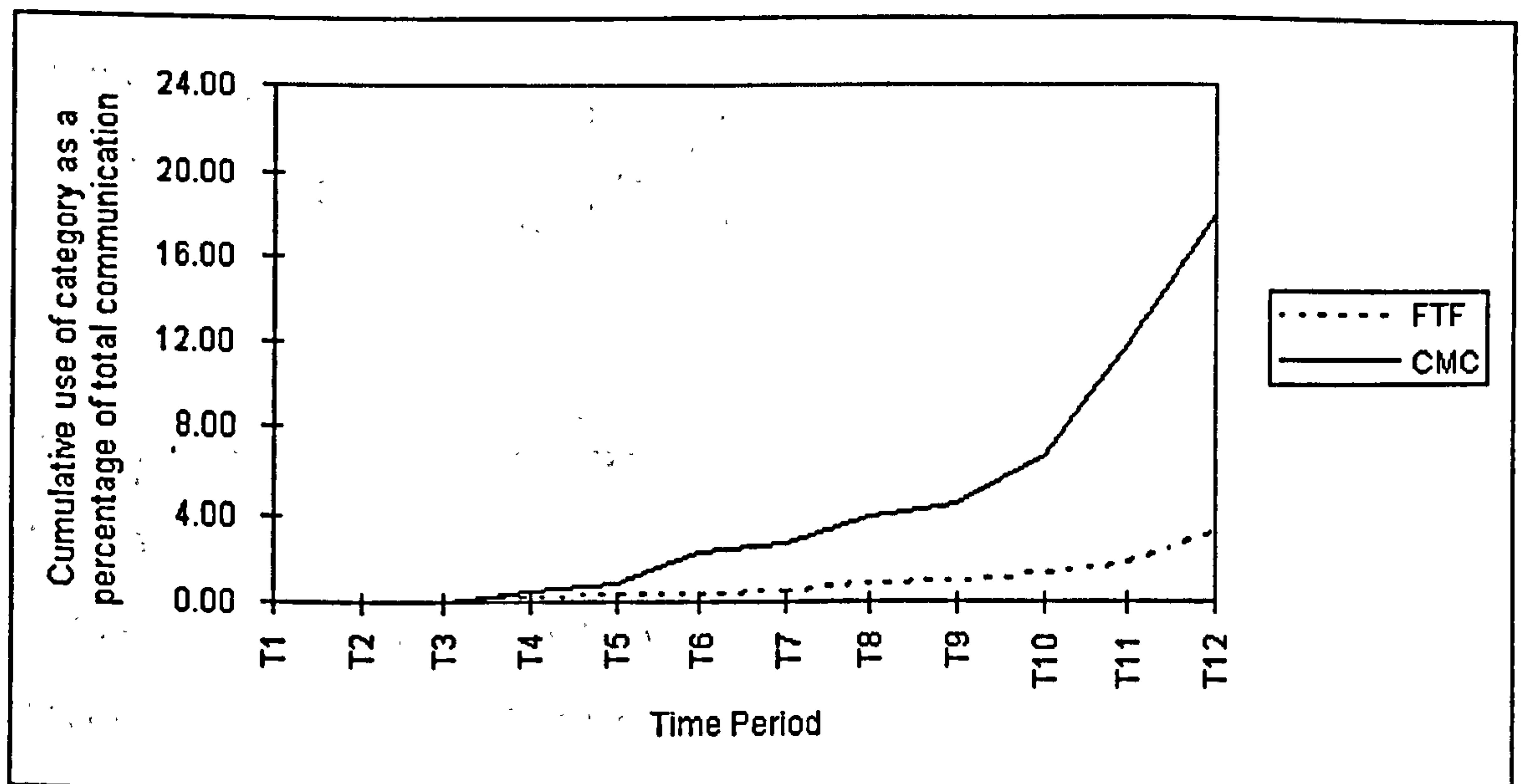


Figure 3.8: The cumulative record of Experiment 1 Expressions of Preference (PREF) as a percentage of total PREF over time

The use of PREF increases gradually from around the moment that most panels begin communicating (time period three) and continues to increase at a gradual rate until around time period ten. At this point the FTF panels continue to communicate at the previous, mostly steady rate, but the CM panels increase their use of expressions of preference as they move towards a final decision, with FTF groups exhibiting a much later, and much smaller increase in the final time period.

3.3.4.6 Procedures (PROC)

The last area of communication selected to consider is that which is aimed at coordinating the group level processes as the individual members of the decision panel attempt to resolve the problem before them. The general rate of production of PROC, is generally much lower, just 2-3% compared to 20% and above for CIT and PREF.

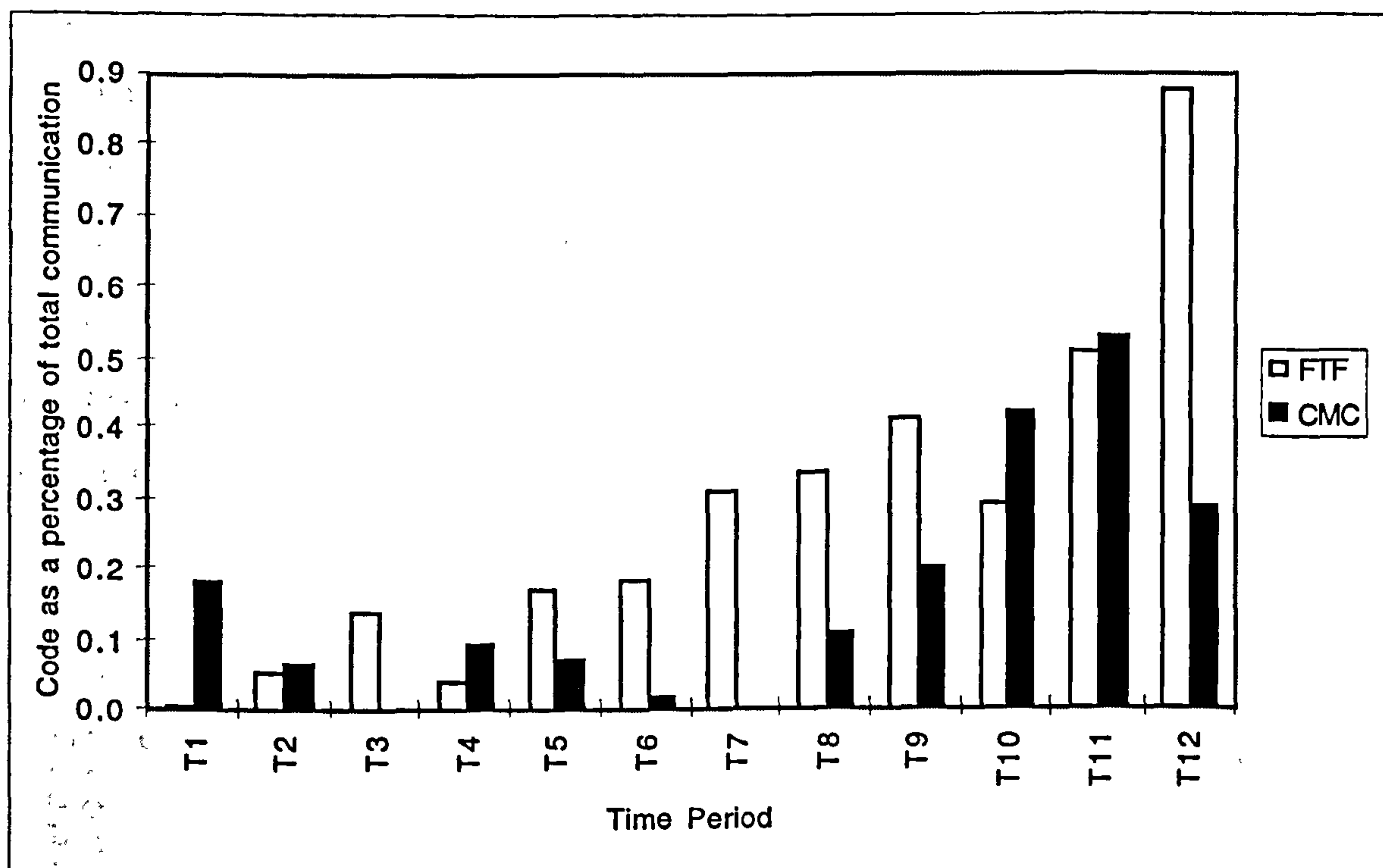


Figure 3.9: The distribution of Experiment 1 Procedural Utterances (PROC) as a percentage of total PROC over time

NOTE: A different scaling is employed on the y-axis to that used on Figures 3.1 to 3.9

The pattern of usage between the two communication defined conditions is quite distinct (Figures 3.9 and 3.10). The FTF panels make small, but frequent efforts to co-ordinate the group from an early stage of the decision process gradually increasing this effort over the course of the decision process.

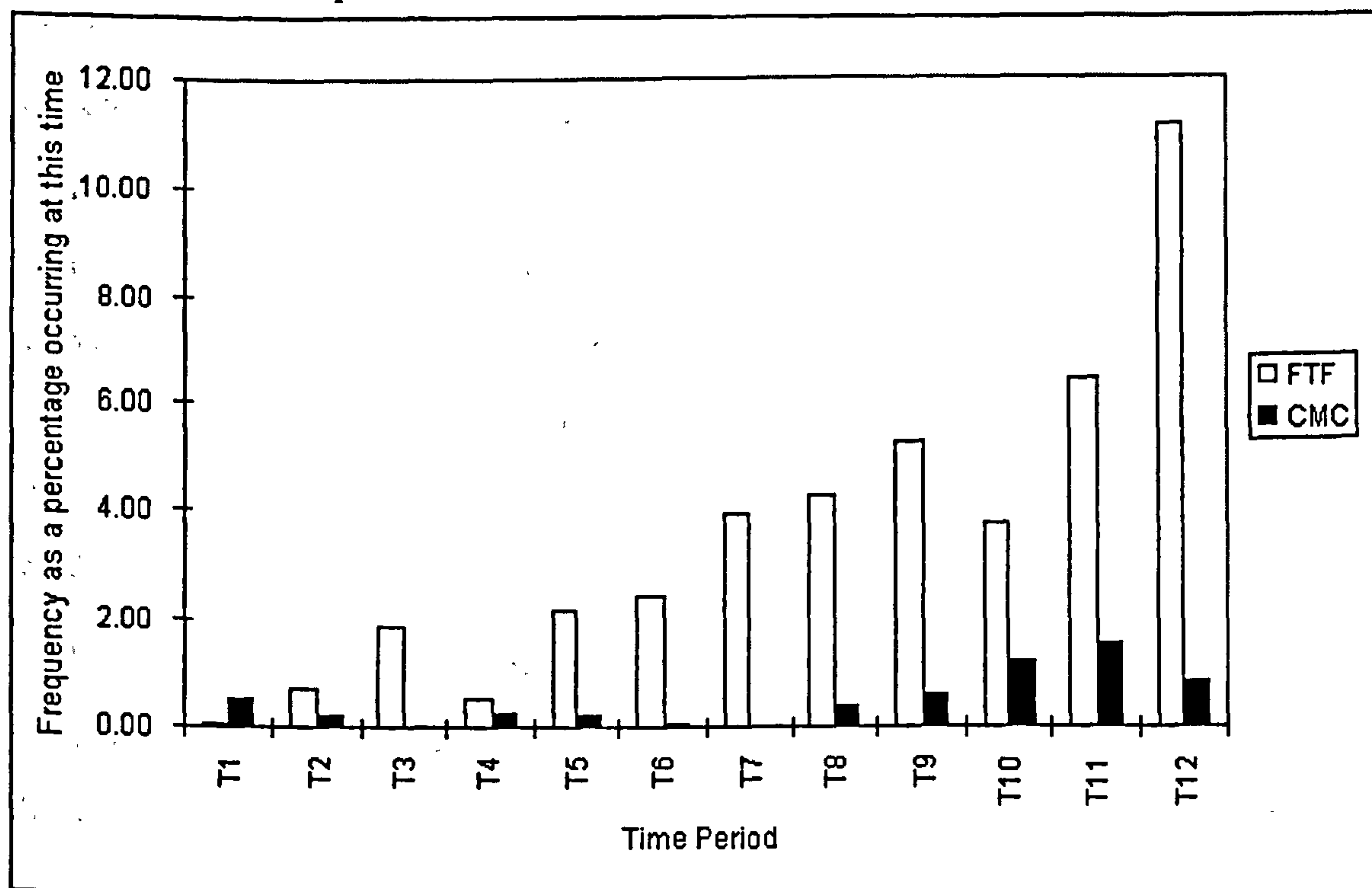


Figure 3.10: The distribution of Experiment 1 Procedural Utterances (PROC) over time.

In contrast, their CM counterparts start with a brief attempt to co-ordinate activity at the beginning which trails off and then only return to a coordinated approach to the task as the decision process draws to a close. This pattern of usage is borne out by the examination of the actual levels of communication in this category (Figure 3.10). As with the preceding two communication styles it is worth considering the cumulative record of PROC production (Figure 3.11). This suggests greater effort is exerted by the FTF panels to coordinate their activities across the whole experiment, but that the general levels of PROC are quite low.

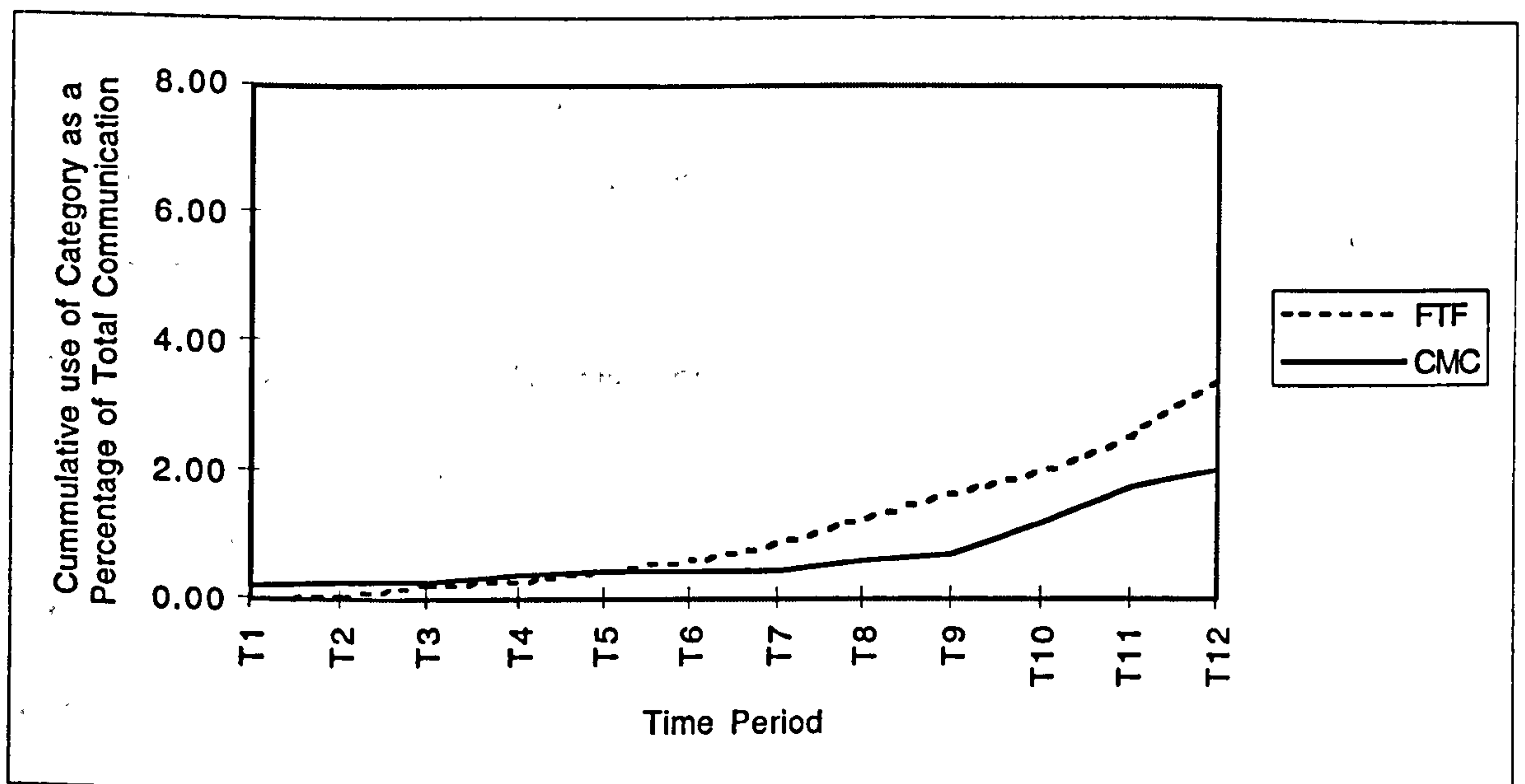


Figure 3.11: The cumulative record of Experiment 1 Procedural Utterances (PROC) as a percentage of total PROC over time

3.3.4 The distribution of communication over time

These data provide a general impression of the nature of communication over time, indeed there is evidence to suggest that there are different levels of communication employed at various stages of the decision making process. The purpose of this experiment is to identify the levels of communication employed by face-to-face and computer mediated panels, levels that can be used to provide target levels of communication for CM panels. It is, however, worth deviating from this main goal to consider briefly the statistical analysis of these data.

The unit of interest in this work is that of the group rather than the individual, therefore rather than taking into account the different components that might exist within the group the unit of analysis is that of the communication levels of the group. It can be hypothesised that the levels of communication within the panels will vary over time, that is there will be a low rate of communication at the beginning of the task which will gradually increase over

time. There is also a suggestion from the earlier examination of the data that the FTF communicate at a greater level and earlier in the decision process.

To examine this for each panel's discussion, the time taken to complete the task was divided into four equal time periods and the level of utterances calculated for each period. To control for the differences in baseline rates of communication, and to examine how the panels distribute their communication output over time the raw scores were converted into proportional levels of communication. The resulting rates of production were then examined for the three target communication categories. A 2-way factorial analysis of variance where mode of communication was examined between subjects and time periods treated as a within subjects factor was then applied to each of the three dependent variables: proportional communication of CIT, PREF and PROC.

3.3.4.1 The distribution of CIT over time

The analysis of CIT (Appendix C1.1) revealed a significant effect of the mode of communicating, FTF or CM ($F_{(1,18)} = 13.37$; $p < .01$) and of the quarterly time periods (Table 3.7 $F_{(3,54)} = 18.03$; $p < .001$) with the FTF panels communicating proportionally more ($M = 4.37$, $SD = 4.08$) CIT utterances than CM groups ($M = 2.39$, $SD = 2.90$). The mode of communication by time period interaction was not significant ($F_{(3,54)} = 1.65$; $p > .1$).

| 1st Quarter | 2nd Quarter | 3rd Quarter | 4th Quarter |
|-------------|-------------|-------------|-------------|
| Mean | Mean | Mean | Mean |
| (Std Dev) | (Std Dev) | (Std Dev) | (Std Dev) |
| .605 | 2.43 | 6.86 | 3.62 |
| (1.59) | (3.05) | (3.80) | (2.72) |

Table 3.7: Mean Experiment 1 proportional CIT for each time period (quarters)

3.3.4.2 The distribution of PREF over time

The analysis of PREF (Appendix C1) again revealed a significant effect ($F_{(1,18)} = 135.63$; $p < .001$) of the mode of communication with FTF panels ($M = 1.29$, $SD = 1.74$) communicating less expressions of preference than CM panels ($M = 6.44$, $SD = 7.92$). It also revealed a main effect of the quarterly time periods ($F_{(3,54)} = 86.69$; $p < .001$), such that the longer the groups communicated the greater the proportion of their communication that consisted of PREF (Table 3.8).

| 1st Quarter | 2nd Quarter | 3rd Quarter | 4th Quarter |
|-------------|-------------|-------------|-------------|
| Mean | Mean | Mean | Mean |
| (Std Dev) | (Std Dev) | (Std Dev) | (Std Dev) |
| .11 | 1.89 | 2.40 | 11.07 |
| (.35) | (2.77) | (2.39) | (8.58) |

Table 3.8: Mean Experiment 1 proportional PREF for each time period (quarters)

However, unlike the use of CIT the mode of communication by time period interaction for PREF was significant ($F_{(3,54)} = 45.17$; $p < .001$: Figure 3.10 & Appendix C1) with greater levels of PREF communication being exhibited by CM panels in all but the first stage of the discussion. Care should be taken when interpreting these data due to the possibility of a floor effect and the small standard deviation of the first, and large standard deviation of the fourth quarter, which might account for the existence of the interaction.

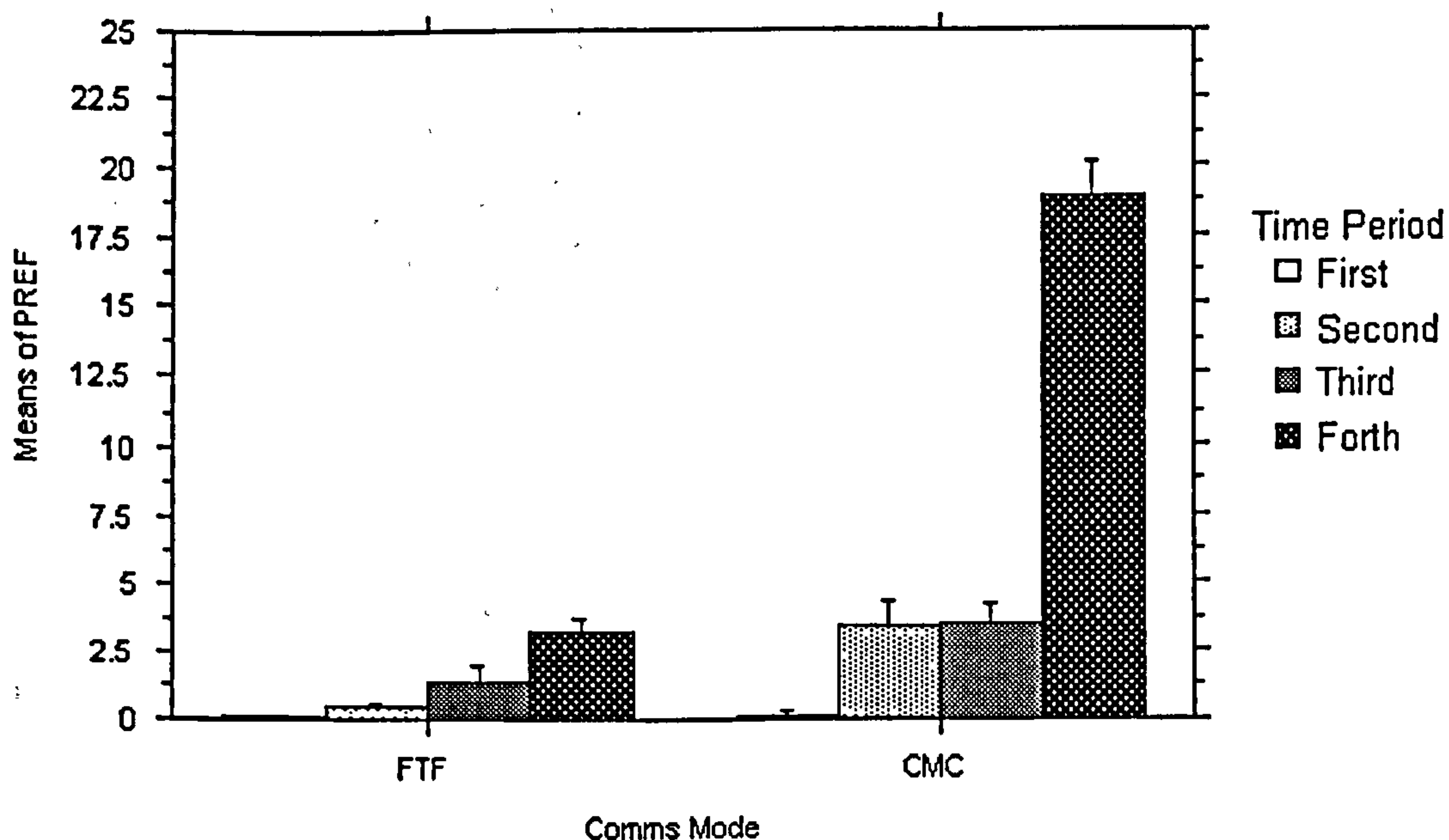


Figure 3.12: The distribution of Experiment 1 proportional PREF over the four time slices.

3.3.4.2 The distribution of PROC over time

As with the analysis of PROC (Appendix C1) an effect of communication mode was revealed ($F_{(1,18)} = 12.78$; $p < .05$) with FTF panels ($M = 1.04$, $SD = 1.09$) making greater effort to coordinate the efforts of the group than CM panels ($M = .37$, $SD = .68$).

| 1st Quarter | 2nd Quarter | 3rd Quarter | 4th Quarter |
|-------------|-------------|-------------|-------------|
| Mean | Mean | Mean | Mean |
| (Std Dev) | (Std Dev) | (Std Dev) | (Std Dev) |
| .26 | .31 | .72 | 1.52 |
| (.50) | (.40) | (.78) | (1.34) |

Table 3.9: Mean Experiment 1 proportional PROC for each time period (quarters)

An effect of time period (Table 3.9) was also significant ($F_{(3,54)} = 13.35$; $p < .001$) along with a significant interaction between the two ($F_{(3,54)} = 2.95$; $p < .05$, Figure 3.11) with FTF groups devoting greater effort to the coordination of the group activity in later time periods.

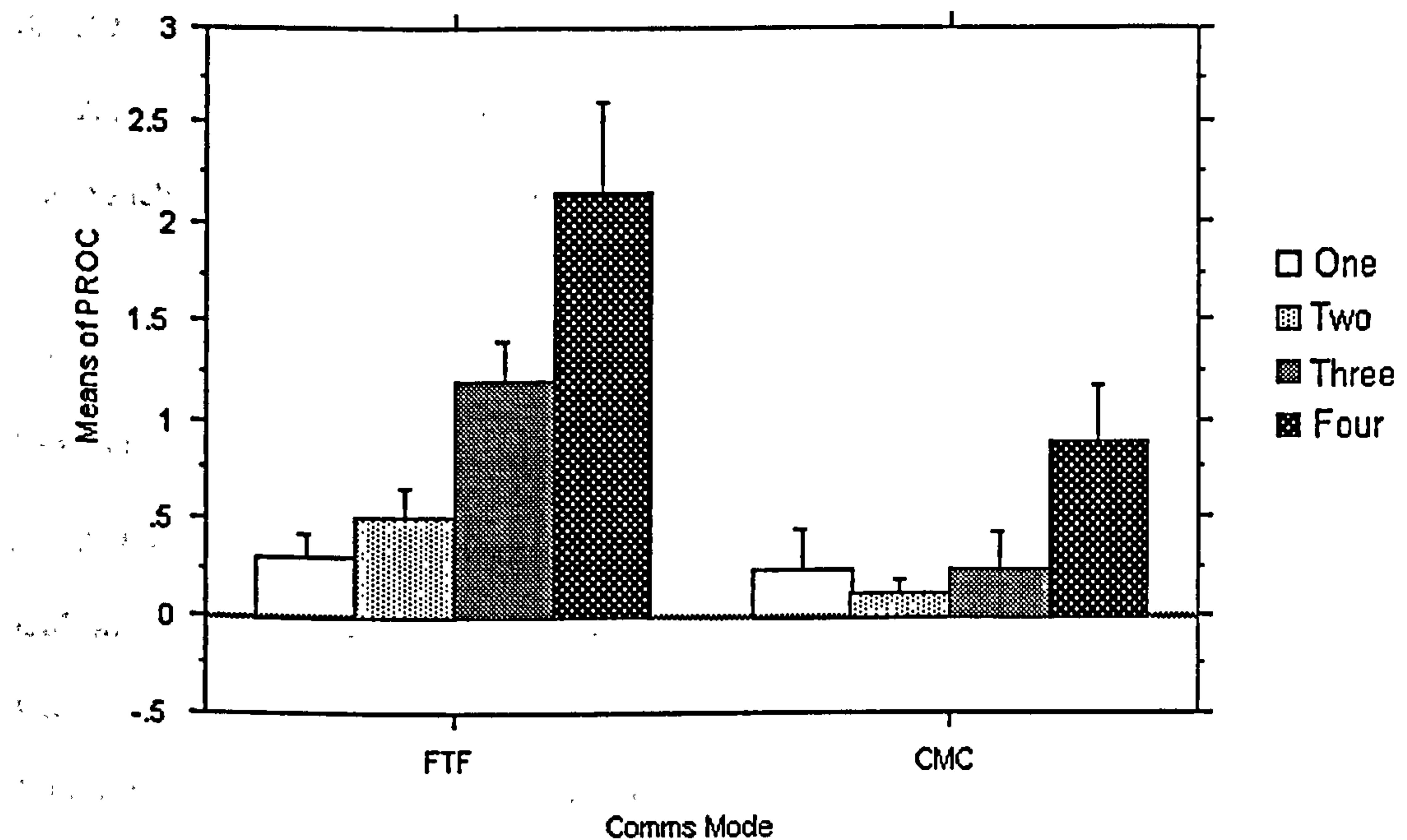


Figure 3.13: The distribution of Experiment 1 proportional PROC over the four time slices.

3.3.5 Final Perspectives on the Decision Process

Having discussed both the initial outcome measures: time taken to reach a decision and decision outcome, and the differences observed in the types of communication used to reach the decision it is worth considering the perceptions of the decision makers themselves (Table 3.10). As discussed in Chapter One an important factor in the use of any computer system are the user perceptions of the system and of the decision reached through the system. The data collected from the post-experimental questionnaire offers a indication of the levels of satisfaction, participant influence, and ease of communications of each group member.

| | Satisfaction | Ease of Communicating | Influence | | | |
|-----|--------------------|--------------------------|-------------------|-------------------|-------------------|-------------------|
| | | | HC | HV | SW | WO |
| | Mean* (Std Dev) | Mean* (Std Dev) | Mean (Std Dev) | Mean (Std Dev) | Mean (Std Dev) | Mean (Std Dev) |
| FTF | 4.30 (1.30) | 3.93 (1.00) | 2.35 (1.07) | 2.03 (.94) | 2.69 (1.00) | 2.94 (.97) |
| CM | 3.75 (.91) | 3.23 (1.21) | 2.10 (1.03) | 2.59 (1.09) | 2.55 (.85) | 2.76 (1.15) |

Table 3.10: Experiment 1 Participant perceptions of the decision making process

Note: * denotes $p < .05$

3.3.5.1 Satisfaction Levels

A member's satisfaction with the group decision suggests the extent to which the decision was reached through consensus or compromise. Low satisfaction with the group decision (1 = very dissatisfied) would suggest that it was reached through compromise between group members, higher levels of satisfaction are indicative of a decision reached through consensus (5 = very satisfied).

A 2-way ANOVA examining the effects of communication condition (between groups - FTF, CM) and participants role (within groups - Hospital Consultant, Health Visitor, Welfare Officer, Social Worker) upon the ratings of satisfaction reveals, a significant effect of communication condition ($F_{(1,18)}=6.44$; $p<.05$). Members of CM decision making groups were significantly less satisfied ($M = 3.75$, $SD = .91$) than their FTF counterparts ($M = 4.30$, $SD = 1.30$), implying that the decisions of CM groups were based more upon compromise than those of the FTF groups which were reached more through consensus. No effect of role ($F_{(3,54)}=0.241$; $p>.05$) or a role by condition interaction ($F_{(3,54)}=0.332$; $p>.05$) was apparent.

| | Health Consultant | Health Visitor | Social Worker | Welfare Officer |
|-----|----------------------|-------------------|------------------|--------------------|
| | Mean (St Dev) | Mean (St Dev) | Mean (St Dev) | Mean (St Dev) |
| FTF | 4.45 (.52) | 4.36 (1.21) | 4.27 (.90) | 4.18 (.87) |
| CM | 3.50 (1.58) | 4.90 (1.37) | 4.00 (1.15) | 3.60 (1.17) |

Table 3.11: Experiment 1 Satisfaction Ratings: Communication Mode by Participant Role

3.3.5.2 Perceptions of Influence

As discussed earlier (Chapter One) computer conferencing systems have been shown to equalise the participation of group members by removing status effects in group decision making. An examination of the perceptions of influence as viewed from the group members themselves offers insight into the extent to which influence was exerted by each group member. Participants ranked the entire group (themselves included: Table 3.10 above) indicating the influence exerted by each upon the group, such that the person ranked one was considered most influential, and the person ranked fourth the least. Removing the self-rating from the continuum, and re-ranking gave for each participant their perceptions of the influence of the other three group members. From the group member scores, mean ratings of influence were calculated such that the influence rating for each group member consisted of the mean perceptions of the remaining group members (Table 3.12)

| | Health Consultant | Health Visitor | Social Worker | Welfare Officer |
|-----|----------------------|-------------------|------------------|--------------------|
| | Mean (St Dev) | Mean (St Dev) | Mean (St Dev) | Mean (St Dev) |
| FTF | 2.40 (1.10) | 2.02 (1.08) | 2.58 (.85) | 2.83 (1.14) |
| CM | 2.15 (1.07) | 2.75 (1.08) | 2.58 (.85) | 2.83 (1.16) |

Table 3.12: Experiment 1 Influence Ratings: Communication Mode by Participant Role with self rating removed.

Examining this influence score in relation to the communication condition (between groups - FTF, CM) and participant role (within groups - HC, HV, SW, WO) reveals no significant effect of condition ($F_{(1,18)}=0.463$; $p>.05$), however the observed effect of role is not sufficient to reject any suspicion of differential influence of participant role ($F_{(3,54)}=2.527$; $p=.067$), but this unlikely to interact with the communication defined condition ($F_{(3,54)}=2.058$; $p>.1$).

Exploring further the mean influence figures obtained for the roles indicates the possibility that the Medical roles; Hospital Consultant ($M=1.80$) and Health Visitor ($M=1.91$) are perhaps more influential than the Social Service roles of the Welfare Officer ($M=2.02$) and the Social Worker ($M=2.28$). This is as would be predicted by Craft & Bettin (1991) with decision makers being swayed more by medical, than non-medical arguments and evidence.

This result suggests that further exploration of the equality of influence is required, a possible measure of the equality of influence can be obtained through calculating Kendall's coefficient of concordance (W) for each group. Here W indicates the level of agreement (1 complete agreement to 0 complete disagreement) within a decision making group. Here groups with high agreement are assumed to have an unequal distribution of influence. Retaining participants self-perceptions of influence, and testing the resultant figures reveals no significant difference ($t_{(18)}=-0.408$; $p>.1$) between the conditions (FTF M=0.394, CM M=0.349) although slightly greater variance in the FTF condition (FTF SD = 0.305, CM SD = 0.170) is observed, suggesting that no difference in the equality of participation exists between the conditions.

3.3.5.3 Ease of Communicating

The final measure of participant perception concerns their perceived ease of communicating ideas to other members of the group. Ratings (1-considerable difficulty in communicating ideas to other panel members to 5-very easy to communicate own ideas) were compared across conditions (FTF, CMC) and across roles (HC, HV, SW, WO).

Mean ease of communicating scores (FTF M=3.23, CM M=3.93) revealed that participants in the face-to-face condition found communicating their ideas easier than the computer-mediated counterparts ($F_{(1,58)}=9.938$; $p<.005$), but that no influence of either role ($F_{(3,54)}=0.992$; $p>.1$) nor a role by communication interaction ($F_{(3,54)}=1.108$; $p>.1$; Table 3.13).

| | Health Consultant | Health Visitor | Social Worker | Welfare Officer |
|-----|----------------------|-------------------|------------------|--------------------|
| | Mean (St Dev) | Mean (St Dev) | Mean (St Dev) | Mean (St Dev) |
| FTF | 3.91 (1.14) | 4.09 (.70) | 3.91 (.94) | 3.73 (1.27) |
| CM | 3.80 (.79) | 2.80 (1.14) | 2.90 (1.66) | 3.4 (.97) |

Table 3.13: Experiment 1 Ease of Communicating: Communication Mode by Participant Role

3.3.5.4 Summary of Participant Perceptions

The post-experimental questionnaire has revealed several interesting features about the user perceptions of the decision process. The first is that the FTF decision makers are more satisfied with the decision than their CMC counterparts. The second is that there is a slight suggestion that regardless of the communication defined condition, that the medical roles

have a more influential role in the final group decision. Finally, as expected FTF groups find it easier to communicate their ideas than CM panels.

3.4 Discussion of Experiment 1

3.4.1 Overview

Three distinct issues surrounding Experiment 1 are addressed in turn before considering the next stage of the experimental work. The first of these, concerns the communication style of CM and FTF groups and the selection of key forms of communication to examine in future experiments. The second issue relates to the experimental and statistical procedures employed in the design and analysis of these data, and finally consideration is given to the interpretation of participants' perceptions of the decision making task.

3.4.2 Communication Style

3.4.2.1 Informational and Normative Influence

Although groups, regardless of their mode of communication (FTF, CM) are devoting the same levels of communication to information that describes in a general nature the information they have or is inferred from the casenotes (INF) before them, FTF groups communicate greater levels of quoted information (CIT) to one another than CM groups. This suggests that whereas the FTF groups offer the information to one another and allow the other panel members to draw their own conclusions, the CM groups offer inferred and general information which perhaps carries less direct impact and greater personal opinion. A direct quote by the very nature of the utterance conveys to the other panel member(s) the information as presented in the casenotes, it is not altered by the speaker/sender of the communication. Inferred information, on the other hand, may include some information as perceived by the speaker/sender. That is, in either summarising the general nature of the communication or in the process of inferring information from the notes provided, the perceptions, biases and influences of the speaker/sender may be conveyed.

In contrast to the informational influence exerted by the decision makers where the FTF groups show a surfeit, when it comes to a normative style of discussion the CM groups show greater levels of communication. Taking this greater concentration on the expressions of preference, and value laden statements together with the decrease in quoted information (CIT) reflected in the analysis of informational influence data, suggests that CM groups are

adopting a decision driven or normative approach to the task and that FTF groups are driven more by evidence and information than personal preference.

3.4.2.2 Reducing the differences between CMC and FTF

The differences in communication styles of CM and FTF groups can be viewed either in absolute or proportional terms. For CM groups to communicate at levels equivalent to FTF groups they must increase their absolute level of communication. Such an increase is prevented by the physical barrier created by the keyboard; even the fastest touch typist communicating to a speed reader could not communicate at rates equivalent to those observed in FTF communication.

The alternative is for CM groups to adjust the proportion of their communication dedicated to the various communication categories, creating groups not of absolute, but of proportional equivalence. In order to communicate at levels proportionally approaching those of FTF groups, CM groups will need to suppress the levels of communication relating to the decision options (PREF) relative to their overall communication levels. At the same time they need to proportionally increase the amount of information quoted from the database (CIT). It would also be beneficial, in terms of process and participant perceptions were they to increase communication aimed at co-ordinating their approach to the problem (PROC). Although other differences exist in the patterns of communication, these three categories are representative of the direction and magnitude of the differences and varied in their content type (informative, normative and miscellaneous) enough to merit exploration of the possibilities for communication support.

Indeed, the analysis of the data corpus reveals the location, direction and magnitude of differences in communication between face-to-face and computer-mediated decision making groups. This analysis has shown that face-to-face groups discussed the content of the available information at length, with a peak exchange of information occurring around ninth time period and placed relatively little emphasis on the decision outcome until the point at which a decision had to be made, indicated by the generally low production of PREF utterances, until the final time period of the decision process.

In contrast with this, computer-mediated groups tended to focus more on the decision outcomes available to them from the outset, with PREF communication apparent across all

stages of the decision process and relatively less on exchanging information and arguments in support of these decision outcomes, with low levels of CIT throughout (cf. Stasser & Stewart, 1992, Dubrovsky, Kiesler & Sethna, 1991; Siegel, Dubrovsky, Kiesler & McGuire, 1986).

In other words, computer-mediated groups tended to be “decision-driven”, whilst face-to-face groups were “evidence-driven.” It is hypothesised that this reflects an adaptation of communication style (see for example Weisband, 1992) as a result of the restrictions placed on communication by the interface used to communicate in CMC.

3.4.2.3 The Lack of Attention Afforded MAT and VAL communication

The difference in the level of communication of MAT can be accounted for by the threshold model of production costs Reid *et al.*, (1995, 1996, 1997), MAT are primarily concerned with statements relating ‘How to...’ perform a function, e.g. turn the page, send a message etc. In CM groups it is quicker to discover the answer by trial and error than to compose a message and await the reply, in a FTF decision panel it is relatively rapid, and of low production cost to ask everyone the same question. As such exploring the relative differences in materials/experimental context offers little insight into the group communication processes. In addition, the cost of conveying individual actions or providing information that locates their position within the casenotes files might also be deemed too costly relative to the impact and advantage that they afford the group.

Statements of Societal and Personal Values (VAL) constitute a relatively small total of the communication and might be considered very similar in nature to PREF in so much as they normative information. Given that the CM groups communicate less VAL and less PREF, and that PREF are more prominent it is more interesting and potentially more rewarding to concentrate on the different levels of PREF rather than VAL. It is assumed that alterations in communication behaviour that can be observed in relation to PREF could also be observed for VAL were sufficient emphasis placed on this style of communication.

3.4.3 Issues of Experimental Procedure

3.4.3.1 Multiple *t*-tests and experiment wise error

The repeated application of *t*-tests to the nine high level communication categories requires some comment regarding the likely errors that this entails. With each application of a test the likelihood of attributing an effect due to sampling error to the independent variable

increases. However, given that alpha level of the significant findings is 1% and below, the likelihood of having made a type I error is within acceptable margins of error.

3.4.3.2 Reliability of the Coding Scheme

The calculation of Cohen's Kappa revealed exceptionally high levels of agreement in the application of the coding scheme. As both coders collaborated upon the developed of the coding scheme this might be expected, it is therefore necessary to test the application of the scheme throughout the series of experimental chapters to ensure that the reliability of the scheme is maintained throughout.

3.4.4 Participant Perceptions of the Decision Task

3.4.4.1 Satisfaction Levels

As with previous studies comparing CMC and FTF groups, the satisfaction levels of participants vary according to the conditions under which they operated. However, unlike previous studies where this has often been attributed to communication condition itself, it is interpreted here as being a result not of the mode of communication, but of the style adopted within that mode. That is to say, it is not CMC *per se* that leads to decreased levels of satisfaction, but rather the way in which people communicate when conducting such tasks via a computer. It is expected that as communication styles change in response to the feedback given by the support system in later experiments that the satisfaction levels will also vary.

3.4.4.2 Perceptions of influence

Although the data collected regarding the perceptions of influence of each group member held by each group member suggest no differences between condition, or any influence of role this information needs to be interpreted with caution. The nature of the two communication mediums being tested are such that participants in the face-to-face condition are aware not only of the messages sent or received by themselves, but also of communication between two other group members. As such their global impression of the dynamics of the group is perhaps clearer than that of the computer-mediated groups whose impression is based only upon the communication that directly involves them. This should not, however, be taken as evidence of a lack of equalisation of participation in the decision making process, the data suggests that equalisation of influence does occur, however this must be tempered by the

knowledge that the perceptions of CM panel members, may be less reliable than those of their FTF counterparts.

3.5 Statement of Intentions

The intention is to explore the possibility of the development of a system that can overcome the tendency of computer-mediated groups to be “decision-driven” by shaping their communication behaviour to be more like that of face-to-face groups. This requires computer-mediated groups to suppress their tendency to concentrate on decision outcomes, and to enrich their conversation with more reference to factual information and reasoned argument. It is the attempt to change the communication style of CM groups forms the basis of Chapter Four.

4.1 Introduction

4.1.1 Overview

Having developed a paradigm within Chapter 2 which enables the testing of the effects of feedback upon communication, Chapter 3 concentrated on the analysis of a data corpus to enable the identification of the differences in the styles of communication employed by face-to-face (FTF) and computer-mediated (CM) decision making groups. This chapter explores the possibility of an intelligent support system modifying the communication of computer-mediated groups, a modification that aims to reduce the dependency of CM panels upon a normative style of communication and increase the level of informational influence. To this aim, an experiment comparing two forms of group communication support system is reported, and future developments of the support system discussed.

4.1.2 Implications of archive analysis

Experiment 1 revealed two key differences between computer-mediated and face-to-face groups. CM decision making groups devoted approximately one fifth (18.4%) of their communication to discussion regarding the decision outcome (PREF) compared to just 3.1% in the FTF groups. In contrast, FTF groups devoted approximately one fifth (21.4%) of their communication to information quoted from the casenotes (CIT), a communication style that contributed to only 16.3% of the CM panels. In addition to these two areas of communication style, it was also considered interesting to examine the effects of communication that aims to co-ordinate the group effort (PROC). Furthermore, differences were observed in the self-reported measures of the decision makers on both their satisfaction with the decision ($p < .05$) and also on their ease of communicating with other group members ($p < .05$).

The two main explanations advanced for these effects are firstly, that the communication medium itself effects the perceptions of the task, or secondly, that as a response communicating via computer CM panels alter their style of communication and this results in the changes observed in the self-report measures.

Expected levels of communication for both computer-mediated and face-to-face decision making panels have been observed in Experiment 1, it is hypothesised that the differences

between the two styles of communication, are reflected in the subjective measures of decision satisfaction and decision performance. This is to say that it might be the different communication process of styles of communication that are responsible for the differences in satisfaction with the decision, and that it is the communication process itself, rather than the medium of communication is the primary cause of this dissatisfaction.

By developing a system to monitor and shape the communication of the CM decision making panels and utilising this in the decision making process, not only can the possibilities for overcoming the relative dependence of CM panels upon a normative style of discussion rather than informational influence be examined, but also the effects of the communication style on both decision process and decision outcome may be observed.

4.1.3 Developing a Support System

The review of existing levels of communication processes and experimental examinations of the theories of CMC (Chapter One) suggests several possible forms of intervention system that might successfully alter the communication patterns of CM groups to more closely resemble FTF decision makers. The starting position adopted for the series of experiments reported in this thesis are from two, almost contrasting positions: one providing directive support and the other non-directive support. The initial premise underpinning this dichotomy is that computer-mediated decision makers can be informed of discrepancies between their own communication style and a 'gold standard' in either of two manners.

Firstly, an approach can be adopted where the decision makers are informed that their communication process does not resemble that of decision making groups who successfully resolve the task. Having been informed of this discrepancy, the decision makers can then be left to continue to communicate either utilising this feedback or ignoring the new information they have received.

A second approach would be to begin in the same way, that is to inform the decision makers of the discrepancy between their own levels of communicating and that of the target group. Then, rather than leaving the decision makers to interpret the information, it can be supplemented with advice on how to proceed. In short, the decision makers can be directed to increase or decrease their communication in line with the target levels held by the support system.

Both these methods of support begin by informing the decision makers that their communication process does not mirror the process of expected communication. The difference lies in the action after the provision of this information, in the first instance no direction is given. Here, the implication is that participants are free to communicate as they wish, where in the second instance, directions occur and the decision makers are encouraged to alter their communication to bring it 'back in line' with the 'gold standard', in this case FTF or information-driven communication.

4.1.1.4 Aim of Chapter Four

The purpose of the experiment reported in this chapter is to explore the possible forms of support for computer-mediated groups and identify the form of feedback most likely to shape computer-mediated communication to resemble that of a face-to-face group. To develop successful intervention rules it is necessary to address three issues i) the purpose of the intervention, ii) the user expectations of the support system, and iii) the form of communication to be supported each of which will now be addressed in turn.

4.2 Decision Task Issues.

4.2.1 Modifications to decision options

The decision options available in the experiment reported in Chapter 3 resembled a continuum from Option 1 - the provision of home help through removing the youngest child (Option 2) to the removal of all three children (Option 3). This presents an obvious omission from the decision options, that of removing the two youngest children. Indeed, when examining expressions of preference for outcomes other than the options available it is apparent that a number of decision panels consider this outcome. Typical of the discussion of these groups was the comment from one Health Visitor, just short of an hour into Experiment 1 who commented,

“But that isn’t even an option to take away the, you know, Mary and Lucie, you just, just the baby.”

Other examples of discussions surrounding non-available options occurred in both the transcripts of FTF panels and the e-mail records from the CM groups. Including this extra option might have two effects. Firstly, although intervention on the basis of process rather than outcome is perfectly acceptable, identifying a difference in outcome in addition to the

difference in process might permit greater understanding of the decision making process, and secondly, it can be assumed that the groups who wish to remove the two youngest children, have effectively reached a decision. These groups are now forced to continue in the decision making process. This has four effects: firstly, the time taken to reach the decision increases, as having reached what they believe to be an acceptable solution to the task before them, the decision makers are forced to continue their deliberations. Secondly, as a result of the continued decision process and the need to select another solution, the satisfaction levels of the decision makers are likely to decrease.

It is likely that a similar adverse effect will be observed upon the other subjective measures of the decision process as assessed by the post-experimental questionnaire and a forth likely effect is that the overall levels of communication in the decision making process will increase, as the discussion is prolonged.

The combination of these factors is such that the appropriateness of the target levels of communication decreases, which leads in turn to a decrease in the effectiveness of the support system. Thus, to increase the understanding of the decision process and to avoid decreasing the integrity of the target levels of communication the extra outcome was included in the decision options presented to the panel.

4.2.2 Modifications to group size

The nature of the semi-automated paradigm (MIMICS) developed in Chapter 2 is such that as the flow of messages through the system increases the efficiency of human component decreases. Two options exist for reducing the workload demands on the system's human component thereby increasing the operational efficiency of the support system: to remove one person for the panel forming a triad or to halve the size of the group creating a dyad.

Although the decision upon group size is largely an arbitrary one, an examination of the transcripts from both the FTF and CM groups reveals that a number of decision panels discussed the information in pairs, often the health consultant with the health visitor and social worker with the welfare officer. As such, dyads would appear to offer the greatest similarity to the original task, but equally importantly, offer the greatest likelihood of operational success for the paradigm.

The remaining question is whether a dyad can be considered to be a group. This is somewhat of a philosophical argument that depends considerably on the definition. The important factor for consideration here is that the patterns and findings from the dyadic decision panel are not systematically different from the patterns and findings expected in larger groups. The issue of the group size was briefly discussed in the first chapter and will be given further consideration when the findings of the series of experiments are discussed (Chapter Eight).

4.2.3 Modifications to task length

Having considered the group size it is now necessary to consider the size of the task. Examining the stages of the decision making process through the communication of decision panel members and also through examining the records of inspection of the databases, what can roughly be considered two stages is revealed: information acquisition and information exchange. There is little communication between group members during the first thirty to forty-five minutes of the experimental task, an examination of the inspection times of the casenotes reveals that the decision makers spend much of this time is spent familiarising themselves with the material contained in the databases. It is therefore likely that this first period of the experiment can be considered to be one of information acquisition, a stage of equipping oneself with the information necessary to complete the task. The second stage, once the decision makers begin to communicate with one another involves the evaluation and exchange of information between decision panel members.

The first stage appears to commonly persist for between thirty and forty-five minutes, however, the second is an iterative process that fills the remainder of the decision time. This pattern is apparent in the majority of the decision panels, although it should be noted that some panels or panel members do enter what may be considered subsequent stages of information acquisition, although in all cases the time spent on stage 1 is shorter on each re-entry. In general terms however, the two stage model of acquisition followed by evaluation/exchange holds true.

The information acquisition stage is likely to remain a constant determined by the level of information before the group members, and to operate independently of the size of the decision panel. Variations in task length however are likely to result from varying time spent

in stage two, which logically varies as a result of the size of the decision panel. It also follows that beyond a minimum point, the pattern of information exchange would remain constant. As such, below the floor effect the process observed in a dyadic panel should resemble that of a group of four decision makers.

It was not deemed necessary to retain a task length of three hours. Rather assuming that the time required for exchanging and evaluating information varies according to panel size permits a reduction in task length. Retaining forty-five minutes to acquire the information from the database, and additional seventy-five minutes to permit discussion would appear suitable. This might be considered generous since a four person decision panel was permitted one hundred and thirty five minutes. Thus the experiment reported in this chapter (Experiment 2) granted decision makers a maximum of two hours in which to complete the task.

4.2.4 Modifications to task materials - Rips Casebook Two

Modifications to both panel size (group of four to dyad) and task length (three to two hours) pose questions about task materials used in the experiment reported in Chapter Three. Given that the databases presented included equal numbers of arguments for each decision option, they can be considered relatively balanced arguments. This balanced state may be disrupted if two databases were selected from those available and presented to decision makers. Clearly, some alteration to the decision materials was required.

The inclination of panels to remove children from the family and thus out of harm and the slightly higher levels of influence of the two medical roles (Hospital Consultant and Health Visitor) reported in Experiment 1 suggests that the medical information appeared to have a greater influence on the decision process. However, for the most part the outcome of the decision process was satisfactory and there appears little justification in developing new materials

Two new fifty statement databases were generated from the pool of two hundred items used in the four original databases. This offered the opportunity to reduce the impact and/or availability of the medical information to the decision makers (cf. Craft & Bettin, 1991) and create databases less inclined to a medical solution.

Two criteria guided the construction of the modified databases: (i) that the databases offer conflicting perspectives on the case therefore requiring a decision to be reached by discussion, and (ii) the overriding impact of the medical information be reduced.

From the ratings data the extraction of the dominant preference of each statement was possible, similarly the second preferred option of each option was identifiable. Through this process each of the original two hundred statements can be classified (Appendix B2) in terms of the rank order of the options that it supports. (Table 4.1 indicates the breakdown of these ratings.)

| The number of statements in the database of... | | | | | |
|--|-----------------|------------------------|-------------------|------------------|--------------------|
| | Option Order | Hospital Consultant | Health Visitor | Social Worker | Welfare Officer |
| Provide | 1-2-3 | 1 | 0 | 23 | 29 |
| home help | 1-3-2 | 4 | 1 | 11 | 6 |
| Remove some | 2-1-3 | 4 | 1 | 8 | 3 |
| children | 2-3-1 | 0 | 0 | 0 | 0 |
| Remove | 3-1-2 | 12 | 14 | 4 | 3 |
| All Children | 3-2-1 | 28 | 33 | 1 | 0 |

Table 4.1: The classification of statements from the original database used in Experiment 1. (Excludes tied rankings)

To create the strongest arguments for the retention of the family unit with provision of home help, fifty statements that provided most support for option one and least for option three were selected. These consisted of twenty-three statements originally used in the Social Worker database combined with twenty-nine from what had previously been classified as the Welfare Officer, with duplicate records relating to the same incident removed. This database was labelled the Department of Social Services (DSS) and presented a predominantly social welfare perspective on the case. A second database (Local Health Authority, LHA) was constructed from a predominantly medical perspective taking thirty-four statements indicating removal of all three children (classified 3-2-1) drawn from the Hospital Consultant and Health Visitor files but also including the sixteen files (classified 2-1-3) that supported the removal of just the youngest child ahead of providing more home help, and offered little support for the

removal of all three children. The construction of the LHA database was such that the majority of information contained had previously been held by the medical databases (HC & HV) but moderated by the presence of some welfare orientated information from the social and welfare files. To maintain the continuity of the statements any information that had previously been contained in the welfare files had the sources altered to ensure that it was attributable to a medical source, this commonly consisted of attributing files that had previously been labelled as being from the social workers department to belonging to the Health Visitors department (See Appendix B6.2)

4.2.5 Developing Target Levels of Communication

4.2.5.1 *The Goal of Intervention*

Assuming that the examination of existing face-to-face communication reveals two important elements: namely the natural levels of communication required to reach a correct decision and also the communication parameters both familiar and acceptable to decision makers, offers a point from which to develop both the form (method of delivery) and content (nature of the messages) of intervention. These assumptions will be addressed in the discussion of the data collected, however, at this point it is sufficient to consider FTF communication as indicative of the communication patterns that users might expect to experience in a CMC system. Although the model of communication employed as the 'gold standard' is a primarily arbitrary decision, the use of FTF communication might be advantageous. The primary advantage is that it is a communication style with which the users will be familiar and as such avoids the inherent dangers adopting a model of communication that is alien to the user.

4.2.5.2 *An Initial Assessment of the Intervention Process*

Whether FTF communication patterns are desirable in decision making groups is a complex discussion point which will be addressed in later chapters. However, the question persists on what level should the intervention into communication be made. Chapter Three identified Citations of Case Fact (CIT), Expression of Option Preference (PREF) and Procedural Utterances (PROC) as key areas for modification. The use of CIT and PROC utterances by CM groups are below the levels observed in FTF groups and hence decision makers need prompting to increase communication of this type. In contrast, CM groups over

communicate their opinions relating to the available options (PREF) and thus need to be encouraged to suppress these utterances.

The examination of the communication patterns discussed in Chapter Three occurred not through real time, but rather through a series of time slices. Time slices were employed to reduce the impact of differences in non-task performance measures such as reading and typing speed. The assumption being that groups would operate using similar stages of decision making, but that these stages would vary in length according to dynamics such as the amount of time taken to read all the statements. Employing the approach of slicing the data is just one possible method for attempting to reduce the impact of a number of less important factors, e.g. speed of reading, and to help enable the identification of the key differences between the decision making groups. Therefore, for each decision making group, the length of each of these slices varies according to the total amount of time spent reaching a decision: the longer the total time, the greater the length of each slice.

Intelligent support of communication must occur in real time, without the knowledge of when the decision will be reached by the decision panel. The requirement for real time intervention necessitates predetermined points of intervention, when the panels communication must be compared to the target levels of communication, as derived from the earlier analyses (Chapter Three).

The levels of each of the nine categories of communication vary over time, and it is possible to speculate on the trade off between the various forms of communication. The exact nature of the covarying of communication categories is unknown, as such it becomes prudent to examine each category as if a single variable, operating independently. In reality the variation in levels of communication is unlikely to occur in isolation, assessing the variation between the communication of any decision panel and that of the model permits a meaningful intervention to occur. The provision of feedback upon all possible styles of communication would offer insurmountable problems, therefore the choice was made to concentrate on just three categories (CIT, PREF & PROC). As such it is necessary to concentrate on the form and nature of the intervention process in relation to each of the three communication codes.

4.2.5.3 The form of Intervention

A number of decisions can be taken in the determining the form of feedback to be included in a support system. Although, for the most part, the choices are guided by the literature the final decision as to which approach to adopt and which to reject can be considered to be arbitrary. The choice between two or more alternatives is often very finely balanced with equal merit in the approach adopted and those rejected. Appendix A4 provides a summary of the considerations and decisions taken in relation to the feedback system employed in this thesis.

The decision was taken to consider two different forms of feedback aimed at supporting the communication of CM groups. The first was to provide information that conveyed to the decision makers the level of the three forms of communication (CIT, PREF, PROC) in relation to the target levels observed in the Experiment 2. This feedback was provided regardless of whether the communication of concern was currently above, below or equal to the target levels derived from FTF groups. This feedback, considered to be non-directive communication support (NDCS) would enable the decision makers to decide whether to alter their communication to reduce the differences or to continue to communicate as they saw fit.

The second form of feedback was to provide information concerning only the categories of communication that deviated from the levels observed in FTF groups and to direct the decision maker's attention to the process required to reduce the differences. This directive communication support (DCS) implies there is little choice and that the decision maker should adjust their communication in the direction suggested. (Consideration of other combinations of feedback is given in Appendix A4).

4.2.5.4 The level of intervention

The levels of communication used by the FTF panels in the preceding experiment are taken to reflect a 'gold standard' of communication. The high levels of information based communication relative to normative influence that are employed by FTF panels offer what might be considered to be an 'evidence rich' discussion. A discussion which focuses upon the reasons for making the decision rather than merely exchanging preferred outcomes as a method of reaching a solution. The actual levels of communication of FTF groups are unattainable given the necessity of CM panels to overcome the keyboard interface and the

production costs inherent in communicating via CMC. The total communication levels of the CM decision making panels offer a baseline from which to operate. Rather than reduce these levels in direct relation to the shorter task and decreased group size of the current experiment, the decision was taken to try to increase the overall levels of the three communication styles of interest (CIT, PREF, PROC)

From the cumulative percentage distribution of utterances over the decision by the FTF panels *and* the total level of communication expected from CM panels, the levels of communication by each time period of CM panels operating using a FTF style of communication were constructed. These consist of the total communication levels that can be expected of CM panels distributed over the time of the task, with the levels in each communication category determined by the proportions of communication occurring in these categories in FTF groups. These levels form the target levels of communication that are the basis of the group communication support system. The three target levels of communication (Figures 4.1 to 4.3) are those for Citations of Case Fact (CIT), Expressions of Preference (PREF) and Procedures (PROC).

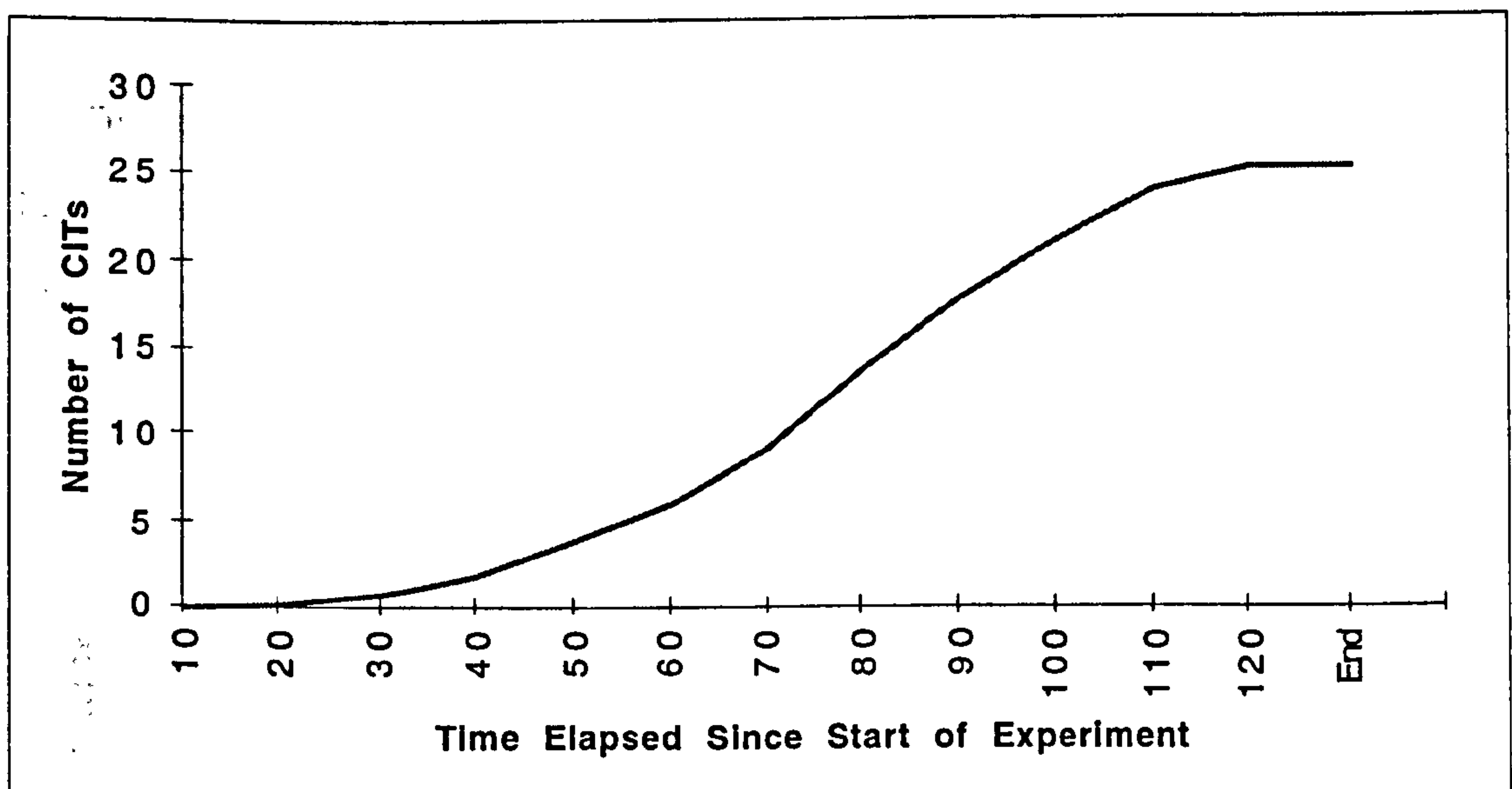


Figure 4.1: Cumulative levels of Citations of Case Fact (CIT) for CM panels operating with FTF styles of communication derived from Experiment 1.

From Figure 4.1 it is apparent that the panels are expected to generate around 25 CIT style utterances over the course of the two hour task. Very few of these will occur during the opening period of forty minutes, however the majority of CIT will occur between the period an hour into the decision and twenty minutes from the end.

The pattern of PREF is quite different, very few are required over the opening hour of the decision task (Figure 4.2) with a steady increase during the second hour to levels around a third of those seen for CIT.

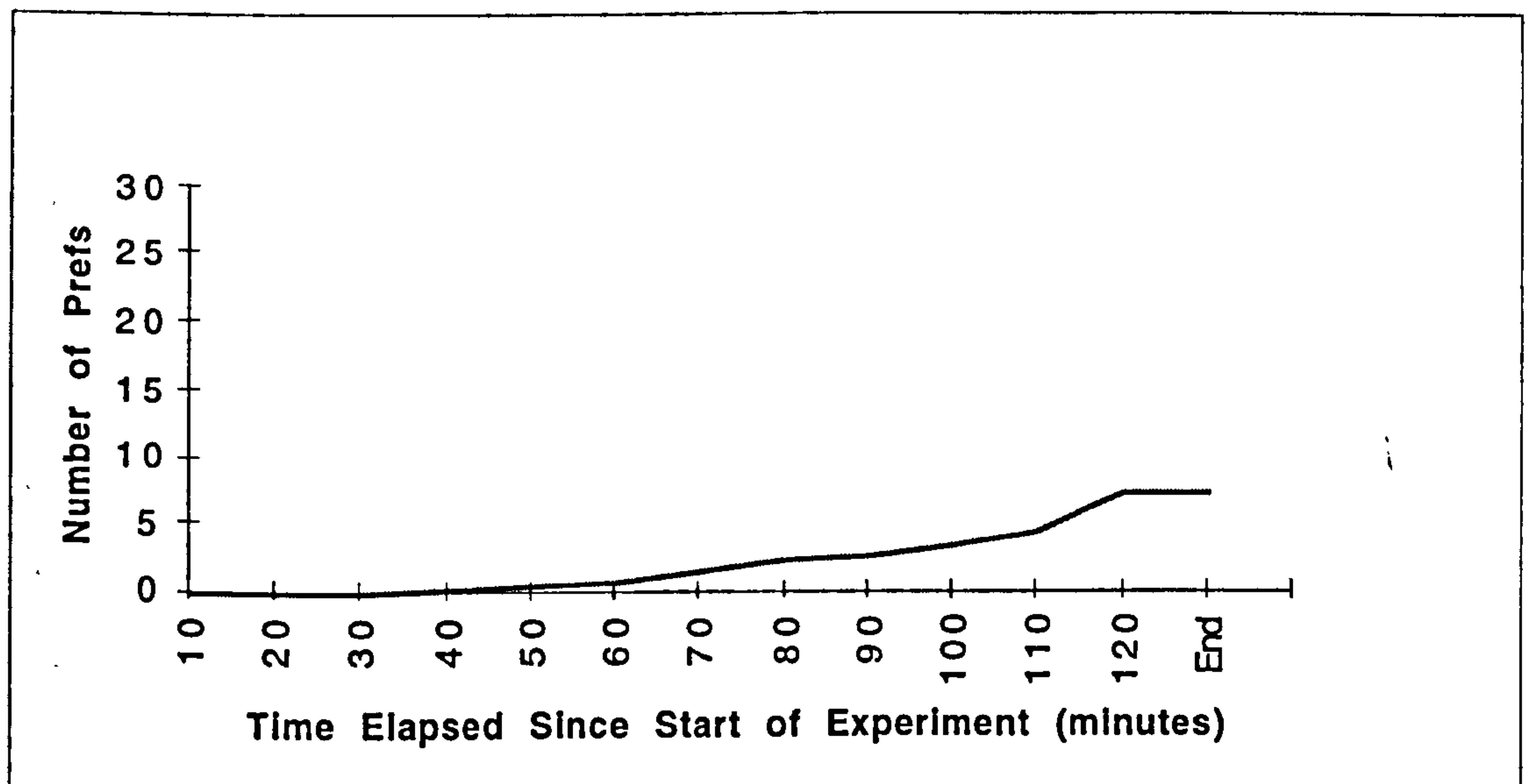


Figure 4.2: Cumulative levels of Expressions of Preference (PREF) for CM panels operating with FTF styles of communication derived from Experiment 1.

The generation of PROC (Figure 4.3) follows a similar pattern to those seen for Expressions of Preference (Figure 4.2). The increase for PROC is much more gradual with a low level overall but a steady rate of production to total levels similar to that of PREF, around eight.

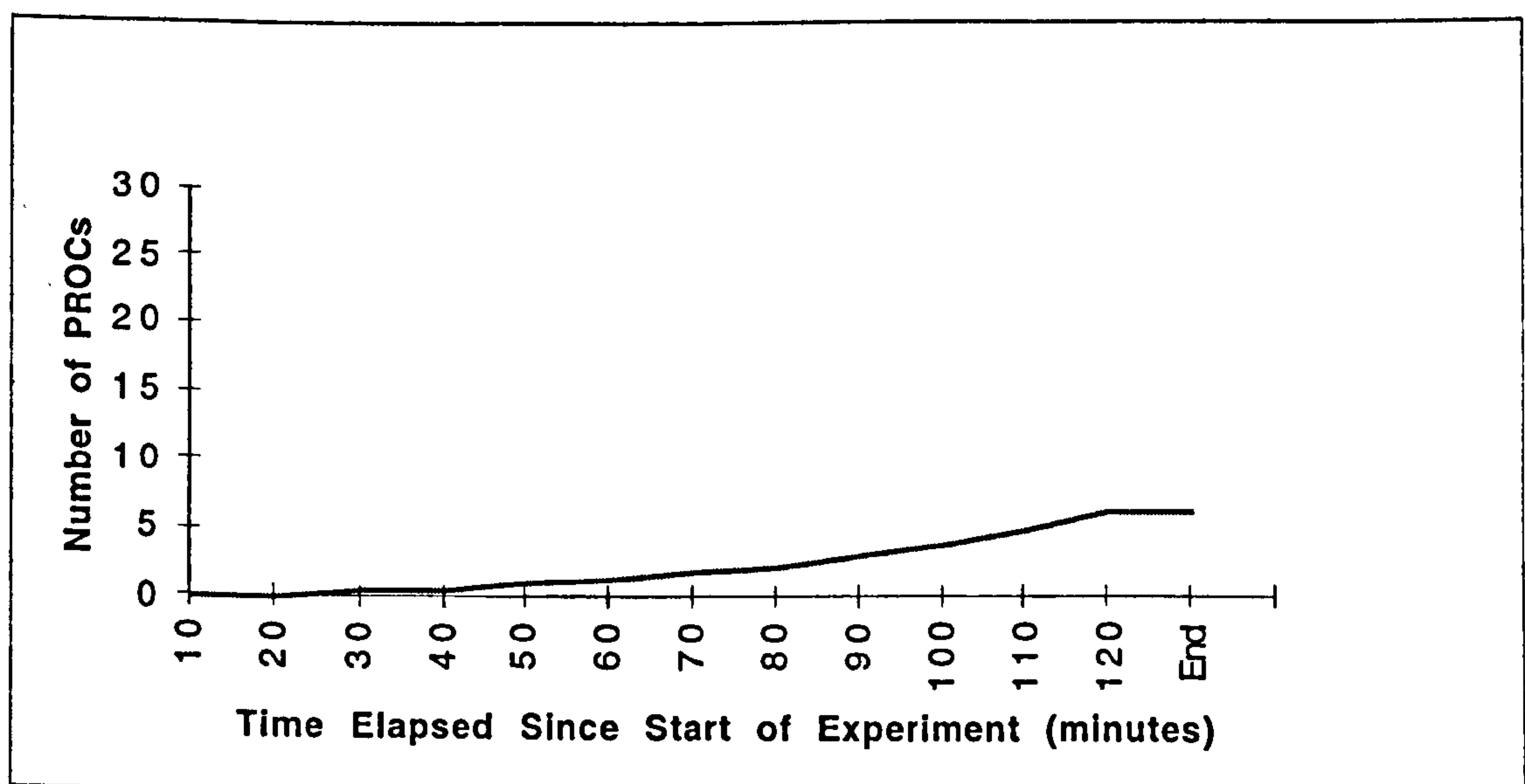


Figure 3.3: Cumulative levels of Procedures (PROC) for CM panels operating with FTF styles of communication derived from Experiment 1.

4.2.6 Participant Issues

4.2.6.1 Selection of Participants

The administration of the Choice Dilemma Questionnaire (CDQ) prior to conducting the experiment reported in Chapter Two presented several difficulties, notably one of maximum utilisation of the information obtained. Although the rationale for administration of such a tool remained, the difficulties of identifying a tool that could fulfil the functional requirements of the experiment prevented its subsequent use. Instead participants were assigned to roles at random and the selection criteria for the experiment was one of competent operation of the e-mail and database system, details of which are given below.

4.2.6.2 Training of Participants

All participants who were recruited to the experiment had prior experience of the basic operation of a computer, therefore rather than concentrating on basic computer skills the training equipped participants with the ability to navigate around the database system and to communicate via electronic mail.

The purpose and uses of each button in the database was explained to the participants, as this explanation occurred the participant gained hands on experience of the results of pressing each particular button. Participants progressed to reading through a reference file, skimming through the cards and reading information that caught their eye. It was explained that the reference file would be available in the experimental session and that the purpose of looking through now was primarily to get used to moving around the database and secondly to present them with some background prior to the experiment. Participants were encouraged to ask questions regarding the operation of the system, which where possible were answered with examples. Once the participants and the experimenter felt that they were capable of using the database, the participants progressed to being trained to use the electronic mail.

The training of sending and receiving electronic mail consisted of five phases: (i) opening the electronic mail, (ii) sending a new message, (iii) reading a new message, (iv) replying to a message, (v) returning to the database from the electronic mail system.

Participants were talked through the sending of their first electronic mail message by the experimenter. This consisted of a step by step guide to opening the mail system, composing the message and sending it to the other decision panel member. Participants then received

instructions on how to read a message that had arrived, either by opening the message immediately or storing it for reading later. Finally the participants were instructed how to reply to an existing message, so that the content of the message contained the message that they were replying to.

At this point the experimenter left and observed the participants through video cameras, re-entering the room only upon signals for help from the participants. Participants proceeded until they felt confident in their own ability to use both the database and the electronic mail. If at this point they had sent at least three messages and used both the send message and reply functions then they were thanked for their time and allowed to leave, if not they were encouraged to send another message or to reply to an existing one before being thanked and allowed to leave. Those who were unable to use the system were thanked and asked to withdraw from the experiment.

4.2.7 Aims of Experiment

The primary aims of this experiment were:

- i) To assess the feasibility of intervening on the basis of communication content style.
- ii) To identify the form of intervention most likely to succeed in modifying the communication of computer-mediated decision makers.

The secondary aim of this experiment was:

- iii) To test the paradigm under the heavy workloads demanded by experimental conditions.

It was hypothesised that:

- i) supported computer-mediated (CM) groups will operate with communication levels closer to FTF groups than unsupported CM groups.
- ii) self report measures of satisfaction with the decision outcome and the decision process of supported CM groups will more closely resemble the measures of FTF than unsupported CM groups.
- iii) the self report measures of CM groups operating under directive communication support (DCS) will differ from those operating under non-directive communication support (NDCS).

iv) the levels of communication of CM groups operating under directive communication support (DCS) will differ from those operating under non-directive communication support (NDCS).

4.3 Method

4.3.1 Design

The communication process of forty two-participant decision panels were examined under four communication defined conditions, three consisting of configurations of computer-mediated communication (Unsupported, CMC; Directive Communication Support DCS; Non-Directive Communication Support, NDCS), and the fourth a traditional face-to-face group (FTF).

4.3.1.1 Unsupported CM Decision Making Groups

Ten groups were randomly assigned to an unsupported computer-mediated communication (CMC) condition in which each member of the dyad sat in a room isolated from the other and communicated only via the electronic mail system. Participants in this condition experienced the same decision making conditions as those in the CM condition of the archive analysis (Chapter Three).

4.3.1.2 Supported CM Decision Making Groups

Ten groups were randomly assigned to each of two supported computer-mediated conditions. The first of these supported conditions comprised a directive group communication support system (DCS) that offered support to the users only when the communication deviated from the target levels and conveyed information only about the target category (CIT, PREF or PROC) that needed adjusting.

The second system (NDCS) offered communication support to the decision makers but in a non-directive form and did so about all three communication categories conveying both deviance from, and compliance to the model.

The systems thus differed in their style, the DCS interventions were irregular hence unexpected by the user, appeared unsystematic and were determined by communication behaviour. The NDCS prompts were regular and therefore expected, obviously systematic and determined not by behaviour but time. The essential difference between the systems is

however in their perception by the users, DCS prompts imply that there is *no choice* and that a *requirement exists* for the users to change their behaviour, in contrast NDCS interventions offer a *choice* to the user whether or not they alter their communication, and merely *suggest* rather than *require* modifications in the communication process.

4.3.1.3 FTF Decision Making Groups

The remaining ten groups made their decision face-to-face (FTF) and sat in a single room on either side of a large table. In the FTF condition, care was taken to ensure that participants could not see the computer screens of the other decision maker. Thus, in addition to being able to use the mailing system available in all CM conditions, participants in FTF condition were able to see and speak to each other as they worked on the decision task.

4.3.1.4 Roles within each group

Within each dyad, a different role was assigned at random to each decision maker. This differs from the previous study where a choice dilemma questionnaire (CDQ) had been utilised in the attempt to create conflict within each decision making panel. The CDQ was dropped from the procedure due to high number of problems with settling upon the most appropriate way to utilise the information it provided, relative to the low benefits the experiment gained from this procedure. In addition, generating panels where members had conflicting viewpoints presented an unassailable barrier to recruitment.

The first participant had access to a database consisting of records drawn from those of a Hospital Consultant and a Health Visitor. This participant, the Local Health Authority (LHA) had records of a medical nature, whilst the second member of the dyad: the Department of Social Services (DSS) was presented with records from the Social Work and Welfare Offices. Each role was clearly identified through the electronic mail and (in the FTF condition) supplemented by role labels on each computer.

Detailed descriptions of the design are provided prior to each analysis. However, in the majority of the analyses reported, coded communication utterances were treated as a dependent variable and examined in relation to the communication medium (I.V.) under which they occurred.

4.3.2 Participants

Participants were recruited by advertisement in the Department of Psychology at the University of Plymouth. First year psychology undergraduates enrolled on the Department of Research Methods and Statistics module formed the majority of the participants.

Forty decision making dyads were formed from the eighty participants who successfully completed a training phase consisting of instruction in using the synchronous electronic mail system and the use of a hypertext database system. Three participants failed to achieve satisfactory levels of operation of the system, and were asked to withdraw from the study and paid in full for their co-operation. Nine participants withdrew from the psychology course between the training and their scheduled participation in the experimental phase of the experiment. Extra participants were recruited from the undergraduate psychologists who had not yet agreed to take part in the experiment, these participants were trained and allocated experimental phases at times convenient to both the original group member and the new group member. In return for their time each participant received a cash payment of £3 and a number of credits towards a course requirement.

4.3.3 Materials

4.3.3.1 Databases

Each participant was provided with a networked Apple Macintosh Classic computer equipped with the electronic mail and Hypercard databases described in Chapter 2. Each machine contained a database representing the role to which they were assigned containing 50 statements varying in length from 50 to 200 words. Statements were selected to suggest that a particular course of action was the most appropriate in these circumstances. The databases presented a unique, conference file for each participant and held the information from one of two agencies in the case (Local Health Authority or Department of Social Services). The division of information between the databases followed the algorithm described by Stasser & Titus (1985) and was such that the LHA was predisposed biased towards removing the children into care and the DSS towards providing additional home help. These biases were included to ensure that the initial preferences of the dyad members differed and that a decision could only be reached through discussion.

4.3.3.2 Decision Options

Four decision options were presented to the dyad, the first of these enabled them to provide *home help* for the family, the second option was to *remove the youngest child* and place her in care. Option three involved *removing the two youngest children* and placing them in care, whilst leaving the eldest with the mother and the final option was to *remove all three children* and place them in care. The task of the decision makers was to select the option that they felt was most appropriate given the information that they had before them and to notify the experimenter of the panel's joint decision, within a two hour time limit.

4.3.3.3 Post-Experimental Questionnaire

A post-experimental questionnaire (PEQ) was constructed to sample the opinions of the decision making panel once the task itself had been completed (Appendix B5.2). This questionnaire was a modified version of the PEQ used in the earlier experiment (Chapter Three), designed to reflect the changes in the decision process and included a series of questions that were specific to each of the communication defined conditions.

Three versions of the questionnaire were constructed each contained the same key questions relating to i) participants perceptions of influence, ii) satisfaction with the decision, iii) ease of communicating, iv) obstructiveness of requests for own preferences, v) whether the decision was the correct decision or a compromise and vi) the decision that the participant would make alone.

This standard version of the questionnaire was used for the unsupported CM condition. The version of the questionnaire administered to decision panels receiving communication support contained additional questions regarding the obstructiveness and utility of the support system and the effects of support upon their communication. It also addressed the perceptions of importance of adjusting their communication according to the feedback they received and the degree of deviation from the target levels of communication that existed before they considered it important to adjust their communication levels.

The last two questions asked open-ended questions relating to the participants perceptions of what the 'care' detailed in the options entailed and a final open question for additional comments.

4.3.3.4 Procedure - Briefing, Decision Options & Task

Participants were briefed (Appendix B4.2) regarding the nature of the task and the case materials before them. They were informed that the task before them was to choose the best course of action from four options presented and that no other alternatives were available. In reaching their decision two criteria were to be met: (i) the decision must be a unanimous decision and (ii) that they were each to read all the information contained in their databases. Participants were told that although both decision panel members had a database unique to their role and access to a shared, common reference file, some of the information held in the databases might overlap and that they might each have information relating to the same incident, other information would be unique to their own records, and would only be known by all panel members if raised by that group member.

Two hours were available in which to reach a decision, and each decision panel was told to take as much of the time as necessary. After forty minutes a reminder of the uniqueness of the case materials was sent to each participant via the e-mail and that it was likely that they would need to discuss the information before them in order to reach a joint decision. A warning of the time remaining was issued with half an hour remaining, and again fifteen and five minutes from the end of the experiment. However, panel members could contact the experimenter at any time during the task. Finally, they were informed that when they decided upon a decision they should communicate this by sending an electronic mail message with the subject line "Final Decision (Joint)" and containing the number of the decision option selected through the system and that this would alert the experimenter to the end of the decision task.

After completing the briefing, participants were seated at their computers and instructed to begin. Video and Audio tape recordings of each FTF group were made and each e-mail message stored with the time of composition and the time of reading. For any group which had not sent a message containing their final joint decision (one reached in full agreement of both panel members) after one hundred and twenty minutes a message was sent requesting their final decision, this message was repeated at five minute intervals until either the group delivered a final decision or an additional twenty minutes had elapsed, at which point the experiment was ended and the group was recorded as being unable to make a decision.

Upon completion of the task, participants individually completed a post-experimental questionnaire (Appendix B5.2) and once these were collected, a joint debriefing took place. Following this, any participants questions were answered, the participants paid and thanked for their time.

4.3.3.5 Procedure - Recording Individual Preferences

Participants were informed that during the course of the decision task they would be asked to indicate how they felt, individually, about each of the four options available to them. The sampling of their opinions first occurred ten minutes into the task and thereafter every twenty minutes until either the time limit was reached or the dyad reached a joint decision. Participants were informed that the sampling of their individual preferences would occur through the e-mail such that the other member of the dyad would have no access to their current feelings on the case, and that they should use the votes to express how they as an individual felt about the decision task.

4.3.3.6 Procedure - Provision of Communication Support

Dyads operating in conditions with support from either the Directive Communication Support system (DCS) or the Non-Directive Support System (NDCS) received additional prompting via the electronic mail. As discussed earlier these were devised to enable the groups to overcome the process deficits commonly observed in CMC. The format and timing of the support messages varied according to the support system monitoring the communication. The timings were calculated on the basis of the likely interventions and the time required to it would take a typical participant to respond to a request to increase or decrease their communication (See Appendix A4). As such feedback about communication levels in the DCS condition occurred, if required every ten minutes, whilst groups operating with assistance from the NDCS received feedback every fifteen minutes regardless of their levels of communication. It was hoped that the different timings of feedback would result in groups receiving approximately the same number of support messages over the course of a decision.

So for each supported decision panel electronic support was provided to encourage them to (i) increase the levels of informative information they communicated (CIT), (ii) decrease the levels of normative information they communicated (PREF) and (iii) to increase the procedural remarks (PROC).

This support was provided using the MIMICS paradigm outlined in Chapter Two, where each e-mail rather than being sent directly to the decision panel members was unobtrusively diverted via the support system for analysis, before arriving at its intended destination. The target levels of communication held by the support system against which decision makers communication was compared were revisions of the communication levels observed in FTF groups in the analysis of Experiment 1 revised on a *pro rata* basis to account for the reduction in panel size and time available in which to reach a decision.

4.3.3.7 Directive Communication Support

Decision panels operating in the DCS condition, received support that compared directly the dyads' own communication with that of FTF decision makers and informed them of the changes in communication that they would need to make to bring their communication in-line with the model.

These messages (Appendix A7) informed users of i) the direction of the discrepancy between their communication and the target, ii) the magnitude of the difference and iii) the action that they should take to remove the discrepancy. Messages consisted of support aimed at only the communication (CIT, PREF or PROC) currently deviating from the target, and users were informed that if no mention of the communication was made, or no messages were being sent that the communication levels at which they were operating were in line with the communication target levels held by the support system.

The support system compared the communication of the dyad with the target levels at regular intervals of ten minutes, based upon the communication that had been received by the decision making group, and presented this information to the users *only if* the communication deviated. As such users of the system received support depending upon the degree of deviation from the model (See Appendix A6 for calculations of bands of deviation) directing them to increase or decrease their communication of a given style either slightly, moderately or considerably. The selection of the quantifiers used in the feedback messages was based around a pilot study involving a paper and pencil task which requested participants perceptions of the levels of communication conveyed by various quantifiers.

4.3.3.8 Non-Directive Communication Support

Decision panels operating in the NDCS condition, received support that presented users with the dyads own communication and that of FTF decision makers without drawing any direct comparison between them. These messages (Appendix A7) informed users of the current levels of their communication in relation to the target levels and unlike the support of the DCS condition provided this information about all three of the communication categories being monitored (CIT, PREF and PROC). At no point did the support messages suggest courses of action to be taken by the decision makers, rather they offered information about the current levels of communication in relation to the target groups.

The support system compared the communication of the dyad with the target levels at regular intervals of fifteen minutes, based upon the communication that had been received by the decision making group, and always presented this information to the users. As such users of the system received support that emphasised the degree of deviation from the target (See Appendix A6 for calculations of degree of discrepancy).

4.4 Results

4.4.1 Overview

The analysis of the experiment is presented in several sections. The first section details the time taken to reach a decision and the outcome of the deliberations for the forty decision making panels studied. This serves as a context for the majority of the result section which addresses the impact of the two configurations of the group communication support systems: directive and non-directive, and presents them in comparison to unsupported CM decision panels.

However, prior to these analyses it is necessary to first establish the integrity of the model of communication derived from the observation of FTF decision making panels in Experiment 1. To this aim, the patterns of FTF communication from this experiment are compared to the model. Finally, the section concludes with a brief examination of the users perceptions of the computer-systems and the decision task in general.

4.4.2 Decision Duration & Outcome of Discussions

4.4.2.1 Decision Panel Decision

Examining the time, to the nearest minute taken to reach a decision from the moment that the participants were instructed to begin to the time at which a final decision was registered with the experimenter provides a small measure of process.

The three computer-mediated conditions on average take nearly the full two hours available to reach their decision (CMC: M = 116.6, SD = 23.472; DCS: M = 115.2, SD = 23.472, NDCS: 116.3, SD = 17.359), which is half an hour longer than their FTF counterparts (M = 90.4, SD = 20.018). Tukey HSD follow-up analyses (Appendix E2) reveal the significant differences to be between the FTF and each of the other three conditions (p<.05). Of the forty groups, four failed to reach a decision within the time limit and were recorded as being unable to agree upon a decision.

| | Decision Outcome | | | | |
|------|------------------|-------------------------------|------------------------------------|-------------------------|---------------------|
| | Home Help | Removal of the Youngest Child | Removal of the 2 Youngest Children | Removal of All Children | No decision reached |
| CMC | 1 | 1 | 2 | 5 | 1 |
| NDCS | 3 | 3 | 1 | 1 | 2 |
| DCS | 3 | 1 | 1 | 4 | 1 |
| FTF | 3 | 1 | 1 | 5 | - |

Table 4.2: Decision outcomes examined for each condition in Experiment 2

As with the previous experiment there is no clear picture of the decision outcome (Table 4.2). Although the modal response for three of the conditions is the removal of all children, there is some suggestion that the provision of home help is also an acceptable solution to a number of panels.

4.4.3 The Integrity of the Target Levels

The decision task as reported in Experiment 1 and the task tackled in this experiment were based upon the same original welfare case. However, prior to the testing of the two prototype support systems several modifications were made to the task. As a result of these modifications the possibility exists that the target levels of communication that underpin the

support system are no longer valid. Prior to any examination of the results of the GCSS it is first necessary to dispel these concerns.

Target levels of communication for CIT, PREF and PROC were each constructed from the FTF communication, observed in the first experiment. These were based upon the proportions of total communication that fell in each of the three target categories and how these were distributed over the time to discuss the case before decision panel. The overall level of communication of all ten panels across all nine categories in Experiment One was 12,776 utterance units, this is approximately three times the level observed of 4353 utterances produced by the ten panels in this experiment. This suggests a similar level of communication in Experiment 2, reflecting the reduction by half of the size of decision making panels and the reduction by a third of the time available to reach a decision.

Table 4.3 shows that the variation in the proportion of communication of each of the normative and informational styles is similar across the two experiments. With the exception of the level of inferences from the case information (INF) the differences are under 2%.

| | Informational | | Normative | |
|------------|--------------------|--------------------|------------------|------------------|
| | CIT | INF | PREF | VAL |
| FTF Expt 1 | 80.20 (18.42%) | 189.00 (43.42%) | 24.10 (5.54%) | 8.50 (1.95%) |
| FTF Expt 2 | 207.70 (16.28%) | 510.70 (39.93%) | 59.00 (4.62%) | 32.50 (2.54%) |

Table 4.3: A comparison of the average percentage of FTF panels communication in the informational and normative categories across Experiment 1 and 2.

A comparison of the remaining five categories (Table 4.4) also suggests the similarity in communication style over the two experiments. The level of communication concerning both the legal issues (LEG) that relate to the case and communication not related to the task have both dropped with the decrease in time between Experiment 1 and Experiment 2.

This initial impression suggests that the overall levels of face-to-face communication are consistent with those from the first experiment and that the target levels are applicable. However, before this conclusion can be drawn it is necessary to test this assumption.

| | Non-Specific Categories | | | | |
|------------|-------------------------|--------------------|------------------|-----------------|------------------|
| | LEG | MAT | OTH | PRESS | PROC |
| FTF Expt 1 | 63.10 (4.93%) | 281.60 (22.04%) | 61 (4.77%) | 9.60 (.75%) | 52.40 (4.10%) |
| FTF Expt 2 | 0.40 (0.09%) | 106.40 (24.44%) | 10.50 (2.41%) | 0.00 (0.00%) | 16.20 (3.72%) |

Table 4.4 : A comparison of the average percentage of panels' communication in the non-specific categories for Experiment 1 and 2

4.4.3.1 Target Level for Citations of Case Fact (CIT)

The variation between Experiment 1 and 2 in both task length and group size renders a comparison of the absolute levels of CIT of little value. However, a comparison of the proportions of total communication that were Citations of Case Fact (Student *t*-test assuming unequal variances) reveals no significant difference in the levels observed in the two experiments ($t_{(14)} = .82$; $p > .1$, two-tailed). Although the average proportions of CIT (Expt 1 = 16.04, Expt 2 = 12.06,) are similar there is greater variance (Expt 1 SD = 7.53, Expt 2 SD = 13.49) in the latest experiment.

Given that levels of communication will vary between group members, and that the groups in Experiment 1 consist of a greater number of members this is to be expected. The variation in levels of communication of individuals will be averaged over the four members of the larger panels, reducing the influence any one decision maker exerts on the overall levels. In effect the panels in Experiment 2 are more sensitive to individual differences and it is this that is reflected in the higher standard deviations. A comparison of the distribution of the Citations of Case Fact over Time (Figure 4.4 overleaf) confirms the assumption that the use of CIT is the same across the two experiments.

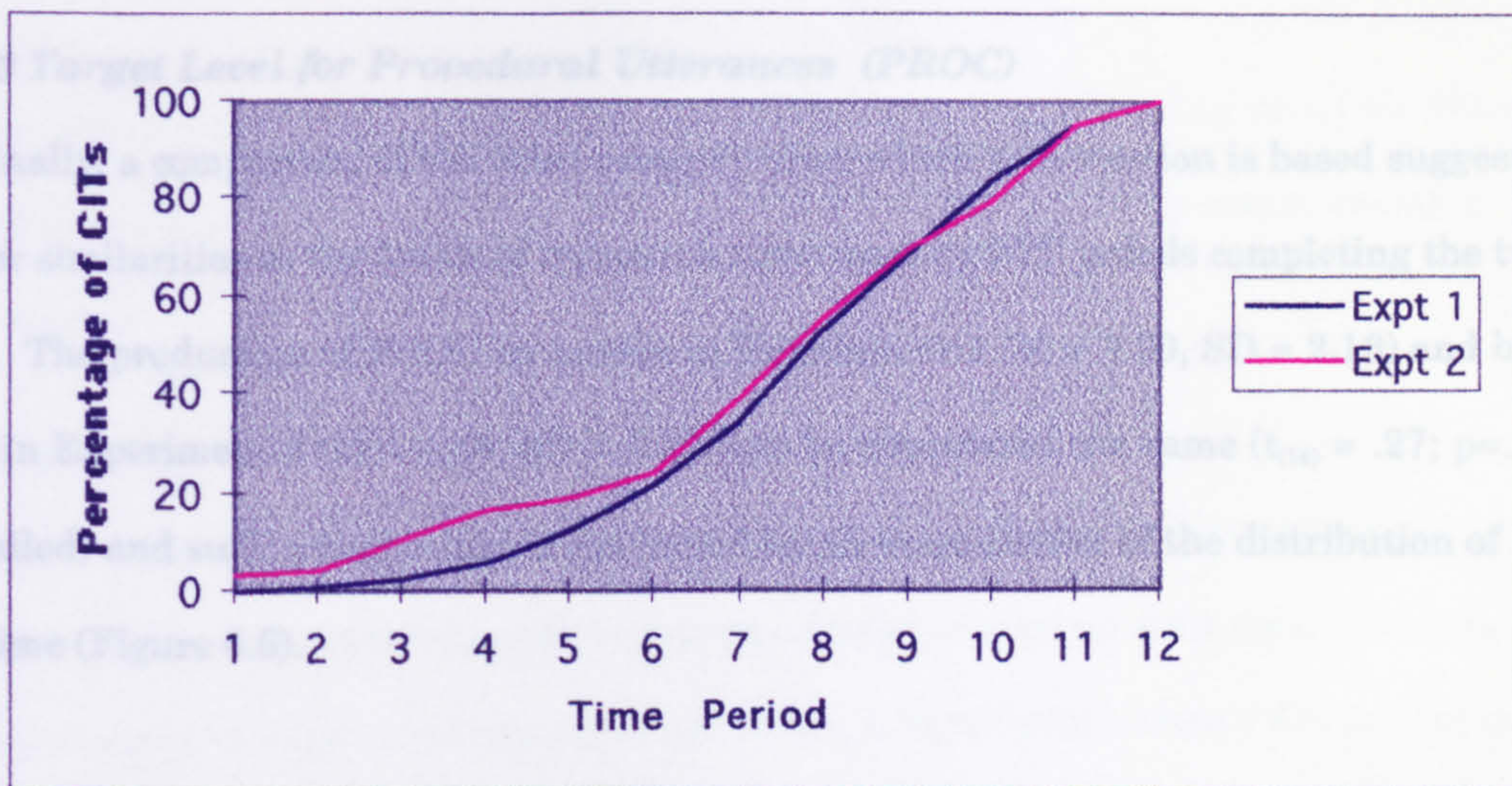


Figure 4.4: A Comparison of the Cumulative Percentage of CIT by FTF Panels in Experiments 1 and 2.

4.4.3.2 Target Level for Expressions of Preference (PREF)

The comparison of the expression of preferences for the available options also supports the idea that the use of PREF by FTF panels across the two experiments is the same. However, the results of the Student t -test do not indicate complete confidence in arriving at this decision, ($t_{(16)} = 2.10$; $p = .052$, two-tailed). The descriptive statistics for Experiment 1 ($M = 4.58$, $SD = 2.15$) and those from Experiment 2 ($M = 6.96$, $SD = 2.85$) suggest there might be a slight increase in the expression of preference in the later experiment.

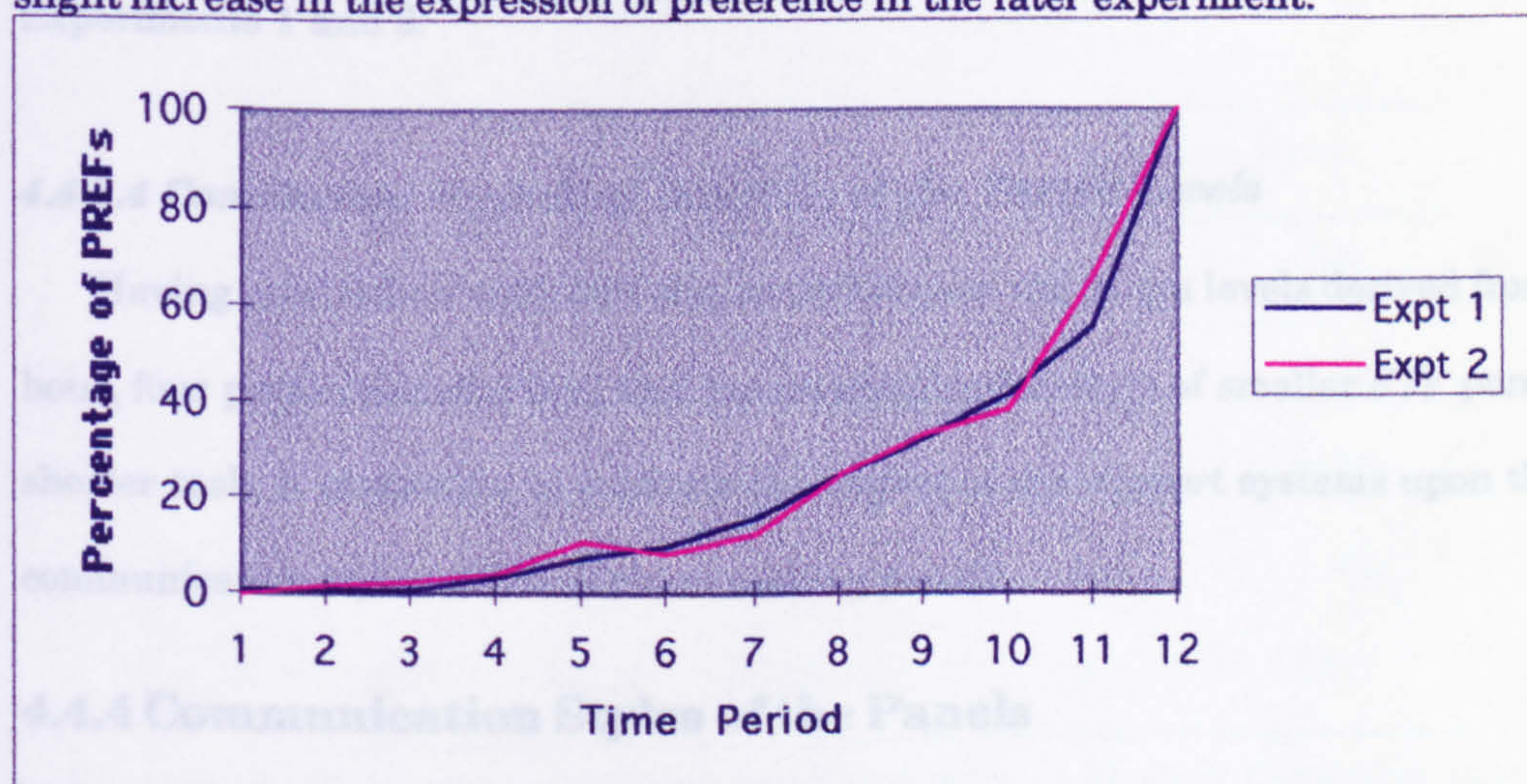


Figure 4.5: A Comparison of the Cumulative Percentage of PREF by FTF Panels in Experiments 1 and 2.

However, a visual comparison of the distribution of these PREF over time (Figure 4.5) reduces the concern over the integrity of the target levels with the two cumulative frequencies remarkably close over the course of the decision task.

4.4.3.3 Target Level for Procedural Utterances (PROC)

Finally, a comparison of the third category upon which intervention is based suggests further similarities in the levels of communication used by FTF panels completing the two tasks. The production of PROC by panels in Experiment 1 ($M = 3.90$, $SD = 2.16$) and by those in Experiment 2 ($M = 4.26$, $SD = 3.63$) can be considered the same ($t_{(14)} = .27$; $p = .79$, two-tailed) and such a suggestion is confirmed by an examination of the distribution of PROC over time (Figure 4.6).

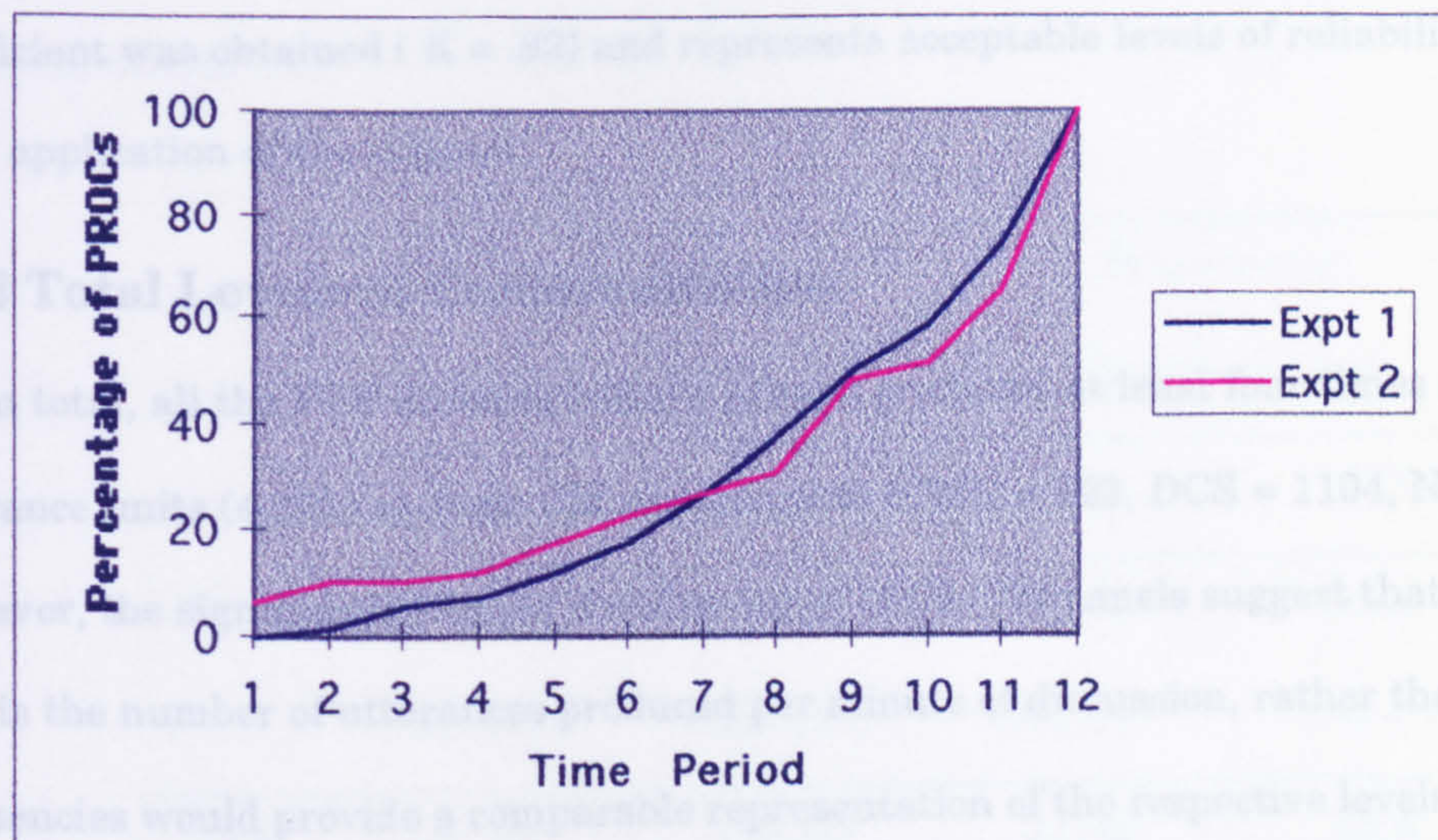


Figure 4.6: A Comparison of the Cumulative Percentage of PROC by FTF Panels in Experiments 1 and 2.

4.4.3.4 Conclusions regarding Integrity of the Target Levels

Having established sufficient similarity between the target levels derived from the three hour, four person decision task and the communication style of smaller FTF panels in a shorter task, it is possible to evaluate the impact of the support systems upon the communication styles of CM decision making panels.

4.4.4 Communication Styles of the Panels

4.4.1 Overview

From the analyses so far it can be seen that although no difference in outcome is present across the four conditions, as expected the FTF decision panels are considerably quicker than those in three CM conditions. Having considered the outcome of the decision process, it is important to now consider the process itself. This section begins with an examination of the total levels of communication employed in each of the conditions and how this is distributed

across the nine categories in the coding scheme, before analysing in further detail the three key categories (CIT, PREF and PROC) that were monitored by the group communication support system.

4.4.2 The Application of the Coding Scheme

To assess the reliability of the application of the coding scheme 878 utterances -- consisting of all the communication of two groups selected at random from each condition -- from the total pool of 6,907 units were doubled coded. A significant Cohen's Kappa Agreement Coefficient was obtained ($K = .82$) and represents acceptable levels of reliability in the inter-rater application of the scheme.

4.4.3 Total Levels of Communication

In total, all the FTF decision making groups produced at least four times as many utterance units (4,353) as their CM counterparts (CMC = 823, DCS = 1104, NDCS = 627). However, the significantly longer decision times of the CM panels suggest that utterance rates, that is the number of utterances produced per minute of discussion, rather than utterance frequencies would provide a comparable representation of the respective levels of communication in the two conditions (Table 4.5).

| | Total Utterances | | Utterance Rates | |
|------|------------------|----------|-----------------|--------|
| | Mean | SD | Mean | SD |
| FTF | 435.30 | (132.64) | 4.52 | (3.17) |
| DCS | 110.40 | (38.43) | .72 | (.25) |
| NDCS | 62.70 | (28.15) | .97 | (.36) |
| CMC | 82.30 | (30.18) | .53 | (.20) |

Table 4.5 Mean Utterances and Utterance Rates for each Mode of Communication in Experiment 2

This measure further emphasises the communication advantage of FTF groups, with over 4 utterances per minutes being more than four times the rate of the most productive CM panels (NDCS) and almost nine times the rate of unsupported CM groups. It should also be

noted that although the e-mail system was available to the FTF groups no panels used the system prior to reaching a decision.

4.4.3.1 Total Informational Utterances

The large differences in absolute levels of communication identified in the analysis of communication totals necessitate the consideration of proportional levels of communication, that is the number of utterances of a group relative to the total level of communication for that group. It is, however, useful to consider this in conjunction with the absolute levels therefore these are provided within the tables to enable the magnitude of communication to be placed in context (Table 4.6).

| | Total | | Proportional | |
|------|---------------|-----------|---------------|-----------|
| | Communication | | Communication | |
| | CIT | INF | CIT | INF |
| | Mean | Mean | Mean | Mean |
| | (Std Dev) | (Std Dev) | (Std Dev) | (Std Dev) |
| FTF | 79.50 | 178.50 | 21.40 | 43.42 |
| | (133.04) | (156.84) | (13.49) | (16.15) |
| DCS | 21.4 | 22.14 | 18.42 | 43.03 |
| | (8.73) | (43.03) | (8.73) | (8.46) |
| NDCS | 5.60 | 15.50 | 8.56 | 44.34 |
| | (6.35) | (44.34) | (6.35) | (14.73) |
| CMC | 6.70 | 23.03 | 6.7 | 49.21 |
| | (8.12) | (49.21) | (6.34) | (15.69) |

Table 4.6: Total and proportional levels of Experiment 2 informational influence

However, direct quotations (CIT) drawn from the database accounted for 21.4% of the FTF groups communication and only 16.3% of the computer-mediated groups ($t_{(18)}=2.41$; $p<.05$, two-tailed).

4.4.3.2 Total Normative Utterances

The standard deviations of the normative utterances are less of a cause for concern than those in the informational influence categories. Although the actual number of utterances (Table 4.7) across the conditions is similar, it is apparent that the FTF groups make little use of expressions of preference (approximately 5%) in comparison to the greater use of this style of communication used by the three computer-mediated conditions. The use of appeals to societal values and norms (VAL) is similarly low in all conditions.

| | Total | | Proportional | |
|------|---------------|-----------|---------------|-----------|
| | Communication | | Communication | |
| | PREF | VAL | PREF | VAL |
| | Mean | Mean | Mean | Mean |
| | (Std Dev) | (Std Dev) | (Std Dev) | (Std Dev) |
| FTF | 24.10 | 5.54 | 8.50 | 1.95 |
| | (14.76) | (2.86) | (8.07) | (2.37) |
| DCS | 14.90 | 13.50 | 5.10 | 4.62 |
| | (5.57) | (5.57) | (3.48) | (2.97) |
| NDCS | 15.20 | 24.24 | 1.40 | 2.23 |
| | (5.09) | (13.55) | (2.76) | (2.86) |
| CMC | 17.50 | 21.26 | 2.80 | 3.40 |
| | (12.00) | (17.56) | (3.33) | (2.82) |

Table 4.7: Total and proportional levels of Experiment 2 normative influence

4.4.3.3 Miscellaneous Categories

Of the remaining five communication styles that are included in the coding scheme under one percent of all communication is concerned with the legal nature of the case (LEG), neither is there much application of pressure (PRESS) upon other members of the group nor much use of non-task related communication (OTH: Details of these categories can be found in Appendix D2). It is however interesting to consider the use of both the Materials/Context/Computers

category (MAT) and the other category monitored by the group communication support system, that of procedures (PROC).

| | Total | | Proportional | |
|------|---------------|-----------|---------------|-----------|
| | Communication | | Communication | |
| | MAT | PROC | MAT | PROC |
| | Mean | Mean | Mean | Mean |
| | (Std Dev) | (Std Dev) | (Std Dev) | (Std Dev) |
| FTF | 98.70 | 14.40 | 24.00 | 3.50 |
| | (72.31) | (13.13) | | |
| DCS | 7.80 | 5.50 | 9.48 | 6.68 |
| | (6.71) | (4.86) | | |
| NDCS | 13.20 | 5.10 | 11.96 | 4.62 |
| | (5.20) | (5.17) | | |
| CMC | 8.20 | 3.50 | 13.08 | 5.58 |
| | (8.95) | (3.95) | | |

Table 4.8: Descriptive statistics for total usage of Experiment 2 PROC and MAT style communication.

As shown in Table 4.8 a large degree of communication in the FTF condition is about the computers, materials or experimental context and these levels are not reached in any of the computer-mediated conditions. The absolute levels of communication aimed at co-ordinating the group approach to the problem is higher in the FTF condition, but represent a lower proportion of the overall group communication.

4.4.4 Distribution of Communication Across Time.

The descriptive statistics presented only offer a brief insight into the processes being observed, to gain a greater understanding the processes it is necessary to examine the three target communication behaviours, as they occur across the duration of the experiment.

The analysis of these data poses a number of problems, most notably the differences in task duration. A straightforward analysis comparing the total levels of communication across

time for a given category is problematic, due to the absence of data for any panel that has completed the task prior to that time.

The approach adopted to remove these difficulties is to compare the data across artificial time periods that equal a twelfth of the total time taken by the panel to reach a decision. Using this method it is possible to compare the levels of communication of a group that communicated a lot in a short space of time, with a group that communicated a different amount whilst taking longer (or shorter) to reach their decision. The logic being that the steps are taken to try to remove the effects of typing and reading speed that differ between the groups.

4.4.4.1 Citations of Case Face (CIT)

An initial impression of the differences between the three CM conditions can be gained from the analysis of the total level of citations of case fact observed in each panel. This analysis reveals a significant difference in the level of CIT between the *conditions* (Appendix C2 $F_{(2,27)}=12.79$; $p<.001$). *Post-hoc* application of Tukey HSD (Appendix C2) reveals the differences to lie between the DCS ($M = 21.40$, $SD = 8.733$) *condition* and both the NDCS ($M = 5.6$, $SD = 6.346$; $p<.05$) and CMC ($M = 6.7$, $SD = 6.346$; $p<.05$), no significant difference exists between the NDCS and the CMC condition.

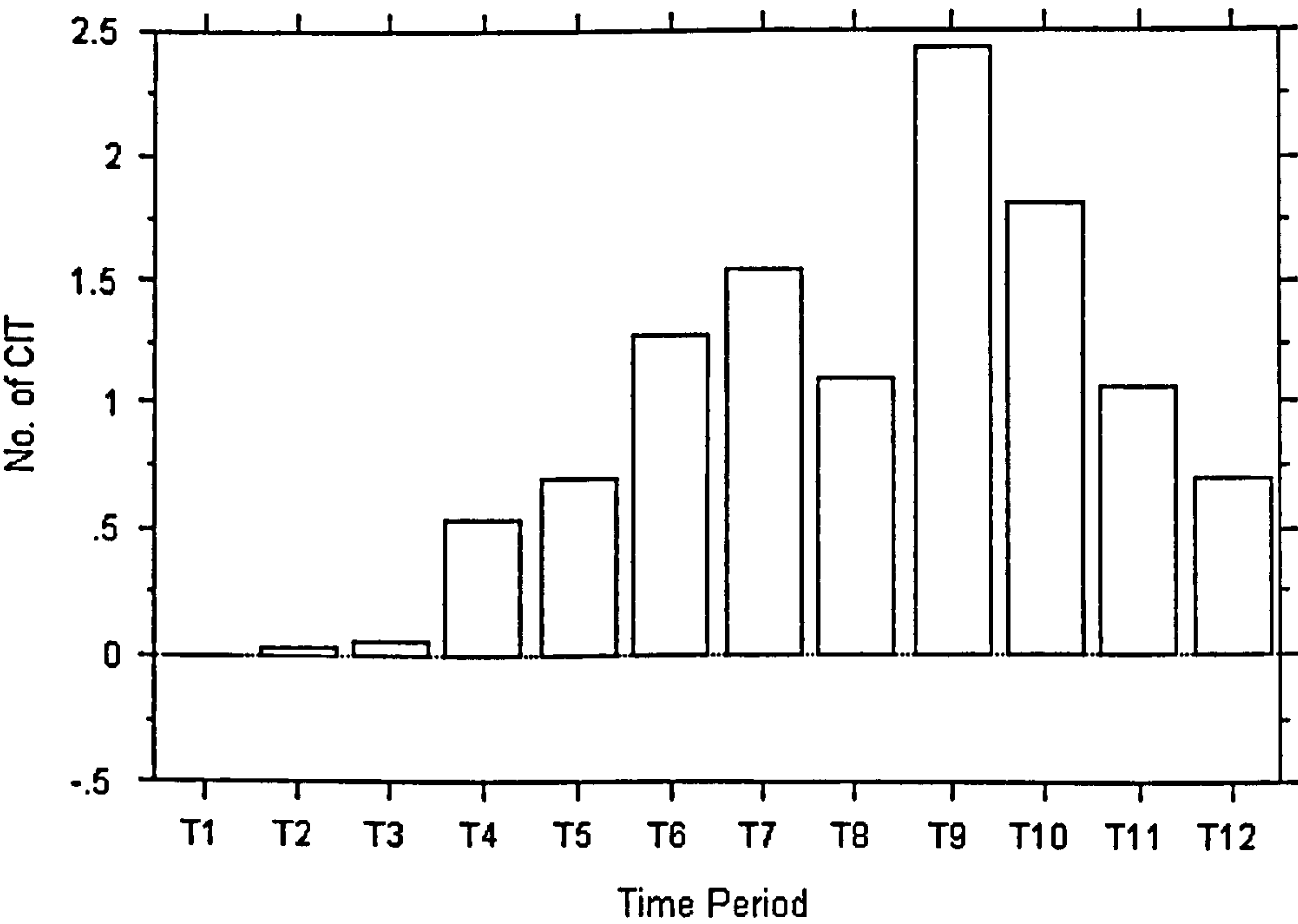


Figure 4.7: The distribution of Experiment 2 CIT over time.

Examining these differences further by considering their distribution over twelve *time periods* reveals a peak in production at time period nine (Figure 4.7). A 2-way factorial ANOVA where the between subjects variable is the condition and the within subjects variable is the time period (Appendix C2) examining the number of CIT produced in each time period reveals a *time period by condition* interaction ($F_{(22,297)}=2.754$; $p<.001$) with the production rate of CIT appearing more consistent over time in both the NDCS and CMC conditions, with the DCS condition showing a prominent peak at time period nine as suggested by Figure 4.7.

Finally, examining the cumulative totals of the CM panels enables an impression of the pattern of communication in relation to the model to be gained. Figure 4.8 shows that the rate of increase and overall levels of production of CIT is higher in the DCS than in the other GCSS conditions: NDCS or the unsupported CMC (control) condition.

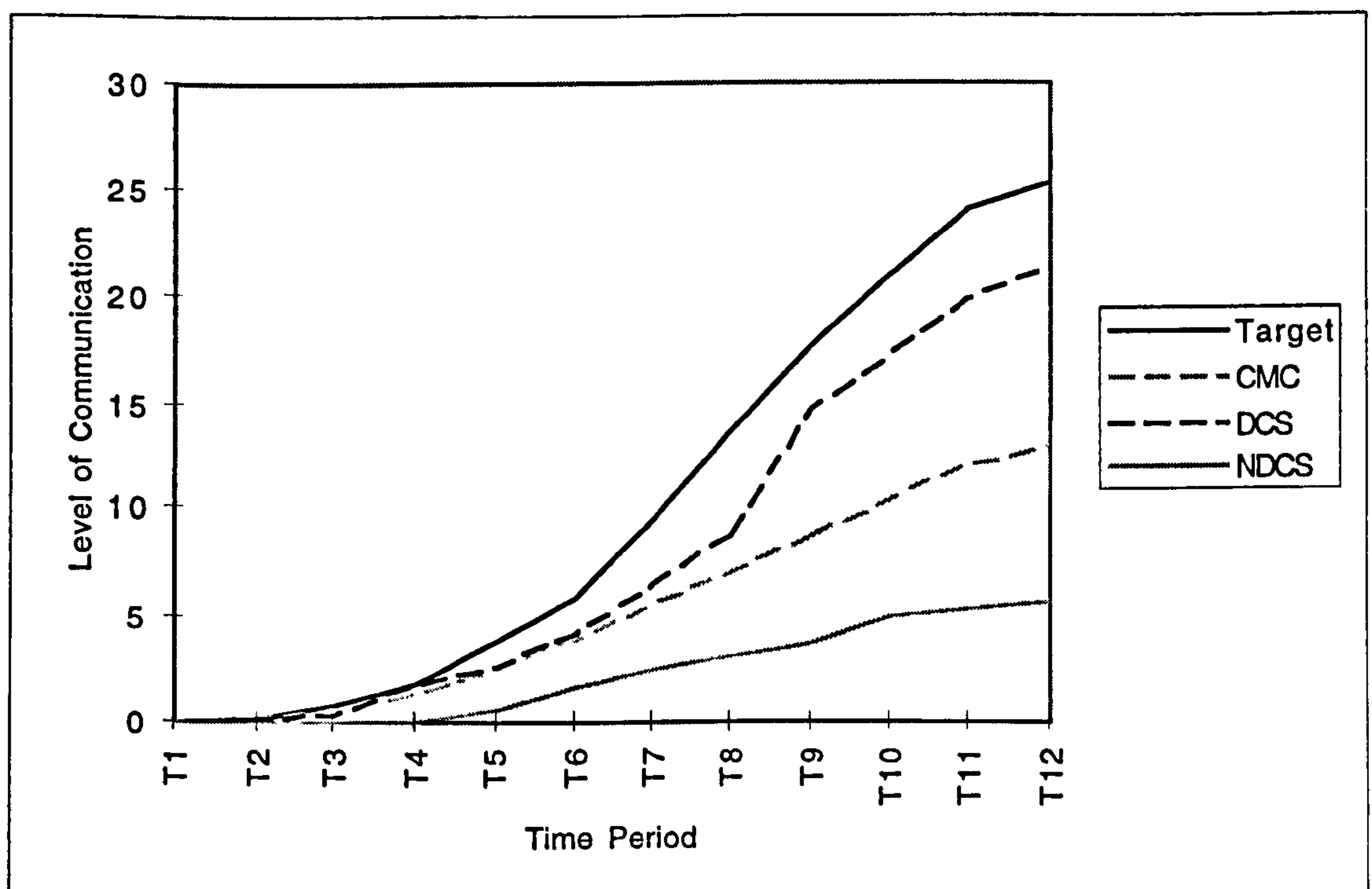


Figure 4.8: Cumulative occurrence of CIT across all CM conditions of Experiment 2

4.4.4.2 Expressions of Preference (PREF).

As with the CIT it is useful to consider the total number of PREF produced by the panels irrespective of the time of production. Such an analysis (Appendix C2) reveals no effect of *condition* ($F_{(2,27)}=.302$; $p>.1$) with the total number of preferences being very similar across

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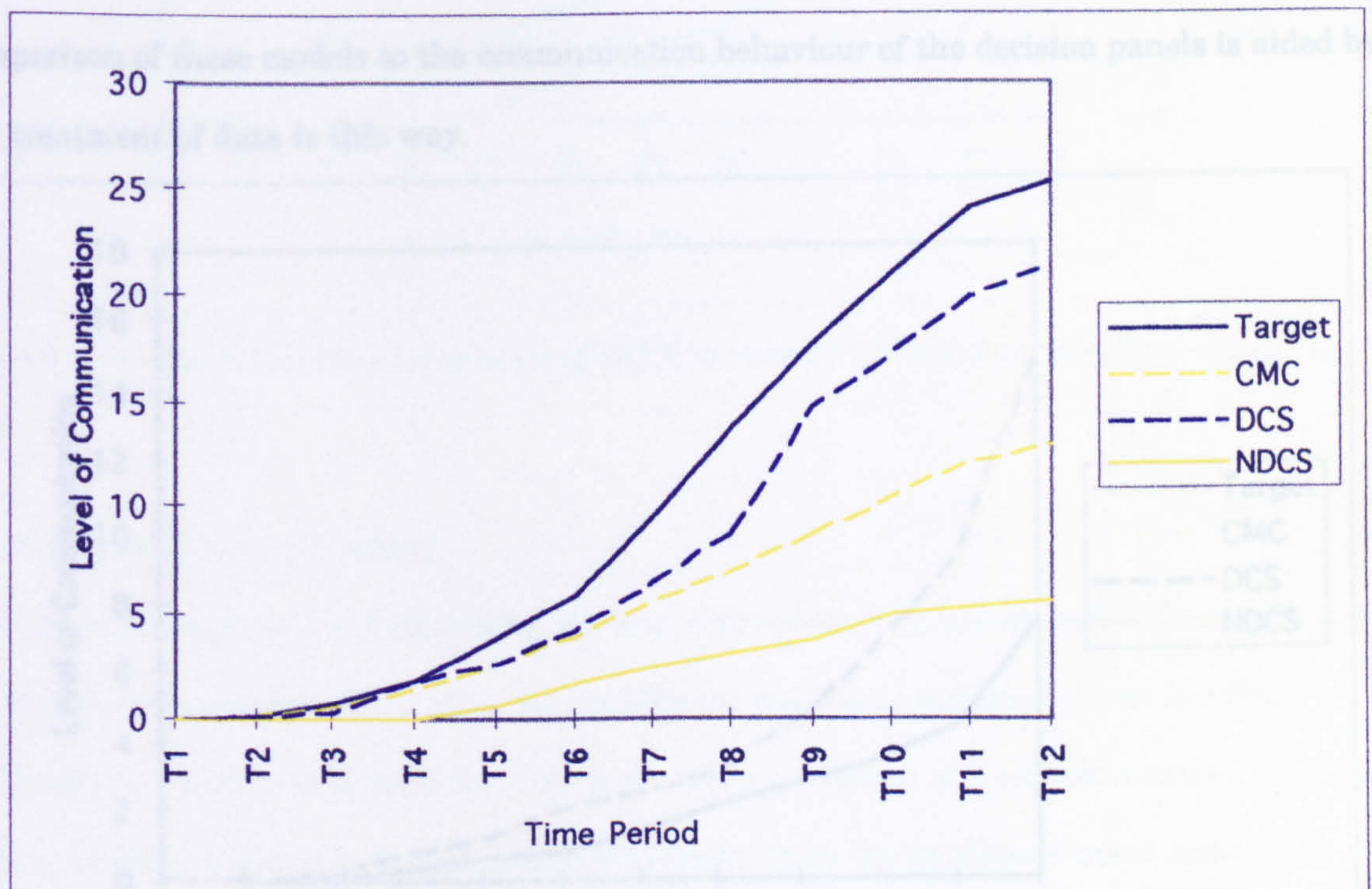


Figure 4.8: Cumulative occurrence of CIT across all CM conditions of Experiment 2

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As with the CIT it is useful to consider the total number of PREF produced by the panels irrespective of the time of production. Such an analysis (Appendix C2) reveals no effect of *condition* ($F_{(2,27)}=.302$; $p>.1$) with the total number of preferences being very similar across

all three conditions (CMC $M = 17.5$, $SD = 12.00$; DCS $M = 14.9$, $SD = 5.567$; NDCS $M = 15.2$, $SD = 5.095$).

An analysis of the production of PREF over time (Appendix C2) reveals a steady increase in production as time passes (Figure 4.9), a 2-way ANOVA where condition is between subjects and time within subjects reveals a significant effect of *time period* ($F_{(3,81)}=.64.347$; $p<.001$).

The pattern of preferences exhibited bears a similarity to the target levels of PREF held by the GCSSs, however, the levels of production; 17.5 PREF in the unsupported condition to 14.9 PREF in the DCS are above the levels in equivalent FTF panels. Although the analyses are conducted using quarters (i.e. Four time periods) the figures are presented as cumulative records over twelve time periods due to the similarity in presentation of this data to the models of communication held by the support system. That is that the visualisation and comparison of these models to the communication behaviour of the decision panels is aided by the treatment of data is this way.

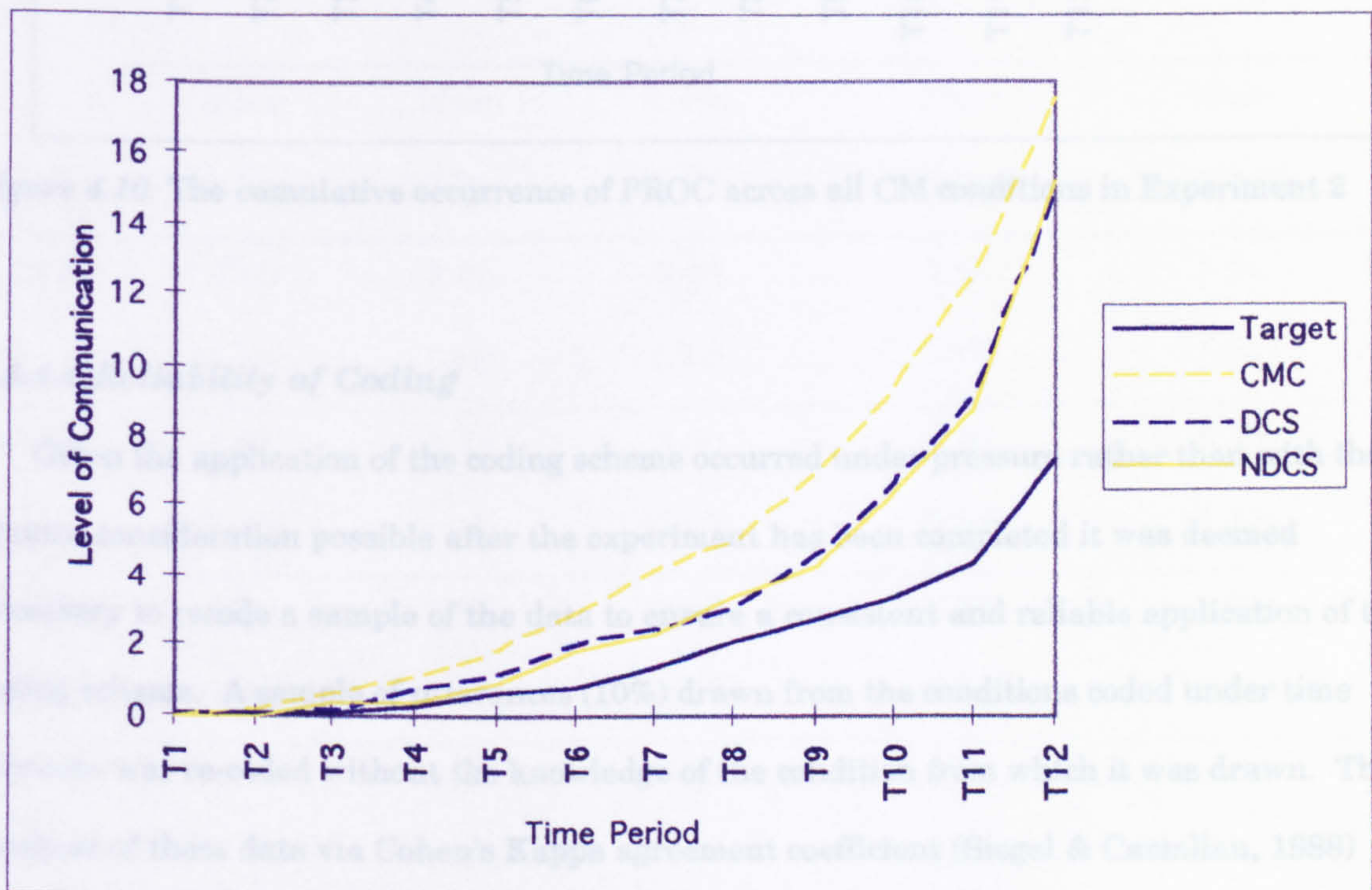


Figure 4.9: The cumulative occurrence of PREF across all CM conditions in Experiment 2

4.4.4.3 Procedures (PROC)

The third category of communication that was monitored by the GCSSs (DCS and NDCS) was that aimed at a group level co-ordination of effort. As with the analysis of PREF there is no effect of *condition* ($F_{(2,27)}=.655$; $p>.1$). The average totals of PROC for the three conditions

are again very similar (CMC $M = 1.375$, $SD = 2.2724$; DCS $M = 1.275$, $SD = 2.112$; NDCS $M = .875$, $SD = 2.209$), but repeating the previous analysis using PROC as the dependent variable reveals a main effect of *time period* ($F_{(3,81)}=20.69$; $p<.0001$: Appendix D2) that shows a steady increase in the level of PROC over time. Again a cumulative record of the communication levels aids in the visualisation of the process (Figure 4.4).

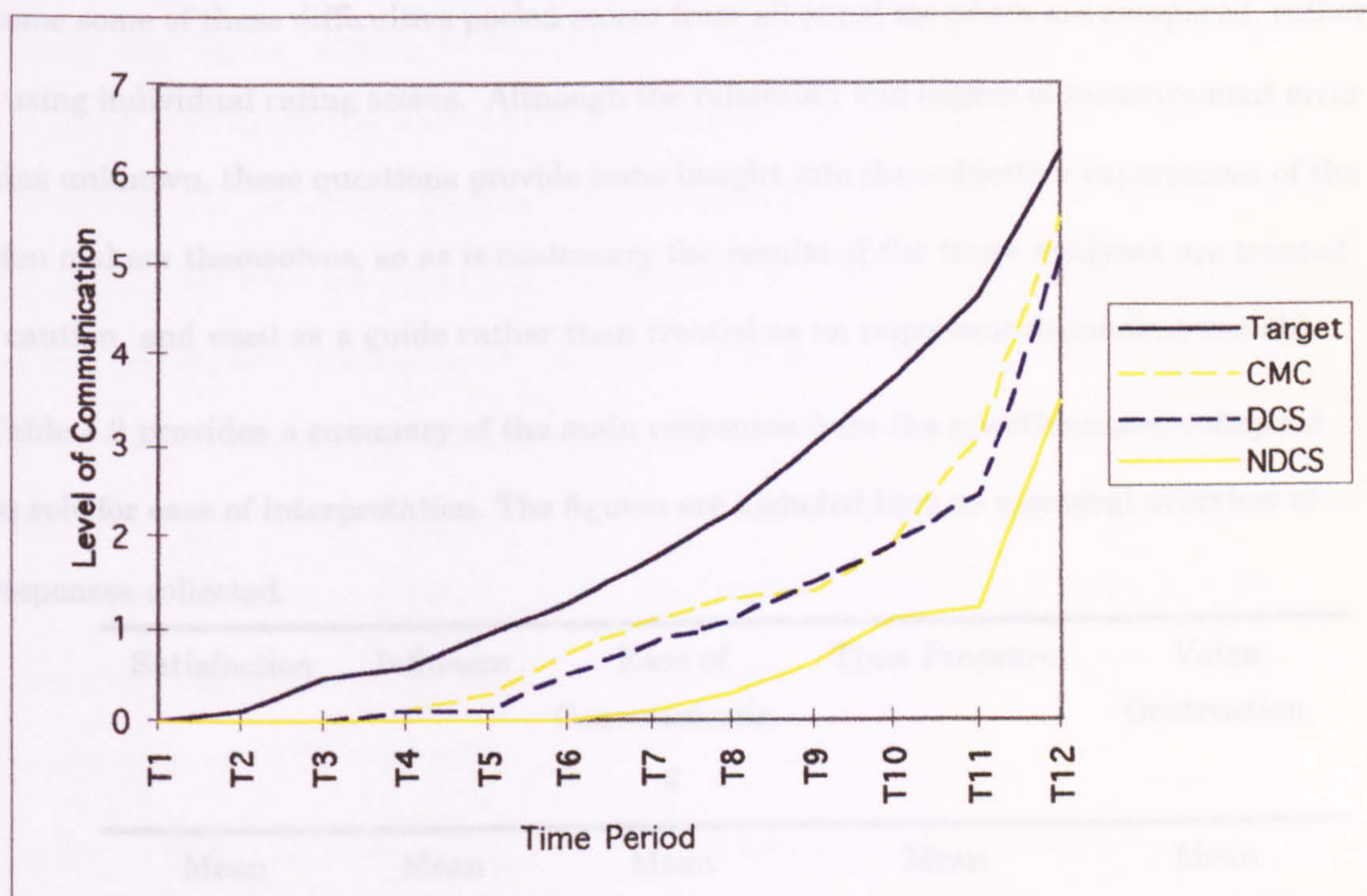


Figure 4.10: The cumulative occurrence of PROC across all CM conditions in Experiment 2

4.4.4.4 Reliability of Coding

Given the application of the coding scheme occurred under pressure rather than with the greater consideration possible after the experiment has been completed it was deemed necessary to recode a sample of the data to ensure a consistent and reliable application of the coding scheme. A sample of utterances (10%) drawn from the conditions coded under time pressure was re-coded without the knowledge of the condition from which it was drawn. The analysis of these data via Cohen's Kappa agreement coefficient (Siegel & Castellan, 1988) revealed satisfactory levels of intra-observer reliability ($\kappa = .88$).

4.4.5 Participants Perceptions of the Task

4.4.5.1 Overview

Finally it is worth considering the user perceptions of the task as recorded by the post-experimental questionnaire. Many of the measures used in the post-experimental

questionnaire are single-item Likert scale measures. This itself might be considered problematic as the constructs could be influenced by any number of other, unmeasured elements. However the sub-scale approach (e.g. Hiltz & Johnson, 1990) to this issue is somewhat cumbersome in this context so single Likert items suffice. As an attempt to overcome some of these difficulties pooled scores from all panel members are compared, rather than using individual rating scores. Although the reliability and degree of measurement error remains unknown, these questions provide some insight into the subjective experiences of the decision makers themselves, so as is customary the results of the these analyses are treated with caution, and used as a guide rather than treated as an important dependent variable.

Table 4.9 provides a summary of the main responses from the questionnaire, collapsed across role for ease of interpretation. The figures are included here as a general overview of the responses collected.

| | Satisfaction | Influence | Ease of Communicatin g | Time Pressure | Votes Obstruction |
|------|----------------------|----------------------|------------------------------|----------------------|----------------------|
| | Mean (St Dev) | Mean (St Dev) | Mean (St Dev) | Mean (St Dev) | Mean (St Dev) |
| CMC | 3.85 (1.31) | 3.05 (.94) | 3.65 (.99) | 2.65 (.67) | 2.50 (1.05) |
| NDCS | 3.60 (1.43) | 3.10 (.64) | 3.60 (1.27) | 2.85 (1.37) | 2.20 (1.11) |
| DCS | 2.80 (1.61) | 3.05 (.76) | 3.40 (.995) | 2.74 (1.05) | 3.25 (1.41) |
| FTF | 3.50 (1.57) | 2.65 (.93) | 4.3 (1.17) | 2.90 (.96) | 3.75 (1.48) |

Table 4.9: Descriptive statistics for Experiment 1 PEQ responses regarding the task itself

Considering each of these briefly before examining the data in greater depth, shows that, in general the FTF groups find the task easier (high scores), are more satisfied with the outcome (high score) and found the votes were not obstructive (high score). The higher the

score for influence, the greater the influence of the medical role exerted on the decision. These data will now be considered in turn.

4.4.5.2 Individuals Own Decision

The decision that each panel member would make, if they had to alone, matched the decision reached by the panel in all but two cases. Here it was clear that a compromise had been reached, but that the decision maker favoured the information provided in their own case notes over the information they had been supplied by the other member of the decision making panel. However, the data on the individual's own decision merits some examination for the four panels who failed to reach a decision. In these cases three of the panels: one in each of the three computer-mediated conditions, had reached a position of bi-polarised views. In these cases the decision maker with access to the materials from the Department of Social Services wished to provide more home, whilst the Local Health Authority panel member indicated that they would remove the children into care. In two of these cases the number of citations of case fact (CIT) was zero.

Finally, in all the conditions except the NDCS where there was a almost even split, the majority of the decision makers felt they have reached the correct decision (Table 4.10), by a ratio of almost 2:1.

| | Decision | | |
|------|-------------|---------|------------|
| | No Response | Correct | Compromise |
| CMC | 2 | 13 | 5 |
| NDCS | 2 | 8 | 10 |
| DCS | 2 | 13 | 4 |
| FTF | 0 | 13 | 7 |

Table 4.10: The number of decisions considered to be reached through compromise and those considered to be the correct answer in Experiment 2.

4.4.5.3 Satisfaction with Outcome

The members of the decision making panel were requested to record on a 5-point Likert scale how satisfied they were with the outcome of their deliberations. Considering the scores of the two panel members as a within-groups factor and role as between subject factor reveals (Appendix E2), reveals no effect of *condition* ($F_{(2,27)}=2.497$; $p=.101$) but a significant effect of

role, $F(1,27)=4.291$; $p<.05$) with those participants with access to the DSS database ($M = 3.767$, $SD = 1.406$) more satisfied than those presented with the LHA casenotes ($M = 3.067$, $SD = 1.530$).

4.4.5.4 Participant Influence

Given the findings of Craft and Bettin (1991) it might be expected that the LHA with access to the medical files would exert greater influence on the decision outcome, such speculation would be supported by the tendency for panels to decide to remove the children from their mother reported earlier. A 2-way ANOVA with communication mode as the between subject factor and the role as a within subjects factor (Appendix E2) offers no support for this suggestion of *role* differences ($F(1,27)=.000$; $p>.1$) and reveals no effects of *condition* ($F(2,27)=.46$; $p>.1$) with participants reporting that they exerted equal influence upon the decision process and across all three conditions.

4.4.5.5 Ease of Communicating

On average panels reported communicating as being “moderately easy” (CMC: $M = 3.65$, $SD = .988$, DCS: $M = 3.40$, $SD = .995$, NDCS: $M = 3.60$, $SD = 1.273$) with no effects of *condition* or *role* to report (Appendix E2).

4.4.5.6 Perception of Time Pressure

All panel members were asked the extent to which the time available was sufficient to complete the task, regardless of *condition* ($F(2,27)=.210$; $p=.81$) or *role* ($F(1,27)=.813$; $p=.37$) participants found the time limit somewhere between “about right” and needing “slightly less” time.

4.4.5.7. Obstruction to task of the votes

It is interesting to consider the effects upon the decision panels of the request for their personal preferred decision at regular intervals (Table 4.9 & Appendix E2) Encouragingly there is no differential effect across *roles*, however, the degree of obstruction varies across *conditions* ($F(2,27)=3.553$; $p<.05$) with the DCS ($M = 3.25$, $SD = 1.41$) reporting more obstruction than the NDCS ($M = 2.2$, $SD = 1.105$, Tukey HSD, $p<.05$).

4.4.6 Perceptions of Support Systems

4.4.6.1 Overview

The final question to be addressed is that of “How do the users perceive the support systems?” Four key questions were asked relating to this issue, the obstructiveness of the feedback, the utility of the feedback, adherence to the feedback, and perceptions of the importance of change. The findings from these analyses offers additional insight into the design of the support system, the two key findings are summarised in Table 4.11.

| | Feedback Obstruction | Utility of Feedback |
|------|----------------------|---------------------|
| | Mean | Mean |
| | (St Dev) | (St Dev) |
| NDCS | 2.05 | 2.15 |
| | (.95) | (.93) |
| DCS | 3.25 | 3.4 |
| | (1.44) | (1.32) |

Table 4.11: Descriptive statistics for PEQ responses regarding the feedback in Experiment 2

4.4.6.2 Obstruction to task of the feedback system

The feedback from the two forms of GCSS was seen to block the primary task of making the decision differentially across the two feedback conditions ($F_{(1,18)}=9.708$; $p<.05$, Appendix E2). Those in the DCS condition reported greater obstruction ($M = 3.25$, $SD = 1.44$) than in the NDCS condition ($M = 2.05$, $SD = .95$), these translate as moving towards being occasionally obstructive in the DCS condition and being slightly obstructive in the NDCS.

4.4.6.3 Utility of the feedback provided

The differences in the obstruction caused by the feedback are reflected by the utility ratings given to the feedback. The directive support ($M = 3.4$, $SD = 1.314$) is viewed as being of significantly greater use ($F_{(1,18)}=14.92$; $p<.001$, Appendix E2) than the non-directive support ($M = 2.15$, $SD = .93$).

4.4.6.4 Relative importance of increasing and decreasing communication.

Members of the decision panels reported a large difference in their perceptions of the required changes of communication. Overall, 17 of 20 DCS panels considered it more

important to increase than decrease communication, the same pattern was observed in the NDCS condition where 15 of 20 panels felt the same.

Only two panels, both in the DCS condition, viewed the need to decrease communication with equal importance as an instruction to increase communication in a given category. The other remaining panels (1 DCS, 5 NDCS) considered it more important to decrease information.

4.4.6.5 Adherence to the feedback from the DCS

Participants responded to several items in the post-experimental questionnaire that indicated how they responded to the feedback from the DCS system. 17 of the 20 participants reported increasing their CIT communication on the basis of the prompting, two adapted their communication regardless of direction with the remainder split approximately equally over those who responded to the instructions to considerably ($n = 6$), moderately ($n = 4$) and slightly ($n = 5$). Only four indicated an attempt to decrease their communication when instructed to do so.

The pattern is very similar for both PREF and PROC, only four panel members attempt to follow instructions to decrease communication, but the majority respond to instructions to increase. Unlike the CIT data, for both PREF ($n = 7$) and PROC ($n = 7$) the largest number of participants report responding to prompts to moderately increase communication.

Given that those that respond to a request to slightly increase communication, will also respond to the larger prompts (moderately and considerably) enables an overall impression can be gained, by summing these responses (Table 4.12).

| Increase Communication | CIT | PREF | PROC |
|------------------------|-----|------|------|
| Always | 2 | 3 | 3 |
| Slightly | 7 | 6 | 8 |
| Moderately | 11 | 13 | 15 |
| Considerably | 17 | 18 | 18 |
| Never or no response | 3 | 2 | 2 |

Table 4.12: Responses to instructions to increase communication from DCS in Experiment 2.

4.4.6.6 Adherence to the feedback from the NDCS

Again participants responded to several items in the post-experimental concerning their responses to the non-directive feedback. The most common reaction to this feedback was to not respond. Thirteen of the participants ignored the feedback regardless of direction or category, 1 always attempted to adjust their communication regardless of category or direction, and the remaining 6 panel members responded when their rates of communication fell below half the levels expected by the model.

4.4.6.7 Message Latencies & User Models of Communication Process

The latency between a participant beginning to compose a message and the actual reading of that message by the other decision panel member is consistent with the latencies observed in the archive analysis (Chapter Three) and suggests no need for further analysis.

4.4.6.8 Concluding Comments

It is suggested that the directive communication support (DCS) was more successful than the non-directive communication support (NDCS) in eliciting the required alterations in communication behaviour. This is borne out more from the interpretations of the representations of the data than a clear indication from the statistical analysis of the findings.

It is apparent from the data that there are two problems that require attention prior to further development of the system: i) conscious disregard of the communication support and ii) failure to suppress normative communications.

Both the communication data and the self-report measures identify a small subset of decision making panels who disregard the instructions from the support system. Regardless of the potential effectiveness of the system if users decide to ignore the advice offered or instructions given by the system, then ultimately the system will fail.

Furthermore the success in suppressing the informative communication was not matched by a corresponding decrease in normative communication behaviour. Issues relating to the partial success of the support system must be addressed before the final selection of a system for development: DCS or NDCS.

4.5 Discussion

4.5.1 Overview

After an initial recap of the results of the experiment questions relating to the validity and integrity of the target levels are discussed along with a brief look at the issues of time scarcity and the use of the post-experimental questionnaire. Finally, the conclusions that can be drawn from the data are presented and the issue of the revising the feedback systems addressed.

4.5.1.1 Summary of Results:

The measures of outcome reveal no significant difference in final decision of decision panels resulting from the communication channels available. However several interesting differences in the decision process are revealed. The previously observed (Chapter Three) differences between FTF and CM communication were again apparent, however, the intervention of a directive communication support (DCS) system succeeded in altering communication patterns to more closely resemble FTF communication than unsupported CMC. This alteration was not observed in groups operating in conjunction with the NDCS system, whose communication behaviour is marginally greater than that of the unsupported CM panels.

Perceptions of the utility of the feedback information varied both across conditions (DCS - NDCS) and across panels within a condition, with the identification of deliberate rejection of the support observed in a small number of groups. Although examinations of the communication behaviour offers some conflict with the responses from the PEQ the majority of participants did attempt to respond to the feedback and alter their communication accordingly.

The other self-reported measures indicate very few differences between the two roles, suggesting that the adopted approach of examining the data at a group level returns a representative picture of the decision process. The physical process of making the decision: the production of e-mails, voting for preferences and receiving feedback offered little in the way of perceived obstruction to the users of the systems. Encouragingly the support provided by the DCS systems was considered by the decision makers to be a useful aid, although less encouraging is the notion that on occasions the users found this to be occasionally obstructive.

4.5.1.2 The extent to which the aims of the experiment have been achieved

The primary aims of this experiment were:

- i) To assess the feasibility of intervening on the basis of communication content style.
- ii) To identify the form of intervention most likely to succeed in modifying the communication of computer-mediated decision makers.

The secondary aim of this experiment was:

- i) To test the paradigm under the heavy workloads demanded by experimental conditions.

The success of meeting these aims has been only partial. It is apparent from the data that intervention upon the basis of communication is possible and has some desirable effects. However, the successful alteration of communication behaviour was dependent upon the category of communication being adjusted. An increase in informative communication (CIT) leading to more evidence driven discussions occurred, unfortunately this was not matched by a decrease in normative (PREF) decision driven communication. A Directive (DCS) rather than Non-directive (NDCS) system offers the greatest probability of the development of an operational system.

The secondary aim, of assessing the paradigm under high workload conditions was achieved. The demand placed upon the system was such that real time processing of the communication by the human component of the system was achieved with little error and with no delay discernible to the decision makers themselves.

4.5.2 Issues Surrounding the FTF Target Levels

4.5.2.1 Integrity of the Target Levels

Although with hindsight assessing the effects of the support upon decision panel members and questioning them for an awareness of the generation of target levels of communication would have been beneficial this was not undertaken. It is, however, still advantageous to speculate on the likely effects of the communication support.

If users generate a representation of the target levels of communication it is possible that they compare this representation to the desired target levels of the support system, and attempt to reduce the differences, as they are instructed to do by the support system itself. However the levels of communication that the support system is based around are for the

communication behaviour of the decision panel as a whole, whereas any representation generated by users will reflect only what they know about the decision process. In effect the support system has an overall impression of the decision process from an external perspective. The individual panel members representations are very much subjective, they reflect only communication behaviour that has been completed and will not reflect any unread messages.

As such the impressions of individual users may be in conflict at various stages of the decision process, not only with one another but also with the levels of communication expected by the support system. In effect if a message containing several utterances of an informative nature is sent by the first panel member, but not read by the second panel member, conflicting impressions exist. Panel member one has a representation of communication behaviour that contains more citations of case fact than the representation generated by the second panel member. Parallels can be drawn between the discrepancies here, and the four asynchronicities identified by Bowers and Churcher (1988). Opportunities exist for the target levels and the users current representation of communication to diverge at three separate stages (i) during composition of the message, (ii) between it being sent and received, (iii) between it being received and read. The second of these is contributed to by the interception and coding by the MIMICS system. Awareness of these potential differences are unlikely, and it is probable that the user's model and the target levels of communication held by the system will converge shortly after the difference occurs. This suggestion is supported by an examination of the message latencies which suggest that all messages are read very soon after their receipt. However, for a brief moment, the representation of user two is in conflict with the current representation of the support system itself. Were support to occur, informing users of a discrepancy between their actual communication and the target levels, then it is possible that the support system will lose credibility in the eyes of the user two, were this process to repeat itself on more than one occasion then it is possible that the system will lose credibility, and with the loss of face validity of the system a loss in adherence to the prompts will occur.

A second more likely scenario that would lead to a removal of the integrity of the system would occur in panels where a greater number of messages remain unread. If both users have unread messages in their e-mail in-trays, then not only do the users have conflicting models of

their communication behaviour, but neither user representation matches the support system impression. In such instances, the likelihood of adherence to the support falls, and it is perhaps these groups who perceive the support to have little use or report little adherence to the messages.

This issue is not immediately pressing and will be addressed at greater length in Chapter 8, however, attempts to decrease the lag in messages from user to user, and decrease the likelihood of support occurring at points where possible representations of communication conflict, are addressed in the experiments reported in Chapter Five. For now an awareness of the potential problem, however small is sufficient.

4.5.2.2 Validity of Target Levels of Communication

The inclusion of a FTF condition and subsequent examination of the communication behaviour of these decision panels suggests that the modifications made to the target levels as a result of alterations to the task, were satisfactory. No major discrepancies between the communication styles of four- and two- person decision panels are apparent, however, once more it is important to reiterate that the exact shape and nature of the target levels are of secondary importance (cf. Target level related issues in Chapter Three). The key to the development of the system remains the nature of the intervention rather than the target to which the intervention system is shaping communication.

The idea being developed here is that the alterations to communication style are an act performed by the decision makers in response to their own perceived restrictions of the media being used to discuss the problem. If this is the case, then the key to altering behaviour is being able to develop a system capable of altering their communication styles. The exact nature of the target levels to which their communication is being compared is somewhat arbitrary, the “standard” used in this experiment was face-to-face discussion, but as was revealed in Chapter One, the literature points to a number of known flaws in the FTF decision making process.

Some authors would object to the suggestion that informational influence is the benchmark for the measurement of a *good* decision. Although clearly not “*the*” gold standard that FTF can offer for the measurement of CMC, the publications of Karau and Kelly (1992)

and also the work of Stasser and Stewart (1992) lends itself to the conclusion that normative influence, at least in terms of compliance, is a less profitable strategy.

Examining the target levels of CIT and PREF simultaneously lends some support to the idea that it is only when the deadline for the completion of the task nears, that an increase in PREF is observed whilst the production of CIT decreases. This might suggest a move away from informational to normative influence under time pressure, a finding that has been suggested elsewhere, see for example Reid & Hards (1997) discussion of the effects of temporal constraints affect upon the way in which disputes are interpreted and collaboratively managed in computer conferencing. However, an examination of the production of INF (Appendix C2) shows that they too increase around the same time period, suggesting that the exchange of "quoted" information trail off, and that the decision makers infer the implications of their decision from previous examples. There are asymmetries in the time used in the two conditions, leading to a greater potential time pressure in CMC but this is a recognised feature of CMC. Determining the trade-offs between communication styles is somewhat problematic, and requires a more detailed discussion of this and related in the final discussion (Chapter 8) where the approach as a whole is evaluated in light of the data from several studies.

4.5.2.3 Explanations for the partial success of the approach

Four possible explanations can be advanced for the systems achieving only partial success. These are i) factors advanced in the literature relating to feedback, ii) panels consciously ignoring the feedback due to the support system losing credibility, iii) the dynamics of increasing versus decreasing communication behaviour and iv) the existence of minimum level of communication required to reach a decision.

The literature relating to the provision and receipt of feedback (Chapter One) offers several possible explanations for the partial success of the support systems. The most immediate of these is the decreased effectiveness of group level feedback in comparison to individual level feedback (Chapter One). Given the nature of the discussion, and the difficulties that can be experienced in imposing a rigid communication structure upon decision making panels the argument has already been made for feedback provision at a group level.

Nevertheless, it is important to consider methods of increasing adherence to the feedback from the support systems.

It is likely that several factors will lead to an increase in adherence to the interventions (and thus the communication target levels): i) providing clear representations of desired/target communication to the users, ii) decreased delay between communication and support and iii) increased identifiability of the effects of individual messages upon the panels communication levels. These important issues are developed further and directly addressed by the experiment reported in Chapter Five.

Another possible reason for the partial success of the support might be that some decision panels consciously ignore the feedback provided by the system. This disregard for information may occur as a result of the interventions occurring at a point where the panel has fallen so far below the communication levels required that the distance between their own communication and the target levels too great to close in the remaining time for the decision to be reached. If this point is reached then the panel members might decide (consciously or otherwise, that it is too difficult to recover or that the source of information, the support system itself lacks credibility and therefore the information that originates from the system serves little or no purpose. The key to preventing this occurring is to ensure that the feedback occurs at sufficient intervals to ensure that the panel remains within contact of the target levels of communication throughout the course of the experiment.

A third possible reason for the partial success of the system might be the direction of movement in the communication that is required. It is important to note that the system requires the decision makers to add informative utterances (CIT) to the communication style that unsupported panels employ. However, they are required to decrease their references to the decision options themselves (PREF). It is likely and supported partially by the self-report measures of the relative importance of increasing/decreasing communication, that the users view an increase in communication as *adding* something to the decision process. It is easy for the decision makers to see how the addition of communication to a process can improve the decision itself. It is harder to picture how a decrease in communication, as is required of PREF can benefit the process. To understand the need for a reduction in a form of communication requires the decision makers to develop an insight into the overall decision

process. They must realise that the flow of communication can take many forms, and that they approach adopted at the beginning of the task may not be the approach that they maintain over the entire course of the decision making process. The provision of the target levels or repeated exposure to support over several tasks may result in a greater adherence to requests to decrease a given communication style. This factor may also interact with the previous issue of the current communication levels deviating to such an extent from the required levels that it becomes increasingly difficult, even if desired by the decision makers, to return communication to the levels required by the support system. If the initial rate of production of a given style is high, then it might conceivably exceed the levels required by the FTF model, and result in repeated prompts to decrease communication, losing the credibility of the system. Either singularly or in conjunction with another explanation it is possible to advance explanations for the behaviours observed.

Finally, it had been assumed during the construction of the target levels of communication that proportional communication rates are important in the decision making process. However, the ineffectiveness of the intervention in suppressing expressions of preference (PREF) suggests a possible shortcoming in this premise. Although the absolute levels of PREF are greater than those derived from the FTF panels, the distribution of these utterances over time, is similar in shape to the target levels.

A conceivable explanation of this finding is that rather than the proportion of PREF in the communication it is the absolute levels of PREF that are important. It is perfectly feasible that there is in operation a threshold of utterances that must be exceeded for a decision to be reached. If this threshold exists, then given what we already know about CMC, the threshold is likely to be higher for CMC than that for FTF communication.

In a FTF exchange, the shortest possible exchange to reach a decision would be the offer of an option as the decision (one expression of preference) followed by an acceptance of that offer (a second expression of preference).

Decision Maker 1: Shall we go for option 3?

Decision Maker 2: Yes

The nature of the medium is such that there can be little confusion following the exchange that both members of the panel are agreed as to the option selected. Similarly the addition of

non-verbal cues is likely to leave little doubt whether the message was received and/or understood by Decision Maker 2. The same exchange by CMC will inevitably take a greater number of utterances. The offer and the acceptance of an option are the same,

Decision Maker 1: Shall we go for option 3?

Decision Maker 2: Yes

however the nature of the medium is such that determining whether the reply (*Decision Maker 2: Yes*) is a reply to the offer of a decision, is difficult. At any given time in CMC numerous topics of conversation exist, it is possible that the 'Yes' reply is to an earlier message. This possibility is further compounded by the reluctance of e-mail users, even experienced users of mailing lists, to alter message headers to accurately reflect the content of the message. As such, although the shortest possible conversation leading to a decision in CMC might be the two PREF exchange seen in FTF panels, it is more likely to contain an additional confirmation phase:

Decision Maker 1: Shall we go for option 3?

Decision Maker 2: Yes

Decision Maker 1: So option 3 is our final decision?

Decision Maker 2: Yes.

or

(Decision Maker 3: Yes, our final decision is option 3

This leads to at least a four PREF exchanged as the minimum likely offer and acceptance of a final decision.

If a minimum level of exchange exists for the reaching of the final decision it also follows that the overall levels of PREF. communication in CMC may need to be greater than in FTF panels. The exact number of utterances in these exchanges is of less importance than the possibility that CM decision makers require a higher number of PREF to reach the same decision.

The target levels based on proportional levels of communication may require users to communicate at levels below the 'threshold' making the reaching of a decision impossible. If this is the case then one of two outcomes will occur; either the decision panel will fail to reach a decision or they will operate at levels above the levels derived from the FTF panels. Either or both of these might be suggested by the data collected so far. As yet, no alterations to the target levels of communication will be made, however, the possibility of requiring decision

makers to operate at proportional levels of utterances for some forms of communication and at absolute levels for others will be considered at a later stage. Also at that stage the issues raised by the feedback literature, ways of increasing or maintaining the credibility of the GCSS and the effects of the dynamics of increasing/decreasing communication behaviour will be addressed.

4.5.2.4 Understanding Decision Makers Preferences

A compliance approach to the issues emphasises the coordination of information and combination of conflicting preferences intentionally incorporated into the experimental design. This combination of initial preference's of group members should not be considered to reflect the groups position on the "best" response to the problem, but rather a reflection of what can be considered to be an "acceptable" response. This is to say, that when faced with positions of conflicting opinion and information, the initial goal to reach the "correct" decision is often replaced by a more realistic attempt to reach compromise rather than alter what could be entrenched, opposing opinions. Such a process would be reflected in the early exchange of CIT which would give way to a later exchange of PREF as the time to reach a decision neared. Such a change to compromise positions is a feature of many of the studies reported in the literature where a shorter time span is permitted in which to reach a decision, resulting in a sudden shift towards consensus near the end of the experiment, see for example the data presented by Postmes *et al*, (1994).

The medium itself might be considered to hinder any approach to reaching the "correct" decision. The increase in normative influence as exhibited by the relatively high number of PREF utilised by CMC panels can be read as an indication that the decision makers are struggling to move towards the "correct" solution, however, the extensive evidence gained from the post-experimental questionnaires (PEQs) fails to reveal serious disagreements with the final panel decision, perhaps suggesting a move towards compromise decisions. This is only partially supported by the question directly asking whether the decision was correct or reached through compromise.

This should not be taken as a suggestion that consensus seeking is an act that reflects a curtailment of discussion. Such an interpretation would be to grossly underplay the role of social validation (cf. work of Turner) that consensus seeking fulfils. Merely that the time

demands and phases of the decision process make this a natural outcome to the decision making process.

4.5.3 Further Developments

The findings of this exploratory experiment suggest that it is possible to intervene through a series of simple interventions to shape the communication of computer-mediated decision panels to resemble the communication expected in a FTF decision. The success however of the intervention system was varied, Citations of Case Fact (CIT) were increased in line with FTF panels, however, altering procedural information (PROC) and suppressing the expression of option preferences was less marked.

In nearly all cases information directing the panels to alter their communication (DCS) was more successful than non-directive information (NDCS) and possible reasons for this have been advanced. As such it is the directive communication support system (DCS) that will be developed further, however, before alterations to the target levels of communication and intervention process are made, an important issue must be addressed. This is whether it is the content of the intervention messages that leads the panel to change their communication behaviour or is it merely the presence of a prompt. If the intervention system is heightening the awareness of users to their communication and that itself is leading to the alterations then developing a communication support system to shape communication might be more than is required.

It is important to determine just how important this issue is to the development of the support system. Chapter 5 therefore addresses the importance of the content/presence of intervention.

5.1 Overview

The preceding chapter reported an experiment in which the communication patterns of computer-mediated decision-making dyads were successfully shaped by feedback from a Group Communication Support System (GCSS) to 'more closely' resemble the communication patterns of face-to-face (FTF) decision making panels. The alterations in communication were attributed to the most salient feature of the support system, the utility of the information provided in the support messages, however, this is not the only possible interpretation of the changes observed. It is possible that the mere presence of a support system that offers feedback regarding the communication behaviour of decision panel members might cause the changes. The knowledge that a system is present that is, in some way monitoring the communication process might lead to an increase in the self-monitoring behaviour of the panel or lead to differences in the processes by which the decision makers consider what information to communicate to one another. If it is this or some other process related to the presence of a GCSS, rather than the information that it provides, that causes the observed changes in communication behaviour then the focus of the system development must alter. This chapter aims to determine whether the observed changes in behaviour are attributable to the information provided by the support system, or whether the presence of the support system is sufficient to illicit the changes observed in the previous chapter.

5.2 Introduction

5.2.1 Implications of Experiment 2

The data reported in Chapter Four indicates the relative success of the directive communication support (DCS) system in comparison to the effects of the non-directive support system (NDCS). Three forms of communication were examined, expressions of preference (PREF), citations of case fact (CIT) and procedural information (PROC). The support systems employed had varying degrees of success or failure across these three target categories.

Although neither system completely suppressed the level of communication concerned with expressions of preference (PREF) to the required levels, the DCS system did manage to bring

decision makers closer to the model than their counterparts in the NDCS condition. Greater success was observed in increasing the levels of CIT, with groups operating under assistance from both the NDCS and DCS exhibiting favourable alterations in their communication. That is to say that the groups moved away from relying upon normative influence and increased their informational style of discussion. However, only the DCS panels operated at levels that closely resembled the target levels derived from the FTF condition. Attempts to adjust the levels of PROC in either condition proved somewhat more difficult. The observed changes in the levels of communication have been attributed to the support systems themselves as this is the only factor that differed between Experiment 1 and Experiment 2. However, the precise causal effects of the system remain unclear.

5.2.2 The Cause of the Changes in Levels of Communication

The most compelling argument is that the changes in the levels of CIT, PREF and PROC are due to the content of the feedback messages. At present it appears that the feedback messages convey meaningful information to the decision makers that they successfully interpret and utilise to shape the decision (communication) process. Through their understanding of the feedback messages they are able to alter the content of the communication and adjust the various levels of communication (CIT & PREF) to increase the extent to which they communicate information about the case and reduce the degree of dependence upon expressions of preference. This is to say that the members of the decision panel are able to interpret the content of the feedback messages, relate this to their own behaviour and adjust their communication processes in accordance with the instructions.

In assessing the role of the support system it is possible to explain the change in communication process in another way. The nature of computer mediated communication might be such that as a result of some feature of CMC, for example the multiple threads of discourse reported by Black, Levin, Mehan and Quinn (1983) or Kerr & Hiltz (1982), that the overall monitoring of communication content becomes increasingly difficult, and this difficulty expands as time advances. As such it is possible to argue that the user is aware that informational influence is the desired mode of communicating, and that this will enable them to reach the correct decision. Yet they might be prevented from doing so by the nature of

CMC, it might, for example hinder the ability of decision makers to monitor the level of such information resulting in an increased reliance upon normative influences.

The suggestion here is that given the difficulty that users might have in monitoring their own communication over time, it would be unsurprising if they failed to accurately represent, or even consider their communication. In FTF exchanges the conversations are comparatively quick and the capacity to maintain a record of what has and has not been said is greatly enhanced. The flow of topics, with subjects often opened and closed before moving on to address the next issue also serves to ease the communication process, and attempts to monitor the progression of the discussion.

It remains possible that the addition of a support system to the communication process may serve to highlight the need to monitor communication and in effect enhance the capacity of the users to address discrepancies between their current and ideal communication. After all, the briefing for Experiment 2 (Appendix B4.2) explained the purpose of the GCSS and gave a brief outline as to its monitoring of communication and subsequent suggestions about communication that it would make. It might be that it is not the prompting *per se* that causes the panel members to alter their communication but an indirect result of the support system being present. The prompts might highlight the need to attend to the type of communication being sent, leading to greater consideration over the communication style. It might be argued that it is quicker to send another decision panel member an indication of the current preferred position than give a detailed explanation of why. The presence of the GCSS might lead the user to consider the impact of their communication, and therefore convey why they believe something to be the case by providing supporting evidence in the form of CIT rather than relying upon communication that merely portrays their currently favoured outcome (PREF). Such a process might lead the supported decision maker: whether they be operating with assistance from either a directive communication support system or non-directive communication support system, to send less PREF style communication. Similarly, they might conclude the need to send a greater number of CIT. Indeed, if this is the case it might explain why the levels of CIT and PREF can be altered to some degree but PROC remains at the levels of unsupported CMC panels. It would be a rare group indeed that would derive the need for an altered in the level of PROC.

There is little doubt that this interpretation of the findings is purely speculative. The argument that it is the form of the feedback that causes the alterations in communication behaviour is by far the more compelling interpretation, and the alternative advanced here is just one possibility, however, it is a useful starting point from which to consider the alternative interpretations of the findings.

Experiment 3 addresses the question of whether it is the content of the feedback that alters the communication, or if the mere presence of a system can lead indirectly to the alterations observed.

5.2.2 Experiment 3: The Relative Importance of the Presence versus Content of the Support

5.2.2.1 Assessing the impact of the prompts

The process of deciding whether it is the prompting provided as feedback or the mere presence of a support system that results in changes in communication is problematic. The prompts might lead to a realisation regarding communication style that results in changes in communication behaviour. This process of realisation, if indeed it exists, is potentially complicated, therefore the first step in determining its existence is to dispense with any in-depth attempt to determine the process and merely describe the action as a theoretical 'black box.' Within this black box a process occurs that results in changes in communication. These changes occur not due to the wording, content or nature of the support received from the GCSS, but due to an unidentified component. What is known about this component is that it results in the realisation that something is wrong. That a comparison occurs between current levels of communication and a gold standard, such as FTF communication, and that this comparison results in an awareness that the communication style needs altering. The central argument here is that the user, either implicitly or explicitly, knows the form of communication that is required by a task of this nature. The feedback system in some way reminds them of this, leading to a change in communication and the subsequent effects observed in Experiment 2.

This notion is relatively simple to test and it is worth digressing to consider why no such process occurs in unsupported computer-mediated (CM) panels. The main difference between unsupported and supported CM panels is the existence, via e-mail of the messages from the

support system and/or an awareness of the goals of this system. In the supported condition, the presence of the feedback either directly leads to changes in communication as the decision makers adhere to the content of the support messages, or the presence of the support system lead the decision makers to reflect upon the content of their communication and this leads to the observed changes in communication. In the unsupported CMC condition of the experiments no process exists which results in the panel reflecting upon the nature of their communication, they are left to proceed in whichever way they feel is appropriate. The lack of reflection removes the possibilities for the realisation of the need to change communication style hence the lack of effects in unsupported CM panels.

Returning to the central theme: that of the effect upon communication behaviour of a prompt from the GCSS, predictions can be advanced and tested. If the content of the support system feedback results in the alteration of communication behaviour then an intervention prompt from the GCSS should result in a change in the communication levels of the decision panels regardless of the nature of the prompt. This is to say, that if the panel is operating at levels above those of the target levels and they are instructed to increase the level of communication, then the levels of communication of that type (CIT, PREF or PROC) should increase. That is they should follow the prompts regardless of their current levels of communication. Similarly if communication is below the levels of the target levels, then an instruction to decrease communication of that category should result in the continued presence of less communication, either CIT, PREF or PROC than would be predicted by the FTF target levels of communication.

In contrast, if the presence of the messages results in a realisation of the differences between current and desired communication, then prompts that suggest an increase in communication should have no effect. If awareness of the target levels of communication is being fostered by the GCSS then prompts to communicate above and beyond the levels of the target should be ignored. In this scenario the content is unimportant the feedback merely serves as a cue. The same can be said for the impact of an instruction to decrease current communication levels. If a panel realises that they are communicating below the required levels then they will ignore any instructions to communicate even less of this style of information.

5.2.2.2 Summary of Predictions

If the presence of the feedback is the key then changes in communication will only occur if the change accurately reflects the differences between current communication and the target. If the content of the messages from the GCSS is the key then alterations in communication behaviour will occur regardless of the current differences between communication levels and those of the target. In other words, feedback that suggests a move away from the target will only be adhered to if the decision makers are utilising the content of the information. If on the other hand the decision makers are using the prompts as a cue, then instructions that further distance the panels communication from that of the target will result in the same effects as previously observed.

5.2.3 Developing the Experimental Design

5.2.3.1 Generating Realistic Support Messages

The patterns of messages received from the GCSS are difficult to predict. They reflect changes in the communication and as such are likely to progressively increase or decrease in the magnitude of the differences they convey. The support messages will sometimes reflect discrepancies in all three target forms of communication (CIT, PREF, PROC) and on other occasions only detailing the need to change the levels of just one communication type. The key to testing the predictions made is to generate support messages resemble those used in Experiment 2, not just in terms of the content of those messages but also in the pattern from one message to the next.

5.2.3.2 Using Random Feedback

It would be possible to generate random support messages from the complete list of potential feedback outlined in Appendix A7. Taking just the directive communication support (DCS) system as an example, the six possible forms of feedback that are generated from combining the magnitude of the difference (slightly, moderately & considerably) with the direction (more or less) that exist for each of the three categories (CIT, PREF & PROC) means that 18 possible individual messages exist. These 18 messages consist of six regarding CIT, six regarding PREF and six regarding PROC. Given that one or none of these forms of feedback can be taken from each of these sets of six and that these can be combined to form the feedback there are 577 different combinations. Clearly, a randomised procedure for

generating feedback messages and testing these responses is unlikely to yield data of interest. Consider further that any of these 577 combinations could fill each of 12 time slots for feedback and there is clearly a need to consider an alternative method for testing the predictions.

The other disadvantage of this approach is that the progressive nature of the messages. The pattern of messages that indicate an increasing or decreasing severity of discrepancy between user communication and the target levels of communications is unlikely to be random. Successive messages from the support system would be very unlikely to suggest the need for a large increase in CIT followed by the need for a large decrease in CIT style communication. Instead the feedback is more likely to suggest a moderate increase, followed by a large increase, or indeed a moderate increase followed by a slight increase. The changes in levels of communication follow a non-random pattern between the need to increase or decrease, with often only slight changes in magnitude between one time and the next. This pattern is highly unlikely to be conveyed by the random provision of feedback messages. So even if a method for generating all forms of feedback and gaining sufficient data on each were possible, it would still be unlikely to yield meaningful data.

5.2.3.3 Using Existing Feedback

It is possible to examine the patterns of feedback from the groups examined in Experiment 2 and from these data to generate transformation matrices indicating the likelihood of a given form of feedback preceding or succeeding any other form of feedback. Thus, if it is known that following a given set of feedback W that there is a 20% chance of feedback X occurring, 30% chance of feedback Y following and that on the remaining 50% of occasions feedback of content Z occurs it would be possible to generate realistic patterns of support messages on the basis of these patterns. Such a model would ensure that the flow of feedback and the changes in direction or magnitude mirror those observed in panels actually operating under the decision support system.

At one level it is possible to see how this would be advantageous to the problem currently being addressed. However, the possibility remains that this is under utilising the data available. Another method of ensuring the natural flow of the content of support system messages is to employ messages that have actually been generated for decision panels

undertaking the task. The added advantage of using the prompts from previous decision making panels is that the relative impact of the feedback can be assessed. Employing this method enables the decision panels in Experiment 2 to be treated as a baseline against which the data collected in this experiment can be assessed. In effect this method uses a yoked experimental design, where the messages from the support system for decision panels in this experiment are yoked to the messages from the support system for decision panels in Experiment Two.

5.2.3.4 Further Development of the Yoked Design

In assessing the impact of the support system messages it would appear prudent to only evaluate the efficiency of messages in the most effective form of support system, that of Directive Communication Support (DCS). It has already been established in Chapter Four that the feedback provided by the Non-Directive Communication Support (NDCS) system demonstrates little success in achieving the desired changes in communication levels. Therefore to examine the yoked impact of this feedback would provide only misleading information, with little hope of clarifying the link between feedback and changes in communication behaviour. If the effect of the original feedback is unclear then the effect of yoked feedback would be even harder to interpret. In an attempt to gain clear and interpretable data the experiment reported in this chapter examines only the impact of the feedback messages received by panels operating with assistance from the DCS examined in Experiment 2.

5.2.3.5 Development of Case Materials - Davies Casebook One.

Although the impact of the system is the primary aim of the study it is worth considering the development of further case materials. The original experimental materials from Chapter Three: The Rips Casebook, consisted of 200 entries of between 50 and 200 words in length. From these data a second set of materials, The Rips Casebook Two was constructed and used in the experiment reported in Chapter Four. This casebook consisted of half of the materials from the original database sampled to create two distinct and opposing perspectives on Linda Rips and her three children; William, Lucie and Mary.

The remaining 100 items have yet to be re-used and were modified to form the casebook materials for Experiment 3. To reduce any confusion between the materials several changes

were made to the entries (Appendix B6.3), these were mostly of a cosmetic nature and involved alterations to the family names, the region where they lived, the era in which the events took place, etc. Again to avoid confusion but also to give the decision materials a more modern flavour the panel roles were altered from Local Health Authority (LHA) to Health Trust (HT), and the Department of Social Services (DSS) was renamed Community Services (CS) to reflect the change in times from the mid nineteen eighties, to the early nineteen nineties. The general nature of the databases was maintained therefore the HT database consisted of 50 entries suggesting the harsher end of the decision options: the removal of the children ahead of the provision of home help, and the CS files consisted of the same number of entries but suggesting that the most appropriate course of actions was the provision of home help rather than the fostering of any of the children.

5.2.3.6 Decision Options, Panel Size and Task Length

Although the materials themselves were modified, the four decision options; the Provision of Home Help, the Removal of the Youngest Child, the removal of the Two Youngest Children, and the Removal of All Three Children were retained. In addition to holding the options constant both the panel size (dyads) and the length of task (two hours) were maintained at the levels used in the preceding experiment. (The rationale for these levels is presented in the preceding chapter).

5.2.4 Summary of the experiment aims

The data already reported in Chapter Four indicates that communication support of a directive nature can assist CM decision making panels to become more 'information-driven'. The two most immediate explanations for the alteration in communication behaviour are (i) the presence of the feedback which in some way heightens the decision makers awareness of their communication and this leads to an increase in communication, or (ii) that feedback from an intelligent system provides information which the participants successfully follow which results in the greater use of an information based style of communication. Participants expect the system to monitor their communication and subsequently follow the instructions provided. If the system merely heightens awareness of communication and this in turn is sufficient to modify communication then the development of a fully operation GCSS is an overly technical solution to the problem, as rather than prompting specific to the current pattern of

communication much more general prompting can be given. Prior to further development of the system it is necessary to first establish that it is the *content* of the intervention that successfully alters communication behaviour, Experiment 3 aims to do just this by providing feedback to CM panels that is yoked, in time, to the panels from Experiment 2.

5.3 Method

5.3.1 Design

Due to a limited supply of participants, rather than a complete control condition of ten decision panels, a reduced control condition of five panels was employed. The purpose of these panels was to establish consistency between Rips Casebook Two and the Davies Casebook, however, the key comparison in this study is that between the various yoked supported panels.

Five panels were randomly assigned to an unsupported computer-mediated communication (CMC) condition. The remaining ten panels each received intelligent support relating to their communication from the directive communication support system employed in Experiment 2 (Chapter Four). This support was derived not from the content of their own messages but related to that received by a panel, selected at random from the earlier study, creating in effect a pair of panels receiving Yoked Directive Communication Support (YDCS).

5.2.2 Training and Selection of Participants

From the perspective of the decision panel members the experimental task is identical to that reported for Experiment 2. Therefore, the process of training to use the database and e-mail system for participants in Experiment 3 were the same as those reported in Chapter Four. For this study all participants had prior experience of the basic operation of a computer, therefore rather than concentrating on basic computer skills the training equipped participants with the ability to navigate around the database system and to communicate via electronic mail. All the participants recruited for training achieved satisfactory levels of competence -- as judged by their ability to navigate the database *and* send and receive e-mail -- who progressed to the main (experimental) phase of the study.

Fifteen pairs of decision makers were formed from 30 participants who successfully completed a training phase. This phase consisted of instruction in using the electronic mail

system and the hypertext database system. In return for participation each panel member received a mixture of cash payment and credits towards a course requirement. All participants had previous experience of similar computer system by virtue of enrolment on the BSc (Hons) Psychology course at the University of Plymouth and a small number had prior experience of electronic mail.

5.3.3 Materials

Each participant was provided with a Networked Apple Macintosh Classic computer equipped with the electronic mail and Hypercard databases. These machines were networked via the experimenter's computer as detailed in the paradigm advanced in Chapter Two.

5.3.3.1 Databases

The Davies Casebook described above was generated from the pool of items that constituted the Rips Casebook described in Chapter Three. Each database contained 50 statements varying in length from 50 to 200 words, and statements were selected to suggest that a specific course of action as the most appropriate in these circumstances. The databases represented a unique, conference file for each participant and represented the information held by one of two agencies in the case. The division of information between the databases was such that the role of the Health Trust (HT) was biased towards removing the children into care and the representative of the Community Services (CS) towards providing additional home help. As with the earlier experiments these inbuilt biases were included to ensure that the initial preferences of the panel members differed and that a decision could only be reached through comprehensive discussion.

5.3.3.2 Decision Options

Four decision options were presented to the panel, the first of these enabled them to provide *home help* for the family, the second option was to *remove the youngest child* and place him in care. Option three involved *removing the two youngest children* and placing them in care, whilst leaving the eldest with the mother and the final option was to *remove all three children* and place them in care. The task of the decision makers was to select the option that they felt was most appropriate given the information that they had before them and to notify the experimenter of the panels joint decision, within a two hour time limit.

5.2.3.3 *Post-Experimental Questionnaire*

A post-experimental questionnaire (PEQ) was used to sample the opinions of the decision making panel once the task itself had been completed (Appendix B5.3). This questionnaire was the same version of the PEQ used in the experiment reported in Chapter Four but modified slightly to reflect the changes in the decision materials and including a series of questions that were specific to the directive communication support (DCS) system.

A questionnaire was issued to the participants in the unsupported computer-mediated condition and contained items relating to perceptions of the task and perceptions of the decision. This included the participants perceptions of group members influence upon the decision, their perception of the ease of communicating with one another and the obstructiveness of requests for own preferences. Additionally, questions concerned with the individual's satisfaction with the final decision and whether this was considered to be the correct decision or to be reached through compromise were included. Finally, the panel members were asked what decision they would make alone were they to make the decision alone.

A version of the questionnaire was administered to decision panels receiving yoked directive communication support (YDCS), this questionnaire contained additional questions regarding the obstructiveness and utility of the support system and the effects of support upon their communication. It also addressed the perceptions of importance of adjusting their communication according to the feedback they received and the degree of deviation from the model that existed before they considered it important to adjust their communication.

Finally an open-ended question relating to the participants perceptions of the 'care' in the options entailed was included and a space left to enable the participants to add any additional comments.

5.3.4 Procedure

The MIMICS paradigm was employed with groups receiving yoked support for Citations of Case Fact (CIT) and Expressions of Option Preference (PREF) along with communication coordinating the group activities (PROC) based upon the feedback provided to panels in the DCS condition of Experiment 2.

5.3.4.1 Procedure - Briefing, Decision Options & Task

Informed consent was obtained from each participant and a brief reminder given of the system that they had been trained to use. Where applicable checks were made to ensure that participants understood how to interpret the feedback provided by the system. A copy of the four decision options was provided and participants informed of two conditions to be fulfilled prior to their reaching a decision: i) the decision required was a joint decision with which they both agreed and ii) they were required to have read all of their own case notes. It was, however, emphasised that there was no necessity to have read all the notes prior to communicating and that they could begin to discuss the case whenever they wished.

Each participant was led to a separate room and informed that they could signal to the experimenter if they wished to ask questions as to the nature of the task and reminded that the information they had in their case files was unique but that the reference file was shared. Once the briefing was completed participants were left to complete the task unless they requested assistance. Forty minutes into the task subjects were reminded through the electronic mail system, that the case records that they were reading were unique and that it was 'likely' that they would need to convey some of this information to the other member of the dyad.

Each panel was permitted a maximum of two hours plus a ten minute period of grace in which to reach a decision. Any decision panel failing to register a decision after this period was stopped and a verdict of 'no decision' recorded. Reminders of the time remaining were sent through the electronic mail thirty, fifteen and five minutes from the end of the experiment.

Either at the point with which the panel's final decision was logged with the support system or the time limit expired, participants were issued with a short post-experimental questionnaire. After the questionnaire was completed on the participants were thanked for their participation and debriefed.

5.3.4.2 Procedure - Recording Individual Preferences

Participants were informed that during the course of the decision task they would be asked to indicate how they felt, individually, about each of the four options available to them. The sampling of their opinions first occurred ten minutes into the task and thereafter every

twenty minutes until either the time limit was reached or the dyad reached a joint decision.

Participants were informed that the sampling of their individual preferences would occur through the e-mail such that the other member of the panel would have no access to their current feelings on the case, and that they should use the votes to express how they as an individual felt about the decision task.

5.3.4.3 Procedure - Provision of Communication Support

Panels operating under the Yoked Directive Communication Support system (YDCS) condition received communication support messages via the electronic mail. In general, the purpose of the information was to encourage the decision makers to (i) increase the levels of informative information they communicated (CIT), (ii) decrease the levels of normative information they communicated (PREF) and (iii) to increase the procedural remarks (PROC).

This support was provided using the MIMICS paradigm outlined in Chapter Two, where each message rather than being sent directly to the decision panel members was unobtrusively diverted via the support system for analysis, before arriving at its intended destination. However, rather than making a comparison of the panels communication against the target levels held by the support system, the support messages were those received by decision panels in Experiment 2. This process enabled panels in this to be yoked 'in time' to panels from the earlier experiment.

In Experiment 2 decision panels operating in the DCS condition, received support that compared directly the dyads' own communication with that of FTF decision makers and informed them of the changes in communication that they would need to make to bring their communication in-line with the FTF target. These messages (Appendix A7) informed users of i) the direction of the discrepancy between their communication and the target, ii) the magnitude of the difference and iii) the action that they should take to remove the discrepancy. Messages consisted of support aimed at only the communication (CIT, PREF or PROC) currently deviating from the target, and users were informed that if no mention of the communication was made, or no messages were being sent that the communication levels at which they were operating were in line with the model that system held.

5.4 Results

5.4.1 Overview

The analysis of the findings from Experiment 3 are presented in several sections. The first section of the results provides a general background to the experiment, considering the decision duration and decision reached. The main comparison, however, is not between the two halves of this study but between this experiment and the experiment to which the groups receiving support are yoked.

The control condition (CMC) is compared with the unsupported condition from Experiment 3 to establish whether the population from which the sample is drawn has altered between the running of the two experiments. Having established, whether or not the yoked comparison is valid, the main analysis is the comparison of the yoked decision panels (YDCS) with the panels that determined the feedback they received (DCS: Experiment 3). Finally, the data collected via the post-experimental questionnaire is presented to enable a general impression of the study to be formed.

5.4.2 Preliminary Measures of Outcome

5.4.2.1 *Decision Duration & Outcome of Discussions*

Initially, prior to examining the communication style used and the effect of the feedback, it is worth considering the outcome of the panels deliberations. The unsupported panels ($M = 105.6$, $SD = 7.12$) took on average five minutes longer than the groups receiving yoked feedback ($M = 100.6$, $SD = 24.24$). As with the earlier experiments no single solution emerged as a clear favourite (Table 5.1), however, the modal decision for the unsupported panels was the removal of the two youngest children, which also attracted half the panels in the yoked condition with the remainder electing to remove all three children.

| | | Decision Outcome | | |
|------|-----------|---------------------------|----------------------------------|-------------------------|
| | Home Help | Removal of Youngest Child | Removal of Youngest Two Children | Removal of All Children |
| CMC | - | 1 (20%) | 3 (60%) | 1 (20%) |
| YDCS | - | - | 5 (50%) | 5 (50%) |

Table 5.1: Percentage of panels selecting each decision options in each condition of Experiment 3

NOTE: CMC *n* = 5 , YDCS *n* = 10

5.4.3 Comparing Experiments 2 and 3

5.4.3.1 Establishing Equivalent Controls

The purpose of this experiment is not to compare the unsupported panels with those receiving yoked support, but rather to compared the effect of prompts based upon the communication of the group with the effects of yoked feedback. Due to the differences in the time of testing between Experiments 2 and 3 it is first necessary to compare the unsupported (control) conditions to establish equivalence. Table 5.2 considers the levels of informational and normative influence for unsupported groups in the two studies.

| | Informational | | Normative | |
|------------------|---------------|----------|-----------|---------|
| | CIT | INF | PREF | VAL |
| CMC Expt 2 | 6.70 | 40.50 | 17.50 | 2.80 |
| (<i>n</i> = 5) | (8.14%) | (49.21%) | (21.26%) | (3.40%) |
| CMC Expt 3 | 12.80 | 41.60 | 21.20 | 6.00 |
| (<i>n</i> = 10) | (10.96%) | (35.62%) | (18.15%) | (5.14%) |

Table 5.2: A comparison of the average percentage of panel communication in the informational and normative categories for unsupported panels in Experiments 2 & 3.

A slight cause for concern is the increase in Citations of Case Fact (CIT) observed in Experiment 3, however this high figure is attributable to one exceptional decision making panel that communicated 50 of 184 using this style. This places it more than three standard deviations above the mean and therefore can be considered to be an outlier. Removing these data from consideration allays the fears concern the comparability of the tasks with unsupported panels devoting 5.31% of their communication to CIT (*M* = 8.00, *SD* = 8.08).

A brief comparison of the remaining categories (Table 5.3) supports the assumption that the tasks are equivalent. The main concern here is the high level of non-task related communication (OTH) that is exhibited by panels in the latest experiment. This communication has occurred at the expense of another form, and the most obvious trade-off is the lower production rate of INF from the previous table.

| Non-Specific Categories | | | | | |
|-------------------------|---------|----------|----------|---------|---------|
| | LEG | MAT | OTH | PRESS | PROC |
| CMC Expt 2 | 0.20 | 7.80 | 1.20 | 0.10 | 5.50 |
| (n = 5) | (0.24%) | (9.48%) | (1.46%) | (0.12%) | (6.68%) |
| CMC Expt 3 | 0.60 | 13.60 | 12.50 | 0.60 | 8.00 |
| (n = 10) | (0.51%) | (11.64%) | (10.62%) | (0.51%) | (6.85%) |

Table 5.3: A comparison of the average percentage of panel communication in the informational and normative categories for unsupported panels in Experiments 2 & 3.

Again, a large proportion of the OTH utterances were communicated by the unsupported group that communicated an exceptionally high level of CIT. Removing this outlier from the data reduces the level of OTH to a more comparable level, but still high level (M = 8.0, SD = 8.05). Once this outlier has been removed, the levels of communication suggest the task and the sample are comparable to Experiment 2.

5.4.3.2 Comparing the effects of support and yoked support

All the decision making panels reached a decision within either the two hour time limit permitted for the task or in the case of three of the YDCS groups, the time limit plus the ten minute grace period. Those panels receiving yoked support were (M = 100.6, SD = 24.24) on average fifteen minutes faster than those receiving support derived from their own communication levels (M = 115.2, SD = 16.42). The difference is not, however, statistically significant (t (18) = .83; p>.1). Exploring the decision outcomes reveals that both conditions are split between the choice of two options (Table 5.4).

| | Decision Outcome | | | |
|------------------|------------------|---------------------------|----------------------------------|-------------------------|
| | Home Help | Removal of Youngest Child | Removal of Youngest Two Children | Removal of All Children |
| DCS* (Expt 2) | 3 | 1 | 1 | 3 |
| YDCS (Expt 3) | - | - | 5 | 5 |

Table 5.4 The number of DCS panels selecting each decision options in Experiments 2 & 3
 NOTE: One DCS panel in Experiment 2 was unable to reach a decision

In experiment 2, both the Home Help and Removing all three children were chosen most frequently by groups operating with assistance from the DCS. In experiment 3, the removal of all the children is again the joint mode, but in this case, along with the removal of the two youngest children.

5.4.3.3 Target Communication Categories

The results concentrate upon the levels of communication in the three target categories (CIT, PREF & PROC) which form the basis of the support system feedback (Table 5.5)

| | CIT | | PREF | | PROC | |
|------|----------|------------|----------|------------|----------|------------|
| | Raw | Proportion | Raw | Proportion | Raw | Proportion |
| | Mean | Mean | Mean | Mean | Mean | Mean |
| | (St Dev) | (St Dev) | (St Dev) | (St Dev) | (St Dev) | (St Dev) |
| | 19.93 | 21.40 | 14.90 | 5.10 | 5.10 | 4.62 |
| DCS | (9.94) | (8.73) | (5.57) | (3.48) | (5.17) | (4.87) |
| | 18.9 | 8.91 | 20.5 | 9.02 | 4.3 | 8.72 |
| YDCS | (9.98) | (5.52) | (11.87) | (5.73) | (4.27) | (9.47) |

Table 5.5: A comparison of the average percentage of DCS panel communication in the informational and normative categories for Experiment 2 & 3.

Dividing the duration of each groups decision task into four equal quarters permits the comparison of the effects of the time to be examined. A 2 (experiment) by 4 (Time Quarters)

ANOVA (Appendix C3) with experiment treated as a between subjects factor and time as a within subjects variable reveals a significant effect of the time period ($F(3,54) = 19.04$; $p < .001$) with the level of CIT increasing in the first two time periods ($M = .08$, $SD = .38$ & $M = 2.51$, $SD = 3.40$) to a peak in the third quarter ($M = 10.78$, $SD = 7.50$) before falling in the final part of the decision process ($M = 7.39$, $SD = 5.47$).

A similar effect is revealed for PREF, again there is no difference between the conditions (Appendix C3), however, a main effect of time period is apparent ($F(3,54) = 31.42$, $p < .001$) only this time the increase is maintained from the first quarter ($M = .07$, $SD = .22$) through the second ($M = 1.72$, $SD = 1.97$) and third ($M = 3.40$, $SD = 2.61$) to a peak in the final quarter ($M = 13.42$, $SD = 9.01$).

Finally the effects upon PROC are the same (Appendix B3), with the same significant effect of the time period (quarters: $F(3,54) = 22.39$, $p < .001$) revealing that in the final quarter ($M = 3.07$, $SD = 2.20$) that the groups attempt to coordinate their activity but in the three preceding time slots less than one percent of communication is devoted to PROC.

5.4.3.4 Comparisons to the FTF Target Levels

The final comparison is between the levels of communication used by the decision panels and the target levels provided by the support system.

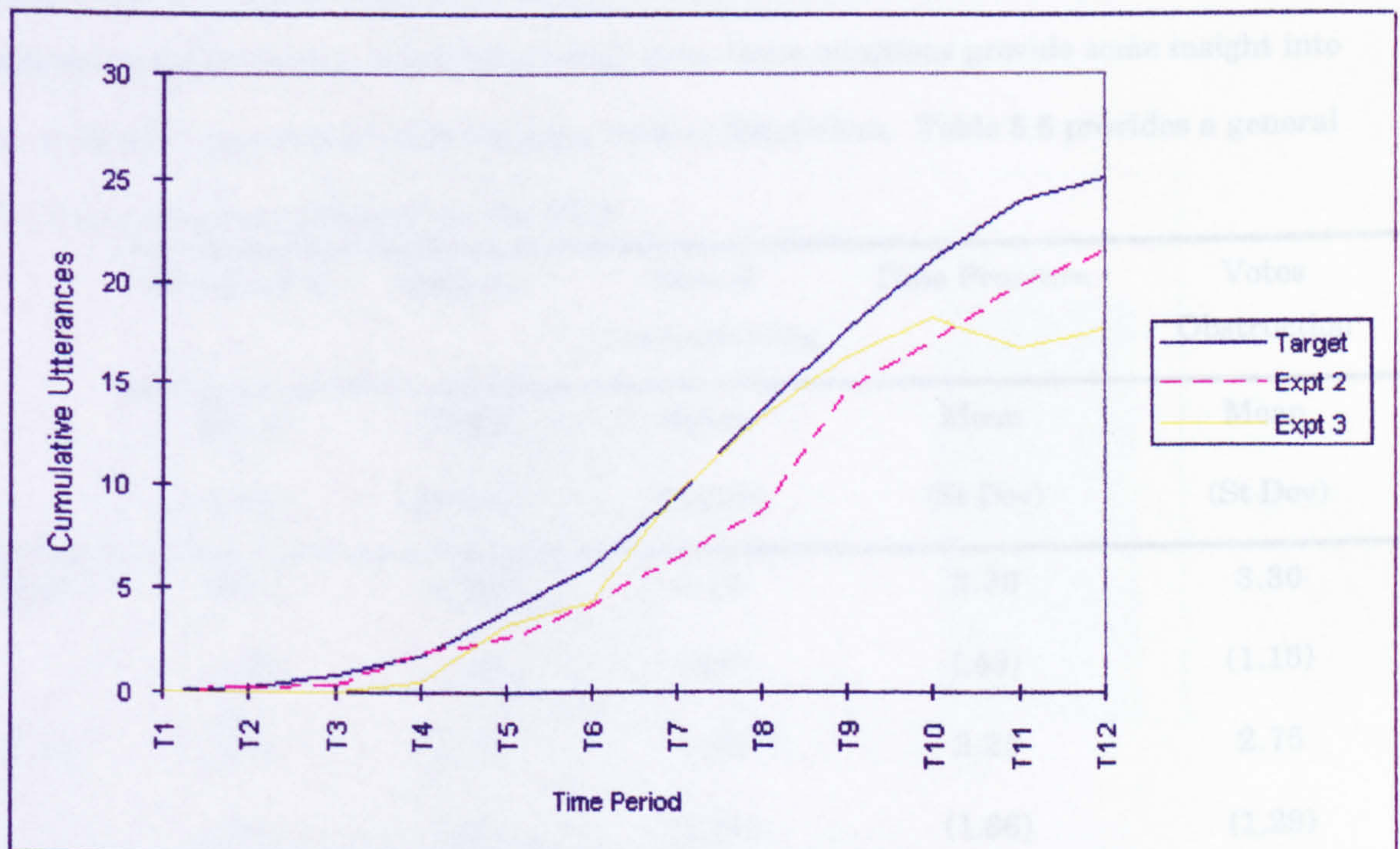


Figure 5.1: Cumulative Frequency of Citations of Case Fact (CIT) for DCS from Experiment 2 and YDCS from Experiment 3

Surprisingly the levels of CIT exhibited by panels in both experiments resembles the target levels of information driven communication exhibited by FTF groups. The levels do not quite reach those of a panel that was truly operating as if FTF but the levels of communication exhibited are a reasonable match for the target. One possible reason behind this can be revealed by examining the number of prompts received by the yoked panels in comparison to the number of prompts that they would have received were the feedback derived from their own communication. Of the ten decision panels examined three received exactly the prompts they would have received were they operating with ‘normal’ assistance from the support system. Five others received prompts that exceeded the number they would have received by no more than two, and only two panels received less prompts than would be expected (the groups with the second and third lowest level of CIT respectively). Indeed, the correlation between the number of prompts received and the number that they would have received is high ($r_s = .595$) perhaps accounting for the effects observed.

5.4.4 Participants Perceptions of the Task

5.4.4.1 Overview

Finally it is worth considering the user perceptions of the task as recorded by the post-experimental questionnaire. Although care must still be taken in the interpretation of the findings resulting from a single Likert scale item, these questions provide some insight into the subjective experiences of the decision makers themselves. Table 5.6 provides a general overview of the data collected via the PEQ.

| | Satisfaction | Influence | Ease of Communicating | Time Pressure | Votes Obstruction |
|------|--------------|-----------|--------------------------|---------------|----------------------|
| | Mean | Mean | Mean | Mean | Mean |
| | (St Dev) | (St Dev) | (St Dev) | (St Dev) | (St Dev) |
| CMC | 4.00 | 2.80 | 4.10 | 3.30 | 3.30 |
| | (1.15) | (.42) | (.32) | (.48) | (1.16) |
| YDCS | 4.35 | 3.05 | 4.00 | 3.25 | 2.75 |
| | (.93) | (.51) | (1.17) | (1.86) | (1.29) |

Table 5.6: Descriptive statistics for Experiment 3 PEQ responses regarding the task itself

There appears to be a slightly less more equal influence than in the previous studies -- the midpoint of three indicates equal influence), and across the other measures the responses appear very similar across the two conditions, with satisfaction ratings and ease of communicating reasonably high, these data are now considered in turn.

5.4.4.2 Individuals Own Decision

Of the thirty decision makers examined the vast majority (26) would make the same decision if they had to decide alone. Of the four who would make a different decision, each would remove either one more, or one less child than the decision agreed between the panel members. Additionally 20% of the yoked condition, and 30% of the unsupported condition considered the outcome to have been reached via compromise rather than through the selection of the correct decision option.

5.4.4.3 Satisfaction with Outcome

There was no effect of *condition* upon the satisfaction levels of the decision makers nor of *role* (Appendix E3) however, a significant interaction ($F_{(1,13)} = 5.375$; $p < .05$; Figure 5.3) between condition and role was revealed. The satisfaction levels of the representative of the Community Services (CS) were lower in the unsupported condition ($M = 3.40$) than the satisfaction levels of the other decision makers (CMC HT $M = 4.60$, CMCY HT $M = 4.10$, CMCY CS $M = 4.60$).

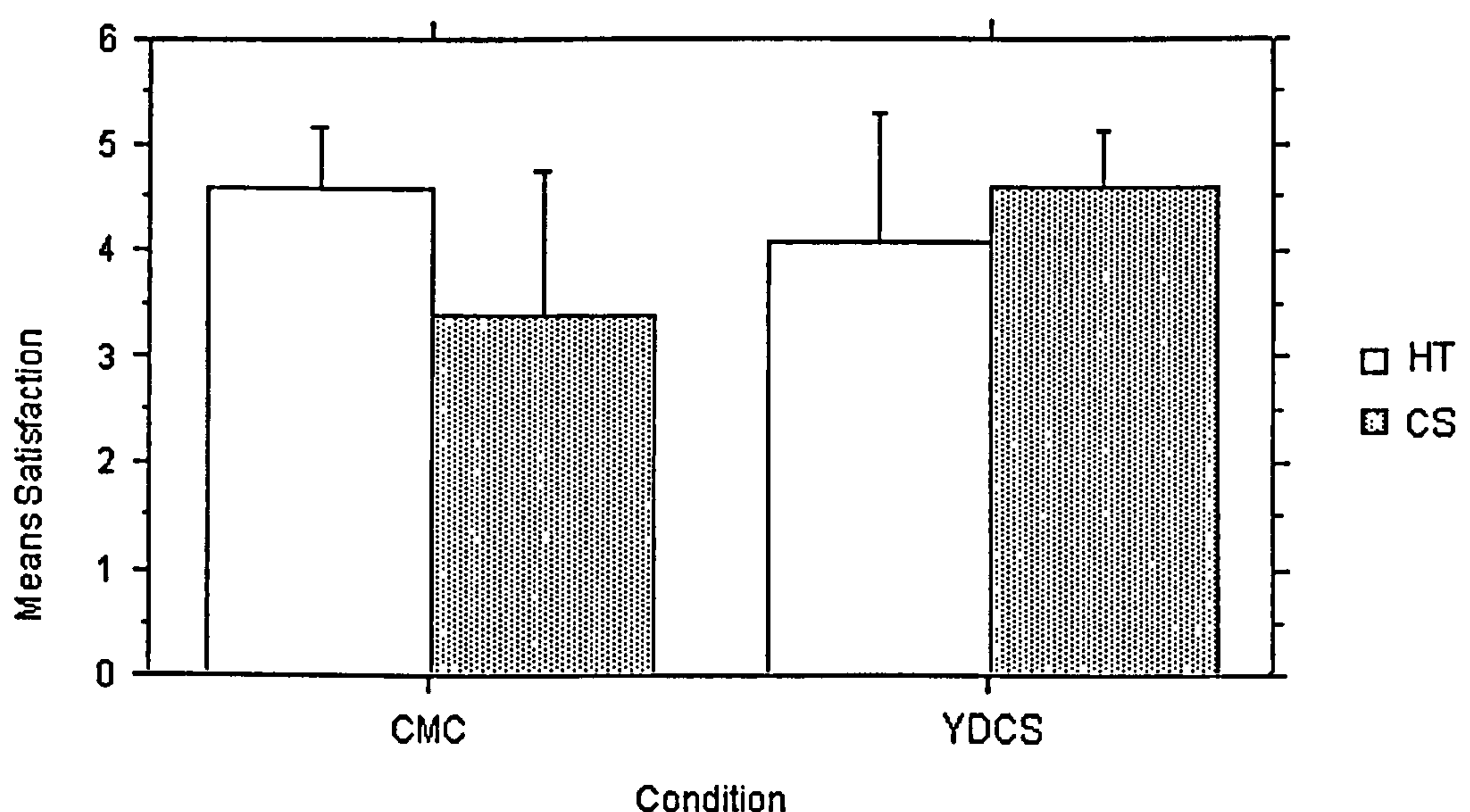


Figure 5.2: The interaction between *role* and *condition* of satisfaction with standard error bars with the decision outcome in Experiment 3

5.4.4.4 Participant Influence

The influence that each decision maker exerted over the decision was measured by the PEQ. Encouragingly (Appendix E3) this reveals no effect of *condition* or *role*. However, the possibility of an interaction between role and condition cannot be fully discounted ($F_{(1,13)} = 4.00$; $p = .067$). Although the scores might suggest a differential influence of role, the mean responses to the questionnaire suggest an equal influence by each role in three of the four combinations of *role* and *condition* with the likely difference being the HT exerting slightly more influence under the CMC *condition*.

5.4.4.5 Ease of Communicating & Perception of Time Pressure

All participants reported being able to communicate with the other member of the decision panel “moderately easily”, regardless of *role* or *condition* (Appendix E3). The perception of the time pressure to complete the task in the given, two hour time limit, was that this was “about right” and that this was consistent regardless of *role* or *condition* (Appendix E3).

5.4.4.6 Obstruction to task of the votes

Finally, the participants reported that the collection of their individual preferences by the system was only “barely obstructive” to their process of decision making, and as with perceptions of time pressure and ease of communicating, this was irrespective of either the decision makers *role*, or the communication defined *condition* (Appendix E3).

5.4.5 Perceptions of Support Systems

5.4.5.1 Overview

The information regarding the decision makers perceptions of the feedback system contains two elements; their perception of the system *and* their impressions of the information it provided and their adherence to the instructions to increase or decrease their communication.

5.4.5.2 Obstruction & Utility of the feedback provided

Those decision makers that received support on average considered the yoked feedback to be “barely useful” ($M = 2.50$, $SD = 1.47$) and found the presence of messages from the GCSS as “occasionally obstructive” ($M = 2.65$, $SD = 1.31$).

5.4.5.3 Relative importance of increasing and decreasing communication.

Of the sixteen decision makers that responded to the question, three decision makers considered it equally important to follow an instruction increase their communication as to decrease their communication. However, as with the previous study, the majority of users (13) considered it more important to increase communication over any instruction to curtail the flow of communication.

5.4.5.4 Adherence to the feedback from the YDCS

As with the analysis of the previous experiment it is assumed that anyone responding to a request to slightly increase communication, will also respond to the larger (moderately and considerably) prompts. Summing the cumulative effects an overall impression can be gained, by summing these responses (Table 5.4) for those receiving yoked support (the opinions of those operating under the DCS have already been considered in the previous chapter.

| Increase Communication | CIT | PREF | PROC |
|------------------------|-----|------|------|
| Always | 4 | 2 | 2 |
| Slightly | 9 | 8 | 5 |
| Moderately | 9 | 10 | 7 |
| Considerably | 9 | 10 | 7 |
| Never or no response | 6 | 6 | 8 |

Table 5.7: Responses to instructions to increase communication from YDCS in Experiment 3

One of the notable features of this is the high proportion of participants around half who ignore the yoked feedback from the support system regardless of the magnitude of deviation indicated by the support messages. The other feature worthy of note is that a quarter of the participants did not respond to this item, which itself suggests that they were not following the yoked prompts from the system. A similar pattern is apparent from the reports of the adherence to responses to decreased communication (Table 5.7).

| Decrease Communication | CIT | PREF | PROC |
|------------------------|-----|------|------|
| Always | 4 | 2 | 2 |
| Slightly | 8 | 3 | 5 |
| Moderately | 8 | 3 | 5 |
| Considerably | 8 | 3 | 6 |
| Never or no response | 6 | 6 | 8 |

Table 5.8: Responses to instructions to decrease communication from YDCS in Experiment 3

Again a large number of the decision makers gave no indication of their adherence to the support, which is more likely to be indicative of ignoring the prompts than of any other action. Although a similar number indicate following (or attempting to follow) instructions to decrease the level of CIT communicated as was reported for increasing CIT, this pattern is not reflected for either PREF or PROC. Only three participants report attempting to reduce the level of PREF and twice this number report an attempted reduction in PROC.

The discrepancy between these figures and those for attempted adherence to instructions to increase communication merely serve to support the earlier reported finding that the decision makers pay greater heed to instructions to increase communication compared to similar size instructions to decrease communication.

5.5 Discussion

5.5.1 Summary of Experiment 3

The data collected in Experiment 2 suggests that an intervention system based around the premise of altering computer-mediated groups communication profiles is a viable option. Two reasons were advanced the change in communicative behaviour; the first is that the presence of the intervention prompts heightened subjects awareness of their communication and this awareness leads to an increase in communication. The second possibility is that feedback from an intelligent system has demand characteristics for the user. Participants expect the system to monitor their communication and subsequently follow the instructions provided.

In Experiment 3 participants operating under the guidance of a directive support system received feedback believed to relate their current communication levels. In reality the prompting of the communication support system related not to their own levels of communication but were based upon the levels of communication exhibited by groups in the previous experiment. As such each panel was randomly yoked to another decision making group enabling a comparison of the responses to the intervention prompts.

The yoked groups managed to communicate at levels that resembled the target levels of communication, despite the fact that the feedback was intended to bear no resemblance to their own communication. This might be interpreted as an indication that any prompts from the feedback system, even those of a general nature will lead to the desired increase in informational influence. The difficulty is in distinguishing between the effects of a general appeal to increase evidence based communication as indicated in both the briefing and by the general presence of the system and the effects of the yoked support.

Unfortunately, by their nature unsupported CM panels communicate at levels lower than the face-to-face target. Therefore the large majority of prompts will be instructions to increase the communication, for example just four of the forty-two prompts from the DCS concerning CIT were instructions to decrease (and in all cases it was a moderate decrease), thereby effecting the same change that a genuine prompt would exert.

Furthermore, as the post-experimental questionnaire reveals that participants were more likely to follow instructions to increase rather than decrease their communication, this just adds to the potential difficulty in isolating the desired effects.

An interesting side effect of the yoked prompts was also revealed. Due to the nature of the yoked prompts there were occasions when groups operating at 'reasonable' levels of communication were instructed to *considerably increase* their communication. On these occasions a number of participants deliberately failed to adhere to the instructions, both the data collected from a post-experimental questionnaire and comments recorded from the debriefing suggested that this occurred as a direct result of the support system losing credibility. Participants assumed that the system was faulty and ignored all future prompting that it offered. This serves to highlight the importance of maintaining the credibility of the support system as an information source and also to ensure that the

prompting occur at sufficient intervals to ensure that the users are able to respond to the feedback

The results of this experiment fail to clearly identify the content of the feedback as the important factor. There is some evidence emphasising that CM decision makers can be instructed to alter their communication levels to more closely resemble the communication of face-to-face panels regardless of the method by which the feedback instructions are generated. Indeed prompts can be successful in modifying communication to levels exceeding those observed in equivalent face-to-face panels. Additionally an important factor in the system has been revealed by this study, that the support system must retain credibility in the eyes of the users. The credibility of the source of the information is one of the major factors in compliance with the support provided, the face validity of the system must be maintained at all times for successful support to be delivered. Further issues relating to the credibility of the system are discussed in Chapter Six.

5.5.2 The Next Stage in the Development of the Support System

The partially implemented methodology employed so far has been vindicated and the differences in process have been identified as being theoretically more interesting than any difference observed in outcome measures. Adherence to the target levels of communication held by the support system has only been partially successful. The system successfully increased the levels of informational communication, however, the corresponding decrease in normative communication has yet to be achieved. Chapter Five addresses issues that might increase the effectiveness of the intervention system itself.

6.1 Introduction

6.1.1 Statement of Intent

The experiments reported in the previous chapters demonstrate the applicability of the support system proposed. It has been suggested that computer-mediated decision panels can overcome the effects inherent in the medium to operate as an “information-driven” panel, in effect communicating less like a group linked via computers and instead using a style of communication resembling that of a face-to-face group.

Attention now turns to focus on two other areas, the first of these is driven by the desire to increase the utility of the feedback information and is an examination of the incorporation of visual information into the support system messages. The second area of interest is to consider the longer term effects of exposure to the feedback. Having been supported during their consideration of a first decision task, are there any prolonged effects that can be observed when solving a second related task without the support system present.

6.1.2 Incorporating Visual Information into the Feedback System.

6.1.2.1 Overview

Visual information, is by its nature more easily interpreted than written information (e.g. Loftus, Nelson & Kallman, 1983). Furthermore as a result of the greater ease of interpretation the uptake of visual information is often quicker than written information (Potter & Faulconer, 1975). It is therefore likely that the incorporation of visual feedback into the support system will enable an easier and faster uptake of the information provided, which in turn, should permit greater adherence to the information-driven style of communication that is presented to the CM panels as their target or ideal communication style.

Although much research has focused on the effects of feedback upon individuals and the factors that influence the perceived utility of the feedback. There is a lack of a coherent body of research into the effects of feedback given to groups, and even less on the effects that feedback has on group communication (Chapter One). What little published research there is, often focuses upon organisational productivity (see for example, Pritchard, Jones, Roth &

Stuebing; 1988, 1989) and how feedback at a group level effects the organisation and the individuals within it. Despite the absence of work directly in this field, it is possible to draw inferences from the work on individual feedback which suggest improvements to be made to the support system being tested.

6.1.2.2 A Brief Background of Visual Information

It is a popular conception that “a picture speaks a thousand words” indeed this assumption has formed the focus of a number of studies of learning and information acquisition. These studies have concentrated on the effects of illustrations upon the uptake, retention and recall of information. This body of work suggests text illustrations can have important effects on learning (Mandl & Levin, 1989; Mayer, 1989; Mayer & Gallini, 1990; Willows & Houghton, 1987) and that the structure of a picture, like language consists of both “a surface structure and a meaningful deep structure” (Bower, Larlin & Dueck, 1975).

Indeed in a review of 155 experiments comparing learning from illustrated text and learning from text alone, Levie and Lentz (1982) report a consistent finding that illustrated text is advantageous to learning. Similar findings are reflected in other disciplines, in studies of human factors (Edworthy & Adams, 1996) where the processing of information from a pictorial representation is faster than from written warning and reasoning from pictorial representations (Evans & Over, 1996) where less errors are made and decision times decrease.

In several different domains, the addition of visual or pictorial information has suggested improvements in performance. These studies suggest that supplementing the text based feedback from the communication support system with some pictorial representations of the state of the groups communication, will assist both the uptake and possibly adherence to the target levels of communication.

It can be predicted that providing decision makers with a visual model of the desired communication in comparison to their own current levels of communication would enable the panel to communicate with greater adherence to the FTF based model presented as the 'gold standard'. The testing of this assertion forms part of the focus of this chapter, the second purpose of this chapter is concerned with the longer term effects of the support. Having demonstrated that the communication profiles of panels might be modified to overcome the

barriers presented by computer-mediated communication a further question remains. That is, although panels can overcome the medium and operate as “information-driven” panels when supported by a feedback system are there any lasting benefits of such exposure?

6.1.2.3 Provision of Communication Support

As with the considerations prior to Experiment 2, there are several issues regarding the form of the feedback from the support system that require consideration. In the previous experiments the support system has attempted to convey information regarding three forms of communication: Citations of Case Fact (CIT), Expressions of Preference (PREF) and Procedural Communication (PROC). The success of the support system has been partial, some increases have been seen in the levels of CIT expressed by supported CM decision panels. These have often reached levels that resemble the proportion of communication of this form found in face-to-face panels, but the success is not always complete and not always consistent with large variations in the levels of CIT between different decision panels.

The level of PREF exhibited by unsupported CM panels is far greater than the proportion of communication in this category observed in FTF panels. Although the provision of support has reduced the extent to which communication is preference based it has not suppressed communication of this type to the levels used by equivalent FTF decision makers.

Attempts to alter the level of PROC to match those of FTF panels has been wholly unsuccessful. The main reason advanced for this in the previous chapters draws upon the nature of the coding scheme itself. To recap, PROC are utterances aimed at the group level co-ordination of effort, these are quite prevalent in decision panels consisting of four members, however, when the panels consist of dyads, communication aimed at co-ordinating effort between the two panel members tends to be of the ‘You should do this....’ or ‘I am going to.....’ nature. These utterances serve the same function as PROC in larger decision making panels but due to the nature of the coding scheme are recorded as Materials/context/computer (MAT) rendering any attempt to consistently analysis these utterances problematic.

Given the partial success and stated problems with the support system as originally envisaged, for future studies it is proposed to concentrate upon only PREF and CIT style communication. Although a more detailed consideration of PROC style communication is

presented in Chapter Eight, given that CIT and PREF embody the focus of attention any further study of procedural communication (PROC) is disregarded.

Indeed, the nature of these areas encapsulate the two changes of communication level and the two main distinctions between communication types that are given much consideration in this thesis. The distinction between informational communication (CIT) and normative communication (PREF) is maintained and examined, and the extent to which communication can be increased (CIT) or decreased (PREF) is studied.

Having taken the decision to focus the support on two forms of communication the issue of full or partial support must again be considered. The distinction here is between providing feedback on both categories simultaneously or only upon the categories (CIT or PREF) that deviate significantly from the 'target' levels of communication. The workload requirement on a panel member receiving feedback relating to both forms of monitored communication is naturally greater if information regarding both CIT and PREF is relayed. However, it can be argued that the more information the decision makers receive regarding the communication of their decision panel, the more comprehensive a picture of the overall communication patterns they can construct. Provision of both forms of communication enables a global perspective to be developed, and permits some inference of the trade-off that might exist between normative communication and that containing information drawn from the database. As previously discussed the existence of the nine categories of communication incorporated into the coding scheme (Appendix A3) makes identifying the trade off between the levels of one and the levels of any of the other eight somewhat problematic. Especially given that an increase in one might be accommodated by the decrease in a combination of the others. Furthermore, the trade-off between CIT and PREF is the least controversial and forms the basis of much of the argument concerning informational influence and normative styles of communication that has been presented.

6.1.2.4 Development of Visual Feedback

The MIMICS paradigm developed in Chapter Two and used to provide the support system for Experiments 2 and 3 incorporates graphical representations of the communication of the group alongside the target levels derived from FTF groups. These representations are used in conjunction with calculations of the discrepancies between existing and expected communication levels to determine the feedback to be conveyed to the decision makers. There

is, however, no reason why the feedback should not incorporate the representations and convey these to the members of the decision making groups.

The calculations within the MIMICS support system are performed within a spreadsheet environment, and this environment can easily be conveyed to the panel members themselves (See for example Collyer, 1992), either via the existing computer terminals used to browse the databases or through a dedicated system providing a visual form of feedback.

The Macintosh IIfx used for the support system simultaneously supports two monitors: a computer monitor and a TV monitor. As is shown in Figure 6.1 the first (computer) monitor is used to support the coding of the communication during the support system operation, whilst the second displays representations of the feedback (as detailed in the description of the support system in Chapter Two).

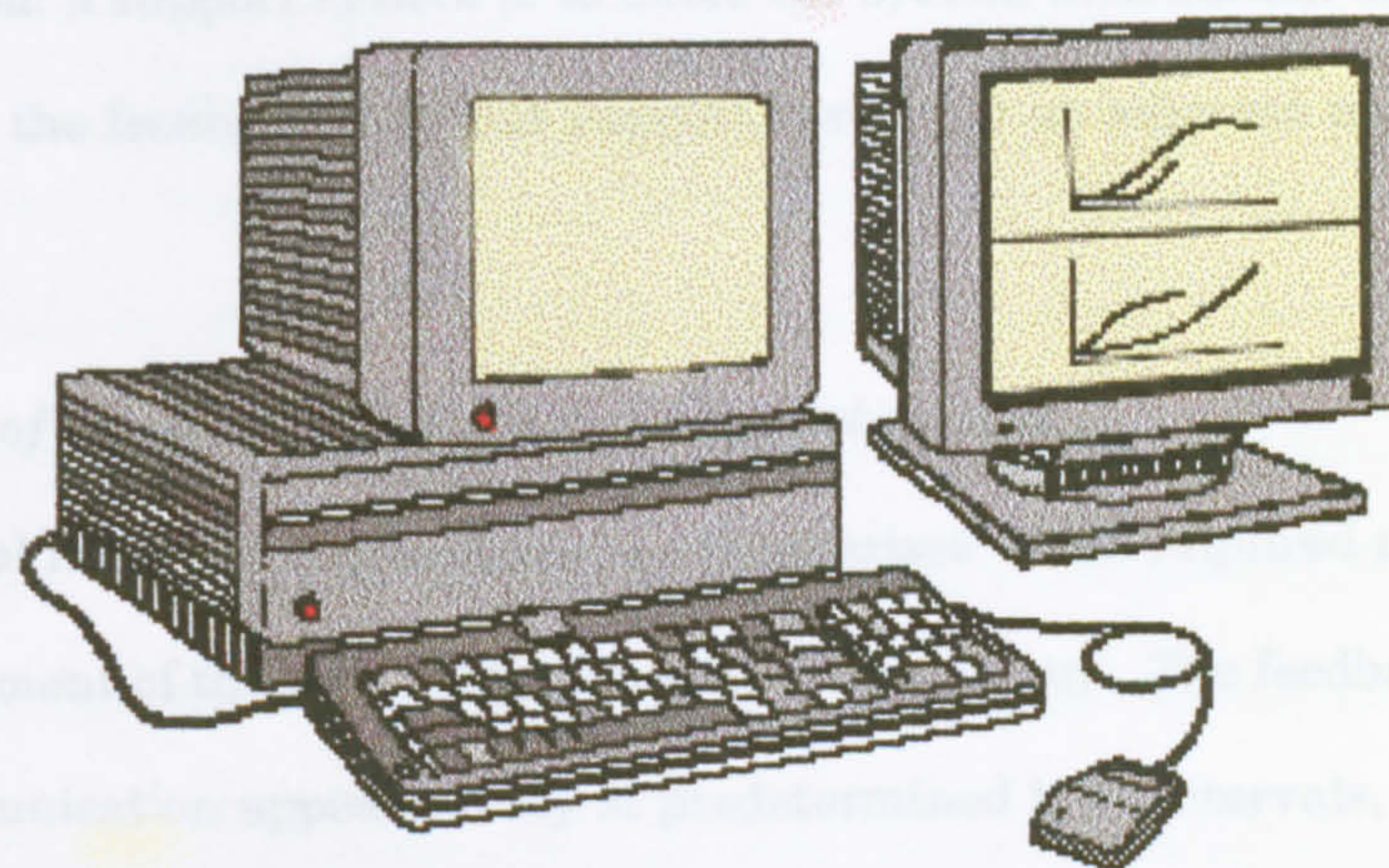


Figure 6.1: The support system computer displaying intervention calculations and coding on the left hand monitor with representations of the models of communication on the right.

The two graphs, one of CIT and one of PREF can be arranged one above the other to enable a clear picture of the support advice to be presented. The image from the second monitor can be fed through a “mixer” to allow the support system information to be displayed on monitors adjacent to the computers used by the decision makers in a configuration similar to that displayed in Figure 6.1, but with the coding screen replaced by the computer used for accessing the databases and communicating via e-mail.

An additional advantage of this configuration is that the display of the feedback does not hinder the use of the databases or e-mail. The databases provide the decision makers with the levels of expertise required to make the decision, and the same computers also contain the e-mail system used for all communication between the members of the decision panel. Were the feedback to be displayed on the same screen as the casenotes and the communication

system then this would require a reconfiguration of the computer systems to cope with the operation of three separate systems.

Although such a change would give the database, communication channel and feedback system an integrated feel, the major disadvantage of this approach is either the size of the display area would be reduced or the decision makers would have to change their view between the e-mail/database and the support. The small screen area of the computers being used prohibits a change in screen layout and were the later to be adopted this would require effort on behalf of the decision makers to acquire the information. Although, the same effort is required to move between the database and the communication system this is central to the task before the decision makers. The gathering of feedback is less central, and it is apparent from the literature review (Chapter One) that one of the key factors in ensuring maximum uptake of advice from a support system is to make the system information as available as possible. Providing the feedback from this support system on an adjacent monitor achieves just this.

6.1.2.5 The extent of the feedback from the support system

Due to the visual nature of the feedback, an issue arises which required no consideration prior to the development of the system described in Chapter Four. The feedback concerning the nature of communication appeared only at predetermined time intervals, the visual feedback proposed for this experiment will be available to the user at all times due to its appearance on the second monitor. It is possible to conceal this information from the user, having it “pop up” into vision at the required intervals, in much the same way as the verbal feedback appeared in the early experiments. Although this would permit a greater comparison between this experiment and those that have preceded it, the increased utility of the data gained from this experimental configuration in comparison with the value of the data that would be gained from a “pop-up” system is such that the reservations of comparing two different systems are less pressing than the information that can be gained.

If this information is to be displayed, it would seem both prudent and easier to maintain this information at all times. An advantage of such an approach is the ease of which participants can acquire the information, e-mail based messages can then draw attention to the information at the critical points in the decision process. Where a distinction between full

and partial information was drawn between the configurations of support reported in Experiments 2 and 3, here the visual system is better suited to full information at all times.

The continual presence of the models presents an opportunity to supplement the feedback in either a directive or non-directive manner via a text-based channel. To recap, directive communication support (DCS) informs the decision makers of the state of their communication in relation to the target levels in such a manner that the user receives the impression that there is *no choice*, that they are *required* to alter their communication behaviour. In contrast non-directive support (NDCS) implies that there is a *choice* and that the user *can decide* whether or not to alter their communication behaviour to the levels that are being suggested (For a more detailed explanation see Appendix A7.3).

6.1.2.6 Summary of Support Provision

Visual feedback is to be incorporated into the system to increase the ease with which participants can interpret the feedback and to provide a continuous source of information for decision makers to refer to. This is achieved by linking the graphic representations of communication, as used by the support system to a television monitor placed alongside each participants computer. Thus as communication is coded by the support system the representations of communication can be conveyed to the decision making panels.

Although the DCS system has so far demonstrated clearer effects upon communication than the NDCS system, the addition of a visual component to the study might benefit the NDCS style system. Therefore, the first aim of Experiment 4 is to examine the effects of non-directive visual communication support (NDVS) and visual support supplemented by a directive written component in the form of e-mail support messages as per those in the DCS conditions from earlier experiments, in effect a form of support that is both directive and visual (DVS).

6.1.3 Examining the longer term effects of support

6.1.3.1 Overview

Some success has been demonstrated in moving CM decision making panels away from a normative style of discussion and towards an evidence or information driven approach to their deliberations. Although there is some suggestion that this support is beneficial in the short term a second related question remains and that is how do decision making panels

communicate after being exposed to the support system messages? Having successfully overcome, or at least reduced their reliance upon a normative style of communication and increased, relative to unsupported panels, their information-driven communication, can decision makers continue to use this modified style in a subsequent task? If the decision making panels are faced with a similar problem, a problem which they must again resolve by communicating only via computer it might be predicted that the earlier task and the support given would have effects on their future communication style.

Although each panel member received training in the use of the database and communicating via e-mail, they received no instructions regarding the types of communication that they should send. Instead they received advice offered by the support system upon their style of communication in relation to that of successful groups. As such, signs of an information-driven approach to communicating via e-mail might be observed in further tasks rather than a reversion to the previously exhibited normative communication style.

6.1.3.2 Expectations of a transfer effect

It is possible to hypothesise as to the cause of the effects of the support system. One possible explanation of the findings is that the decision makers might understand the principles involved in expressing their opinions and communicating in order to reach a joint decision, but fail to achieve this because they lack the ability to monitor their communication. There is some evidence that can be advanced in support of this assertion, firstly within face-to-face conversation issues for discussion occur often one at a time and conclusions are often reached before the conversation moves on to the next issue (Fisher, 1980; Griffin & Humphrey, 1978; Mehan, 1979; Sacks, Schegloff & Jefferson, 1974). In contrast to face-to-face communication, computer-mediated discussions contain the simultaneous discussion of multiple issues, several messages each concerning a different issue may exist at the same times, that is they contain what has been termed multiple threads of discourse (Black, Levin, Mehan & Quinn, 1983) Furthermore within any single message several items may themselves be under discussion and when this is combined with the removal of traditional turn taking and "holding of the floor" apparent in face-to-face conversation, the ability of subjects to monitor the conversation is impaired.

Face-to-face meetings permit a richness in communication that is both expressive and interactive, features which are limited when communicating via e-mail (Kraut, Galegher, Fish

& Chalfonte, 1992). There is an interactivity within face-to-face speech that permits the speaker to modify their communication on the basis of the reaction of the listener, increasing both the ease of comprehension and the persuasive nature of the utterance (Clark & Wilkes-Gibbs, 1986). These abilities are reduced within CMC, the only channel of feedback is via the CMC itself and comprehension and persuasiveness can only be altered in subsequent messages. As such, there is little opportunity for CM panels to assess the relative impacts of their style of communication and to judge the persuasive nature of normative influence relative to informational influence.

In many ways parallels can be drawn between this line of argument and the ideas of reduced social cues theory (RSC: Kiesler *et al*, 1984; Hiltz, Johnson & Turoff, 1986; Rice, 1984) discussed in the opening chapter. Recall, that this asserts that e-mail based discussion is devoid of some of the cues that through speech we have come to depend upon and that this disrupts the process of communication.

Secondly, for decision tasks of this nature the process of communicating via a computer-interface is alien to the majority of users. The approach that they adopt and their method for compensating for the effects the communication medium imposes may result in modifications to the communication process which the decision maker *believes* will improve their ability to reach a decision, but in fact hinder the process to a considerable degree. This interpretation incorporates the Threshold Theory interpretation, advanced in Chapter One, that asserts that communicators assess, in some manner, the production costs associated with the construction and sending of a message with the perceived utility of the information it contains. It is possible that the decision makers employ a normative style of communication rather than an information-driven approach to compensate for the costs of message production, and that this compensation results in the problems revealed by the post-experimental questionnaire and the more objective measures of the decision making process.

Initially the question being addressed by this thesis was can the barriers to communication inherent in CMC be overcome through the provision of feedback. It has been suggested by Experiments 2 and 3 that this is the case. The question that is now addressed is whether the effects of the support remain beyond the provision of the support itself. Are there lasting effects of exposure to the support system being examined, effects that can be observed in subsequent tasks in the absence of the support system itself.

6.1.3.3 Isolating the short and long term effects of support

Long term studies of computer-mediated communication (e.g. Hiltz & Turoff, 1981; Hollingshead, McGrath & O'Conner, 1993) show that over time the behaviour of user changes. These alterations in behaviour occur as users adapt to the systems they are using and develop methods of (sometimes effective) communication.

In the same way that social conventions have developed to govern face-to-face speech, over time users of electronic systems develop their own methods and conventions for communicating. At the simplest level this manifests itself through an increased use of abbreviations, for example '*by the way*' being shortened to BTW or '*in my opinion*' to IMO. These might easily be viewed as ways of reducing the production cost of the message in that it is quicker to type a single three letter acronym that produce the full version. Similar adaptations to the medium, but for different reasons can be seen in the development and use of emoticons to convey emotion, sarcasm and other tones of speech that are harder to convey in the written word.

To understand further the impact of the intelligent support system and the alterations in communication that have been witnessed, it is necessary to determine whether the communication support provided has any lasting effects or if continual support is required to maintain an information-driven or face-to-face style of communication in computer-mediated groups.

Thus far each experiment reported has explored the decision making panels over the course of a single decision task. The longer term effects of communicating via e-mail with assistance from the group communication support system have been left unexamined. Having communicated via e-mail and reached a successful resolution of the problem before them, the decision makers may find subsequent tasks easier to complete due to their earlier experiences, for example the information they have gained via the feedback from the support system (Newell, 1991). In a second task, decision making panels may communicate with an increased reliance upon informational communication and reduce their dependence upon normative communication as a result of their prior completion of the task. Similarly, they may gain little from the earlier completion a related task and the method of communicating as if a FTF panel may only be achievable with consistent monitoring by and prompting from the prototype support system.

One of the purposes of the experiment reported in this chapter is to assess the impact of the support system upon such subsequent discussions. If, as has been the case in the preceding chapters, panels increasingly rely upon an information-driven approach to their discussions whilst receiving support, then this suggests that the interventions proposed can successfully enrich the group discussion. Given instructions, in the form of feedback from the support system, on the styles of communication to employ, some longer term effects may exist which will manifest themselves in the increased use of the information-driven style of communication in subsequent, unsupported tasks.

6.1.3.4 The development of case materials

The nature of Experiment 4 requires decision makers to tackle two tasks with a break between them, given the practicalities of lab space and recruitment the decision was taken to shorten the duration of the task, a decision which necessitates some changes to the casenote materials. Recall that the development of the Rips Casebook Two, (Experiment 2) involved the selection from the initial casenotes used in Experiment 1 (Appendix B1) of information suggesting that the removal of the children was the most appropriate course of action, and that this information formed the Local Health Authority (LHA) casefile. In contrast to this the information contained in the Department of Social Services files indicated the provision of home help as a satisfactory solution to the problem. Recall also that the weight of medical information as identified by Craft and Bettin (1991), often outweighs information from other sources. To counteract this discrepancy in the impact of information, the LHA databases also contained information suggesting the home help course of action. The ratio of information suggesting 'removal' as opposed to 'home help' in these files was approximately two to one (34 entries to 16).

To ensure that the participants are faced with a task that can only be resolved through collaboration it is necessary to create initial disagreement by ensuring that the casenotes available to one decision maker are in conflict with those of the second. However, given the shorter duration of the task, to enable successful resolution within the time permit the level of conflict between the LHA and the DSS files was reduced, by removing sixteen entries from the LHA files; entries that were predominantly encouraging the removal of the children. A reduction in the number of entries contained in the Department of Social Services (DSS) files

resulted in a comparable database. These reductions created a shortened version of the casenotes regarding Linda Rips and her family: The Rips Casebook Three (Appendix B6).

A similar reduction in the length of the case notes used in Experiment 3 (Chapter Five) created a second version of the Davies case notes (Davies Casebook Two) resulting in two sets of task materials (Rips Casebook Three & Davies Casebook Two) that could be used for two consecutive tasks. The two casebooks had sufficient differences in the nature of the cases to prevent participants simply using one case as a precedent for deciding on the outcome of the second. To further reduce the comparison between them, the available decision options were varied so that in one task the decision makers would be faced with deciding the level of home help to provide and in the second they would consider how many children were at risk. Further details of the combination of casebooks with decision options are provided within the method and full details of the generation of the casebooks can be found in Appendix B6.4.

6.1.4 Aims of Experiment 4

In summary, the purpose of this experiment is twofold, the first is to examine the effects of providing a graphical or visual component to the formerly text-oriented support messages. This is in the hope of reducing the deficit between CM and FTF decision panels use of CIT, and also reducing the reliance upon a normative style of discussion as seen in their use of PREF.

The second, and equally important purpose of this study is to attempt to discover if there are any longer term effects of exposure to the support system, namely does subsequent communication behaviour differ as a result of prior exposure to the support system messages.

6.2 Method

6.2.1 Design Overview

The communication process of thirty-six, two participant decision panels were examined under three communication defined conditions over the course of two decision tasks, separated by a short break of fifteen minutes. Panels of two decision makers read case files relating to a family of a mother and her three children and selected a course of action from three predetermined options.

All panels communicated via CMC, however, during the first task twenty-four received feedback regarding their communication with twelve remaining unsupported. Of the

supported groups, half were provided with a graphical representation of their communication (NDVS) that altered across time according to the communication content of the decision panels e-mails. The other twelve supported panels (DVS) were not only presented with a visual representation of their communication but had this information supplemented by written messages (as per the DCS condition in Experiments 2 and 3) that indicated the magnitude and direction of the differences between their communication and the model.

In the second task, panels were provided with a new set of casenotes and a different set of decision outcomes, from which to make a new decision. For this task all thirty-six panels communicated without the assistance of the support system.

6.2.2 Training of Participants

The training procedure for the participants who agreed to take part in the study mirrored the training procedure reported prior to Experiment 2. That is, participants were instructed on the sending and receiving of e-mail, the operation of the database system and the use of the notepad. In addition participants who were assigned to conditions that received feedback from the communication support system were shown the feedback system appropriate to their condition. As well as their exposure to the form of the feedback, brief instructions on how to interpret the information conveyed were given. It was explained that the target levels of communication were those employed by decision panels who successfully completed the task. This information was provided as a guide which they were encouraged to use, to enable their own successful completion of the experiment. The levels of communication and examples of how their own communication might match, exceed or exist below the level of the model were explained, and questions on the interpretation of the feedback answered. It was further explained that questions regarding the feedback system could be asked at any point, and if they were unsure of how to interpret the information they should ask the experimenter.

6.2.3 Participants

Participants were recruited by advertisement in the Department of Psychology at the University of Plymouth. First year psychology undergraduates enrolled on the Department of Psychology, Research Methods and Statistics module formed the majority of the participants.

Thirty-six decision making dyads were formed from the seventy-two participants who successfully completed a training phase consisting of instruction in using the synchronous

electronic mail system and the use of a hypertext database system. All participants who undertook training achieved satisfactory levels of operation of the system, In return for their time each participant received a cash payment and a number of credits towards a course requirement.

6.2.4 Roles within each group

Within each dyad, a different role was assigned at random to each decision maker. The first had access to a database consisting of records drawn from those of a Hospital Consultant and a Health Visitor. This participant, the Local Health Authority (LHA) had records of a medical nature, whilst the second member of the dyad: the Department of Social Services (DSS) was presented with records from the Social Work and Welfare Offices. Each role was clearly identified through the electronic mail and supplemented by role labels on each computer. After the first task the roles were reversed for the second study, thus each participant tackled one decision from the perspective of the health authority and one with the information contained in the social service files.

6.3 Materials

6.3.1 Databases

Each participant was provided with a Networked Apple Macintosh Classic computer equipped with the electronic mail and Hypercard databases described in Chapter Two. Each machine contained a database representing the role to which they were assigned containing 35 statements varying in length from 50 to 200 words. Statements were selected to suggest that a particular course of action was the most appropriate in these circumstances. The databases presented a unique, conference file for each participant and held the information from one of two agencies in the case (Local Health Authority or Department of Social Services). The division of information between the databases again followed the algorithm described by Stasser & Titus (1985) and was such that the LHA was predisposed biased towards a harsher stance in the each case than the DSS. These biases were included to ensure that the initial preferences of the dyad members differed and that a decision could only be reached through discussion. Two different databases were used, the revised versions of both 'The Rips Case' and 'The Davies Case', half the groups tackled the Rips Case as the first decision

task and the Davies case as the second, with the remainder receiving the casenotes in the opposite order.

6.3.2 Decision Options

Each case file was presented in conjunction with either of the two sets of decision options. The first set, *Removal*, contained three options concerning the removal of the children and their placement with foster parents. Option 1 enabled the removal of the youngest child, whilst leaving the two older siblings with their mother. Option 2 was to remove the two youngest children placing them both into care, leaving only the eldest child with the mother, whilst the third, and final option (option 3) involved the placement of all three children into care.

The second set of decision options, *Home Help*, varied the degree of help offered by the local services to the mother. Option 1 consisted of the provision of home help consisting of two days per week. The second option provided for four days of support and Option 3 permitted the allocation of a full seven days per week of home help.

6.3.3 Decision Overview

The combination of casefiles (Rips or Davies) with the decision options (Removal or Home Help) was such that four slightly different tasks were presented to decision making panels in each of the three conditions: (i) Removing the Rips children, (ii) Removing the Davies children, (iii) Providing Home Help for the Rips family, and (iv) Providing Home Help for the Davies family. These variations, albeit small were intended to restrict the degree to which participants in the second task could refer to their performance on the previous task as a reference point.

The combination of the decision options with the decision task was counter-balanced such that across the 36 decision panels (i) each decision option *and* decision task appeared equally frequently as task one and task two and (ii) each combination of option and task appeared equally frequently in both tasks.

6.3.4 Post-Experimental Questionnaire

The post-experimental questionnaire (PEQ) issued in the earlier experiments was used to sample the opinions of the decision making panel once the task itself had been completed (Appendices B5.4 & B5.5). A version appropriate to the decision *casefile* and *options* of the

task was issued at the end of the experiment. As with earlier experiments, versions of the questionnaire containing statements specifically related to the support system and the utility of the information it provided were constructed for each of the conditions. In addition, the questionnaire issued after the second decision asked the extent to which the users considered the second case relative to the first, that is how much they based their decision on the comparison between the two sets of casenotes and how much they judged the second case on its own.

6.4 Procedure

6.4.1 Procedure - Briefing, Decision Options & Task

Participants were briefed regarding the nature of the task and the case materials before them. They were informed that the task was to choose the best course of action from three options presented and that no other alternatives were available. In reaching their decision two criteria were to be met: (i) the decision must be a unanimous decision and (ii) that they were each to read all the information contained in their databases. The reading of the databases created a log file of inspection times for each page of the database, an examination of these data revealed that one decision panel in the DVS condition failed to fulfil the condition to read all the pages contained in their database prior to making a decision. Two more participants were recruited and after training were randomly assigned to a condition. As the group were examined under the DVS condition, the data they provided was substituted for the group who had failed to fulfil the experimental requirements.

Seventy minutes were available in which to reach a decision, and each decision panel was told to take as much of the time as necessary. After thirty minutes a reminder of the uniqueness of the case materials was sent to each participant via the e-mail along with a reiteration of the instruction that it was likely that they would need to discuss the information before them in order to reach a joint decision. Warnings of the time remaining were given with fifteen and five minutes remaining but panel members could contact the experimenter at any time during the task. Finally, they were informed that when they decided upon a decision they should communicate this by sending an electronic mail message with the subject line "Final Decision (Joint)" and containing the number of the decision option selected through the e-mail system and that this would alert the experimenter to the end of the decision task. A decision sent by one subject without the knowledge of the other member

of the group was not deemed sufficient for the experiment to end, but rather a consensual decision agreed upon by both decision makers was required.

After completing the briefing, participants were seated at their computers and instructed to begin. For any group which had not sent a message containing their final joint decision after seventy minutes a message was sent requesting their final decision, this message was repeated at five minute intervals until either the group delivered a final decision or an additional ten minutes had elapsed, at which point the experiment was ended and the group was recorded as being unable to make a decision.

Once the decision panel had selected an outcome for the first case they were permitted a fifteen minute break before returning to complete the second task, which was completed without support by all decision groups. After a decision had been logged with the experimenter for the second task, the participants received a full debriefing before being released from the experiment.

6.4.2 Procedure - Recording Individual Preferences

Participants were informed that during the course of the decision task they would be asked to indicate how they felt, individually, about each of the three options available to them. The sampling of their opinions first occurred ten minutes into the task and thereafter every 15 minutes until either the time limit was reached or the dyad reached a joint decision. Participants were informed that the sampling of their individual preferences would occur through the e-mail such that the other member of the dyad would have no access to their current feelings on the case, and that they should use the votes to express how they as an individual felt about the decision task.

6.4.3 Procedure - Provision of Communication Support

6.4.3.1 Unsupported CM Decision Making Panels

In the first task, twelve panels were randomly assigned to an unsupported computer-mediated communication (CMC) condition in which each member of the dyad sat in a room isolated from the other and communicated only via the electronic mail system. Participants in this condition experienced the same decision making conditions as those unsupported panels in Experiments 1 and 3. For the second task, all panels regardless of the condition in which they had previously reached a decision, operated as unsupported computer-mediated groups.

6.4.3.2 Supported CM Decision Making Panels

For task one, twelve panels were randomly assigned to each of two supported computer-mediated conditions. The first of these supported conditions comprised a non-directive group communication visual support system (NDVS) this system presented a visual record of the panels communication patterns in the two target communication categories (CIT or PREF) alongside the target levels of communication observed in panels operating as if communicating face-to-face.

The second system (DVS) offered directive support by supplementing the visual record of communication with a series of written prompts that served to highlight discrepancies between the model and the panels communication. The format of this information was as per the directive communication support (DCS) system used in Experiments 1 and 3 (Appendix A7).

Using the MIMICS paradigm, dyads operating in conditions with support from either the Directive Visual Support system (DVS) or the Non-Directive Visual Support (NDVS) received support via a monitor placed alongside the screen of their computer terminal. This monitor consisted of two graphical displays representing their communication (in terms of CIT and PREF) in relation to the target levels of expected communication derived from FTF panels. The target levels held by the support system against which decision makers communication was compared were revisions of the communication levels observed in FTF groups revised on a pro rata basis to account for the reduction in panel size and time available in which to reach a decision.

The support system compared the communication of the dyad with the target levels at regular intervals of six minutes, based upon the communication that had been received by the decision making group, and only presented this information to the users if the communication deviated. This feedback was designed (as with earlier experiments) to encourage decision makers to (i) increase the levels of informative information they communicated (CIT), and (ii) decrease the levels of normative information they communicated (PREF).

In addition to the visually provided information, panels operating under the DVS system received additional prompting via the electronic mail. The format and timing of the support messages was as per the DCS system examined in Experiments 2 and 3. These messages informed users of i) the direction of the discrepancy between their communication and the

target, ii) the magnitude of the difference and iii) the action that they should take to remove the discrepancy. Messages consisted of support aimed at only the communication (CIT, or PREF) currently deviating from the target, and users were informed that if no mention of the communication was made, or no messages were being sent that the communication levels at which they were operating were in line with the model that system held.

6.5 Results and Discussion

6.5.1 Overview of the Analysis of the Data Corpus

A number of analyses from the data are presented. As with the other results sections it is initially useful to concentrate on the main measures of decision outcome: the time taken to reach a decision & the decision itself. Having briefly examined these data the main question of interest, the communication of the decision makers is explored, before finally using the perceptions of the decision makers to place the whole process in a wider context.

6.5.2 Preliminary Measures of the Panel Decisions

6.5.2.1 Decision Outcome and the Time Taken to Reach a Decision

The two most obvious measures of group performance on the task are the time taken to reach a joint decisions and the duration of the task. Table 6.1 reveals that there is a tendency for the panels to select the most severe of the options as the most suitable course of action. When offered the possibility of providing home help, ten groups from the each of the CMC and NDVS conditions elect to provide help for 7 days a week.

| | | Provide home help for... | | | | Remove... ..children and place | | | |
|---------------|------|--------------------------|---|----|--------|--------------------------------|-----|-------|--------|
| | | ...days | | | | into care | | | |
| | | 2 | 4 | 7 | Unable | One | Two | Three | Unable |
| Mode of | CMC | - | 1 | 10 | 1 | 2 | 4 | 4 | 2 |
| Communication | NDVS | - | 2 | 10 | - | - | 2 | 8 | 2 |
| | DVS | 1 | 2 | 9 | - | - | 4 | 6 | 2 |

Table 6.1: Experiment 4 decision outcomes (including no decision reached) for each condition regardless of casenotes or task order.

When faced with the prospect of removing children into care, the pattern is less clear. The modal response for each condition is to remove all three children, however, the number of

groups selecting this option is higher in the NDVS condition ($n = 8$) than either the unsupported CMC ($n = 4$) or DVS panels ($n = 6$).

Across the two decision tasks seven of the panels failed to reach a decision within the time permitted, four of these were on the first task and three on the second, no group failed to reach a decision on both of the problems, i.e. no group failed to reach at least one decision within the time limit. No effect of the condition upon duration was found ($F_{(2,33)} = .041, p > .1$) with DVS panels ($M = 67.67, SD = 10.26$) and NDVS panels ($M = 67.42, SD = 8.35$) being less than a minute quicker than CMC panels ($M = 68.21, SD = 11.77$).

Groups did, however, take less time to reach a decision on the second task ($M = 65.58, SD = 11.498$) than on the first ($M = 71.95, SD = 6.18$; $F_{(1,33)} = .15.11, p < .001$), though there was no interaction between the support defined condition and task ($F_{(2,33)} = .041, p > .1$).

6.5.3 Total Levels of Communication

In total all the CMC panels produced 732 utterances in the first task and 778 in the second, the NDVS panels communicated slightly more 793 and 860, with the DVS panels achieving the highest levels of communication with 859 utterances in the first task and 958 in the second. To assess the reliability of the application of the coding scheme the codes assigned to each utterance unit during the real-time coding as part of the MIMICS paradigm were compared to the coding of the same utterances under conditions of less time pressure for 409 of the total pool of 4980 utterances, consisting of two groups selected at random from each condition. A significant Cohen's Kappa Agreement Coefficient was obtained ($K = .86$) representing acceptable levels of intra-rater application of the scheme.

The mean number of utterances of each panel dependent upon the condition under they were communicated are presented in Table 6.2. Although no difference exists in the duration that might account for the total number of utterances, utterance rates are provided for ease of comparison with the previous experiments.

| | Task One | | | | Task Two | | | |
|------|-----------------|---------|-----------------|-------|-----------------|---------|-----------------|-------|
| | Total Utterance | | Utterance Rates | | Total Utterance | | Utterance Rates | |
| | Mean | SD | Mean | SD | Mean | SD | Mean | SD |
| CMC | 61 | (28.01) | .83 | (.38) | 70.25 | (37.07) | 1.11 | (.50) |
| DVS | 66.08 | (26.08) | .92 | (.34) | 75.83 | (39.46) | 1.19 | (.59) |
| NDVS | 71.58 | (26.25) | .99 | (.34) | 76.33 | (23.25) | 1.22 | (.32) |

Table 6.2 Mean Utterances and Utterance Rates for each condition across the two tasks.

No difference in the total levels of communication (Appendix C4) was revealed for condition ($F(2,33) = .328; p > .1$), task ($F(1,33) = 1.973; p > .1$) nor the interaction between the two ($F(2,33) = .080; p > .1$). Although a difference was revealed in utterance rates (Appendix C4) according to the task with a greater rate of communicating in the second task ($M = 1.175, SD = .472$) than in the first ($M = .917, SD = .336; F(1,33) = 11.00; p < .01$).

6.5.4 Total information influence

The analyses reported in this section concern the effects upon the actual and proportional levels of communication of the communication mode and the task. These are examined using a 2-way Analysis of Variance with communication (DVS, NDVS, CMC) treated as a between subjects variable and task (one, two) as a within subjects variable.

Encouragingly the levels of CIT (Table 6.3), regardless of the task, used by DVS panel are 20.16% of all communication which is less than a 1% away from the target level of CIT style communication that is employed by FTF groups tackling the same task. An inspection of the two tasks reveals that a shortfall of 3% in the first task is more than compensated for in the second task (Table 6.3). Both unsupported (CMC) and the NDVS panels user lower levels of CIT in both actual and proportional terms.

Considering the levels of informational influence in terms of both the total number of utterances and the proportion of all communication devoted to this style of communication reveals (Table 6.3 overleaf) no differences between conditions (Appendix C) in the total levels of either informational communication category (Appendix C4).

| | | Total | | Proportional | |
|----------|------|---------------|----------|---------------|----------|
| | | Communication | | Communication | |
| | | CIT | INF | CIT | INF |
| | | Mean | Mean | Mean | Mean |
| | | (St Dev) | (St Dev) | (St Dev) | (St Dev) |
| Task | CMC | 7.33 | 25.58 | 11.40 | 39.30 |
| | | (4.79) | (13.97) | (7.83) | (12.08) |
| One | NDVS | 10.92 | 26.42 | 15.26 | 38.95 |
| | | (8.33) | (14.23) | (7.86) | (14.01) |
| | DVS | 13.58 | 29.83 | 18.13 | 40.36 |
| | | (8.53) | (14.16) | (7.43) | (10.30) |
| Task | CMC | 13.67 | 25.83 | 19.82 | 36.50 |
| | | (10.81) | (14.31) | (15.70) | (9.39) |
| Two | NDVS | 12.42 | 30.50 | 15.07 | 43.39 |
| | | (10.72) | (14.82) | (9.27) | (13.72) |
| | DVS | 16.84 | 34.42 | 22.18 | 45.45 |
| | | (7.13) | (11.72) | (10.20) | (11.14) |
| Combined | CMC | 10.50 | 25.71 | 15.606 | 37.91 |
| | | (8.79) | (13.83) | (12.86) | (10.68) |
| Tasks | NDVS | 11.67 | 28.46 | 15.17 | 41.14 |
| | | (9.42) | (14.36) | (8.41) | (13.74) |
| | DVS | 15.21 | 32.13 | 20.16 | 42.90 |
| | | (7.87) | (12.93) | (8.97) | (10.81) |

Table 6.3: Experiment 4 Total and proportional levels of informational influence across both tasks

Although not significant ($F(1,33) = 3.94$; $p=.055$; Appendix C, Table C4.17) an examination of the effect of the two tasks suggests that the proportional levels of CIT could be higher in the second task ($M = 19.02$, $SD = 12.088$) than the first ($M = 14.93$, $SD = 7.98$). As this category is one of the target categories under closer examination it is sufficient for now to

note this finding and to return to address it in a later section, when the distribution of the category over time will be considered.

6.5.5 Total Normative influence

| | | Total Communication | | Proportional Communication | |
|----------|------|------------------------|----------|-------------------------------|----------|
| | | PREF | VAL | PREF | VAL |
| | | Mean | Mean | Mean | Mean |
| | | (St Dev) | (St Dev) | (St Dev) | (St Dev) |
| Task | CMC | 10.83 | 3.42 | 19.81 | 4.45 |
| | | (3.66) | (2.58) | (9.54) | (5.74) |
| One | NDVS | 11.17 | 2.58 | 17.96 | 4.04 |
| | | (4.57) | (2.15) | (6.83) | (3.82) |
| | DVS | 10.00 | 2.17 | 15.38 | 2.87 |
| | | (4.73) | (2.33) | (7.96) | (2.85) |
| Task | CMC | 9.00 | 1.42 | 15.80 | 2.16 |
| | | (4.89) | (1.56) | (9.98) | (2.60) |
| Two | NDVS | 11.76 | 2.25 | 16.96 | 2.92 |
| | | (7.59) | (2.60) | (7.34) | (3.15) |
| | DVS | 7.92 | 4.08 | 10.50 | 4.78 |
| | | (5.58) | (4.87) | (7.27) | (5.29) |
| Combined | CMC | 9.54 | 2.42 | 17.80 | 3.30 |
| | | (4.26) | (3.75) | (9.76) | (4.51) |
| Tasks | NDVS | 11.46 | 2.42 | 17.469 | 3.48 |
| | | (6.14) | (2.34) | (6.96) | (3.47) |
| | DVS | 8.96 | 3.13 | 12.94 | 3.83 |
| | | (5.17) | (3.86) | (7.86) | (4.24) |

Table 6.4: Experiment 4 Total and proportional levels of normative utterances across both tasks.

Turning to the levels of normative influence exerted by the panels (Table 6.4) again reveals no differences in the absolute or proportional levels of communication (Appendix C4)

There are no differences (Appendix C4) to be observed between the levels of either PREF or VAL, dependent upon the mode of support defined conditions, when examined in either total utterances or proportions of total communication. The trend is, however, in the predicted direction with DVS groups devoting 12.94% of their communication to PREF, less than either of the other two conditions, but not as low as the levels of PREF seen in FTF panels who devote less than of their total communication to this category. The effect of completing a second task is to significantly decrease the proportional level of PREF style communication ($F(1,33) = 7.52; p < .05$) with panels in the first task averaging 17.80% of their communication as PREF ($SD = 8.16$) and this falling to 14.43% ($SD = 8.55$) in the second task (Appendix C4).

6.5.6 Miscellaneous Categories of Communication

A consideration of the total utterances in the remaining five communication categories (Table 6.5) reveals few effects of interest (see Appendix D4 for full details). On average there is less than one LEG utterance per task, regardless of the condition under which the panels are operating. Similarly, the level of pressure (PRESS) exerted by one panel member of another is less than a single utterance. There are also very few attempts to coordinate the group effort (PROC) and very few communication essentially irrelevant to the experimental task (OTH).

What is revealed is the suspicion of an increase in the level of OTH between the first and second task ($F(1,33) = 4.02; p = .05$; Appendix D, Table D4.9) with panels in the second task communicating twice as much ($M = 2.70, SD = 4.92$) irrelevant material as in the first ($M = 1.31, SD = 2.57$). The actual level of this communication is, however, so low that there appears to be little merit in exploring this further. Indeed, the levels are such that it might be interpreted as almost no communication concerning issues other than the experiment in either the first task or the second task.

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| | | Total Communication | | | | |
|----------|------|---------------------|----------|----------|----------|----------|
| | | LEG | MAT | OTH | PRESS | PROC |
| | | Mean | Mean | Mean | Mean | Mean |
| | | (St Dev) | (St Dev) | (St Dev) | (St Dev) | (St Dev) |
| Task | CMC | .00 | 9.42 | 1.92 | .42 | 2.83 |
| | | (.00) | (6.24) | (3.34) | (.79) | (2.17) |
| One | NDVS | .58 | 10.33 | 1.42 | .08 | 2.58 |
| | | (.99) | (5.81) | (2.26) | (.29) | (1.93) |
| | DVS | .42 | 13.00 | .58 | .42 | (1.58 |
| | | (.90) | (8.32) | (1.44) | (1.00) | (1.24) |
| Task | CMC | .17 | 15.25 | 2.67 | .08 | 2.17 |
| | | (.58) | (13.26) | (5.37) | (.29) | (2.13) |
| Two | NDVS | .17 | 12.00 | 3.58 | .42 | 2.75 |
| | | (.58) | (10.23) | (6.40) | (1.00) | (2.77) |
| | DVS | .08 | 8.42 | 1.83 | .58 | 2.17 |
| | | (.29) | (5.84) | (2.33) | (1.38) | (1.34) |
| Combined | CMC | .08 | 12.33 | 2.29 | .25 | 2.50 |
| | | (.41) | (10.57) | (4.39) | (.61) | (2.13) |
| Tasks | NDVS | .38 | 11.17 | 2.50 | .25 | 2.67 |
| | | (.82) | (8.18) | (4.91) | (.74) | (2.33) |
| | DVS | .25 | 10.71 | 1.21 | .50 | 1.88 |
| | | (.68) | (7.41) | (2.00) | (1.18) | (1.30) |

Table 6.5: Total levels of miscellaneous communication categories across both tasks of Experiment 4.

The other significant finding is an interaction between the levels of MAT communicated on the two tasks and the condition under which they occur (Figure 6.1, $F(2,33) = 4.73; p < .05$).

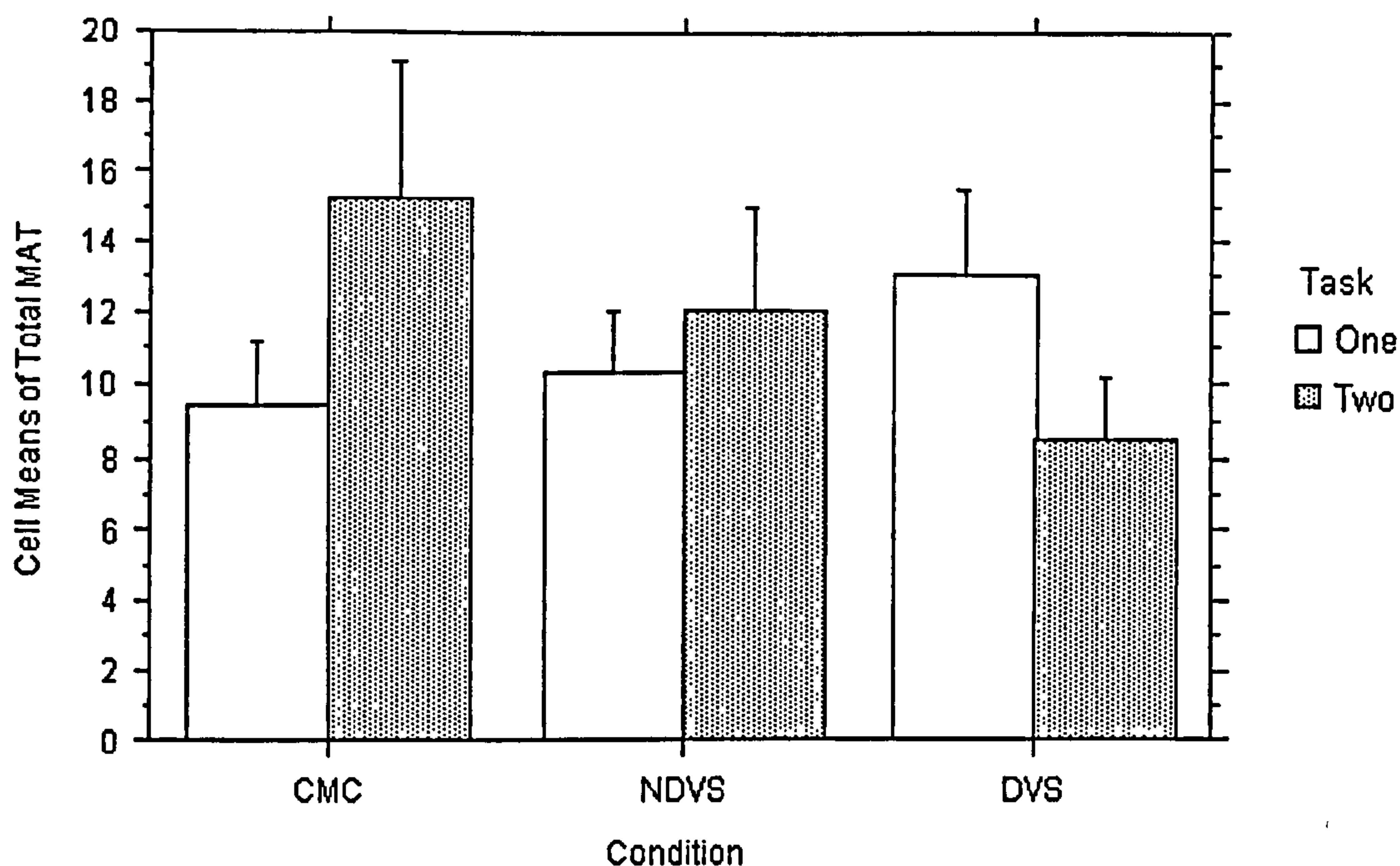


Figure 6.1 The interaction between Experiment 4 task and condition for MAT communication (including standard error bars)

Both the CMC (Task 1: $M = 9.42$, $SD = 6.24$, Task 2: $M = 12.00$, $SD = 10.23$) decision making panels and the NDVS (Task 1: $M = 10.33$, $SD = 5.81$, Task 2: $M = 15.25$, $SD = 13.26$) increase their MAT communication from the first to second task, however, the level of MAT communicated by DVS panels falls from the first task ($M = 13.00$, $SD = 8.32$) by over a third to the levels seen in the second task ($M = 8.42$, $SD = 5.84$).

There are no other effects of condition or task upon the levels of communication in any of the miscellaneous communication categories, therefore, attention turns to the proportional levels of communication (Table 6.6 overleaf). Given the low levels of LEG and PRESS communication, they do not warrant commenting upon being less than 1% of all communication.

The main finding of interest again concerns the use of MAT (Appendix D4), with a significant interaction between task and condition ($F(2,33) = 5.81$; $p < .05$) as previously identified from the total levels of communication.

| | | Proportional Levels of Communication | | | | |
|----------|------|--------------------------------------|----------|----------|----------|----------|
| | | LEG | MAT | OTH | PRESS | PROC |
| | | Mean | Mean | Mean | Mean | Mean |
| | | (St Dev) | (St Dev) | (St Dev) | (St Dev) | (St Dev) |
| Task | CMC | .00 | 16.04 | 2.77 | 5.78 | .45 |
| | | (.00) | (8.47) | (4.26) | (6.73) | (.84) |
| One | NDVS | .92 | 15.98 | 2.31 | 4.50 | .08 |
| | | (1.48) | (7.91) | (4.40) | (3.94) | (.26) |
| | DVS | .57 | 19.02 | .93 | 2.15 | .58 |
| | | (1.07) | (12.77) | (2.47) | (1.74) | (1.53) |
| Task | CMC | .18 | 19.35 | 3.21 | 2.90 | .09 |
| | | (.62) | (10.15) | (4.99) | (2.32) | (.31) |
| Two | NDVS | .12 | 14.23 | 3.37 | 3.61 | .39 |
| | | (.42) | (7.93) | (5.56) | (2.71) | (.92) |
| | DVS | .08 | 10.54 | 2.40 | 3.02 | 1.05 |
| | | (.27) | (5.30) | (3.05) | (2.12) | (2.49) |
| Combined | CMC | .09 | 17.69 | 2.99 | 4.34 | .27 |
| | | (.44) | (9.30) | (4.54) | (5.13) | (.64) |
| Tasks | NDVS | .52 | 15.10 | 2.84 | 4.05 | .22 |
| | | (1.14) | (7.80) | (4.93) | (3.37) | (.67) |
| | DVS | .33 | 17.78 | 1.66 | 2.59 | .82 |
| | | (.80) | (10.50) | (2.82) | (1.95) | (2.03) |

Table 6.6: Proportional levels of miscellaneous communication categories across both tasks of Experiment 4.

6.6 Communication Over Time

6.6.1 Citations of Case Fact (CIT)

The analysis of the differences between the communication style of FTF groups and those communicating via e-mail has shown the FTF groups make widespread use of evidence based

communication, in this case measured by the CIT category code. The main purpose of this experiment was to examine both the effects of incorporating a visual component into the feedback provided by the support system and also to examine the effects upon subsequent tasks of earlier support.

Attention now turns to considering the effects upon CIT of both the support system and its subsequent removal. Recall from earlier that there was a suspicion that the level of CIT increases in the second task. A useful starting point is to consider the average cumulative raw totals of the groups operating under the two forms of support system (DVS & NDVS) and the unsupported, control condition (CMC) over the two tasks.

Over the first task (Figure 6.2) those operating with assistance from the DVS more closely resemble the communication pattern of the target information driven groups than the NDVS. As expected the unsupported panels use less CIT style communication.

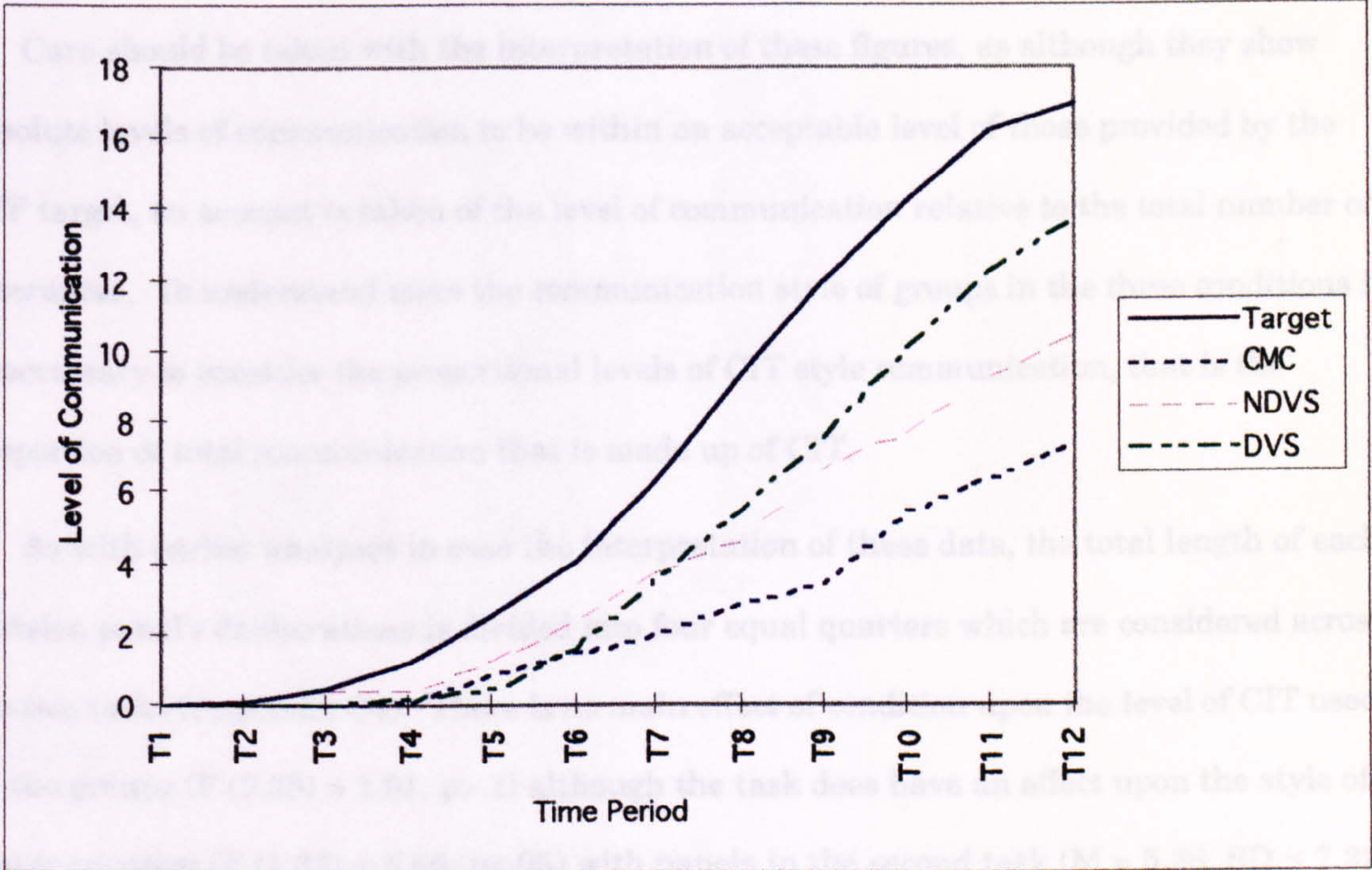


Figure 6.2: The cumulative distribution of CIT over time for task one of Experiment 4.

In the second task (Figure 6.3) where all groups are communicating without assistance from the support system, the levels of CIT are higher than those seen in the first task. Indeed, both those previously unsupported (CMC) and those with assistance from the DVS communicate at levels approaching those of the target, with those previously communicating with assistance from the NDVS exceeding the levels of the model.

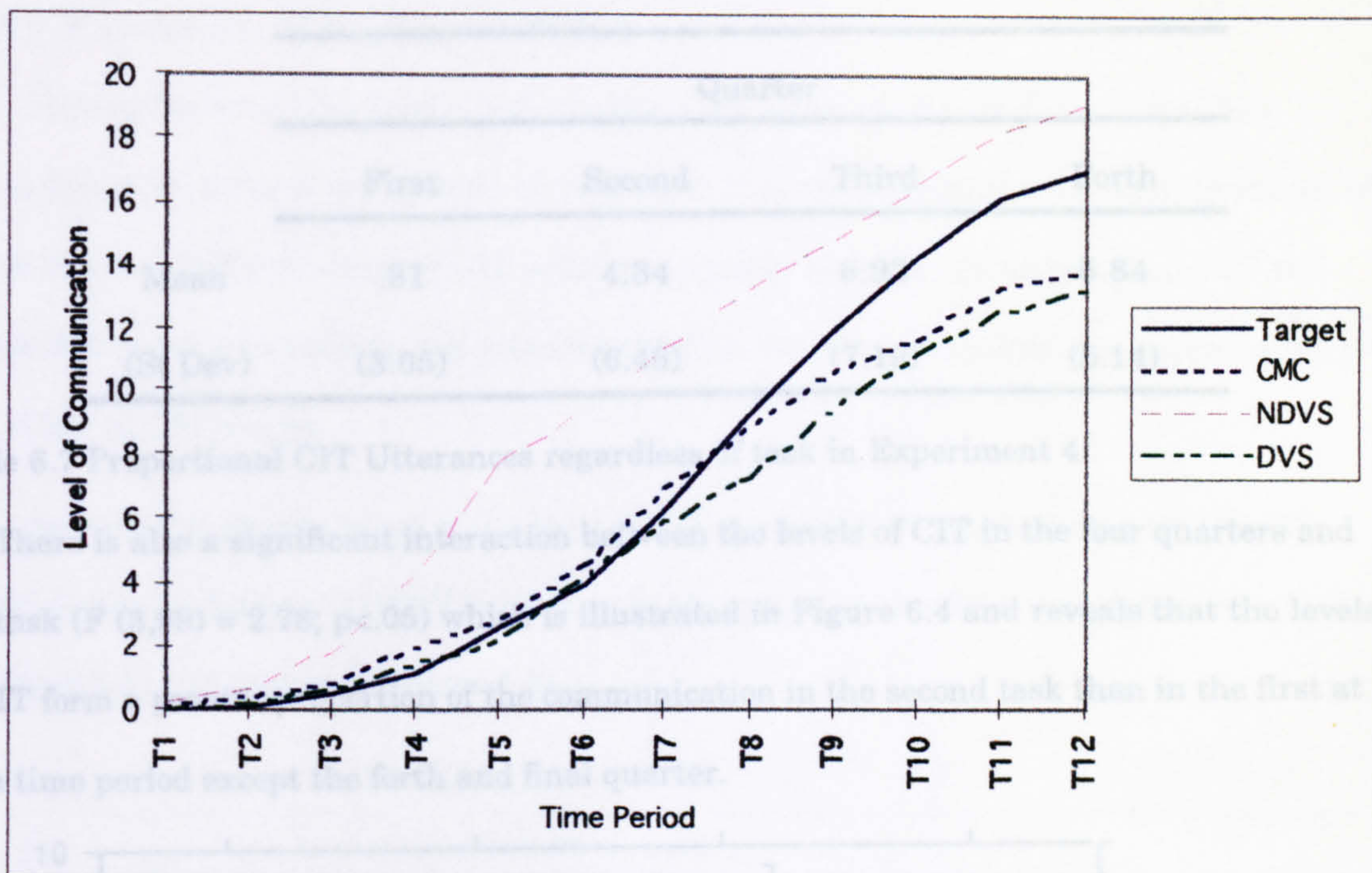


Figure 6.3: The cumulative distribution of CIT over time for task two of Experiment 4.

Care should be taken with the interpretation of these figures, as although they show absolute levels of communication to be within an acceptable level of those provided by the FTF target, no account is taken of the level of communication relative to the total number of utterances. To understand more the communication style of groups in the three conditions it is necessary to consider the proportional levels of CIT style communication, that is the proportion of total communication that is made up of CIT.

As with earlier analyses to ease the interpretation of these data, the total length of each decision panel's deliberations is divided into four equal quarters which are considered across the two tasks (Appendix C4). There is no main effect of condition upon the level of CIT used by the groups ($F(2,33) = 1.91; p > .1$) although the task does have an effect upon the style of communication ($F(1,33) = 5.55; p < .05$) with panels in the second task ($M = 5.28, SD = 7.22$) devoting a greater proportion of their communication to CIT than in the first task ($M = 3.67, SD = 4.61$).

As expected and indeed to some extent predicted by the target levels of communication, the four time slices have an effect (Table 6.7) suggesting that there are low levels of CIT in the first quarter and that this rise in subsequent time periods with a slight decrease at the end.

| | Quarter | | | |
|----------|---------|--------|--------|--------|
| | First | Second | Third | Forth |
| Mean | .81 | 4.34 | 6.92 | 5.84 |
| (St Dev) | (3.05) | (6.46) | (7.19) | (5.14) |

Table 6.7 Proportional CIT Utterances regardless of task in Experiment 4.

There is also a significant interaction between the levels of CIT in the four quarters and the task ($F(3,99) = 2.78$; $p < .05$) which is illustrated in Figure 6.4 and reveals that the levels of CIT form a greater proportion of the communication in the second task than in the first at each time period except the forth and final quarter.

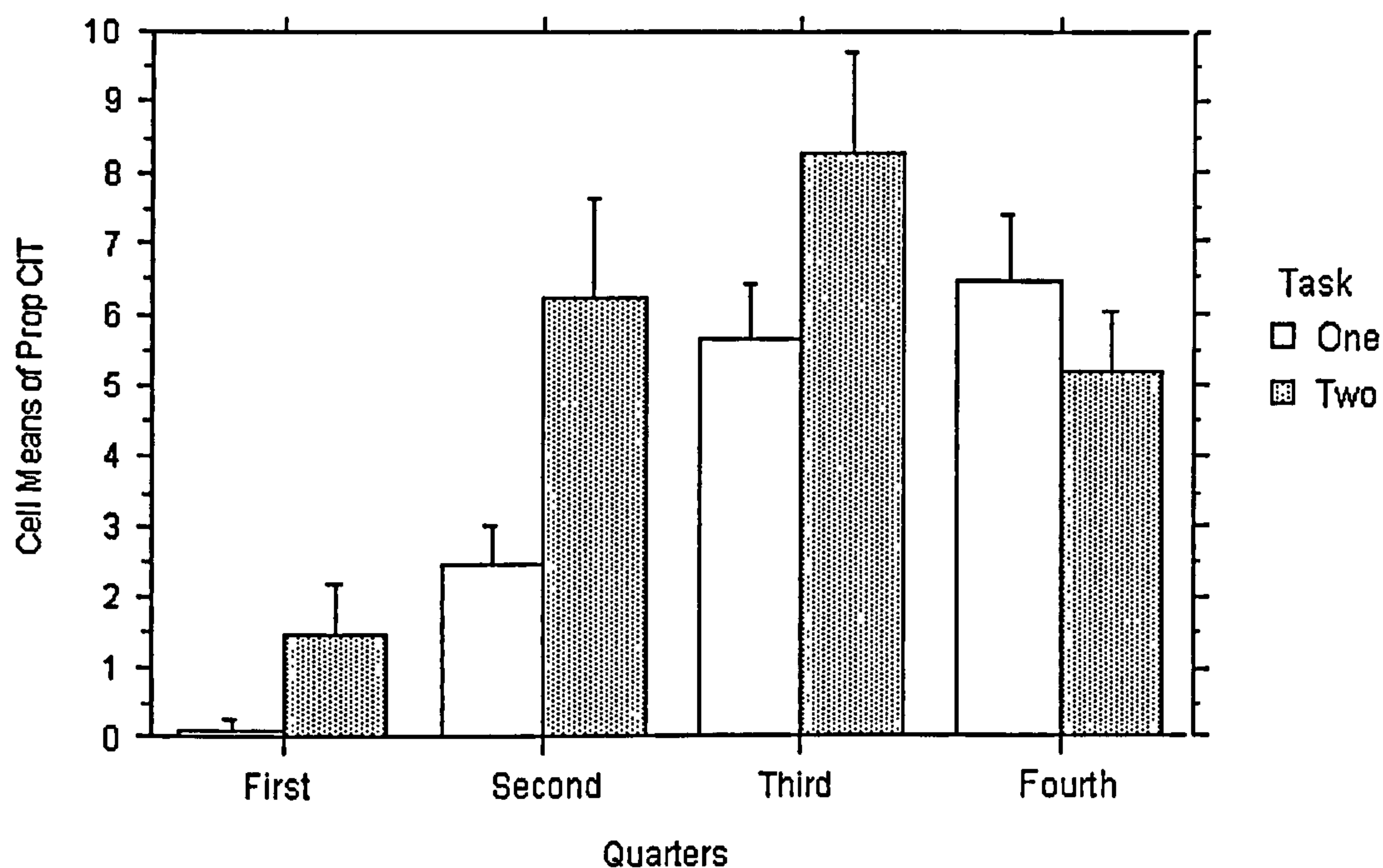


Figure 6.4 The interaction between time period and task (with standard error bars) for Experiment 4.

In summary, it appears that the DVS panels are operating at levels that more closely resemble the target levels of communication derived from FTF panels when the support system is present. However, in subsequent tasks there is no difference in the levels of all three conditions, with NDVS groups operating at levels generally higher than the (absent) target and both DVS and CMC groups in line with the target until time period 8 when after which they operate at levels below the target.

6.6.2 Expressions of Preference (PREF)

Having examined the level of informational influence via the citations of case fact, attention now turns to the number of utterances that are concerned with the expressions of preference. Unlike the level of CIT which are usually lower in CM panels than FTF and therefore require increasing, the requirement from the support system is to suppress the level of PREF in CM groups.

As with the consideration of the level of CIT a useful starting point is to consider the cumulative production of PREF in relation to the target levels of communication over task one (Figure 6.5) and task two (Figure 6.6).

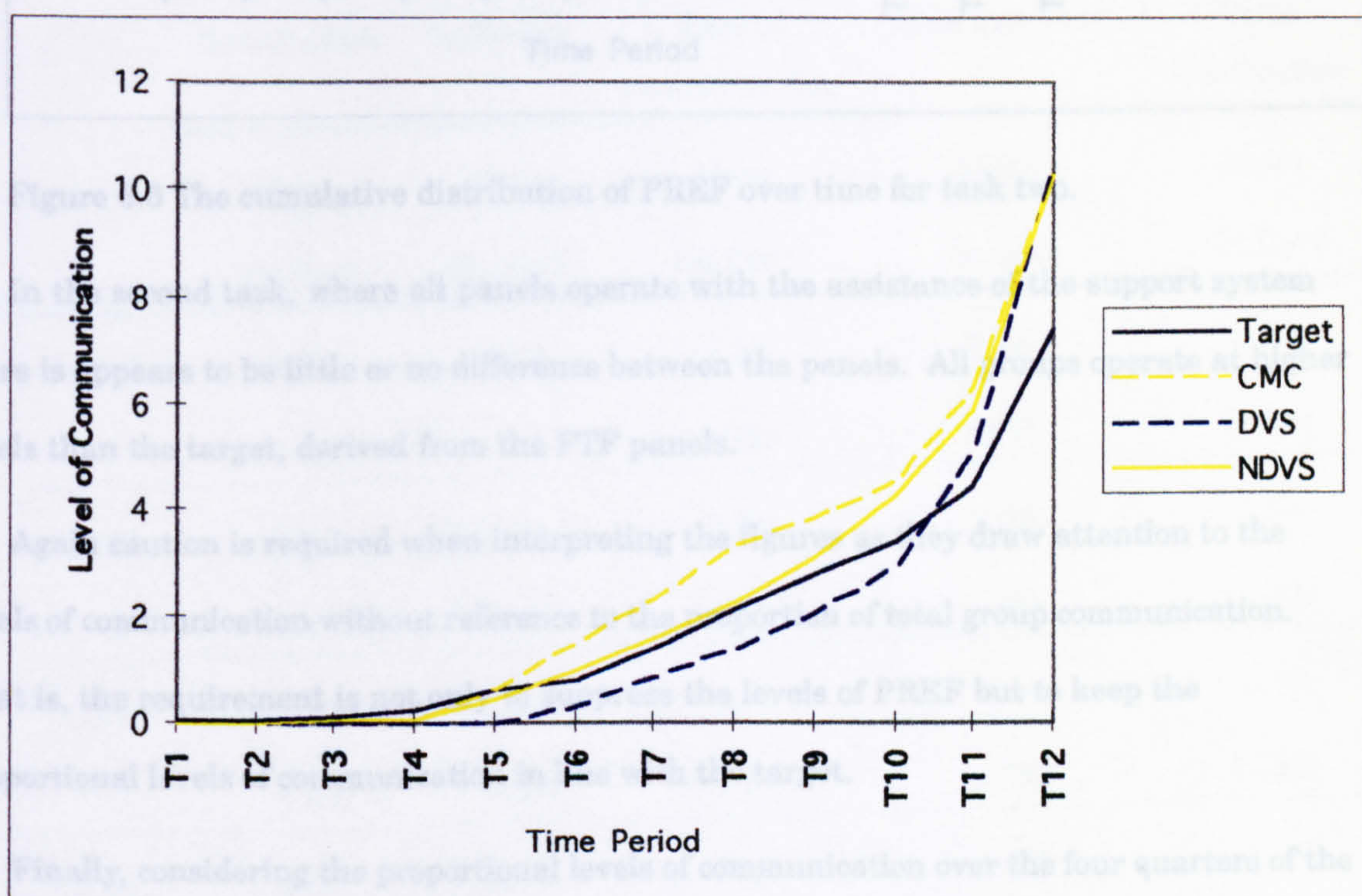


Figure 6.5: The cumulative distribution of PREF over the first task

There is some success in suppressing the level of PREF with the DVS system, however this is limited and as the task approaches conclusion the level of PREF increases beyond the level of the target and into line with both the NDVS and the unsupported panels. The overall levels of communication are the same for each condition, the system has merely managed to alter the shape of the distribution, and delay the occurrence of PREF in the DVS panels.

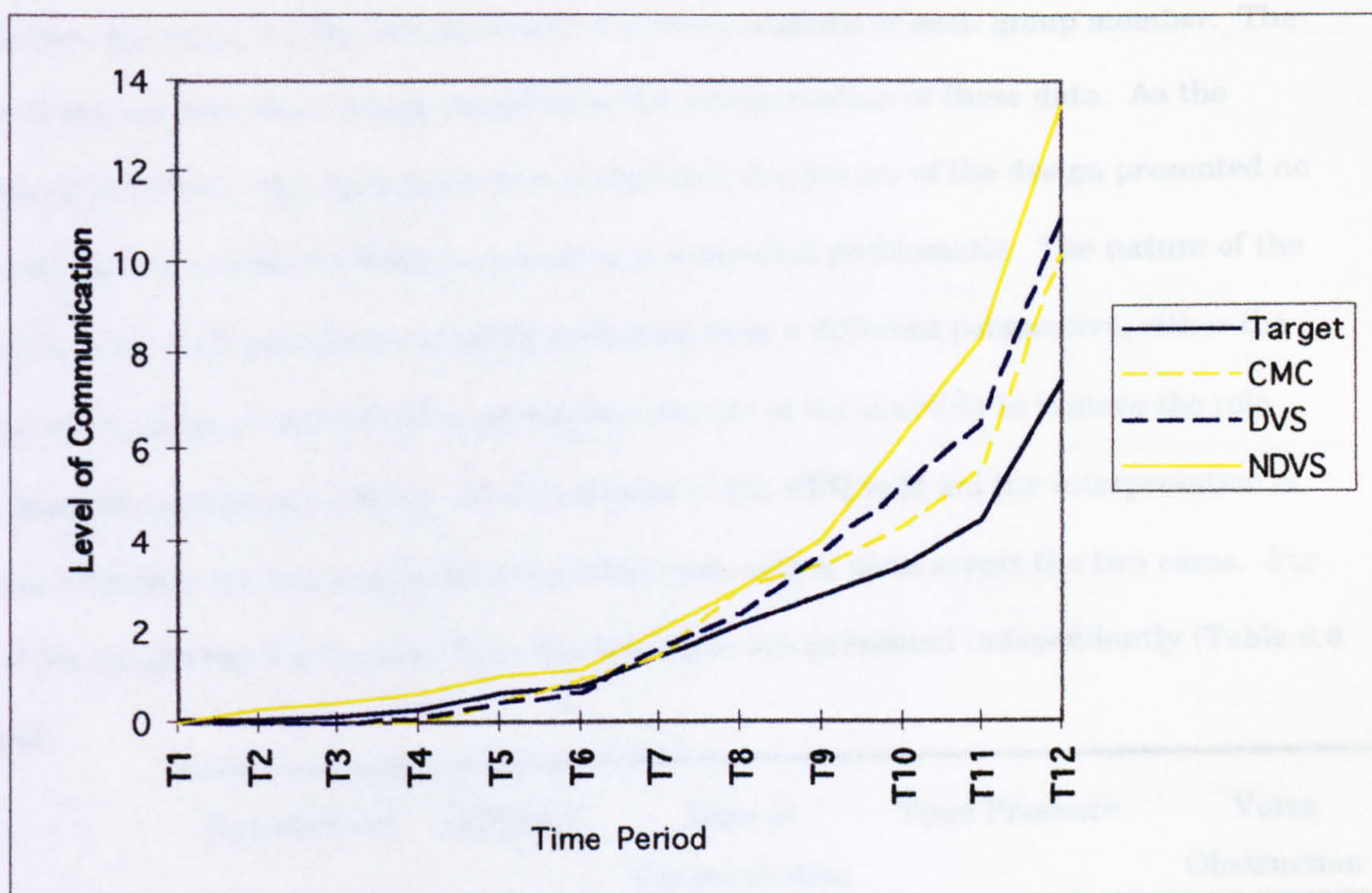


Figure 6.6 The cumulative distribution of PREF over time for task two.

In the second task, where all panels operate with the assistance of the support system there is appears to be little or no difference between the panels. All groups operate at higher levels than the target, derived from the FTF panels.

Again caution is required when interpreting the figures as they draw attention to the levels of communication without reference to the proportion of total group communication. That is, the requirement is not only to suppress the levels of PREF but to keep the proportional levels of communication in line with the target.

Finally, considering the proportional levels of communication over the four quarters of the decision enables a more accurate impression of the communication to be formed. No effect of *condition* (Appendix C4, Table C4.25) nor a *task by condition* interaction is apparent, however, a significant *task* effect exists with panels employing less PREF in task two ($M = 14.43$, $SD = 8.55$) than in task one ($M = 17.72$, $SD = 8.16$).

6.7 Participant Perceptions of the Decision

Having discussed both the initial outcome measures: time taken to reach a decision and decision outcome, and the differences observed in the types of communication used to reach the decision it is worth considering the perceptions of the decision makers themselves. The data collected from the post-experimental questionnaire offers an indication of the levels of

satisfaction, participant influence, and ease of communications of each group member. The nature of the experimental design complicates the interpretation of these data. As the analysis of communication took place at a group level, the nature of the design presented no problems, however, with the PEQ responses it is somewhat problematic. The nature of the two tasks, with each participant tackling each task from a different perspective, either the medical role or from a social/welfare perspective results in the inability to remove the role effect from the participant effects. As the purpose of the PEQ is to aid the interpretation of the data collected, the key comparison is within task, rather than across the two cases. For ease of interpretation the findings from the two tasks are presented independently (Table 6.8 overleaf).

| | | Satisfaction | Influence | Ease of Communicating | Time Pressure | Votes Obstruction |
|------|------|------------------|------------------|--------------------------|------------------|----------------------|
| | | Mean (St Dev) | Mean (St Dev) | Mean (St Dev) | Mean (St Dev) | Mean (St Dev) |
| Task | CMC | 3.71 (1.48) | 2.58 (.71) | 3.37 (.96) | 2.66 (.87) | 3.04 (1.33) |
| | VCS | 3.33 (1.74) | 2.79 (.81) | 3.58 (1.17) | 2.38 (.92) | 2.88 (1.51) |
| One | NVCS | 3.73 (1.59) | 2.83 (.56) | 3.75 (1.03) | 2.54 (.78) | 3.00 (1.32) |
| | CMC | 4.08 (1.08) | 2.75 (.62) | 3.92 (1.24) | 2.83 (1.11) | 3.16 (1.52) |
| Task | VCS | 3.16 (1.99) | 1.92 (1.08) | 3.93 (1.62) | 2.75 (1.35) | 2.75 (1.35) |
| | NVCS | 3.50 (1.45) | 2.42 (.96) | 4.00 (1.04) | 3.42 (.79) | 2.92 (1.24) |

Table 6.8: Descriptive statistics for PEQ responses regarding the two tasks of Experiment 4

There appear to be very few differences in the levels of satisfaction although there is the possibility of the medical roles being more influential (higher scores) on the second task. Ease of communicating is consistently high across the task and the completion of the votes data

does not appear to greatly obstruct the task at hand. Each of these areas are now examined in turn.

6.7.1 Satisfaction with Decision Outcome

No differences in the satisfaction of outcome were reported by the decision makers (Appendix E4). Regardless of *role* (DSS M = 3.50, SD = 1.63, LHA M = 3.69, SD = 1.58) or *condition* (Table 6.9) satisfaction with the outcome of the deliberations remained constant at levels approaching “mildly satisfied.”

| | Count | Mean | Std. Dev. | Std. Error |
|------|-------|-------|-----------|------------|
| CMC | 24 | 3.708 | 1.488 | .304 |
| VCS | 24 | 3.333 | 1.736 | .354 |
| NVCS | 24 | 3.750 | 1.595 | .326 |

Table 6.9: Descriptive statistics of satisfaction ratings of each condition for Task 1 of Experiment 4.

In the second task, no differences in the satisfaction of outcome were reported by the decision makers (Appendix E4). Regardless of *role* (DSS M = 3.86, SD = 1.45, LHA M = 3.58, SD = 1.55) or *condition* (Table 6.10) satisfaction with the outcome of the deliberations remained constant at levels approaching “mildly satisfied.”

| | Count | Mean | Std. Dev. | Std. Error |
|------|-------|-------|-----------|------------|
| CMC | 24 | 3.875 | 1.393 | .284 |
| VCS | 24 | 3.625 | 1.813 | .370 |
| NVCS | 24 | 3.667 | 1.308 | .267 |

Table 6.10: Descriptive statistics of satisfaction ratings of each condition for Task 2 of Experiment 4.

6.7.2 Influence of Roles upon Task One Outcome

As with previous experiments there was no evidence of differential impact of the two *roles* upon the decision outcome (Appendix E4). Both the LHA (M = 2.68, SD = .631) and the DSS (M = 2.74, SD = .780) indicated the belief of equal influence upon the decision, with perhaps a suggestion of a leaning towards slightly more influence by the medical information (LHA). On the second task the analysis of the relative impact of the two *roles* (Appendix E4) reveals a significant difference ($F_{(1,33)} = 9.569$; $p < .005$) with the DSS considering there to be equal influence (M = 2.889, SD = .919) upon the decision process and subsequent outcome, but the LHA viewing themselves as exerting greater influence (M = 2.36, SD = .961) than the other member of the decision making panel.

6.7.3 Ease of Communicating in Task One

Regardless of *role* or *condition* the decision makers considered communication of with one another to be somewhere between “satisfactorily” and “moderately easily” (Appendix E4). Encouragingly, regardless of *role* or *condition* the decision makers considered communication of with one another to be “moderately easily” in the second task. Suggesting little change between the two.

6.7.4 Perception of Time Allowed to Make the Decision on Task One

On average the decision makers considered the time limit permitted to be a little short, with the mean responses, ranging from VCS $M = 2.38$ to NVCS $M = 2.54$ (Appendix E4) being closer to the suggestion of “needing slightly longer” than “being about right.” This reflects the results of the analysis of the time taken to reach a decision, which showed on average panels taking around two minutes longer than the seventy minute deadline.

The data collected on the perceived time pressure for the second task of the 70 minute limit indicates that the decision makers found the limit to be “about right” (Appendix E4). Given that the earlier data revealed that on average the panels logged their decision with the experimenter seven minutes prior to the deadline, this information is consistent with objective measures of decision duration.

6.7.5 Obstruction to Task One Decision Making Caused by Voting

Little obstruction was reported as being caused by the regular requests for current decision preferences. Panels, on average, considered these requests to be “barely obstructive” with no differences reported as a result of *role* (Appendix E4) or condition (Table 6.11)

| | Count | Mean | Std. Dev. | Std. Error |
|------|-------|-------|-----------|------------|
| CMC | 24 | 3.042 | 1.334 | .272 |
| VCS | 24 | 2.875 | 1.513 | .309 |
| NVCS | 24 | 3.000 | 1.319 | .269 |

Table 6.11: Descriptive statistics of Perception Of Obstruction caused by voting each condition for the first task of Experiment 4.

On the second task, regardless of the panel members *role* or the communication *conditions* under which they operated, the requests for current preferences were considered to be “barely obstructive” (Appendix E4) and can therefore be considered to have offered little obstacle to the decision makers whilst they attempted to reach their decisions.

6.7.6 Perceptions of the Feedback System

Table 6.12 provides a summary of the participant observations concerning the feedback they received.

| | Feedback Obstruction | Utility of Feedback |
|------|----------------------|---------------------|
| | Mean | Mean |
| | (St Dev) | (St Dev) |
| NDVS | 2.45 | 2.50 |
| | (1.45) | (1.32) |
| DVS | 2.02 | 2.42 |
| | (1.37) | (1.25) |

Table 6.12: Descriptive statistics for Experiment 4 PEQ responses regarding the feedback

It is apparent from these data that despite the trend for the shaping of the communication in line with the target levels provided by face-to-face panels, that the CM participants do not perceive a great advantage in the feedback provided. The utility ratings for both scales are just below the mid point and suggested that information was useful, but not much. Twelve participants in the NDVS condition and thirteen in the DVS reported attempting to follow the feedback advice, this include two pairs in the NDVS and five within the DVS.

Of the DVS, 16 participants considered it more important to try and follow an instruction to increase communication and 5 perceived it of equal importance to increase as decrease, the remainder considered it more important to decrease communication levels when instructed. These differ slightly from the 12 who thought that increasing communication was more important when supported by the NDVS and 8 who perceived it as the same.

6.7.8 Summary of Participant Perceptions

What is apparent from the findings of the post-experimental questionnaire is the similarity of perceived influence, satisfaction and interaction with the computer system. Those users being supported by either the directive visual communication support (VCS) system or receiving non-directive visual communication (NVCS) report no ill-effects of the additional material being received via the e-mail. The key to the benefits of the system will lie in any changes in communication behaviour exhibited as a result of these support systems

On the second task, given that all panels operated without the assistance of the support systems, and in effect are all CMC conditions it is encouraging to note that no differences exist in their perceptions of the experimental task.

6.8 Discussion

6.8.1 *The Effect of Adding Visual Feedback*

Two components of a single experiment have been reported in this chapter. Visual feedback was incorporated into the system to increase the ease with which subjects could interpret the feedback and to provide a continuous source of information for subjects to refer to. This was achieved by linking the graphic representations of communication, as used by the support system to a television monitors placed alongside each participants computer. Thus as the communication was coded by the intelligent system the representations of communication were presented to the decision making panels at six minute intervals.

As the presence of visual feedback could only take the form of a non-directive system a second version of visual support system was constructed. In this version, the continuous visual feedback was supplemented by the prompts present in the previously successful directive system.

These data collected from this experiment revealed that the non-directive visual communication support (NDVS) was treated in much the same way as non-directive support system in Experiment 2. The passive nature of the support system permitted subjects to ignore the feedback that it provided and consequently groups assisted by this configuration of the support system performed only marginally better than unsupported groups.

The continuous visual feedback with the presence of prompts was only partially successful in creating computer-mediated groups using “information-driven” patterns of communication. As with the previous experiments informational communication was increased but not completely to the levels exhibited by face-to-face equivalents. Although the presence of feedback helped reduce the occurrences of decision focused information, these did not fall to the low levels exhibited by “information-driven” groups. The overall levels of PREF were consistent across all three conditions. Although it should be noted that the absolute levels were lower than those exhibited in the Experiments employing non-visual support. This perhaps suggests that there may be room for suppression of PREF and that although some

minimum level of PREF required to negotiate a decision may exist (See discussion of Experiment 2) it might not be as high as the figures in the earlier experiments suggest.

6.8.2 The extent to which the aims of the experiment have been achieved

The primary aim of this experiment was to examine whether incorporating visual information into the feedback system would enable computer-mediated decision making panels to communicate in a style that resembles the information driven approaches of FTF groups. The extent to which this has been achieved is mixed. Although no significant differences exist in the total levels of CIT the distribution of this communication over time suggests some success of the approach, that is it appears closer to the target levels the earlier non-visual configurations of the system. The lack of success in suppressing PREF offers further evidence for the existence of a minimal (absolute) level of PREF required to reach a decision.

6.8.3 Summary of findings from task two

Pairs of participants who had recently completed one task tackled a similar task using a different set of case materials and different decision outcomes. Regardless of the presence or absence of support during the first task, the panels exhibited increased levels of CIT in the second task. Suggesting that previous experience of a decision task itself leads to an increase in the level of evidence based discussion. It might be hypothesised that this is in response to the feedback during the first task for supported panels or due to dissatisfaction with the first process they increase their level of CIT.

There is evidence in the data that there are effects of repeated performance on the task. The increase in the use of evidence or information based communication (CIT) over the two tasks regardless of prior exposure to support systems indicates a general learning effect.

This strengthens the earlier arguments that over time users of computer systems modify their behaviour, as they adapt and evolve apparently effective strategies for communicating ideas and tackling problems. It is likely that the users realised the lack of evidence based argument employed in the first task and increased the levels of this style of communication during the subsequent task.

It is unlikely that learning is solely responsible for changes observed, and some impact of the system, even if just focusing attention of the nature of the communication being used, is likely to have occurred.

Regardless of task or support system, little success has been achieved in the reduction in the level of PREF use. It appears that users are increasing the level of informational communication but not at the cost of reducing the levels of normative influence. The almost constant levels of PREF in conjunction with the increase in CIT emphasises the difficulty in determining the trade-offs between different forms of communication discussed in earlier chapters. Given that the levels of PREF are still over the levels predicted by the FTF groups it might suggest that more than just an adaptation to the keyboard and that, as was suggested earlier, there might be a minimum level of PREF communications, an absolute rather than proportional level, that is required to reach a decision via e-mail

6.8.4 Concluding Comments

The nature of support is such that there will always be an element of training. The concept of information as feedback and the effects on skills acquisition have been well documented (Newell, 1991; Ven Lehn, 1991) and learning through active participation in a task is a known method for acquiring the necessary skills (Anzai & Simon, 1979). The nature of support over subsequent tasks would be such that over time it would be expected that the number of prompts required by the support system would decrease. The reduction would occur as decision makers through their experience of the task and the support systems acquire the ability to communicate in the required fashion. In part this may be occurring already and is manifesting itself as an increase in CIT in the second task. The number of tasks over which this reduction would occur will vary across a number of factors; the length of time between tasks, external experiences of other forms of decision making, the individual learning rates of decision makers, these factors make the experimental identification of the process a lengthy and cumbersome one. However, some learning through support is almost inevitable.

It remains prudent for the continual operation of the support system to monitor the levels of communication to ensure that even amongst experienced decision makers, habits and processes detrimental to the successful outcome do not enter the decision process. Experiments 2 to 5 have suggested at potential benefits of support, attention now turns to

examining in greater detail the content of the communication that results from the prompting of the support system.

7.1 Introduction

7.1.1 Overview & Confirmation Bias

It has long been established in the individual decision making literature, that rather than falsify existing opinions, decision makers often seek supporting evidence for their position (See for example Evans & Over, 1996). In short, individuals seek confirmatory evidence rather than adopting a Popperian position of falsification (Evans, 1989). A practice that leads to the maintenance of the existing viewpoint rather than the discovery of information that necessitates a change in opinion.

Confirmation bias is one of the most well known and well studied biases to have emerged from the study of human reasoning. It has been shown that human beings have what might be considered to be a fundamental tendency to seek information that is consistent with their current beliefs. Furthermore, it has been shown that people will actively avoid information that might lead them to question their theories and hypotheses. In the study of individual decision making it has been identified (Baron, 1985) as the central problem preventing the application of rational decision strategies.

There is some debate as to whether the bias is a motivational bias, with people actively seeking to avoid information for reasons that can loosely be described as a desire to maintain existing belief structures. or a positivity bias with people confirming not because they want to, but because they cannot think of a method to falsify. Regardless of the eventual resolution of this debate, what is known is that attempts to overcome confirmation bias have been mixed in their outcome.

Mynatt, Doherty & Tweeney (1977) demonstrated that confirmation bias was not affected by instructions, that is individuals could not simply be instructed to falsify. It was, however, revealed that when they encountered evidence contrary to their beliefs that they could recognise the significance of this information and modify their position accordingly.

This finding offers encouragement for the process of group decision making. The formation of a group from a number of individuals, each with their own beliefs and therefore offering the

possibility of conflicting opinions may lead to the discovery of disconfirmatory evidence. Indeed, if there is conflict within a group, the likelihood of differences arising and disconfirmatory evidence being revealed might be expected to be high.

The work of Stasser and colleagues (Stasser & Titus, 1982, 1985; Stasser *et al*, 1987, 1989) reveals this not to be the case. Their work on “Hidden Profiles” reveals that even when information is readily available to individual group members that counters the position of the group this is not brought to bear on the decision. The group instead concentrating their discussion on shared, common information which by its nature confirms the current group opinions rather than acting as a dissenting voice.

This idea of confirmation bias occurring in groups is supported by Janis’ Groupthink Theory (1972, 1982b) where it is demonstrated that groups can be driven by the pressure for uniformity and therefore do not question their existing beliefs. The pressure for uniformity can manifest itself in the self-censorship of deviations from the apparent group consensus, a person in effect suppresses their own doubts about the current position to maintain the feeling of consensus within the group. A shared illusion of unanimity concerning the judgements merely confirms the currently false assumptions. In addition, pressure can be seen to be exerted upon those who do raise questions concerning the current beliefs. For a group to overcome confirmation bias an environment needs to be fostered in which doubts surrounding the current position held by the group can be questioned. In short, panels need to be able to raise a dissenting voice and create conflict and be able to pursue counter examples.

There is a danger that overcoming confirmation bias might be viewed as resulting simply from the increase in conflict or a reduction in status that enables people to question the beliefs. However, overcoming confirmation bias requires more than contradiction, it requires the seeking and recognition of counter examples. Counter examples that can then be brought to bear upon the decision.

The preceding chapters have established the possibility for altering the communication profiles of computer-mediated decision making groups to more closely resemble those of face-to-face groups. These changes have thus far been assumed to enrich the discussion process through the provision of a greater level of evidence or information based communication and a

relative move away from the normative based discussions evident in computer-mediated discussions. Although the measures employed in the experiments reported are relatively complex in nature, they provide what might be considered to be a relatively general impression of the communication content. The paradigm employed recognises both a repetition of existing information and the provision of previously undisclosed information in the same manner. That is, both the repetition of existing information and the provision of new information would be recognised as an increase in the level of CIT. If true enrichment is occurring as a result of the feedback provided by the support system, then there should be evidence of increased discussion of information not shared by all group members and/or an increase in the provision of information that conflicts with the existing opinions and information.

This chapter examines in greater detail the increased discussion of Citations of Case Fact (CIT) for evidence of conflict and provision of new information using a sub-set of the data from the experiments reported in the previous four chapters.

7.1.2 Causes of increased Informational Levels

It has been established in the preceding chapters that it is possible to increase the levels of communication in computer-mediated groups, and that decision makers can be encouraged to alter their communication profiles away from preference based discussions towards a more evidence driven discussion.

The greater dependence upon information supporting a decision outcome rather than a reliance upon personal or societal concepts of the “right” outcome has been advanced as evidence for the provision of an enriched discussion process. This process is considered to be richer due to the decision being based upon the exchange of factual information rather than upon the exchange of opinion. It is not that informational influence is good (reasoned arguments based upon evidence) and that normative influence is bad (compliance based and relying heavily upon personal opinion) as this would be to present a false dualism. Informational influence is considered to be a benchmark test for good quality decision making as a decision that can be supported with factual information has a stronger grounding. Personal opinion has traditionally been viewed as a weaker line of argument than factual

decision making. Indeed, it is often the case that the more information that can be provided in support of a decision outcome, the better that decision is seen to be.

In previous chapters the link has been drawn between an increase in evidence and an improved decisions making process, an improvement that ultimately results in a better decision. This is, however, not the only available interpretation of the data, the alternative view is that in response to pressure from an external force - the support system - to increase the levels of information based discussion the decisions makers respond by providing evidence that supports the existing preferences of either themselves or the group as a whole. Although such an alteration in the process does serve to enrich the decision, by providing greater support for the opinions exhibited it does not maximise the potential of the group: to maximise or at least greater utilise the potential group productivity (cf. Steiner, 1972) the support system should increase the overall levels of information discussed.

The groups examined by Stasser *et al* (1987, 1989) could only been said to be truly maximising their potential were they to reveal the hidden profiles within the dataset before them, that is they maximised the information available and brought it to bear on the decision. In the experiments reported in this thesis the decision making panels, if truly enriched, should maximise the information available to them and reach the best decision on the basis of all the information before them, not just the information that supports their initial preferences.

7.1.3 Biased Information Sampling in Groups

Numerous studies demonstrate the existence of biases in the information recalled and discussed by decision making panels. These papers draw upon the information sampling model of group discussion and reveal that panel members discuss common information (information held by all panel members) and that this focus on shared information increases in relation to panel size.

The work of Stasser and colleagues focuses on three-, four- and six-person panels and demonstrates that structuring the discussion process can increase the amount of information discussed. Despite this, the increase does not occur as a result of the addition of new, unshared information but rather “predominantly due to the discussion of already shared information.”

Information can therefore be viewed as being offered in support of current arguments, rather than to disprove alternative positions. As such decision makers can be argued to confirm their current position of preference rather than offering conflicting information that may suggest an alternative course of action, (cf. Evans' 1993 discussion of confirmation biases in hypothesis testing).

Persuasive arguments theory (Burnstein & Vinokur, 1977) proposes that a shift in preference results from the presentation of unique and persuasive material. If biased sampling occurs in the decision making process under examination then the discussion of shared information is unlikely to lead to alterations in the decision makers preferences, or that of the panel. Indeed this is a theme that Stasser and Titus (1985) themselves take-up:

“Burnstein and Vinokur (1977) are primarily concerned with the group polarisation phenomena, and in their analysis they assumed that the preponderance of unshared arguments tends to favour the initially most popular position... They thus concluded that unique arguments exchanged during discussion tend to bolster the initially popular sentiment within the group.”

From this position Stasser and Titus developed an interest in which the balance of information held by the panel indicated an outcome position that was different to the initially most popular position. In this case, according to the information sampling model, the unshared information will tend to be omitted from the discussion and will subsequently have little (or no) effect on the members preferences during the discussion. Indeed this has been shown to be the case, not only in the initial paper but also in subsequent studies (e.g. Kameda & Sugimori, 1995).

7.1.4 Expectations of Preferences

On the basis of this work it can be suggested that the effects of sampling information manifest themselves in the preferences of the decision making panel. As such the decision preference data collected in the Experiments 1 to 4 might reveal evidence of biased information sampling. One would expect there to be greater and more sudden shifts of preference in face-to-face panels and panels operating as if FTF (i.e. those communicating with the assistance of the directive communication support system (DCS) than those communicating in the traditional style of computer-mediated panels i.e. the unsupported and

non-directive communicate support (NDCS) panels. These changes should be apparent from an analysis of the votes data collected during the experiments.

So far the analysis of the data relating to the final decision reached by the various groups has failed to reveal a difference in the measures of decision outcome. This is unsurprising given the consistent absence of outcome effects in the literature examining decision making and telecommunications. Instead attention often focuses upon measures of the decision making process itself, that is, the way in which the decision makers arrive at their outcome.

Analyses in this thesis have so far concentrated upon the examination of the communication styles employed by the members of the group. These styles are revealed as the decision makers attempt to convey the information or outcome suggested by the case note databases. However, during the course of their deliberations they were asked at pre-determined time intervals to respond to the voting preference requests that originate from the MIMICS system. These preferences were requested at regular time intervals and presented to the decision makers as a way of enabling them to remain focused on the decision task before them.

It is likely that although the final decision reveals no insightful differences in the group outcome that these time-sampled preferences might show a difference in the way in which the decision outcome is reached. Treating the current preferences of each decision maker as a point in three-dimensional decision space, where their current preference (as expressed on the 5-point Likert scale) for each option provide the coordinates, permits an analysis of the movement of the current preferences to be undertaken.

Recall these data were collected independently, that is a decision maker might express the opinion that all three options are currently considered viable and thus rate all three as 5's or that none are currently being considered appropriate (all rated as 1's) or some point in between. Consider the three expressed preferences of a single decision maker at time $_n$. Their preferences might consist of a clear preference for either the first option; scored as a 5, and the second option, also rated as a 5 with a reluctance (at this point in time) to select the third option as the final decision and thus rated as a 1. When they are next asked to express their preferences, time $_{n+1}$, the preference for option 1 might have remained the same, but their feelings towards options 2 and 3 have converged leaving both rated as undecided (3's).

Therefore time_n might be expressed as the coordinates (5, 5, 1) and time_{n+1} as (5, 3, 3). Extending Pythagoras' theorem from two dimensions to three permits the distance between the two points to be calculated as the root of the sum of the squared differences (Equation 7.1)

$$\begin{aligned}
 &= \sqrt{\left(\text{Op } 1_{\text{time}_{n+1}} - \text{Op } 1_{\text{time}_n}\right)^2 + \left(\text{Op } 2_{\text{time}_{n+1}} - \text{Op } 2_{\text{time}_n}\right)^2 + \left(\text{Op } 3_{\text{time}_{n+1}} - \text{Op } 3_{\text{time}_n}\right)^2} \\
 &= \sqrt{(5 - 5)^2 + (5 - 3)^2 + (1 - 3)^2} \\
 &= \sqrt{0^2 + 2^2 + 2^2} \\
 &= \sqrt{0 + 4 + 4} \\
 &= \sqrt{8} \\
 &= 2.828
 \end{aligned}$$

Equation 7.1: The distance between the votes at time_n and at time_{n+1}

Thus the total distance moved in the decision space between these two times of measurement is 2.828. Calculating the distances between each successive set of votes permits the distance that a decision maker has moved in the decision space to be calculated, and enables a comparison between groups to be undertaken.

The flow of information in face-to-face groups is based heavily upon an exchange of information either in the form of CIT or INF. It might be expected that in response to this the decision makers will continually make minor adjustments to the way in which they view the options available as a final decision. In short they will make continual adjustments to their preferences as revealed by the votes data returned to the MIMICS system.

In contrast to this computer-mediated groups exchange expressions of preferences for decision outcomes and rely less heavily upon information that conveys the content of the databases before them. It is likely that this style of communication will result in larger changes in the decision preferences, seeing relatively larger leaps from one position to another, rather than a gradual change. Faced with a flow of information that relates directly to the decision being made, a FTF decision maker might be expected to alter their view on the outcome in a series of changes, each taking into account the new information recently made available, the persuasive nature of the information being reflected in each expression of individual preferences records by the experimental paradigm. In contrast to this, a CM decision maker receives information that reflects the opinion of the other group member,

information that is less likely to have an immediate and gradual influence, but more likely to cause what might be thought of as 'leaps in preference' in response to either the general weight of opinion or the arrival of an occasional piece of information reflected the specific content of their colleagues database.

When viewed in terms of the votes data this would manifest itself in a number of ways. Firstly, in its most simple manifestation when viewing the votes it would be expected that when examined in terms of change in preference and no change in preference, the CM groups will show a greater number of occasions where no change in their preference exists from one time to the next. FTF groups would be expected to show a greater degree of change, with fewer occurrences of no change.

Returning to the idea of distance moved in decision space, no overall difference in the total distance would be expected as the final outcome arrived at by the decision makers is often the same regardless of the communication channels through which it was reached. As the starting points (votes at the first time of measuring) often resemble one another, commonly being undecided across all possible options, or showing a preference for the most socially desirable outcome the distance between the first and last votes is often the same. However, the way in which they move between these two points in decision space might vary. Following the earlier arguments about the impact of the different styles of communication, the average movement across times would be expected to be less for FTF groups (small changes) whilst CM groups should make relatively greater movements within the decision space.

The value of undertaking such an analysis is perhaps limited, the pattern of preference predicted would reveal only the behavioural outcome of such a process. Conclusions about the cause of the change would remain at best tentative, and at worst speculative.

In the work driven by the information processing model the sampling of information for discussion is measured through an examination of the recall of participants pre- and post-discussion of all the information available to them (Stasser & Titus, 1985, 1987; Bodenhausen, 1988). Little attempt is made (or at least reported) to directly map the content of the communication to the content of discussion. An examination of the literature reveals that although plenty of work exists of tracing common themes and elements (Black *et al*, 1991) or examining the discussion in detail through qualitative methods (Antaki, 1985;

Mulkay, 1986), relatively little quantitative work has focused on directly tracing information back to its source.

The controlled environment of the series of experiments reported in Chapters Three to Five offers an opportunity to attempt to do just this. Although post-experimental measures of the participant perceptions are now impossible, the data collected enables (within acceptable margins of error) a reconstruction of the decision making process down to a minute detail. Given that the information on screen, the information communicated between panel members, and the current decision preference of each participant can all be recovered from the data, the ability exists to sample the information in such a way as to reveal the decision process in great detail.

7.1.5 Enrichment of Decisions

The 'gold standard' against which group decision processes are judged is the decision process where the panel members are equally free to contribute to the discussion, where counter opinions are sought and discussed, and where the final decision outcome is based upon the available evidence rather than normative influences. Although this standard is rarely achievable it follows that the greater the information discussed in the decision process, the better the decision. Consequently, the more information relevant to the task that is discussed the richer, the decision process can be said to be.

The primary purpose of the support systems examined in this thesis has been to alter the communication process of the groups to resemble the evidence driven communication of face-to-face groups. These changes have been achieved through an increased in information exchange that suggests a given course of action. These increases could be due to a repetition of existing known information or through the provision of *new* information not previously utilised in computer-mediated decision groups. Although both alterations can be said to enrich the decision making process, the discussion of new information leads to groups with a more varied and thus improved decision making process. The process would be still richer were this additional information to be of a conflicting nature. i.e. if when searching for [new] information to add to the discussion, group members seek evidence that conflicts either their personal preferred decision outcome, or the position currently favoured by the group as a whole and that this information can be brought to bear upon the decision.

The increased richness results from the greater variety of material discussed which ensures a wider consideration of available options, some of which will conflict with the preferred decision outcomes (cf. Janis, 1982, Steiner, 1982).

Evidence of the existence of conflicting information by group members would increase the benefit of the provision of intelligent support to computer-mediated decision makers. The remainder of this chapter explores the possibility that such changes occur through an examination of the data from the previously reported experiments. It is expected that groups operating under conditions of support will *more frequently* offer conflicting information for discussion than groups who communicate without support who will show a tendency for confirmatory evidence.

7.1.6 Citations of Case Fact (CIT)

Each utterance deemed to be quoted either from the casebooks has been previously classified by the experimenter as a CIT. Given that the quote has been drawn from the casebooks, the source of the information, and hence the weight of that information towards a decision can be traced. The nature of the casefile entries are such that a quote drawn from the source casebook entry reflects the overall nature of the material contained in that page of the databases. Therefore, a quote that suggests that the most appropriate course of action for the panel is the removal of the children into care will have been taken from a page of information in the casebook that itself suggests that children would benefit from being removed and placed into care.

With the exception of Experiment 1, all the coding within the thesis has taken place in real time. Unlike Experiments 2 to 4 the coding required for the analysis presented in this chapter has no such requirement. This permits sufficient attention to detail to be able to trace the CIT revealed in the transcripts of FTF and copies of e-mails in the CM conditions to the original sources. On the occasions when the possibility existed that the target CIT originated from more than one source, two processes were employed to resolve the conflict. The first was to examine the nature of the source material. If the two potential sources of the material offered the same or similar information, that is they were both concerned with, for example William, or they were both detailing the same incident from the same perspective then no difference in the data would occur if either entry were used, and the entry was

selected at random. If, however, different perspectives were being offered from the source material and the information it conveyed could relate to more than one of the children then a separate judgement was sort from two independent judges unaware of the nature of the coding and briefed only as to the need to identify the source of the material.

For example, the phrase “Lucie went to the Hospital for observation [CIT-da], having apparently been dropped on her head [CIT-da] whilst having been carried by a young child” [CIT-da] can be traced to the 38th entry from the Hospital Consultant’s casenote file, dated the 7th February 1977 which reads, “Lucie was admitted to the *Brook Hospital* for observation, having apparently been dropped on her head whilst having been carried by a young child three days earlier.....” More problematic is the utterance “Mary took a bottle of Tryptizol tablets” [CIT-da]. This phrase appears in both the hospital records and also those of the social worker. However, given that the speaker, in this instance, was the participant with access to the social welfare case notes the source of this material must be entry 30 (16th January 1976) rather than any of the other potential sources.

Additionally, the ranking studies completed prior to the analysis of Experiment 1, enable the strength of any information to be identified in terms of which decision outcome it supports. As such, a quoted piece of information (a citation of case face - CIT) could not only be traced back to its source, but can be identified in terms of the decision option that it favours.

Given the information sampling model, it would be expected that panel members when offered a piece of information suggesting a given course of action or preference will respond in kind with a piece of information supporting the same course of action. As argued elsewhere in the thesis, given the greater the greater occurrence of CIT in the FTF panels one might also expect that there is a greater likelihood of this information being of a more diverse nature, i.e. biased sampling of information will be greatest in unsupported CM panels, less so in CM panels operating with FTF patterns of communication and least of all under FTF conditions.

The decision panels operating using a highly normative style are unlikely to convey many Citations of Case Fact (CIT) and those that they do will more than likely convey information in support of their expressed preference as way of support for their position than offer conflicting information. Examining the flow of information between panel members in terms

of the decision outcome it supports, and the consistency with the preceding piece of information, enables the extent of confirmatory and conflictory information to be ascertained.

7.17 Summary of Aims of Analysis

It is predicted that the unsupported CM decision making panels will exhibit greater signs of confirmation bias than either supported (DCS) or FTF panels. Confirmation bias is operationalised in this instance as being the provision of quoted information that is related in content (either to the person or incident described in the proceeding utterance) but that offers a conflicting perspective. It is not sufficient to merely offer conflicting, unrelated information, but rather to be an attempt to offer a genuine counter example. For example replying to a piece of information concerning William being admitted to hospital as a result of neglect by his mother, Linda with information regarding William being mistreated on other occasions merely confirms the belief that William is 'at risk', countering with the information that the accident happened whilst William was in the care of the baby sitter, offers a genuine counter example to the idea that William is at risk of harm when with his mother.

7.2 Method

7.2.1 Overview & Selecting a Data Sample

The Citations of Case Fact (CIT) from panels examined in Experiment 2 (Chapter Three) and those utilising the VCS system in Experiment 4 (Chapter Five) were identified. The data presented in Experiment 2 (Chapter Three) offered the most variation in the levels of support offered to the decision panels. Although the prototype support systems examined in the experiment varied in the degree of success, at least when viewed in terms of the ability to alter the communication profiles, the contrast between the conditions offers the greatest likelihood of identifying differences in the levels of confirmation bias. Although this analysis allows an examination of confirmation bias *per se*, it is valuable to consider the degree of bias in the communication of panels operating with the visual support tested in Experiment 4 (Chapter Five). The visual communication support (VCS) system achieved the greatest success in enabling CM panels to communication in a FTF style, and as such presents an opportunity to examine the levels of confirmation bias in successfully supported decision making panels.

7.2.2 Conditions

The data from Experiment 2 provided four conditions: face-to-face (FTF-2), an unsupported CM (CMC-2) and two conditions assisted by a support system, the directive (DCS-2) and non-directive communication supported system (NDCS). In addition, Experiment 4 provided data from an additional unsupported condition (CMC-4) and also from panels operating in conjunction with a visual communication support system (VCS-4). Of these the utility of the NDCS system has been questioned, and therefore the appears little to be gained by examining data from panels under that condition. In effect, the lack of influence exerted by the NDCS system results in the groups operating with non-directive feedback communicating as if an unsupported CM group.

7.2.3 Materials & Procedure

The case materials, decision options and outcome measures for these conditions have been reported in earnest in Chapter Three and Chapter Five. In summary members of the decision panels were assigned to one of two roles that enabled access to either information from medical records or casenotes on the social service departments. Within a set time period, the panels were required to select from three (or four) pre-determined options the most suitable course of action. and convey this to the experimenter. Panels either operated face-to-face, via e-mail or via e-mail with the assistance of prototype communication support systems. Details of the procedures employed to collect these data have also been given at length and can be found in the sections where the data is first reported.

7.2.4 Treatment of Data

The quoted text from the e-mail and verbal utterances were transcribed and the location of the material in the original casebooks identified. This enabled the option supported by the material to be traced and the pattern of confirmatory/disconfirmatory messages to be ascertained. Rather than using utterance units *per se*, clusters of adjacent utterances were treated as one piece of information. Therefore a sentence that might contain two utterance units would be treated as offering a single piece of evidence in support, or in opposition of the previously communicated position. This is an expansion upon the idea of utterance units that was employed in the previous experimental chapters, it is not, however, equivalent to the traditional unit of analysis of a 'turn'. Previously, an utterance was defined as the smallest

unit of communication that can successfully convey information. The concept behind these combined utterances is to identify single events that have been quoted from the information before the decision makers. Frequently, although not always these combined utterances would consist of information contained in a single sentence from the casenotes. Returning to the example used earlier, “Lucie went to the Hospital for observation [CIT-DA], having apparently been dropped on her head” [CIT-DA] consists of two utterances units but would be combined for the purpose of this analysis as they relate to the same incident.

On occasions, such a combined utterance might comprise an entire turn, however, several combined utterances relaying information on different or related events may exist within a single turn. Each utterance or combined utterance was examined under two categories, the first concerned the child being discussed, William, Lucie or Mary (or their equivalents in Experiment 4), or whether it concerned all children, or non of the children. In addition to these five categories, these data were also coded as to whether they indicated care of the children, their hospitalisation or neither.

7.2.5 Sample Size

A number of the panels in the conditions fail to utilise informational influence to levels that enable a meaningful analysis. To ensure sufficient material sampled from the decision making process, the following analysis examines the most productive (in terms of informational influence) panels from each condition, in each experiment. To this aim, the four panels in each condition that relied heaviest upon informational influence (CIT) were examined. For these panels, the use of CIT was identified and separated for analysis.

Information was considered to be confirming evidence when the adjacent CIT conveyed information regarding the same child, e.g. two utterances from separate decision makers considering an event that happened to William, or two incidents involving admission to a hospital. To be considered to be conflicting a piece of information relating a negative event in the life of, for example, Lucie would have to be followed with either a similar incident with a positive resolution. Or more frequently, an event related to a negative event involving one of the children would be countered with a similar but positive event involving another of the children.

It should be noted, that the casenotes in the experiments were set to offer conflicting information regarding the health and welfare of the children. As such, one might expect there to be evidence of conflict between the panel members. Indeed, the purpose of employing this experimental design was to create a task where conflict existed that could only be resolved through a collaborative approach to the task. Evidence of decision makers replying to a previous communication conveying a negative incident involving one of the children with another negative incident involving the same child, can be taken as evidence of confirmation bias in their communication. Indeed, not only might this be viewed as confirmation bias being communicated but also in their reading of the case notes, as it is likely that there were more counter examples available to offer in return than there were pieces of supporting evidence.

The groups were selected on the basis of their high usage of CIT utterances. Twelve of the forty groups examined in Experiment 2 were used, a third being unsupported CM groups (CMC-2), a third being face-to-face (FTF-2) and the remaining four, being the most productive, in terms of CIT, of the panels receiving directive communication support (DCS-2). When combined the CIT communication of these groups consisted of 13% of the total communication in Experiment 2. The communication of panels reaching a decision in the first task of experiment four provided the remaining twelve groups whose CIT utterances comprised 3% of the total utterances observed. Four of these groups were unsupported (CMC-4) with the remainder being supported by the directive, visual communication system (VCS-4).

7.3 Results

7.3.1 Reliability of Coding

All transcripts were coded blind to the condition under which they occurred or the Experiment from which they were drawn. A subsequent intra-observer check upon the reliability of the coding, revealed a significant Cohen's kappa agreement coefficient (Siegel & Castellan, 1988; $\kappa = .75$). Where the coding differed, two independent judges, blind to the hypothesis were asked to interpret the information and trace the original source. Agreement between any two of the three judges -- the experimenter plus the two independent judges -- was taken as indicating a correct classification of the utterance.

7.3.2 Confirmation of Evidence Regarding a Given Child

Examining the codes on the basis of the child to which they refer in conjunction with the condition under which they were produced reveals little difference between the three conditions. Each pair of adjacent utterances was examined for the information it conveyed, therefore a message relating to William that was followed by a second utterance concerning an event in William’s life was treated as confirming evidence about William. Similarly, adjacent messages containing information about either of the other children, were taken as an indication of confirming information regarding them. In this way it is possible to trace the topic of interest through the discussion in terms of the child currently being discussion. This analysis of 447 combined utterances reveals that around 40% of FTF communication maintains the same topic of discussion (Table 7.1) and that these levels are reflected in the other conditions, both supported and unsupported.

| | | FTF-2 | DCS-2/VCS-4 | CMC-2/CMC-4 |
|-----------|------------|--------|-------------|-------------|
| Confirms | Raw Score | 99 | 40 | 26 |
| | Percentage | 31.88% | 36% | 44.9% |
| Conflicts | Raw Score | 150 | 42 | 31 |
| | Percentage | 48.3% | 37.88% | 53.4% |
| Uncoded | Raw Score | 61 | 29 | 1 |
| | Percentage | 19.6% | 26.1% | 1.7% |

Table 7.1 Confirmatory and Conflicting Utterances Regarding the Children

These scores should not, however, be taken as an indication of confirmation bias in the true sense of the word, they merely server to show the flow of the topic of conversation in each of the conditions, and that incidents concerning one child, were usually although not always, followed by another piece of information concerning that child.

Additionally, there were some differences in the extent to which each individual child was discussed. Of the combined units the eldest child (96 occasions) and the youngest child (96 occasions) dominated the discussed, with the middle of the three children, if arranged by age discussed least (56). Of the remaining utterances 140 concerned all three children and the remainder were uncoded as to the child they concerned.

Confirmation of Evidence of the Hospitalisation or Care of the Children

Examining the codes on the basis of whether they refer to the hospitalisation of, or the care of the children (Table 7.2) reveals a different picture.

| | | FTF-2 | DCS-2/VCS-4 | CMC-2/CMC-4 |
|-----------|------------|--------|-------------|-------------|
| Confirms | Raw Score | 152 | 33 | 32 |
| | Percentage | 54.56% | 32.35% | 40.96% |
| Conflicts | Raw Score | 58 | 41 | 11 |
| | Percentage | 20.82% | 40.18% | 14.08% |
| Uncoded | Raw Score | 68 | 28 | 32 |
| | Percentage | 24.41% | 27.44% | 40.96 |

Table 7.2 Confirmatory and Conflicting Information Regarding the Hospitalisation or Care of the Children

This suggests that where as the FTF panels will support the evidence offered by the other decision panel member 55% of the time, in effect exhibiting signs of confirmation bias, or at least not exhibiting a desire to seek and share conflicting information. The effect of computer-mediated communication is to reduce this level (41%), and that this is reduced still further in the presence of a directive communication support (DCS) system to around 33% communication supporting the previous utterance but nearly 40% presenting conflicting information.

The directive communication support panels are exhibiting behaviour that might be interpreted as providing conflicting evidence, that is when offered some information that suggests that the children are in danger, they provide information indicating their safety more frequently than they offer supporting evidence.

Examining further the transition matrices for the supported conditions (DCS-2 & VCS-4) reveals little overall difference between the directive support system and the directive support system supplemented by visual cues (Table 7.3).

| | | DCS-2 | VCS-4 |
|-----------|------------|--------|--------|
| Confirms | Raw Score | 16 | 17 |
| | Percentage | 30.18% | 34.68% |
| Conflicts | Raw Score | 25 | 16 |
| | Percentage | 47% | 32.64% |
| Uncoded | Raw Score | 12 | 16 |
| | Percentage | 22.56% | 32.64% |

Table 7.3 Confirmatory and Conflicting Information Regarding the Hospitalisation or Care of the Children of Support Panels

This suggests that the conducting of the decision via computer helps counteract confirmation bias. Indeed, encouragingly when the DCS panels are instructed via the support system feedback to increase the level of information they convey to the other panel members that they manage to do this, in a way that enriches the discussion (greater evidence based communication) but whilst avoiding falling into the confirming strategy that has been suggested FTF groups employ.

There remains a suggestion of greater effectiveness in the second experiment, however, the difference in the overall length of the experiment with a shorter time period permitted in Experiment 4 and hence less opportunity for the effects of support to fully occur might be advanced as an explanation for this finding. It is interesting to note that no differences exist between the levels of unsupported panels (CMC-2 & CMC-4) across the two experiments.

Taken together these findings suggest that there are differences in the levels of confirmation bias across the conditions, contrary to expectations the directive support system appears to suppress some of the disruptive processes observed in FTF panels. Namely, although FTF decision panels approach the task by exchanging information concerning the content of their respective casenotes, that they share information that supports what is already known. That is, when a piece of information concerning an accident that requires hospitalisation is communicated to the decision panel, the response is more frequently than not to support this information by communicating something from their own casenotes that confirms this to be the case.

In unsupported CM panels, there is evidence of conflicting information being exchanged, but the actual levels of CIT communication are proportionally lower than those exhibited by face-to-face panels. The directive communication support, has previously been shown to increase the use of CIT by CM panels. It is tentatively suggested by these data that not only is there an increase in the level of information exchanged, and therefore an increase in the level of evidence-based discussion, but that this is achieved without a reduction in conflict. This suggests that, the groups are communicating the information that they have before them to one another, but that they are doing so in a way that offers counter-examples to the previously communicated information.

7.4 Discussion

The findings from this examination of the content of the communication are encouraging, not only do decision panels follow the feedback provided to increase the informational influence in their discussions, but they do so in a way that suggests they are not as susceptible to confirmation bias as traditional, face-to-face groups. This remains a suggestion, as the offering of conflicting information is not the key to overcoming confirmation bias, for confirmation bias to be truly overcome requires recognition of the significance of the information on behalf of the group member. On the basis of this criteria the supported panels cannot be said to be overcoming confirmation bias. However, the mere increase in conflict greatly enhances the possibility of recognising the importance of the information being discussed leading to the rejection of currently held opinions.

A further examination of the information being read by the decision makers -- the uptake of information -- might also support these ideas, the underlying assumption being that the greater the uptake of information the greater the exchange of information. In theory, it is possible to match the communication received by an individual to their actions that follow it. It should be possible, although incredibly time consuming, to examine the immediate effects of receiving information from a colleague upon the reading of the casenotes. It might be predicted that having received an e-mail concerning the neglect of Mary, that a user operating under a DCS might offer some contrary evidence having sought this from their own casenotes. This is, however, highly speculative and difficult to examine fully.

What is suggested by these data is that there are some beneficial effects to be gained by making some decisions via e-mail with a support system. Effectively, the support system provides instructions to the group members on how they should communicate, not only do they increase their level of CIT, but they do so in a fashion that increases conflict, which aside from the enrichment argument, is a method known to increase the productivity in groups (See Chapter One, Increasing Conflict in Groups).

Stasser *et al* (1989) introduced a structured discussion procedure that increased the level of information discussed. Their manipulation was such that although the levels of information themselves increased, this was seen as an increase in the discussion of shared information rather than an increase in the levels of unshared information.

It appears that a secondary effect of the directive communication support systems requests for CM users to increase the informational influence is that they also increase the levels of conflicting information presented for discussion. This is a tentative conclusion based upon the transformation matrices of the data. However, the large differences in the percentages of information that either supports or disputes the previously discussed evidence and the reliability of the coding of this information suggest a further enrichment of the decision making process may occur.

It is encouraging that the decision panels do not tend to leap from discussing one child to another and that for the most part they stay consistent. This should not be taken as an indication of the lack of argument or a desire to counter the opinion of the other panel member as the changes between information that suggest the children are being neglected and require frequent hospital treatment is often countered with information indicating sufficient care of the children.

It is unfortunate that the samples do not permit greater recovery of the phases of discussion, as the earlier work of Bales and Strodtbeck (1951) and that of Black *et al* (1983) would suggest that it may prove fruitful to examine more than just adjacent pairs. Hoping to reveal more complex patterns of communication behaviour using techniques such as lag sequential analysis (See for example Bakeman & Gottman, 1997). Indeed, there may be merit in considering these findings through conversation games analysis (Kowtko, Isard & Doherty-Sneddon, 1991) which might give a clearer indication of the nature of these data

collected. This examination is not the central theme of the thesis, it is however a rather interesting by-product of the changes observed and may prove a fruitful path for further research.

The information sampling model and the studies that have examined it (Stasser & Titus, 1985, 1987; Stasser *et al*, 1989) have emphasised the ineffectual nature of group in discovering unshared information. It doing so they have highlighted the reliance upon the discussion of already know, common information. In the studies reported by Stasser (1992) it is possible to argue that the rejection of unshared information is a reasonable approach to the problem facing the decision makers, as the source of the information might itself be unreliable, and that other sources of information are corroborated by the existence in the knowledge base of more than one user. This cannot be considered a viable explanation of actions in this series of decision tasks. There are repeated references to most incidents ensuring the integrity of the data source, and the conflict inherent in the decision task manifests itself in the themes being discussed.

Clearly there are no hidden profiles to recover from the information presented to the decision panels, the information that comprises the case notes has been designed to create conflict, but not to systematically conceal a correct solution that can only be achieved through co-operation. It is a case of the participants own judgement as to the severity of the case set before them, however, it is encouraging to note that they are prepared to offer conflicting information and consider alternative courses of action. This is perhaps a result of the greater anonymity afforded to users of computer-based communication packages which creates an atmosphere in which conflict may occur. In the same way that the it is known that the removal of status permits conflicting opinions to be aired, the same process may well lead to this increase in conflict. Whether this is due to social identity, reduced social cues, or any of the other theories advanced to explain CM that are presented in Chapter One is immaterial, the outcome is the same, and that is of increased conflict, to coincide with the increased levels of informational influence.

The analysis presented here suggests that under certain conditions the computer-mediated decision panel will increase their communication concerning the case facts (CIT) and in doing so offer a conflicting perspective on the case being considered. This is an encouraging

finding, as it removes a doubt that has persisted throughout the course of the experiments. That is, the possibility of users merely repeating existing information that has already been discussed as a method for ensuring the required production of citations of case fact. Such an approach would appear to the support system as compliance with the target levels of communication derived from the informational influenced face-to-face groups and hence be viewed as an enrichment of the decision process. In reality, such an approach would detract from the decision and lead to a poorer decision process than the unsupported (CMC) decision panels.

Of course this analysis only considers the information that is discussed relative to the other information mentioned in decision process. It makes no attempt to consider the proportions of information from the databases that are actually conveyed from one user to another. Such an analysis would greatly favour the FTF conditions, and serve only to emphasise the differences in production rates that are well documented by the literature. Furthermore, although this approach has been favoured elsewhere (see for example Stasser *et al*, 1989) the information sources in those studies contained a level of overlap of information not present in the current series of work. It does however pose interesting questions for future studies.

In conclusion, although the work supports the idea that discussion maintains a focus on relevant issues, being both thematic and consensus confirming in its attempts to support existing or emerging patterns of preference (cf. Fisher, 1980b), it reveals that whilst one thread or theme -- in this case the child being discussed -- may remain constant, other themes -- hospital/care provision -- may serve to highlight conflicts between the decision panel members that enrich the discussion process.

8.1 Introduction

8.1.1. *Aims of this chapter*

This, the final chapter of the thesis has several aims. The first of these is examine the findings across the series of experiments reported in Chapters Three to Seven. These experiments explored different approaches to the provision of feedback and how successful this feedback was in creating CM groups that communicated in a FTF style. They also examined the impact of the system and the communication style it encouraged upon self-reported measures of the process.

The second aim of the chapter is to place these findings in a wider context. It will therefore, where appropriate, outline the experimental results and reflect upon how these could be integrated into the ever changing current literature.

Aim three will be to examine the extent to which these findings can be explained by existing theories of computer-mediated communication. That is the ability of the theories to predict or interpret the data collected.

The experimental design employed, involved a number of decisions that were almost arbitrary in nature, for example, the use of e-mail as a method of communicating via computer, or the choice of decision task. As such, they necessitate a consideration of the alternatives and how the other possible alternatives might have impacted upon the findings of this research programme. The fifth and final aim is to comment on the nature of the design of future support systems and to place the findings of this work in a wider, applied context.

It will be argued that the prospects for overcoming the difficulties of communicating via computer are mixed yet encouraging, and that the limitations presented are more a result of a gap between our understanding and the technology available rather than from a lack of understanding of group communication behaviour *per se*.

8.1.2 *Theoretical and Applied Objectives*

In Chapter One the theoretical and applied objectives of this series of experiments were outlined. The two main theoretical aims were to classify the communication behaviour of

decision making groups and to attempt to explain the causes and consequences of the communication behaviour exhibited.

In understanding the classification of communication behaviour it was necessary to relate the work across several distinct literature's which are only recently beginning to be integrated. Although researchers are moving towards greater integration of the research areas of interest to this work there is still room for closer collaboration. This chapter makes explicit the underlying themes that have guided this work and presents an integrated view of the findings. The consequence of this theoretical examination of the behaviour studied is the construction of a series of guidelines for the future development of intelligent based communication support systems.

8.2 Summary of Main Experimental Findings

Although an overall impression of the communication processes and the impact of intelligent support upon communication style has been given chapter by chapter, it is useful to consider the key themes and findings of the analyses of the data.

Experiment 1 (Chapter Three) identified differences in the communication approaches adopted by face-to-face and computer-mediated groups in solving the decision task before them. The communication of FTF groups was concerned more with the evidence and information supporting a particular course of action, than the opinions of individual group members. In a general sense it has been categorised as an information driven decision process, a process that could be considered to be high in informational influence and relatively low in normative influence. In contrast, CM decision making groups concentrated far more on normative influence with the exchange of opinions regarding the outcome of their deliberations central to their discussion process and concentrated less upon communication that supported their assertions with evidence from the casenotes. This style of communication was considered to be decision driven.

In addition to the findings concerning the communication styles of the decision panels, several self-reported indices of the decision process were taken. These revealed that not only were there differences in the process by which a group reached their decision, a decision that was ultimately the same regardless of whether it was reached by a panel communicating face-to-face or via a computer, but that there were also differences in the perceptions of the

decision and the decision process. FTF panels were, in general, more satisfied with the decision process and outcome, and found communicating easier than their CM counterparts.

The second experiment examined the possibility of providing group level support for computer-mediated (CM) decision panels. This support aimed to alter the communication styles of the CM groups to more closely resemble the processes observed in face-to-face decision panels. That is an attempt was made to adjust the proportional levels of three selected categories of communication within CM panels to levels equivalent to those exhibited by FTF groups. The levels of communication that concerned information cited from the case files (CIT), the degree of discussion of the available decision outcomes (PREF) and the extent to which the decision panels co-ordinated their approach to the task (PROC) were examined.

The degree of success varied, the feedback from the support system increased the levels of CIT employed by CM decision panels, but not to a level proportionally equivalent to that of FTF groups. The CM panels became more reliant upon information drawn from their casenotes but not to the extent that they might be considered to be information driven in the way that FTF groups are. The system was less successful in achieving a greater degree of group level co-ordination, and although a suppression of PREF was observed, the levels did not decrease to a level that could be considered to mirror the levels observed in FTF panels.

The partial success of the approach was attributed to the content of the messages provided by the group communication support system (GCSS), however, rather than speculate over the causes of the changes in behaviour, Experiment 3 examined this directly. Employing a paradigm that yoked the support received by one decision making panel to the levels of support received by another group revealed some interesting effects. Unexpectedly, the decision panels receiving communication support messages that had been sent to groups in Experiment 2, altered their communication to resemble some of the features of information driven decision makers. That is they managed to increase the level of CIT, although in this case without decreasing the level of PREF. Isolating the exact cause of the change in communication is problematic due to the similarity in feedback content that all groups receive. That is, most panels operate at levels below the target, therefore will receive instructions to increase the level of CIT within their discussion. As this itself, is a nature of the message that they would be likely to receive were they receiving support based around their own

communication the end result is the same. A message informing them of a discrepancy between their communication levels and the target levels of the system and frequently highlighting the need to increase a communication style.

An additional benefit of Experiment 3 was that the study revealed the importance of maintaining the credibility of the support system. The yoked nature of the experiment resulted in some decision panels, who were already communicating at high levels, being instructed to greatly increase their communication of a given style. The debrief and PEQ revealed that participants reported attempting to comply with this instruction but when this resulted still further in requests for increases, the credibility of the system decreased and further prompting was ignored by the decision panel members. A recurrent theme of this experiment and those that followed was the rejection of the feedback by some CM decision makers.

The forth experiment (Chapter Five) studied the effects of providing the CM decision makers with a visual (pictorial) representation of their communication process in comparison to the “gold standard” of FTF groups. As with the earlier experiments the prompting of the support system was successful in increasing the levels of factual information provided in support of a decision outcome (CIT), however, unlike earlier experiments the visual prompts enabled a greater suppression of the discussion of the outcome itself that resembled to some degree the deliberations of the FTF panels that provided the target levels of communication.

Although the findings of Experiment 4 were encouraging in terms of the possibilities suggested for the intelligent support of computer-mediated groups, the possibility remained that the decision panels would be better served by training in the use of computer systems rather than real-time support. Thus Experiment 4 also examined the impact of experiencing feedback from the group communication support system on a decision task and the subsequent effects on performance on a second, related task. Although decision panels exhibited the required information driven patterns of communication when the support system was present, they retained only partial information for subsequent tasks. That is, they appeared aware of the need to employ a communication style that involved the exchange of information, but were unable to do this whilst maintaining a balance in the levels of the other communication styles.

A consistent finding of these studies (Experiments 2 to 4) is that the members of the decision making panels are willing to attempt to increase their communication, when instructed to do so by the support system, but that requests for decreases are less frequently adhered to. The self report measures employed after each experiment reveal an almost uniform belief that instructions to increase communication are more important than feedback indicating the need to decrease a style of communication.

The final experimental issues were addressed in Chapter 7. Up to this point the increase in the levels of evidence based discussions had been assumed to be enriching the discussion process by enabling panels to base their judgements on a greater level of information. Chapter 7 presented an analysis of data from experiments 2 and 4 that explored the nature of the communication process further. The extent to which new information was added to the discussion was examined. The flow of information was considered to examine whether the information flow continued along a related theme, with group members offering information to confirm the position implicitly asserted by the previous communication or whether contradictory information was added to the discussion.

It is known that both individuals and groups are susceptible to confirmation bias. Encouragingly the flow of information suggested that not only do decision makers who receive communication support increase the levels of information quoted from the database, but that they do so with a degree of conflict. That is, although the general theme of the preceding utterances are maintained, there is a tendency to offer conflicting information regarding the state of the subject. For example, a group member may relate some information regarding the well being of the youngest child, Lucie and how she is well cared for. On approximately 40% of the occasions where such information is offered a piece of information supporting this assertion will be communicated to the group, however on approximately 60% of the occasions a counter example will be offered suggesting that Lucie is being neglected.

8.2.1 Summary of Secondary Experimental Findings

In addition to examining the style of communication employed by the decision making panels, several other interesting features were revealed regarding the satisfaction levels of, and influence levels exerted by the decision panel members.

The satisfaction levels reported by decision makers communicating via computer are generally lower than those of their face-to-face counterparts, however, there is some suggestion that rather than being solely determined by the mode of communication (computer or face-to-face) that this might be linked to the style of communication employed. That is, there is some indication of increased satisfaction levels being exhibited by computer-mediated decision makers who employ an information-driven, that is a face-to-face, style of communication.

8.3 Experimental Issues

8.3.1 Decision Task

The decision task selected was utilised due to the richness of the information that it contained, a richness that it was hoped would ensure experimental and mundane realism and result in the participants treating the task seriously. Outside of the laboratory, it is not yet typical for welfare conferences or care hearings to be conducted via e-mail, and therefore the ability to generalise to multiple other domains is limited.

The task was, however, typical in some manners of the type of task that might be conducted over e-mail in that it was rich in both its context and in the depth of the materials that could be brought to bear on the decision. The decision task could be satisfactorily solved through either a normative style of communication, or through the exchange of information. The flexibility inherent in the task possessed interesting questions for the participants as they strove to effectively communicate to one another. Indeed, most unsupported panels relied heavily upon normative influence as a mode of communication, however, once panels were made aware of the advantages of holding an evidence-based discussion many adapted to the keyboard interface and communicated as if face-to-face.

Participants computer experience is increasing and it is likely that the levels of communication and the difference in production rates between face-to-face and text-based messaging systems will decrease. As computer firms strive to produce and market reliable speech to text software the differences between production rates may well decrease, however, speech remains more than just the written word. With the advent of media that are no longer text or voice but both the prospects for developments within this field are likely to only be held back by the time taken to evaluate the tools.

There is presently no evidence to suggest that these are not task specific adaptations to the decision process, however, it is initially worth considering these differences and attempting to reduce them before considering the need to explore alternative tasks. Similarly, there is no evidence to suggest that the approach adopted could not be generalised to other tasks and that the form of support employed might be successful in other domains.

8.3.2 Target Levels of Communication

The method of coding the communication along the lines of the approach adopted by Kaplan and Miller (1987) was to ensure that both decision-drive (normative) and evidence-driven (informational) nature of the communication was identified. This is not to rule out alternative approaches, indeed other methods of coding the data might prove equally fruitful. The use of other methods of observational coding such Bales' Interaction Process Analysis (1958) would permit the effects of different communication styles to be examined. Generating target levels of communication on the basis of the levels of, for example, what Bales terms Task Area: Questions as a method of increasing the search for information and matching. Were suitable methods available in which to code actions then complex models of both the interaction process and communication content could be incorporated into such systems.

8.3.3 Laboratory versus Field Based Work

There is an on-going debate within the field of CSCW as to the relative merits of conducting studies within the controlled environment of the laboratory compared to the applied settings in which the system will eventually be designed to operate. The extent to which these concerns are considered pressing often appears to depend upon the scientific background of the researcher. Social scientists, for example, appear keen to exert control over the environment on which they are focused, wishing to eliminate the possibilities of confounds effecting the data and examining the variables within a tightly controlled environment. Anthropologists and ethnographers are keener see the wider picture, trading some of the control over the study for greater external validity. The debate is not close to resolution, and as with many of these debates it is highly likely that a place will be found for both approaches to continue to contribute to the development of understanding within the field.

This study is located very firmly within the experimental approach, although certain decisions were driven by the pragmatics of the areas of interest, for the most part attempts

were made to measure or control as many of the influencing factors as possible. In doing so decisions were made concerning the group size and the communication medium. It is unlikely that decisions on the social and medical well being of a family of children will be made by so few representatives of the different agencies with an interest in the case in question. It is also likely that there would be a greater degree of conflict with pressures external to the case conference being brought to bear on the decision. Studies of real life policy making, for example Janis' (1972) study of political policy makers, have shown how the often insular nature of a group and the way in which the need for consensus within a group and the requirement for the decision to be accountable exert considerable pressure upon the decision process and the outcome of the deliberations. Although a high degree of both experimental and mundane realism (Carlsmith *et al*, 1979) exists within the task, it is unlikely that the pressures that are borne by members of real case conferences can be simulated. As such, it is possible that the decisions made have polarised to a more extreme position than would be observed were the tasks to be repeated within an actual case conference environment.

8.3.4 The Use of Ad Hoc Groups

A related issue and one which any work of this nature must consider is the nature of the groups being studied. Chapter One reviewed the key arguments in the use of *ad hoc* as opposed to "real world" groups. It is prudent to return to this debate and briefly consider the extent to which the 'standard' criticisms are applicable to the studies reported here.

One of the criticisms often levelled at the use of *ad hoc* groups is the decrease in pressure both from internal and external source compared to existing groups. This lack of pressure and the lack of investment in the decision process and outcome can, it is said, result in a less serious approach to the task placed before the group members.

It is apparent from the transcripts that the participants took the task assigned to them very seriously. Often submerging themselves deeply into the parts. The gravity of the casebooks and the seriousness of selecting the correct option can be seen in the exchanges between members, for example an exchange in Experiment One between the Health Visitor and the Hospital Consultant; 'It's not a game or anything, we actually deal with people's lives here.' The role labels often became synonymous with the participants own names, with many participants answering questions about their own names with replies giving their role

assignments. Even where participants were known to one another outside of the experimental situation, the predominance of the use of role labels rather than names remains. Although this is partly attributable to an attempt to orientate themselves with the material, it also suggests a “taking on” of the roles assigned. Other examples of this exist within both the face-to-face and computer-mediated exchanges with people questioning the dedication of the different agencies and defending to the hilt the accuracy of their own agencies information gathering systems – a feature about which they were given absolutely no information.

Another criticism that can be levelled on *ad hoc* groups in this form of experiment is that identified by Monk *et al* (1995). Here the short term nature of the group and the novelty of the task can be compensated for by additional effort from the group members. “Since everyone is maximally focused and there are likely to be large differences in their ability to complete an unfamiliar task the lack of sensitivity is unsurprising.” Although a theoretically interesting observation, it is a somewhat difficult accusation to refute. Identifying the point at which novelty ceases resulting in a subsequent decrement in performance is problematic. Rather than rejecting a valid criticism, or attempting to ascertain the point at which this change occurs, it is perhaps better to use this knowledge to moderate the interpretation of any data. Remaining aware of the possibility of enhanced performance as a result of novelty.

8.3.5 The Use of Dyads

The original target levels of communication underpinning the support system development were constructed from four-person decision panels. The extent to which these communication patterns are generalisable to dyads was examined early in the thesis (Experiment 2) where it was discovered that both FTF and unsupported CMC panels exhibited patterns of communication that resembled those of the larger panels. This reduced concerns regarding the suitability of the model, however, questions remain regarding whether or not this constitutes group support.

Although care has been taken through the thesis to refer to decision making panels, rather than decision making groups, no distinction need be made between the two. As was argued in the introduction, a group is any number of individuals that can be considered a collective unit. They are bound by common standards, goals, interests etc. it is shared

behaviours, attitudes and actions that create the group rather than any numerical definition. Whilst the communication patterns between two, three or more people remain the same, the target levels of communication as applied remain valid.

8.3.6 *Groupthink Revisited*

The testing of smaller groups and the extrapolation of findings from larger to smaller groups has been shown to be a valid comparison. Experiment 2 considered the patterns of FTF communication in both two- and four-person groups and revealed strikingly similar approaches in their communication style to the task before them. The extent to which target levels of communication derived from these studies can be applied to larger groups is a somewhat more interesting discussion, and considerably more problematic.

Within larger groups, the possibility for the formation of sub-groups and smaller working parties with specific responsibility for designated duties exists. Indeed, a reading of the transcripts from Experiment 1 reveals several discussions between the medical based; Hospital Consultant and Health Visitor and Welfare based; Social Worker and Health Visitor that suggest a division of duties. There is some suggestion that the two pairings even begin to form in- and out-groups placing greater importance on information drawn from their combined sources and devaluing the information provided by either of the other two members of the group. This is noticeable where participants assigned to the medical roles conveyed doubts about the accuracy and value of some of the information offered by the other agencies.

It is known from the study of the Groupthink phenomena (Janis, 1982) that large decision making groups are prone to all number of biases and errors in process. These errors or as Janis' occasionally refers to them "forms of temporary derangement" (1982: 3) manifest themselves as a lack of vigilance and excessive risk-taking. The central feature of groupthink are signs of high cohesiveness amongst group members and critically for this discussion, an accompanying tendency for concurrence-seeking.

Given the tendency of computer-mediated panels to focus their communication on discussions of preference (PREF) and a known inclination amongst decision makers to seek information that confirms the current preferred decision state, it might be speculated that the support system proposed not only improves the quality of the decision making process but also creates decision making panels that are less prone to groupthink style errors.

Indeed Janis' (1972, 1982) theory of groupthink refers to a process by which a small group of decision makers subjected to intense stress may become more concerned with achieving concurrence among their members than in arriving at carefully considered decisions. Time pressure and emotional pressure all mount upon group members to create an atmosphere whereby stress increases. The unsupported CM decision panels reliance upon expressions of preference over and above their communication of citations of case fact, might be interpreted as a natural, and to a lesser extent predictable, response to external pressure. Not as in the case of Janis' original hypothesis (see also Flowers, 1977; Hensley & Griffin, 1986) pressure from another human source, but from the computer-experimental set-up.

8.3.7 Electronic mail versus other forms of computer-based communication

The choice to study e-mail was made as much out of convenience than any theoretically interesting reason for the study of e-mail based communication rather than other asynchronous or even synchronous messaging systems. The partially automated paradigm, MIMICS, that was developed and employed in these studies was developed with the express intention of using e-mail as the basis for computer-mediated communication. Were a paradigm to be developed that enabled the same interventions to occur, in say, video mediated discussions, then an examination of the effects would appear prudent. Clearly, there are greater user expectations and often misconceptions regarding what can be achieved through video-conferencing. The large body of literature that is concerned with the issue of eye-contact within this area only serves to heighten the perceived similarities between this form of mediated communication and face-to-face. As with any quickly expanding field, the innovative nature of the discipline and in this case technology creates an almost endless list of potential research projects.

Returning, however, to the issues surrounding e-mail enables some consider of the effects to be undertaken. The use of e-mail at home and at work is increasing at an immense rate, the training in the use of computers from a young age is increasingly common, and the fabled computer-literate generation may soon be upon us. If this is the case then the use of computer-based technology to hold discussions and to reach decisions can be expected to become increasingly common. It might be that the electronic discussion becomes just as common as the face-to-face meeting for the vast majority of people and with this will come the

associated problems of using CMC (See Chapter One). The goal of CMC research is no longer just to identify the shortcomings or advantages of the new technologies but to examine and guide the adaptation of the use to them. In this way the distinction between CMC research and CSCW experiments will continue to blur.

8.3.8 *The Comparison of FTF to CMC*

Although there is widespread acceptance of the comparison of FTF and mediated communication, from which a consistent pattern of findings have emerged (see for example Williams, 1977). There are limitations in any comparison between face-to-face and computer-mediated communication that are frequently “glossed over” in the literature reporting this area. This is usually due to the relative lack of space afforded to authors of journal articles, and obviously within a work of this nature greater attention can be paid to this issue.

The first issue which is often neglected regards the relative production rates of face-to-face and computer-mediated groups. The rate of speech in face-to-face groups is far higher than the rate of typing in computer-mediated groups. Furthermore, the keyboard interface restricts the production of communication differently across computer-users; typing speed varies to a greater degree than the speed at which people talk. The extent of these differences varies in relation to both the time pressure and task demands. The longer the time available for the discussion the greater the differences between the two medium. Both FTF and CM groups show an increase in production rates over time relative to their own initial base rates.

The differences in production rates will be moderated by the levels of competence exhibited by the users themselves. Establishing competence in the use of a system can be complicated. A number of possible approaches exist from the derivation of several tests of user ability (Reid *et al*, 1996) to allowing the users to define when they feel satisfied that they are capable of operating the system (McCarthy, Miles & Monk, 1991). Neither approach is truly satisfactory, the former *may* reveal sufficient skills in operating the system from an objective perspective, but may result in users who lack confidence in their own ability. The latter *may* lead to those being tested reporting feeling confident in their use of the system, but result in a discrepancy between their subjective perspective and a more objective measure.

Although neither approach is truly satisfactory in determining the level of participants competence prior to any experimental phase of a study, they both retain several useful

features. A combination of the two measures, which is implicit in both approaches ensures that not only are participants capable of operating the system before them, but that they *feel* capable of proceeding with the experiment.

One of the advantages of the use of subjective measures is the relatively low cost associated with this method of data collection. Although psychometricians would argue for the need to establish the reliability and various forms of validity of a scale, the analysis of single items without attempting to identify clusters of responses is commonly accepted within the field. The difficulties on which psychometricians focus are less of a problem if the “conclusions are drawn in terms of group tendencies rather than the classification of individuals” (Monk *et al*, 1995).

A related issue regarding differences in production rates is posed when analysing the data. Absolute differences in the levels of production potentially masks the more interesting effects, traditionally this has been overcome by examining the proportions of communication dedicated to each style of communication. Within this series of experiments the comparison between face-to-face and computer-mediated communication has been avoided where possible. Instead, the focus of attention has remained the differences in communication styles (and levels) of decision panels operating with support from different configurations of the support system.

Where comparisons between FTF and CM panels were required, the approach adopted in this thesis was to examine the proportion of total communication devoted to each of the styles of communication outlined in the coding scheme. In this way, the overall differences between a group that speaks at a rate of 10 words a minute, a group that types at a rate of 5 words per minute, and a group that types at a rate of 2 words per minute are removed. Having removed these effects the theoretically more interesting differences in the distribution of different communication styles could be examined.

8.3.9 E-mail (CMC) within the FTF Condition

The possibility of using e-mail within the FTF condition might be viewed as a potential confound, removing the distinction between face-to-face and computer-mediated communication. However, the inclusion of the e-mail within the FTF condition was to permit greater similarity between the FTF and CM conditions. Within CM groups, private

conversation is clearly private as other members of the group remain unaware of the conversation between a *temporary subgroup* of the decision making panel. In a face-to-face situation, private conversation, even if whispered is far from private. The other panel members can easily observe perhaps even hear the conversation, removing the private nature of the discussion. Furthermore, potential fears of a confound are further quelled by an examination of the e-mail usage by FTF groups. Such an examination reveals that decision makers in these conditions only used the e-mail once the final decision had been reached.

It is also worth digressing slightly to consider the implications of both speech and information retrieval occurring via the same channel in CM groups. CM groups cannot communicate and search the database simultaneously, however once more an examination of the transcripts reveals that it is rare for FTF groups to be searching for one piece of information whilst talking about another. Although this doesn't completely allay the fears, it does reduce them considerably.

8.3.10 Time Pressure and CMC

There are asymmetries in the time used by panels in FTF and CM conditions, leading to a greater potential time pressure in CMC but this is a recognised feature of the medium. Although the time periods allowed for the completion of tasks were generous in comparison to those often reported in the literature, the presence of this time pressure (however small) in the form of a deadline for the completion of the task may have a differential effect on FTF groups in comparison to the CM decision making panels. The presence of a deadline, and hence time pressure, may interact with the differing rates of communication (see Kelly & McGrath, 1985; Walther, 1992).

The time taken (or allowed) for a task, might be viewed in one of two ways; either time as experienced by the decision maker, or time as an absolute operative feature. Either interpretation is a valuable tool in the understanding of mediated decision making panels, the approach adopted here of considering slices of time is guided by the idea that a decision making group tackles the problem before it in a phased manner, and that the length of these phases relative to one another remains approximately equal, whilst the overall duration of the decision may vary.

8.3.11 Phases of Decision Making

It is a common assumption that most decision making groups adopt a phased approach to any decision making task (e.g. Bales & Strodtbeck, 1951). They acquire the information, evaluate it and discuss it amongst the other group members. The acquisition phase, perhaps indicated in these studies by a lack of communication between panel members and a concentration upon reading the databases varies in length from 40 minutes in Experiment One to 20 to 30 minutes in the later studies. Gersick (1988, 1989) reported a mid-point milestone in the discussion process. Identifying such a mid-point in the experiments contained in this thesis is somewhat problematic. However, no evidence exists to reject Gersick's ideas and several sources of information point the possibility of a mid-point.

The decision to slice the decision process into a series of phases of the process is very much an arbitrary one. Indeed, in the early studies (Experiments 1, 2 and 3) reported in the thesis twelve time slices are utilised in the analysis, however, in later experiments the decision process is examined in relation to four quarters. Smaller time periods perhaps offer a finer grained analysis of the decision process, however, against this must be weighed the practical difficulty of an increasing number of zero (or empty) cells in any analysis. The practical solution is to use sufficient slices to reveal the processes under examination but avoiding too many.

The shape of the pattern of citations of case fact also points to a mid-point. Examining the model of CIT constructed from the FTF decision panels shows a steady increase in communication over the first half of the task. The rate of increase of CIT climbs steadily over this period, and although it continues increasing in the final half of the study, the rate falls away. Perhaps this is indicative of a change of phase, and reflects the exchange of information over the first half and a move towards reaching a decision in the later stages. Indeed, there is some evidence to suggest (Chapter 3) that the CMC panels adopt a similar pattern to their communication flow, only it occurs at a lower level and lagging behind the time scale of the face-to-face groups.

8.3.12 Time Scarcity

It is possible that the effect of time pressure upon the decision has a direct bearing on the communication styles employed by the decision panels. Karau and Kelly's (1992) model of

attentional focus, suggests that in the later stages of the decision task, computer-mediated groups might realise the lack of progress being made towards their goal: a decision reached by consensus, and alter their communication strategy (i.e. increase expressions of preference) in an attempt to reach this goal. The use of PREF in Experiment 1 showing a steady increase of expressions of preference lends support to this idea.

As the deadline for a decision approaches the levels of communication increase. Studies of group decision making, for example Postmes *et al* (1994), show that as the time pressure increases there are often sudden and unexpected changes in personal preference. The issue here is that as the time for an experiment to end approaches, the participants realise that a successful resolution of problem before them is required and as a result will make large and unpredicted movements towards consensus.

Such issues are less pressing in this research due to the approach adopted in the analysis of the communication data. Rather than consider time to be an absolute variable with equally spaced intervals, the time taken to complete the task was divided into time slices that were equal units of the overall decision process. Although, the effects of this late move towards a consensus based decision will still occur, the impact of these changes is hopefully reduced as it is spread over the times periods rather than concentrated at one time. That is, if the move towards consensus occurs in, say, the final ten minutes this might be dispersed across more than one time period when the time slicing occurs.

One possible interpretation of the semi-successful interventions aimed at reducing the overall level of PREF in CM panels would be that the simultaneous requirement to increase in CIT required by the system, delays the onset of the change in attentional focus. The greater occurrence of citations of case fact (CIT) increases the likelihood of a resolution to the problem being derived, and delays the alteration in style to PREF based exchanges until later in the decision process.

Further support for this idea might be drawn from other sources (Reid & Hards, *in submission*; Reid & Hards, 1997) that show that where compromise is possible arguments under conditions of time-scarcity focus on positional statements necessary to reach a decision within available time frames. To summarise, the speculation here is that the changes in the

communication style of CM decision panels that are bought about by the support system reduce the time pressure on the groups and enable greater consideration of the evidence.

The counter argument to this, is that the decision panels examined in these experiments consistently reported receiving time limits that were “about right” for the decision task. That is, they didn’t feel under a great deal of time pressure, and were not using the upper end of the scale assessing their perceived time pressure. If this is the case, then a change in style towards a normative method for reaching a decision is less likely to occur. It is also worth noting that elsewhere speculation over the style of discussion employed by decision panels that results from differences in time spent reaching a decision has be discounted. Detailed analyses of this possibility on related tasks (Reid *et al*, 1997) revealed that “decision time to be directly affected by communication modality, and not mediated by discussion style.”

8.3.13 Expressions of Preferences

It is interesting to consider the influence of statements of position or preference. Is the influence exerted by such utterances best represented by a raw count of the number of these utterances or by the proportion of such communication in the whole discussion. Considering this point bears similarities to the ideas advance elsewhere in this thesis that in computer-mediated discussion the minimum number of preferences that need to be exchanged to reach consensus is higher than the minimum number required in face-to-face groups.

In the initial analysis (presented in Chapter Three) a difference between the proportional level of normative influence was observed. CM panels communicating proportionally more PREF communications than FTF decision making groups. It was also noted that the absolute, or raw levels of this communication style were quite similar in both frequency and distribution. It remains a possibility that there is a minimal level of the exchange of decision preferences that is required to reach consensus.

Furthermore, the restrictions of CMC have been interpreted elsewhere as promoting the idea that groups operating under these conditions, will at some point during the decision task alter their goal, from a “correct” to an “acceptable” resolution of the problem. Such a shift might be viewed as occurring if an increase in PREF based communication occurs in the later stages of an experimental task, at the same time as a decrease in CIT. This is, however, a difficult theory to test. The speculation of a trade off with informational influence giving way

to a normative style of discussion is partly confounded by the natural flow of the communication process. An initial exchange of information which is intended to enable a group to reach a decision will require some evaluation in respect of the possible decision outcomes. The evaluation, which is more than likely to be of a normative nature, discussing the potential solutions will follow the exchange of evidence. Separating the two concepts, that of a late evaluation of evidence that is quite normative in nature, from the idea of a trade-off between the normative and informational influence is inherently difficult as both explanations manifest themselves in the same way. Perhaps the use of subjective measures would offer some insight into the decision process.

8.3.14 Alteration in User Perceptions

Given the absence of decision outcome effects in any of the experiments reported, the alterations in user perceptions are possibly interesting. Had decision outcome *and* user perceptions both altered in the presence of the support system then the most obvious interpretation would be that the outcome itself has a strong influence upon the self-reported measures.

However, across the series of experiments the decision outcome remains almost constant and it is the communication process itself and the subsequent perceptions that alter. This would suggest that it is the link with the communication process rather than the outcome of the process that is the key factor in the perceptions reported by users, i.e. that perceptions are determined by the process of the decision, not the result.

Such a conclusion adds credence to the idea of intervention in a process where decision outcome remains constant in the absence of support, and where decision outcome is not altered by the presence of support. As the groups are *ad hoc* and have no existence outside of the experimental set-up there is no need for commitment to, or indeed, justification of, the decision itself. Were similar studies conducted in the field the findings would provide an interesting comparison.

8.3.15 Decision Outcome

Indeed, the problems of obtaining distinct differences in the outcome measures of an activity have been long established, and can be traced back to the early work on telecommunications (See Short & Williams, 1977). More recent discussions (McCarthy &

Monk, 1994) have focused less on the reasons for the lack of differences and concentrated on the theoretical importance of the differences.

It is well known from the study of human performance that people will protect their primary task to the detriment of any secondary activities that they are concurrently engaged in. The costs incurred by this action can be identified through an examination of process of task performance (Hockey, 1983). McCarthy and Monk (1994) argue the lack of outcome differences observed in many studies is unsurprising given the insensitivity of measures that look only at the primary task and that where studies examine the actual process of communicating (e.g. Sellen, 1992) rather than the product of this deliberation then effects of the medium are often found.

The argument of McCarthy and Monk is based upon the concept that differences in task outcome are only detectable if they are large and that the majority of outcome effects are small hence remaining undetected. More interestingly if a difference is revealed between the conditions being studied then the interpretation of this difference is somewhat problematic. The link between manipulation and outcome is clouded and determining how the effect occurred presents further problems.

Their argument can perhaps be summarised as a case study in good experimental design. Differences in outcome measures tend to address the issue of comparing two (or more) media, the assumption being tested is that one form will be better (or worse) than another and hence researchers attempt to discover an answer to this question. The difficulty lies in the question itself, the framework is too broad and the approach too general. Exploring the process by which an outcome is reached enables the researcher(s) to pose more refined questions, targeting specific behaviours that can be addressed in a more specific manner. The key to identifying theoretically interesting answers is in asking and attempting to answer, in a systematic manner, specific questions of a narrow focus. Unfortunately this is not an approach that has been readily adopted in this area.

The value of data collected from straightforward measures of outcome is limited when concerned with the evaluation and utility of new or existing technology. Given this perspective, the use of detailed studies of the process of arriving at the decision rather than studies of the decision itself have been advanced as the preferred method for obtaining

understanding of computer-supported co-operative work (Monk, McCarthy, Watts & Daly-Jones, 1995). From a position of understanding of the process it is possible to extend this knowledge to the evaluation of existing and new designs.

8.4 Information vs. Normative Influence

The processes examined in this series of experiments have explored the communication style of the decision panels. This exploration has concentrated on reducing the level of normative communication in computer-mediated groups whilst attempting to increase the informational influence. It is not that informational influence is good (reasoned, based on arguments etc.) and that normative influence is bad (based on compliance, personal opinions etc.) Turner's work amongst others criticises this false dualism, and that *true* social influence is an interaction between the two. Spears and Lea's work applies Turner's Social Influence framework to CMC and argue that people may be prone to a more normative basis of social influence/group polarisation and criticise the informational explanation of polarisation in this context.

Traditional influence paradigms cast the participant in somewhat of a passive role. It is clear that this is a gross oversimplification of the process, an actor is both influenced by and influencing other members of the group. This too distant from the approach of self-categorisation theory and its approach to influence.

One of the ideas that underpins the approach adopted in this thesis is that studies of verbal behaviour in computer-mediated (CM) and face-to-face (FTF) groups show that the medium through which communication occurs fosters different argumentation and conversation styles during the group decision making process. The long-standing but rarely examined notion that CM interaction is bereft of normative influence in comparison to FTF communication is shown to be false.

That normative influence may dominate in computer-mediated communication is theoretically young, the idea that this normative influence can be overcome is younger still. In a purely ostensive stance, informational influence is better in the context of this task paradigm, as it utilises as much of the available information as possible. Although informational influence can be considered to be a benchmark test for good quality decision making, and by implication normative influence indicates a poorer quality decision Kaplan

and Miller (1987) argue that this is very much task dependent. Some problems are very much factual judgement, others more normative in nature. It is important to note that the task chosen in the series of experiments presented is very much *both* factual and normative.

8.5 Interpretation of findings in light of Current Theories

The data collected across the course of the experiments offers different levels of support for the current theories of computer-mediated communication. Considering reduced social cues, SIDE and the developing threshold theory of CMC, different interpretations of the data are possible. No single theory offers a completely convincing account of the data, however taken together some understanding of the processes at work are possible.

8.5.1 Threshold Theory and Support Systems

Threshold theory is a new explanation for some of the findings observed in the CMC literature. The theory being developed (Reid *et al*, 1996) holds that the people communicating via computer systems evaluate (either explicitly or implicitly) the costs of sending a message relative to the potential value of the message; either in terms of the contribution of the message to the discussion or the perceived value of any response to the message.

This theory follows from recent theoretical moves (Lea, 1991; Spears & Lea, 1992, 1994) in interpreting the “social meaning of computerised exchanges and the manner in which electronic media are perceived by users as tools for accomplishing specific tasks.” (Reid *et al*, 1996). The theory reconceptualises Kraut, Galeghar, Fish and Chalfonte’s (1992) classifications of media on the basis of expressiveness and support for interactivity in terms of the “transaction costs to the user.”

A threshold theory account of the relatively high presence of expression of preference (PREF) would be that the decision panel members evaluation of the utility of PREF would be greater than the actual utility. Users of CMC believe that knowing the currently favoured option of both themselves and other members of the panel is of considerable use in reaching a joint decision. Similarly the low levels, relative to FTF groups of Citations of Case Fact (CIT) suggests that the decision makers perceive the cost of reproducing quotations from the database relative to the value of this action as low.

The actions offered of the support system, where target levels of the communication of face-to-face groups are presented as an example of successful groups is to show the “true” value of the utterances. PREF are shown to be of a lower value than perceived to be the case by CM decision makers. The support system corrects or at least adjusts this perception. Decision panels that incorporate this adjusted value into their communication behaviour then operate at lower levels of PREF than unsupported CM panels.

The value of CIT is shown to be greater than their perceived value. Users adjust their communication accordingly. Given that the actual cost, even if just viewed in terms of the time taken to locate the information and then to reproduce it in the e-mail system is high, it is testament to the power of the system that the required adjustments are frequently made.

The cost of producing PREF remains low. These utterances are frequently short in length and often included at the end of other messages. The effect of “tagging” these messages to the end of other communication is to lower the production costs, and it is perhaps the low production cost associated with this form of communication behaviour that results in the continued high number of PREF observed in CM panels, even when assisted by the communication support system.

A brief examination of the occurrence of some other styles of communication, lends further support for the concept of a threshold in the generation of e-mail messages. The occurrence of Materials/ Computer/ Context (MAT) style communication follows a trend for inclusion at the end of other messages containing either evidence- or preference-based discussions. Such occurrences would be predicted by the theory. Usually the cost of sending such a message, often concerned with the computer system itself is high and the value of the answer, when measured against the rate of discovering the answer through trial and error is low. It might be speculated that the pressure of time, the availability of discovering the answer via other methods, the availability of alternative courses of action all influence the likelihood of it's composition. These factors all decrease, if there is the possibility of “tagging” the question onto other mail, decreasing the overall production costs. Further support is leant to this by both Kraut *et al* (1992) and Hiltz *et al* (1986) who present similar findings.

The cost of asking or answering questions can be reduced, Camino, Milewski, Millen & Smith (1998) demonstrate the effectiveness of providing e-mail users with semi-structured

messages for replying to incoming messages. In their study, these responses often consisted of the selection of the required response from a predetermined list, and the authors suggest that “structured responses objects can be a useful tool to increase the convenience and efficiency of electronic messaging,” incorporating such a feature within the system proposed here would possibly enable the levels of communication in other categories identified by the coding scheme to more closely mirror those levels seen in FTF decision making. The communication style most likely to benefit from such a feature would be Materials/Computers/Context (MAT) or any form of communication likely to drop in CM discussions due to the operation of a threshold filter.

Returning to the central theme, the explanation of the success of the directive communication support, the support establishes the true utility of a message. Although the costs of production of CIT remain high, the notification of their utility towards the decision -- recall the model was presented not as a FTF style, but the style of successful panels -- enables users to conclude that the cost of production is outweighed by the benefit to the decision process.

8.5.2 Reduced Social Cues and Support

Trying to interpret the changes in communication behaviour of supported compared to unsupported groups in light of the Reduced Social Cues theory of CMC is somewhat more problematic. The idea that the lack of social cues present in CMC, or that CMC in some way filters out important cues present in FTF communication has to be stretched slightly to account for the changes observed.

One possible interpretation is that the removal of the visual feedback inherent in the nods, smiles and other verbal cues helps to signify the information that is both interesting and useful information in determining the types of communication that is beneficial to the decision making process. In CMC the absence of such cues in identifying useful information removes some of the richness of the communication process. The removal of what amounts almost to a feedback loop in the communication process, restricts the ability of the decision panel members to shape their discussion according to useful information.

The explanation however is somewhat tenuous and a more credible interpretation is that given the presence of high levels of normative communication behaviour, itself somewhat at

odds with reduced social cues theories that the theory lacks immediate application in the specific domain of communication support.

8.5.3 SIDE and Support

In Chapter One it was concluded that one of the main contributions of SIDE theory was that subjective responses to CMC systems and the contexts of their use are of great importance to CSCW. That the information communicated between decision makers reflects a number of aspects of their current preference, position in the decision process etc. is clear.

The provision of target levels of communication at a group level serves to heighten the social identity of the group, over that of the individual. The increased salience of the group may create a stronger desire amongst group members to successfully tackle the problem than those operating in unsupported conditions -- here the salience of the group is lower, as the attention of the decision panel members is not drawn to group processes other than at the time reminders.

SIDE theorists might argue that the impact of the model begins and ends with enhancement of group identity, however if this were the case then the differences suggested by the analysis in Chapter Seven of increased conflict in the discussion of information would not be expected. The presence of these effects suggests an alternative explanation is needed, and for this threshold theory retains the greatest appeal.

8.5.4 Conclusions about Interpretations of Support

Of the accounts presented it is perhaps the threshold theory that most satisfactorily interprets the data presented, encompassing not only a feasible account of why the support is successful but also an explanation of some of the other forms of communication. Some questions regarding the support system remain and it is to the question of the operation of the models and the generalisability of the findings that attention now turns.

8.5.5 Group Level Intervention

Before considering the extent to which the findings from the social-welfare task can be generalised it is worth considering the nature of the interventions. Communication support occurred at a group level, rather than monitoring the level of communication by each member of the decision making panel and intervening at this lower level.

It is well documented that computer mediation equalises the participation of individuals, removing the effects of status. It is also well known that in a decision making environment, regardless of the medium employed to communicate, that the opinions of experts are sought and will hold greater sway than non-expert opinions. Supporting communication at a group level enables the decision makers to communicate with greater flexibility than a system intervening at an individual level. Assuming that the equalisation of participation will prevent any one panel member dominating the discussion process, the group level intervention enables the decision panel greater flexibility in the contributions made to the decision process.

This removes the danger of the software becoming over restrictive and preventing existing user practices to occur within the new system. In doing so, the probability of successful implementation of the system is greatly enhanced.

8.5.6 Generality of Communication Models

The studies within this thesis concentrate solely on one form of decision task - that of a social-welfare judgement. The extent to which the models derived from this decision task can be applied to other domains remains undetermined. Both the absence of decision outcome effects and lack of consensus across panels as to the most appropriate solution suggest that there is no demonstrably correct solution to this problem.

Subtle, yet important variations in the task materials and the available outcomes were employed throughout the series of experiments reported. These differences allowed a small, albeit significant examination of some of the effects of task type to be undertaken. In all cases the effects were negligible, indeed the styles of communication approach has been employed in other studies (Holtgraves, 1997; Reid & Hards, 1997) and the data reported in these papers suggests decision makers adopt a similar communication style when discussing controversial topics.

The extent to which the target levels of communication can be extended to other communication tasks is of a less pressing nature than might be imagined. The key to all these studies is not that the communication profiles of CM decision panels discussing social-welfare issues can be shaped to resemble FTF panels, but rather than it can be shaped at all.

The exact form of the targets are of secondary concern to the nature of the prompts, other levels could be established for different tasks and employ similar approaches. However, what evidence there is regarding CM discussion suggests a reasonable chance of success if these target levels were employed elsewhere. Where the system may fail is in situations where the communication is a secondary activity, for example the co-ordination of another activity such as the collaborative production. In this case, it could be expected that the both the style and content of the communication would differ from those exhibited in these studies.

8.5.7 Discrepancies in the levels of communication

The purpose of the communication support system is to focus the decision makers attention upon their communication style and to affect changes in the levels of communication. The support highlights the differences between the actual communication levels of the user, and the levels determined by the FTF panels, this is however not the only possible source of discrepancies between the communication and the target.

The target levels held by the support system are the accurate representations of all communication that has been *sent* by the members of the decision panel. It is not necessarily the level of all the communication *read* by the decision makers, as sent messages may remain unread in the users in-tray. This leads to the first potential discrepancy between the representation of the communication and the actual communication levels. Assuming that users generate some form of representation of the groups communication, this representation will consist of all messages they have *read* and all messages they have *sent*. A second member of the same group, will have the same representation, if and only if *all* the communication has been read by *all* the members of the panel. Discrepancies occur between one user and another, or one user and the support system when messages remain unread. Admittedly, the number of unread messages, and hence room for discrepancy in the experiments reported is low. In a two member decision panel, the possibility of messages arriving simultaneously is low, as composition of messages tends to occur sequentially with a user composing and sending one message at a time. The possibility of unread messages increases as the number of decision panel members increases, with each additional group member the potential of two messages arriving together increases.

Potential discrepancies could exist between the sender and the support system (if there is a delay in coding), the support system and the receiver (if there is a delay in reading), or the sender and receiver (delay in coding or delay reading). Within the current system, the possibilities for such delays to occur are limited, however, in larger panels the possibility remains. Ensuring delays between the completion of the composition of a message, the sending, coding and reading are avoided is essential to the maintenance of the integrity of the system.

Carver and Scheier (1981) argue that the continual presence of a discrepancy between the users state and the comparison or source of the feedback results in an aversive self-focus. The negative affect of continual comparison with the source that reveals discrepancy is an attempt to remove the possibility of further comparison. In effect, Carver and Scheier have predicted the disregard of the feedback by panels in Experiments 2 to 4. The divergence between the panel's representation of communication and the target FTF model reaches a critical point beyond which further comparisons are ignored due the negative feelings they induce in the decision makers.

Robinson and Weldon (1993) would counter this argument with the suggestion that in some cases the need to improve poor performance may be stronger than the need to evaluate oneself in a positive light. However, in the case of the experiments reported here, the perceived utility and validity of the source of the feedback results in a disregard for the feedback as being inaccurate or of low value enabling the decision makers to continue employing the communication style they desire. This is by no means a new phenomena, Bandura and Cervone (1986) also emphasise the direct bearing upon an individuals self-confidence of evaluative feedback.

This merely serves to strengthen the consequences advanced by Ilgen, Fisher & Taylor (1979) that the perception of feedback is determined by three key factors (a) the way it is perceived, (b) its acceptance by the recipient and (c) the willingness of the recipient to respond to the feedback. The experiments reported here offer no evidence to counter any of these issues and taken together serve to emphasise that regardless of the quality of support system it is the user perceptions of the system that determine the ultimate utility of the information

it provides, a factor maintained by the success of feedback provided by Gowan & McNichol's (1993) GDSS system.

8.5.8 Self-Monitoring Skills

A related issue is in the self-monitoring ability of the decision makers. The system provides a source of information regarding their communication, yet this only has a continual presence in the later experiments, elsewhere the monitoring must be performed by the user. Schoenfield (1981) demonstrated that experts are better equipped to monitor their own problem solving processes than novices, concluding that metacognitive or managerial skills are of paramount importance in human problem solving. Other studies examining problem solvers in different domains (Larkin, 1983; Jeffries, Turner, Polson & Atwood, 1981) support this view. The idea advanced is that experts possess a greater number of domain specific schemas for deriving solutions to the problems with which they are faced. They also are better equipped for assessing the difficulties of the problem posed. If this is the case, then experts have a performance advantage over novices in the selection of a schema which appears to fit the problem, and the subsequent assessment of the match between the scheme and the problem.

This lends support to the earlier arguments regarding the relative impact of feedback as support compared to its instructional value (Chapter Six). The greater the experience of the system that a participant has and the more they communicate with support to resolve similar problem, the less the expected requirement for supporting prompts.

8.5.9 Further Developments of the System

"In any period of rapid technological growth and innovation, the first priority is to demonstrate that an idea is feasible at all" (McCarthy & Monk, 1994). The semi-automated prototype that has been developed over the course of experiments, demonstrates the possibilities for altering the decision making process on the basis of communication style.

It has been suggest that it might be possible to develop target levels of communication on the basis of FTF decision making and that these targets can be applied to CM groups. The positive benefits of the system, through an enrichment of the decision making process could be achieved by increasing the reliance upon informational influence and decreasing the attempting to reduce the presence of normative communication. The problem remains for

participants over the nature of the material that they must convey. The problem for the experimenter remains how to convey this information to the participant. Different forms of computer-based media will permit different styles of communication, and as the media richness literature shows are dependent upon the interaction between task type and media.

One question that must be addressed is the prospect for the development of the system from a semi-automated prototype to a fully operational support system. The technological advances that occurred in computer support and the development of intelligent agents and smart software offers one possible route for expansion of the system. The existence of intelligent agents that can learn from the user, developing an Adaptive User Model (AUM) that develops in relation to the users behaviour are well documented (Selker, 1994). Although the first steps in the technology have been small, the possibility for future developments is vast (Indermaur, 1995). Communication agents that develop models of the communication used during the successful completion of a task, and apply these models to future communications remain a distinct possibility. It is, however, unlikely that these issues will be resolved in the near future, there are many possible avenues for the technology to explore. Important decisions are still frequently made in a face-to-face environment rather than dispersed over a computer network.

In reaching this conclusion, it is important to consider the existing possibilities for the development of the system. The findings from studies of early configurations of CSCW that required the users to code their own communication have shown that the systems quickly fail if they place too heavy a demand on the users (Tatar *et al*, 1991). The prospects for future developments of real-time automated natural language processing (Brill & Mooney, 1997; Walter, 1998) remain variable. What has been demonstrated is that the approach adopted might enable change in communication content to be observed, if the conditions are right.

8.5.10 System Recommendations

Before reaching any final conclusions on the nature of the work it is worth reiterating the key findings from the perspective of decision support. It has been shown that a system based upon occasional prompts that inform users of the discrepancies between their own communication and that of a “desirable” target can shape communication behaviour. These

prompts occur successfully at the group level, and enable users to determine their own approaches to achieving the targets set by the system.

Supplementing this information with a visual record of the communication and a representation of the required model enhances adherence to the system, however the system only retains the ability to shape behaviour whilst it maintains its credibility as a source of information. Experience of a single task with support in the form of communication feedback has short-term lasting effects, whether these can be retained for subsequent tasks or those spread over a longer period of time remains unknown.

In effect, what has been demonstrated is that simple prompts from a simple system might have a dramatic and beneficial impact on communication behaviour and decision processes of electronically distributed decision making groups.

8.6 Conclusion

It is possible to conclude that computer-mediated and face-to-face groups tackle decision making tasks using different styles of communication. The styles might be summarised as being either one of employing informational influence (FTF) or depending upon normative influence (CMC). The feasibility of providing intelligent communication support to enrich CM decisions and overcome this dependence upon normative modes of discussion was examined, through various configurations of support. It was discovered that CM panels can be instructed to alter their process and will sometimes comply with these instructions providing the source of the information maintains credibility. It also appears that a minimum level of communication of normative communication is necessary to select a joint, group decision and that this level is higher in CM than in FTF panels. Finally, the prospect for developing fully automated intelligent support that overcomes the difficulties users experience in communicating via computer is greater than it once appeared. Although, further studies need to systematically examine the transfer of skills from one task to another, the prospect of interventions based at a group level remain promising.

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Appendix A1 Coding within MIMICS

A1.1 Automated Key Strokes

Automac is a commercially available piece of software that enables sequences of key strokes to be recorded and assigned to a single key. Thus, the selection of an entire document which would normally be achieved on the Macintosh through the use of the Command key in conjunction with the A, followed by it's cutting (Command-X), the move to another application (Command-Tab), the creation of a new file (Command-N) and the pasting of the information into the new file in the new application (Command-V) can thus be recorded and assigned to a single key press, for example the 1 on the keypad.

Through Automac it was possible to pre-record a number of functions (Table A1.1 below and overleaf) that were potentially either time-consuming or complicated and reduce the performance of these functions to a single key press. For example the entry of the codes assigned to each member of the group, or the entry of the data concerning the communication codes could be reduced to a single key press, that would also set the cursor at the required point for the next piece of data.

| Macro | Key Press | Function |
|--|--|--|
| LHA (Sender) CIT (High Level) | Keypad 1 | Copies time from previous line of spreadsheet, tabs cursor to the sender cell, enters 'LHA' and tabs to next cell, the high level code and enters CIT |
| LHA (Sender) INF (High Level) to LHA (Sender) VAL (High Level) | Keypad 2 to Keypad 9 | As for LHA CIT, but with relevant code (INF, LEG, MAT, OTH, PREF, PRESS, PROC, VAL entered into high level code cell |
| DSS (Sender) CIT (High Level) to DSS (Sender) VAL (High Level) | Command and Keypad 1 to Command and Keypad 9 | As with those detailed above but with sender details entered as DSS and the colouring of all text in that row red (to ease identification and help prevent errors when checking) |

| Macro | Key Press | Function |
|---|-----------|---|
| Question (Q) entered as low level code | Keypad * | Enters 'q' into cell for low level code, tabs to the text cell into which it pastes the subject line from the cell above, and into the next cell repeats the function for the time of receipt. The cursor is then returned to the beginning of the next line for the next entry and the spreadsheet calculates the delay between sending and receipt in the final cell. |
| Direct Assertion (da) entered as low level code | Keypad - | as Keypad * but with 'da' entered into the cell for low level codes |
| Answer entered as low level code | Keypad + | as Keypad * but with 'a' entered into the cell for low level codes. |

Table A1.1: Data Entry Macros for coding the communication into the spreadsheet component of the MIMICS paradigm

The result of the macros can be seen within the portion of spreadsheet shown in Figure A1.1. For any given row of the spreadsheet, columns A to C have been entered by one Macro, and columns D to H with a second.

| | A | B | C | D | E | F | G | H | I | |
|----|------|------|------|-----|-----------------------|---|---|------|---------|---|
| 1 | TIME | SEND | HIGH | LOW | Message Header | | | Rcpt | Latency | |
| 78 | 61 | DSS | Cit | a | RP: paracetamol reply | | | 63 | 2 | ↑ |
| 79 | 61 | DSS | Inf | da | RP: paracetamol reply | | | 63 | 2 | |
| 80 | 58 | LHA | Pref | q | Decision | | | 63 | 5 | |
| 81 | 58 | LHA | Pref | q | Decision | | | 63 | 5 | |
| 82 | 58 | LHA | Proc | q | Decision | | | 63 | 5 | |
| 83 | 58 | LHA | Pref | q | Decision | | | 63 | 5 | |
| 84 | 64 | LHA | Inf | da | RP: paracetamol reply | | | 65 | 1 | |
| 85 | 64 | LHA | Inf | da | RP: paracetamol reply | | | 65 | 1 | |
| 86 | 64 | DSS | Pref | a | RP: Decision | | | 65 | 1 | |
| 87 | 64 | DSS | Mat | da | RP: Decision | | | 65 | 1 | |
| 88 | 64 | DSS | Proc | da | RP: Decision | | | 65 | 1 | ↓ |

Figure A1.1: A sample of a coded spreadsheet.

The final column I has been automatically calculated by the spreadsheet as the difference between the time of sending (column A) and the reading (column H). The lower portion of the spreadsheet (Figure A1.1) was designed to automatically calculate the total number of utterances that fell into each of the nine high level communication categories (cells C571:D579) using the DCOUNTA function which counts the cells within a predefined range, in this case where the high level codes were entered. Any match for the high level

communication three letter code CIT within the area of the spreadsheet designated for high level codes (column B in Figure A1.1 above) of the spreadsheet would be counted towards the total displayed for CIT style communication in cell D571.

| | C | D | E | F | G | H | I | J | K | L | M |
|-----|---------|-------|---|-------|------|------|-----|-----|-----|------|-----|
| 569 | 9:34 am | start | | | 1'06 | 1'00 | 54" | 48" | 42" | "36" | 30" |
| 570 | All | | | | 4 | 10 | 16 | 22 | 28 | 34 | 40 |
| 571 | Cit | 23 | | Cit | 0 | 0 | 0 | 0 | 0 | 2 | 6 |
| 572 | Inf | 40 | | Inf | 0 | 0 | 0 | 0 | 0 | 4 | 12 |
| 573 | Leg | 0 | | Leg | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 574 | Mat | 26 | | Mat | 0 | 0 | 0 | 0 | 0 | 3 | 4 |
| 575 | Oth | 1 | | Oth | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 576 | Pref | 8 | | Pref | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 577 | Press | 1 | | Press | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 578 | Proc | 4 | | Proc | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 579 | Val | 1 | | Val | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 580 | Total | 104 | | | 0 | 0 | 0 | 0 | 0 | 9 | 22 |

Figure A1.2: A portion of the spreadsheet that determines current levels of communication and records the levels of communication across time..

This process was repeated for each of the remaining eight high level codes and recorded within the portion of column D shown in Figure A1.2. To the right of this area (columns G onwards) the total level of communication after four minutes and thereafter every 6 minutes (for the example shown) could be entered. The data was transferred from column D to the required cells (column G onwards using the relevant by cutting and pasting whenever a warning signal sounded from the countdown function within Superclock™, a system clock for the Macintosh.

Any discrepancies between the current levels of the decision making panel and the levels expected of groups using a FTF style of communication were identified by colour coding the entries, thus information that was deemed to be either above or below the expected levels (Appendix A) was highlighted to the experimenter who could then send select the required support message from a prepared store and send them to the decision makers.

A second visual prompt to the experimenter was provided through the use of graphs of existing and expected communication levels. Whilst the coding all took place on the main computer monitor, displayed on the second monitor were two representations of the key communication categories (Figure A1.3 below), calculated using the total communication of the decision panel and the levels determined by the model. These were dynamically linked to the

spreadsheet to automatically update each time a new total was pasted into the time slots (columns G onwards in figure A1.2), no alerts were issued through the figures, they merely existed as a visual prompt for the actions required of the experimenter as detailed in Chapter Two.

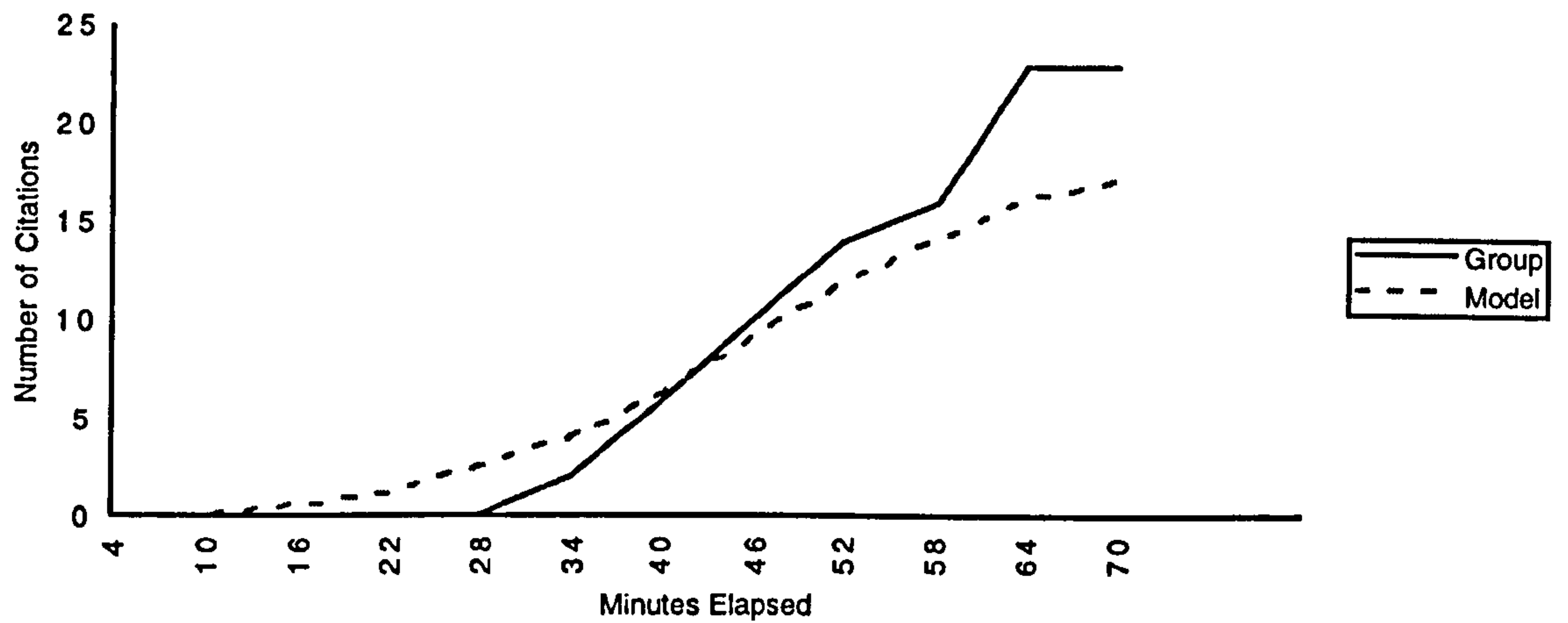


Figure A1.3: One of the graphical representations of the communication categories (CIT) used within the MIMICS spreadsheet.

Appendix A2: A Pilot Study of the MIMICS Paradigm

A2.1 Aim of Pilot Study One

The purpose of the experiment was to test the principles on which the support system and subsequent interventions were based, and also to assess the feasibility of the system proposed. If *both* the credibility and integrity of the system and by implication the paradigm, are maintained then the approach proposed may yield benefits in addressing the overall aims of the thesis. If *either* the credibility or integrity of the paradigm fall, then by association so does the system. Such a failure would require the development of a system for understanding and encoding natural language that is fully, rather than partially automated. In addition to answering these important questions, the data from Experiment P1 be used to examine the extent to which the findings of the archival analysis can be generalised to smaller groups.

A2.2 Method

A2.2.1 Design

Due to the unconventional nature of the pilot experiment, details of the configurations of the system are presented within the results section. This is to enable a clear picture of the operation of the MIMICS paradigm and to enable details of subsequent modifications to be presented.

A2.2.2 Participants

Five pairs of participants were recruited from the first year Psychology Research Methods and Statistics course. Nine participants undertook the study as part of a course requirement, whilst the final participants a volunteer who received no form of recompense for their time

A2.2.3 Materials

Each participant was equipped with a networked Apple Macintosh Classic computer, installed on which was the e-mail application Intermail (Appendix B5) and Hypercard databases (see Appendices B1 and B2). For this pilot study, one machine, designated the “Local Health Authority” (LHA) contained a database constructed from the information previously contained in the ‘Hospital Consultant’ and ‘Health Visitor’ casenote files (Appendix B1). The second machine, consisting of a database of equal size, consisted of information from the files of ‘Social Worker’ and ‘Welfare Officer’ and was assigned to the role of the

'Department of Social Services' (DSS). The information contained in these databases was selected to give conflicting viewpoints on the welfare and health of the Rips family.

The LHA database contained a total of fifty database entries, constructed on the basis of the ratings study conducted by Ball (1990) for the use of these materials. This resulted in a database of 34 entries suggesting that the most appropriate course of action would be the removal of the children, and also 16 entries suggesting that the removal of just the youngest child would suffice. The moderating effect of the 16 entries was introduced to try and reduce the greater influence of medical information (over non-medical information) as identified by Craft and Bettin (1991).

The Department of Social Services database, contained information that suggested that the most appropriate outcome would be the provision of home help and that this was preferable to the removal of either one, or all the children, and their placement into care.

A third machine, unseen by the participants was allocated to the 'Wizard Role' as described by the MIMICS paradigm. This machine, was in effect the crux of the pilot study and consisted of not only the mail server but spreadsheets that contained the coded communication, and monitored these communication levels relative to the model, alerting the experiment of the need for, and content of, support messages.

A2.2.4 Procedure

The participants met outside the laboratory prior to the experiment commencing, they were led into the room containing the computer terminals and given verbal instructions that detailed the purpose of the experiment.

"The experiment in which you are about to take part involves the reading of several pieces of information drawn from two sources, the records of the 'Local Health Authority' and the 'Department of Social Services'. These detail several incidents and reports in the lives of Linda Rips and her three children, William, Mary and Lucie, it is up to you in the course of the next two hours to make a final decision on the family, you must decide whether to 'provide more home help for the family' or 'to remove the youngest, Lucie into care' or 'to remove Lucie and Mary into care' or 'to remove all three children into care'.

Participants were then allocated at random to one of the two roles. When seated at the required computer workstation, the experimenter talked the participants through the databases 'button' by 'button' until they were clear as to how the system operated.

At this point the experiment began and the participants were left to read their databases and reach a joint decision as to the fate of the family. At twenty minute intervals a message arrived via the e-mail requesting the subjects to indicate on a 5-point Likert scale their current feelings towards each of the available options. After forty minutes a further e-mail arrived that reminded the participants that they had unique information, the discussion of which was necessary to the successful completion of the experiment.

All communications sent between the two decision makers was diverted via the MIMICS system. The human component coded all the information into the spreadsheets and followed the instructions that detailed interventions.

Thirty, fifteen and five minutes from the scheduled end of the experiment a message was sent to the participants informing them of the time remaining. Upon reaching a joint decision the decision panel communicated this via the e-mail system to the experimenter, and after completing a short post-experimental questionnaire, they were debriefed.

A2.3 Results and Discussion

Several configurations of the system were tested, each with the purpose of examining different aspects of the decision making process and assessing differing components of the MIMICS paradigm.

A2.3.1 Configuration 1 - Face-to-Face (FTF) Decision Panels

The first configuration of the system, consisted of one pair of the participants involved in a face-to-face (FTF) discussion of the materials. This configuration was primarily to enable the experimenter to ensure the correct operation of the automated processes within the MIMICS paradigm. More importantly, this decision panel enabled the testing, albeit at a low level, of the ability of system to intercept and copy e-mail. Given that the decision makers were seated in the same location any discernible delay in communications sent between them would be a potential problem for the paradigm. If however, the exchanges appeared instantaneous to both the sender and receiver of the e-mail, then it could be concluded that

decision members seated in different locations would also remain oblivious to the brief delay caused by the intervention of the MIMICS system. Both observation of the decision process and post-experimental discussions with the participants revealed that neither suspected anything untoward had occurred, and that the delay had been unnoticeable. This finding alleviated the initial concerns regarding the integrity of the system and permitted the testing of further configurations of the paradigm.

A2.3.2 Configuration 2 - Computer-Mediated (CM) Decision Panels

With the knowledge that the messages could be intercepted by the support system undetected by even a FTF group, the next pair of subjects completed the decision task in different rooms, communicating only via the e-mail. This configuration of the system permitted the workload of the human component within the intelligent system to be assessed. Unfortunately some delay in transmitting e-mails between the decision makers was experienced. This was due a delay in the coding communication caused by other demands on the time of the human component of the system. These delays were not as a result of automated tasks within the MIMICS paradigm, but due to the other demand of the experimental task: for example, time keeping, the generation of messages to request current preferences for the options, or answering participant enquiries.

The automation, where possible, of these tasks enabled the human component to concentrate solely on the coding system and answering any participants questions. Although, no way remained to enable the simultaneous coding of communication and answering of participant questions this was expected to not present a problem. In the early stages of the experiment, panel members are concentrating more on reading the material before them than communicating to one another. It is during these initial stages that participants tend to ask questions relating to the operation of the system. Given the greater training planned for further studies, this problem, already small was expected to be eliminated.

Having incorporated these changes into the experimental task (the MIMICS paradigm itself remained unchanged) any concerns regarding delays in the coding of communication were alleviated when a second decision panel operated using this configuration. The messages were intercepted and coded within satisfactory time frames and with the coding scheme applied correctly. Furthermore, as with FTF groups these CM decision panels reported no

perceptible delays in the messaging system and reported experiences similar to the groups from Experiment 1.

A2.3.3 Configuration 3 - Computer-Mediated (CM) Decision Panels

Finally, to test the potential operation of support system within the paradigm proposed, the target levels of communication established in the analysis of Experiment 1 were incorporated into the system. The three key models of communication, those of statements of case fact (CIT), communication regarding preference for the decision options (PREF) and discussion relating to the coordination of the panels efforts to tackle the task (PROC) were each included in a prototype support system. This prototype used the levels of communication provided by the human component of the system as an indication of the decision panels communication and compared this to the levels expected by the models of FTF communication (adjusted to allow for differences in overall levels of communication).

Although the use of the Komolotov-Smirnov (Siegel & Castellan, 1988) had been planned as a measure of deviance from the model, the reliance of the statistic upon maximum deviation necessitated a change to the use of bands of deviance. These bands indicated levels of deviance from the model; slight, moderate, or considerable, and were based upon the simple use of absolute deviations; less than 5 utterances, between 5 and ten utterances, greater than ten utterances.

Panel members received feedback at regular intervals of twelve minutes indicating the level of deviance from the models. A smooth operation of the procedures for this condition was experienced. The panel members developed their own strategies for when to use the information provided in the prompts and the calculations of the interventions occurred without hitch.

A2.4 Conclusions from Experiment P1

Given the successful operation of the various conditions within this pilot experiment, it was concluded that the MIMICS paradigm was technically feasible. The decision to adopt the paradigm was taken with a number of reservations about potential difficulties allayed. It should however be noted, that the pilot study presented little opportunity for the errors commonly reported in the application of coding schemes. Such analyses are presented within the main chapters, where sufficient data to permit a meaningful analysis is available.

A3 The Communication Coding Scheme

A3.1 Introduction

The coding scheme proposed here is based upon a scheme reported in brief by Kaplan and Miller (1987; see also Kaplan, 1987) which was used to categorise communications arising from decision-making groups discussing issues of a moral and judgmental nature. The similarity between the scheme presented below and that devised by Kaplan and Miller lies in the fact that the present one (a) pivots crucially around their high-level distinction between informational and normative utterances (see below for definitions) and (b) encompasses in many essential respects their full set of intermediate-level coding categories (again, see below for details).

It should be noted, however, that some additional intermediate-level categories have been included in the present scheme in order to enable the categorisation of certain utterances that appear to have arisen because of the task-specific characteristics of the Local Area Network case conference set-up (i.e. computerised database, audio monitoring equipment, e-mail facilities etc.). In addition, the present scheme only uses a subset of Kaplan and Miller's low level codes since the low-level coding was not viewed as being particularly useful for addressing key issues of informational and normative influence in case conference settings. Indeed it seems likely that the Interaction Process Analysis scheme proposed by Bayles (e.g. 1950) would be the most valuable to pick up on issues that the present scheme has not been designed to address.

A final point that is important to stress is that the limited amount of detail that is obtainable on Kaplan and Miller's scheme has meant that the present scheme, whilst employing similar coding categories, may well be different in terms of the criteria that have been adopted for placing utterances in one category or another. As will be seen in the scheme presented below, an attempt has been made to present very strict criteria relating to the categorisation of utterances - including ambiguous cases. The aim of presenting such strict coding criteria is clearly to maximise coding reliability.

A3.2 High- and intermediate-level categorisation of utterances

Kaplan and Miller attempt a basic categorisation of utterances into those that are informational and those that are normative. Utterances that are neither informational nor

normative are non-specific in nature. The informational/normative distinction stands as an attempt to capture the different modes of influence which group members use during discussion. Essentially, then, normative influence "is based on the desire to conform to the expectations of others. Judgement shifts are assumed to result from exposure to others' choice preferences and from subsequent conformity to the norms that are explicit or implicit in these preferences". On the other hand, informational influence "is based on the acceptance of information from others as evidence about reality. Shifts are attributed to the sharing of relevant arguments and factual information about the judged issue".

A3.3 INFORMATIONAL CATEGORIES

A3.3.1 Citation of case information (CIT)

This category includes:

(a) statements directly citing factual information that is provided in the case material (e.g. "I've got September 24: 'Brook Hospital visited Linda and flat - found it in a filthy state and reported seeing broken glass on the lounge floor as well as dirty nappies and a dead mouse in the kitchen'"). Such utterances are easily spotted since they arise when the subject directly reads out sections of case material;

(b) statements indirectly citing factual information that is provided in the case material (e.g. "She was also, uhm, charged with, uhm, possession of a prohibited drug, this girl"). Such statements arise when the subject recalls previously read case information. For such utterances to be coded as CIT they must be accurate renditions of case facts - though it is permissible for such facts to be conveyed in a slightly more abstract and schematised form that contained in the case book (e.g. "At that point, Linda and her father, er neither of them were very keen to have a stranger in to help with the cleaning and the caring of the children").

A3.3.2 Inference from case information (INF)

This category includes:

(a) statements expressing facts not given in the case material but inferred (accurately or inaccurately) from those given (e.g. "But then she has really been given a chance before, hasn't she");

(b) descriptions conveying the general nature of a number of case entries (e.g. "Yeah mine's all about like sort of the injuries - and all these injuries they keep getting"; "Well I keep getting things like ... she seemed a bit scruffy and untidy but happy"; "Mine hasn't said that they warned her, it's like really sympathetic towards her"; "I've got loads of evidence that she's a good mother; they warned her and warned her and she still keeps doing it");

(b) statements expressing personal views and opinions (apart from those defined within the VAL and PREF categories) even when such statements appear to be accurately based upon case information. It is more often the case, however, that such statements over-generalise the true nature of case facts (e.g. "It seems like as they get - as she has more and more to cope with, it's like she doesn't care"; "Maybe this lack of concern relates to her inability to understand the needs of a small child"; "But apparently she's totally useless"; "I think it is obvious that if you take the children away she's going to go down hill"; "you see the social worker seems to be fudging the issue");

(d) statements conveying inaccurate or fabricated case information. Such statements appear to be uttered with sincerity and possibly reflect the operation of unconscious processes aimed toward maintaining prior beliefs and attitudes.

Note 1: Inferences from case facts often appear in the form of forecasts or predictions about possible outcomes ("Yeah going on her past history ... she's likely still to neglect the children like she has before"; "As the children get older Linda will learn to cope more").

Note 2: Opinion-oriented INF statements often involve the use of phrases and constructions such as "It appears that", "It seems like", "It's as if", "I think".

Note 3: Some opinion-oriented INF statements take the form of evaluations of specific case information involving constructions such as "That's interesting" or "This seems to be highly relevant".

Note 4: Notes 6, 7 & 8 below present some further important constraints on what statements should and should not be encoded as INF.

A3.4 NORMATIVE CATEGORIES

A3.4.1 Values/norms (VAL)

This category includes statements (i) directly conveying personal values of right or wrong in actions, outcomes, circumstances or attitudes or (ii) directly conveying or indirectly making an appeal to societal norms of right or wrong in actions, outcomes, circumstances or attitudes. Some examples (see below for many more) are: "I mean parents do slap their children"; "I mean, there are lots of children who are untidy and dirty but are really happy"; "Well you still can't leave a five-year old and a nine-year old alone when you're down the pub"; "but you've got to look at how many accidents like that occur naturally"). For a precise account of exactly which utterances should be encoded as VAL refer to notes 6, 7 & 8 below.

Note 5: A further quote from Kaplan & Miller (1987) may be of help to the coder to grasp the nature of the VAL category. These authors state that "social norms represent the shared expectations about what someone, self or other, ought to believe, feel, or do in various circumstances ... exerting pressure to conform to such norms is one means of attaining consensus and establishing social reality (e.g. about what is ethically, behaviourally or esthetically appropriate) given the lack of a demonstrably correct answer".

Note 6: When opinion-oriented statements explicitly express what someone (self or other): ought/ought not, should/should not or must/must not do, believe or feel, then they are to be categorised as VAL. The latter also applies to statements expressing what someone: has to/hasn't to, has got to/hasn't got to or can/cannot do, believe or feel when a normative sense of these verbs is intended. Some examples are: "And you can't risk them being neglected and being left to get up to their own devices"; "But then I just don't think you can gamble on saying 'Well if we take Lucie away, yeah everything will be rosy'"; "something has got to be done about it";.

Note 7: When opinion-oriented statements explicitly express what is: right/wrong, correct/incorrect, better/worse, good/bad, appropriate/inappropriate, just/unjust, fair/unfair, proper/improper, adequate/inadequate, beneficial/detrimental, helpful/ unhelpful, useful/useless, advantageous/disadvantageous, practical/impractical, important/unimportant, reasonable/unreasonable, satisfactory/unsatisfactory, desirable/undesirable or wise/unwise, then such statements should be encoded as VAL. This is the case whenever the statements

refer to outcomes, circumstances or the attitudes or actions of oneself or someone else (including participants in the case conference, people who were involved - professionally or otherwise - with the Rips family and members of the Rips family itself). Some examples are: "maybe they would benefit from a more stable background"; "When a person's trying to help and all the other person does is take you for granted, I don't think that's a very good attitude"; "The important thing is the children"; "I think permanent care for the children would benefit them more than staying with their mother".

Note 8: When opinion-oriented statements explicitly make use of the adjectival or adverbial qualifier "too" (e.g. "this situation has gone on too long"; "I feel that she may have too much to cope with"; "She has been given too many opportunities"; "I think it's totally too long for a decision to be made about Linda Rips and the children").

A3.4.2 Option preferences (PREF)

This category includes:

(a) statements (i) strongly alluding to or explicitly declaring one's preference for one or more of the available options or (ii) strongly alluding to or explicitly declaring one's preference for some option that is not even available (such as removing only William into care) or (iii) explicitly stating a lack of any particular preference (e.g. "From reading my notes I think that they all ought to be taken into care"; "I think the solution may be to remove all the children");

(b) statements directly requesting the current preference of one or more of the other conference members or requesting their opinion about any option (whether available or not). For example: "That's what I mean, what are your views at the moment?"; "Out of interest, what does everyone think we should do"; "So would you think maybe it's a good idea to take away the youngest child?".

(c) statements applying normative pressure to reach a specific verdict (e.g. "do what the majority thinks is right");

A3.5 NON-SPECIFIC CATEGORIES

A3.5 .1 Non-specific pressure (PRESS)

This category includes statements applying pressure on group or individual actions or decisions, but not necessarily toward any particular decision or outcome ("if we can get this done we can go home"; "Who are we waiting for?").

A3.5 2 Procedures (PROC)

This category includes:

(a) statements referring to the rules, procedures and requirements that have to be followed by the group as stipulated in the experimental instructions (e.g. "should we make a decision now?"; "Well I think we've got to discuss it first really");

(b) statements referring to procedural aspects of the task that are instigated by members of the case conference and are intended to operate at a level of two or more individuals (e.g. "So I guess what we ought to do now is to keep going all through our notes").

A3.5 3 Materials/context/computer (MAT)

This category includes:

(a) statements referring to the experimental set-up, laboratory context and materials (e.g. "see you've got different case notes, haven't you");

(b) statements expressing knowledge or opinions about the computer itself, its operation or one's interaction with the database, Intermail, the voting panel or the Notepad (e.g. "So that's ... that takes you on to the next page like that?"; "I can't even type properly you know"; "Did you get my message?"; "I appear to have lost your previous message");

(c) statements locating oneself or others in relation to the database (e.g. "What sort of year are we at with each of our, uhm, personal case notes?");

(d) statements temporally locating the occurrence of some event either in general terms (e.g. "Well here's something that was written after the children were taken away for a little bit"; "that was right at the beginning"; "that was before Lucie was born") or by referring to a specific date (e.g. "That's the 20th July 1977"; "I've got one here from January to May 1978");

(e) statements referring to the original reporter of some event or opinion (e.g., "This is a quote from Home Helper number three"; "That's from the family health practice");

(f) statements conveying personal intentions to engage in some action or procedure (e.g. "I'm going to read my personal case notes now"; "I'm going to read this bit"; "I'll send more details soon");

(g) statements conveying an instruction to another person to pursue some action or procedure (e.g. "Could you please repeat your last message"; "someone tell linden we've gone for number 2").

Note 9: Direct assertions simply conveying in very abstract terms whether some information is possessed or is not possessed should be encoded as MAT (e.g. "I haven't got that in my notes"; "I haven't got that bit"; "I've got that too"; "I've just found that bit"). Actual questions asking whether some information is possessed or answers given in response to such questions should, however, be encoded as CIT or INF as appropriate (see also section 5);

Note 10: When statements of either type (d) or type (e) above cannot be modified to stand as utterance units as defined in Section 4 below then they should be left uncoded.

A3.5.4 Legal issues (LEG)

This category includes all statements about pertinent legal matters relating to child welfare, child care and fostering as contained in subjects' reference files (e.g. "You can take them into care if somebody's 'proper development is being prevented or neglected' ...").

A3.5.5 Other (OTH)

This category includes:

(a) statements which are essentially unrelated or irrelevant to the case conference (e.g. "What lecture have we got this afternoon?") although such statements may serve social functions relating to group cohesion or tension release;

(b) statements that are nonsensical (e.g. "querty");

(c) statements that convey information that is extraneous to the case conference - though possibly relevant (e.g. "Nits mean that you have got clean hair though")

(d) statements that do not fit into any other category (e.g. "I haven't really spoken to you yet").

A3.6 Low-level categorisation of utterances

An utterance classified according to any of the above categories can be further classified in terms of whether it is:

- (1) a direct assertion (da),
- (2) a question to one or more conference members (q), or
- (3) an answer to a question posed by another conference member (a).

A3.7 Some utterances to leave uncoded

It is important to note that terse utterances of agreement, disagreement or ambivalence (e.g. "Yeah", "No", "Mmn", "Okay", "Don't know") should not be coded at any level of detail unless they are produced in response to VAL or PREF questions - in which cases they are encoded respectively as VAL(a) or PREF(a). A full list of such utterances which should be left uncoded (as should any combination of them) is as follows:

Ah, All right, Am I?, Apparently, Are there? Are they?, Are you?, Are we?, Basically, Could be, Did he?, Did she?, Did they?, Did we?, Did you?, Does it?, Do you?, Don't know, Eh, Er?, Fine, Goodness, Great, Ha!, Hang on, Hang on a moment, Hang on a sec, Have you?, Has he?, Hmmn, Hold on, Huh?, Hum, I am, I agree, I agree there, I don't know, I dunno, I have, I haven't, I'm just thinking, I know, I see, Is he?, Is it?, Is it really?, Isn't it?, Is she?, I suppose, I suppose so, It is?, It isn't, It was, It wasn't, Just a sec, Look, Maybe, Me, Mnm, Mmnn, Na, No, Nope, Not yet, No way, Oh, Oh dear, Oh god, Oh good, Okay, OK by me, Oops, Pardon?, Perhaps, Possibly, Really?, Right, Right O, Righty ho, She did?, So, Sorry, Sorry about that, Sort of, Thanks, Thanks a lot, Thank you, That's it, That's right, That's true, That's what?, There, There we go, There you go, This is it, Uhm, Wait there, Was it?, Was there?, Well, Were there?, What?, What's that?, Why?, Yeah, Yep, Yes, You haven't, You know?, You were saying?

The rationale behind leaving the above utterances uncoded is because of their frequent ambiguity and the associated difficulty in reliably determining their membership of an informational, normative or non-specific category. It should be noted that an analysis of case

conference utterances using Bayles' scheme or at the level of speech acts (see, for example, Searle, 1969) might be more appropriate for picking up details of the illocutionary intent of speakers when they use such utterances as above. It is argued here, however, that the present analysis which omits classification of such utterances is still entirely legitimate as a means of providing a very good estimate of the relative amounts of normative and informational influence arising in case conference communication.

Other verbalisations that should be left uncoded are those such as "The case notes say that" or "It was reported that" which are usually part of the utterance unit encompassing the continuing citation of case information. A fairly comprehensive list of example utterances of this type is:

And then it said that, It also says, It says here, I've got, I've got a report here somewhere that says, I've got her saying here, Look, I've got, The notes I've got say, The report that they made was that ..., There's a report from, Well it says that, What it says is

Finally, whenever subjects sign their name or their role at the end of a message then it is policy to leave this uncoded.

A3.8 Parsing utterances

All statements within the transcripts are parsed into "utterance units" during the actual encoding process. An utterance unit is defined as the smallest statement that meaningfully conveys some influence of a normative, informational or non-specific nature. Such utterance units often exist at the sentence level. It is possible, however, for utterance units to exist as subparts of sentences - but only when they could exist at the sentence level and retain the same essential meaning by (a) the deletion of a one-or two-word connective or relation (such as: "and", "or" "but", "because", "although", "and thus", "and so", "since", "however", "therefore") and/or (b) the addition of an appropriate noun or anaphoric pronoun. The only cases in which these latter criteria do not apply is for conditional statements (e.g. involving constructions such as "if then", ".... if", "if and only if then" and ".... only if") or statements expressing other dependencies such as "either or" constructions. It should be noted that these parsing criteria are only presented as a means to ensure reliable encoding and it is appreciated that in reality the omission of linguistic relations alters certain

important semantic aspects of a statement. It is believed, however, that the normative or informational aspect of the utterance remains unchanged through such deletions.

Some example parsing of statements into utterance units are presented below. (Note that explanations of certain encodings are presented in square parentheses):

(a) Yeah, [uncoded] I don't think that she'd actually harm her children (INF.-da) / because she's, she's very passive toward them. (INF-da)

(b) I feel the children are unsafe with Linda (INF-da) / and [could be omitted] [insert anaphoric pronoun "she" here] should be taken away. (PREF-da)

(c) Yeah, [uncoded] I've got one here from January to May 1978. (MAT-da) / It says that [uncoded] Miss Rips' personal hygiene leaves much to be desired (CIT-da) / but she is keeping her flat tidier at the moment with the help of the home help. (CIT-da) / She has also made friends in the area at the moment, (CIT-da) / er, which are exerting a positive... (speech interrupted briefly by other speaker but then continues) ...influence on her life. (CIT-da)

A3.9 Potentially problematic intermediate- and low-level categorisations

A3.9.1 Incomplete and interrupted utterances

Statements which are fragmentary in the transcript because of sound distortion on the original tape recording should be left uncoded unless the gist of the missing verbalisation can be inferred from its context with a high degree of confidence by the coder. The same strategy should be adopted when a speaker has been interrupted in mid flow by another speaker. Note that if the interrupted speaker subsequently completes an utterance unit then only a single coding should be given to the two fragments of the broken unit. Other statements may be incomplete because the speaker simply tailed off and failed to complete them

A3.9.2 Experimenter-oriented communication

Any communication between the experimenter and members of the group in relation to coffee or biscuits should not be encoded. All other communications between the experimenter and group members should be appropriately encoded. Note that any instructions from the experimenter which are not MAT-oriented (e.g. relating to the operation of the computer) should be encoded as PROC.

A3.9.3 Rhetorical questions

Rhetorical questions should be encoded as direct assertions and not as questions.

Statements in reply to a question

Sometimes a question is asked and the respondent provides an answer to this question but also provides numerous attendant direct assertions - and sometimes questions. In such cases it is only the answer to the explicit question that should be encoded as an (a). The attendant statements should be encoded as (da)s or (q)s as appropriate.

A3.9.4 Questions

Sometimes there can be problems in determining the appropriate intermediate-level informational category for encoding questions. An attempt to adopt the following criteria should be made:

(a) an open request for some case fact or facts should be encoded as a CIT-q unless the request expresses some inference or inferences in need of verification or falsification - in which case it should be encoded as an INF-q.

Some examples of such CIT-q utterances are: "Which foster parent was that?"

Some examples of INF-q utterances where an inference is posed as a request for case information are: "Did she confide in you about such things as her feelings towards her children?"; "Did she understand the consequences if she did not fulfil her responsibilities?");

(b) a request for an opinion or view (other than a PREF.- or VAL.-oriented one) should be encoded as an INF-q Examples of such INF-q's are: "What do you feel about this?"; "Don't you think it could be an exaggeration?"; "Do you think William and Mary are attached to their mother?")

(c) If there is any doubt on the part of the coder as to which is the best informational category to use for the coding of a particular request, then it is recommended that the coder apply an INF-q

Some rules to follow when in doubt

If the coder is in doubt as to whether an utterance unit is informational or normative in nature then it is recommended that a normative encoding be given to the utterance.

If there is doubt as to whether an information-oriented utterance unit is a CIT or an INF then it is recommended that the INF category be applied.

If there is doubt as to whether a normative-oriented utterance is a VAL or a PREF then it is advised that the coder apply the PREF category.

Appendix A4: Support System Development

As discussed in Chapter Four the decisions taken regarding the precise format of the support measures, their content, occurrence rates and method of delivery are guided as much by practical considerations as any underlying theoretical position. The following serves to highlight some of the choices made in relation to the feedback system considered in Experiments 2 and 3.

4.1 Provision of full or partial information

The decision was taken to support only three forms of communication, CIT, PREF and PROC, the next step was to decide whether to provide full or partial information about these three categories within the support system feedback. The crucial difference in this consideration of the merits of relaying information on all categories or just relevant categories is that in this case *all categories* refers to three forms of communication that differ significantly between CM and FTF groups.

The provision of feedback on all three forms of communication places greater demands on the recipient than receiving information relating only to one form. The complexity of the feedback does, however, permit recipients to construct an impression of a more comprehensive pattern of communication. Such a global view of communication enhances the ability of the decision makers to draw comparisons between the three target forms of communication, inferring the trade-off between normative and informative communication that underpins the discussion process.

A disadvantage is that the provision of feedback on all three target forms of communication might suggest to the decision makers that these are the only three forms of communication necessary for the task. This in turn might lead to a situation where the remaining six forms of communication, previously observed to be the same in FTF and CM decision making groups might become neglected, reducing the effectiveness of the support system.

Provision of (partial) information relating only to those (target) communication forms that deviate from the target levels, is unlikely to elicit the same incorrect assumptions about the task communication, and has the added advantage of being more focused and hence quicker

to process than the more complete version of the feedback. However, such a partial picture decreases the ease with which the decision maker can obtain the overall pattern of communication or draw comparisons between the various forms of discussion.

Both approaches have apparent merit, and prudence dictated the examination of both partial and complete feedback in the initial investigation of the possibilities of feedback. Through an exploration of both, an identification of the method with greatest likelihood of success can be made, permitting further development with later experiments.

A4.2 Directive or Non-Directive Models of Intervention

Two possible methods of informing users of their communication style in relation to the targets exist. A Directive form of communication support (DCS) or a non-directive communication support (NDCS) system. DCS informs decision makers of the state of their communication in relation to the model in such a manner that the user receives the impression that there is *no choice*, that they are *required* to alter their communication behaviour. In contrast a NDCS system implies that there is a *choice* and that the user *can decide* whether or not to alter their communication behaviour to the levels that are being suggested.

In both forms of the system the user is made aware of their communication behaviour in relation to the desired levels, the important difference lies in the perception of *forced* alteration of communication versus *suggested* alteration of communication. Either system might be an effective way of inducing a change in behaviour from the decision makers, however, which system offers the greater probability of success is unclear, as such both forms of support (DCS and NDCS) are examined.

A4.3 Partial or Complete Feedback About Communication

Whilst it is desirable to examine: (i) both directive and non-directive feedback and (ii) both partial and complete feedback about communication, examining the combinations of these factors provides two combinations of limited utility: (i) complete feedback in a directive manner and (ii) partial feedback in a non-directive manner.

There is little merit in exploring both partial and complete provision of information in a directive manner. When all three categories deviate from the target levels, the complete

design provides the user with valuable information. In situations when one or more categories reflect the desired levels of communication, there is little rationale for providing directive information about these categories. The logical instruction to continue communicating in the same fashion, would often be counter productive as the natural flow of communication might require either an increase or decrease in the communication over the next time period. Indeed, the instruction should convey the shape of the communication curve, which is problematic as describing the distribution of each communication category across time is fraught with difficulty. The directive form of support lends itself naturally to a partial design, providing instruction only on the communication that deviates from the target levels.

Similarly, the non-directive/partial design offers potentially confusing information. The non-directive nature can easily reflect communication that reflects the FTF derived communication levels, as such the difficulties of conveying complete information encountered by the directive design are overcome. Providing partial information in a non-directive manner is itself incongruous, the form of partial information is that it reflects both adherence to, and deviance from the model. Provision of information relating only to deviance from the target becomes directive rather than non-directive. A continual stream of information highlighting only deviance effectively directs the recipient of the information to change their communication, in effect partial/non-directive feedback becomes partial/directive support.

Neither examining complete feedback in a non-directive manner, nor partial feedback in a directive manner can be eliminated on the basis of such arguments, data on the effects of both are required before the identification of the more effective form of support is possible.

A4.4 Determining the levels of communication required by the model.

The data from the archive analysis indicates large variations in the levels of utterance units employed by the CM decision panels to reach the same decision, ($M = 309.3$, $SD = 112.78$). Thus determining an attainable level of communication to be reached by the panels is a problematic procedure. The requirement is for a target for each of the key communication categories that is attainable by all decision making groups. Furthermore, these levels of communication must permit a comprehensive discussion of the information at levels that reflect the communication patterns of FTF panels. The alterations in communication via the

support system also offers the opportunity to increase the overall levels of communication employed by CM panels.

Several justifications exist for the attempting to increase the overall levels of communication. The first and foremost of these is that the levels of communication in CMC are considerably less than the levels of communication in FTF panels. Therefore any attempt to increase the levels of CMC reduces this fundamental difference between the two modes of communication. Not only do the levels differ but the degree of variation in absolute levels is considerable. Of the groups reported in Chapter Three, the total number of coded utterances of the most talkative group (465) was over two and a half times that of the least talkative (165). Clearly, the impact of the communicating via computer varies from group to group, and no doubt some of this variation is due to the barrier presented by the keyboard interface. However, the large variety suggests that some groups are able to overcome these difficulties and to set target levels that might require these groups to suppress their unsupported levels of communication would be counterproductive.

A second reason for this increase is that the difficulty in devising an intervention level is such that utilising the mean communication levels restricts productive groups. The variability of the data suggests that such groups will be 'held back' by less productive groups. However if the most productive group is taken as the base level then panels that find the keyboard interface restrictive will be prompted to reach levels of communication that are physically beyond them.

Many methods of deriving the target levels of communication exist, the method selected for examination in these studies had communication levels derived from communication levels of the mean group plus one standard deviation. This level stretches a number of decision panels to increase their communication levels beyond those observed in unsupported CM groups, but to a level that should be attainable by all groups. Similarly only the most communicative groups might be required to reduce their level of messaging.

To determine of the level of messages required was a five stage process. For each FTF decision panel in Experiment 1 the coded utterances were divided into twelve time periods; each equal to one twelfth of the total time taken by that panel to reach a decision. From these figures the average (cumulative) number of utterances in each time period was

calculated. These data provide a cumulative record of the number of utterances in each communication category over the duration of the panels deliberations.

From these figures the cumulative percentage of utterances in each time period were calculated, for example 30% of Citations of Case Fact (CIT) have been communicated by the end of the fifth time period, and 51% by the end of time period seven.

The final stage was to calculate the total number of utterances that could be expected from a computer-mediated decision panel. This figure was the average communication levels of the CMC panels from Experiment 1 plus one standard deviation (recall the earlier discussion on the increasing of communication levels in CM decision making groups).

A4.5 Timing of Intervention

The assessment of deviation from the target levels of communication held by the support system can be made continuously. However a constant stream of feedback to the decision panels relaying the extent of the deviation would be counterproductive for two reasons: blocking and intrusiveness.

Firstly, if the group is continually receiving messages that are concerned with their levels of communication, they are prevented from communicating by the presence of the messages, their communication is in effect, blocked. As such the feedback itself creates divergence from the communication of the panel and the levels of communication that the panel is expected to use.

Secondly, the continual receipt of messages relating to the communication becomes progressively more intrusive. The decision makers ultimately want to be allowed to make their decision and could be irritated by the constant arrival of messages. Continual prompting leads to alienation and dissatisfaction with the system, as the system becomes perceived as hindering rather than helping the decision makers to reach a decision. If the system loses its credibility as a useful and productive device, then like many of the systems discussed in Chapter One, it will either be circumnavigated or ignored. If one lesson is clear from the history of computer-supported co-operative work it is that the integrity of the support system is paramount in the utilisation of the information that it provides.

Prompts from the support system were thus sent on the first occasion that significant deviation from the expected communication patterns occurs. Subsequent messages, relating to the deviation should only occur if the level of communication remains below the target levels *and* enough time has elapsed to permit alteration to the communication levels to have occurred.

To ensure that time is given to receive, process and act upon the prompting of the support system and that the intervention does not become excessively intrusive, the time period for this delay needs to be carefully calculated. An examination of the levels of communication employed by unsupported CM groups (Table A4.1) shows the (mean *plus* one standard deviation) number of utterances that can be expected from a CM decision making panel operating at both unsupported CM levels and those adjusted to reflect CM panels operating at FTF level (CM_(FTF)). From this table it can be seen that a CM decision panel can be expected to communicate just over three (3.34) Citations of Case Fact in a ten minute period, but that the same level of CIT (3.75) would be observed in just five minutes were the operating as if a FTF decision panel.

| | | Delay between interventions of... | | | | | | | |
|----------|------|-----------------------------------|---------------------|------------|---------------------|------------|---------------------|------------|---------------------|
| | | 5 minutes | | 10 minutes | | 15 minutes | | 20 minutes | |
| | | CM | CM _(FTF) | CM | CM _(FTF) | CM | CM _(FTF) | CM | CM _(FTF) |
| Category | CIT | 1.67 | 3.75 | 3.34 | 7.51 | 5.01 | 11.26 | 6.68 | 15.01 |
| of | PREF | 2.87 | 0.96 | 5.74 | 1.92 | 8.61 | 3.83 | 11.47 | 4.79 |
| Comms | PROC | 0.28 | 0.93 | 0.56 | 1.86 | 0.84 | 3.72 | 1.12 | 4.65 |

Table A4.1: Number of utterances expected in a given time period for CM groups operating at natural levels (CM) and reflecting FTF levels (CM_(FTF))

The data in Table A4.1 suggests that a delay of ten minutes between the prompts permits the decision panel to adjust their communication, a shorter delay than this would result in groups being unlikely to be able to communicate the required information, especially in terms of procedural remarks (PROC). A longer delay than this would also permit the alterations in communication levels to occur, but given the relatively high occurrence of utterances in a fifteen minute period would lead to problems. If groups were operating at

levels above those required (as is the case for PREF) possibly lead to panels communicating so many preferences that bringing their communications back into line would become increasingly difficult, if not impossible.

A4.6 Group Level or Individual Level Intervention

The feedback provided by the support system can be focused upon either the individual's own communication behaviour or upon the communication of the decision panel as a whole. The unit around which the feedback is based is critical, however before discussing the likely effects of the two approaches, it is worth briefly reconsidering some of the literature on group level feedback that was discussed in Chapter One.

A4.7 Feedback and the group

Given that "Performance feedback, also known as knowledge of results, is frequently heralded as one of the most effective tools available in directing and motivating behaviour in social systems (Friedlander & Brown, 1974; Larson, 1984; Nadler, 1976, 1977 as cited in Conlan and Barr, 1988), it is unsurprising that organisational psychologists have devoted considerable time to exploring the effects of group level feedback upon the workforce (e.g. Argote, 1993; Robinson & Weldon, 1993). From a social psychological perspective this is unfortunate as it means that there is a scarcity of work within the area looking into the effects of group level feedback upon performance (See Kluger & De Nisi, 1996 for a review).

One notable exception to the idea that most research into feedback and groups is directed at organisational psychology is the 1990 work of Losada, Sanchez and Noble. Their analysis of the collaborative group behaviour through a time-series examination of the patterns of interactive sequences in face to face meetings showed that where groups were supported by group process feedback in a computer-supported meeting the number of socio-emotional interactive sequences can be increased. This finding, although having strong implications for maximising the collaborative benefit of computer technology has yet to be fully incorporated into the CSCW literature, indeed there is scope for the development of their ideas. Here the impact of group level feedback on changes in communication behaviour will be examined

The two main reasons for basing the intervention on group levels of communication rather than individual levels are: (i) the low levels of communication used by individuals to reach a decision and (ii) the expected utility of the information held by group members.

Given the low levels of communication expected from the decision making panels, intervention on the basis of individual communications would make meaningful target levels difficult to derive. Additionally, allowing time enough for the prompting of the support system to be acted upon by the decision makers might only permit one or two interventions in the entire decision making process. With so few intervention possibilities for intervention it is unlikely that communication could be shaped to resemble FTF communication.

Equally important, requiring each member of the group to communicate at specific levels imposes a communication structure upon the panel that may be counterproductive. Initial impressions might be that equality of participation, reflected by each decision maker communicating in equal amounts to the decision process, would be beneficial. However, although the system should *permit* equality of communication, it should not *demand* equality of participation. It is likely that one person will wish to say more, indeed an examination of the decision process often reveals one decision maker attempting to persuade another by providing information. Given the suggestion reported in Chapter 3 that the roles assigned to participants have a differing levels of influence on the decision making process, this would also point to the need for a group level intervention. As to require equality of participation would remove what has already been established as being a natural division of communication "floor time."

Appendix A5: Functions of the electronic mail application

Functions available within Intermail.

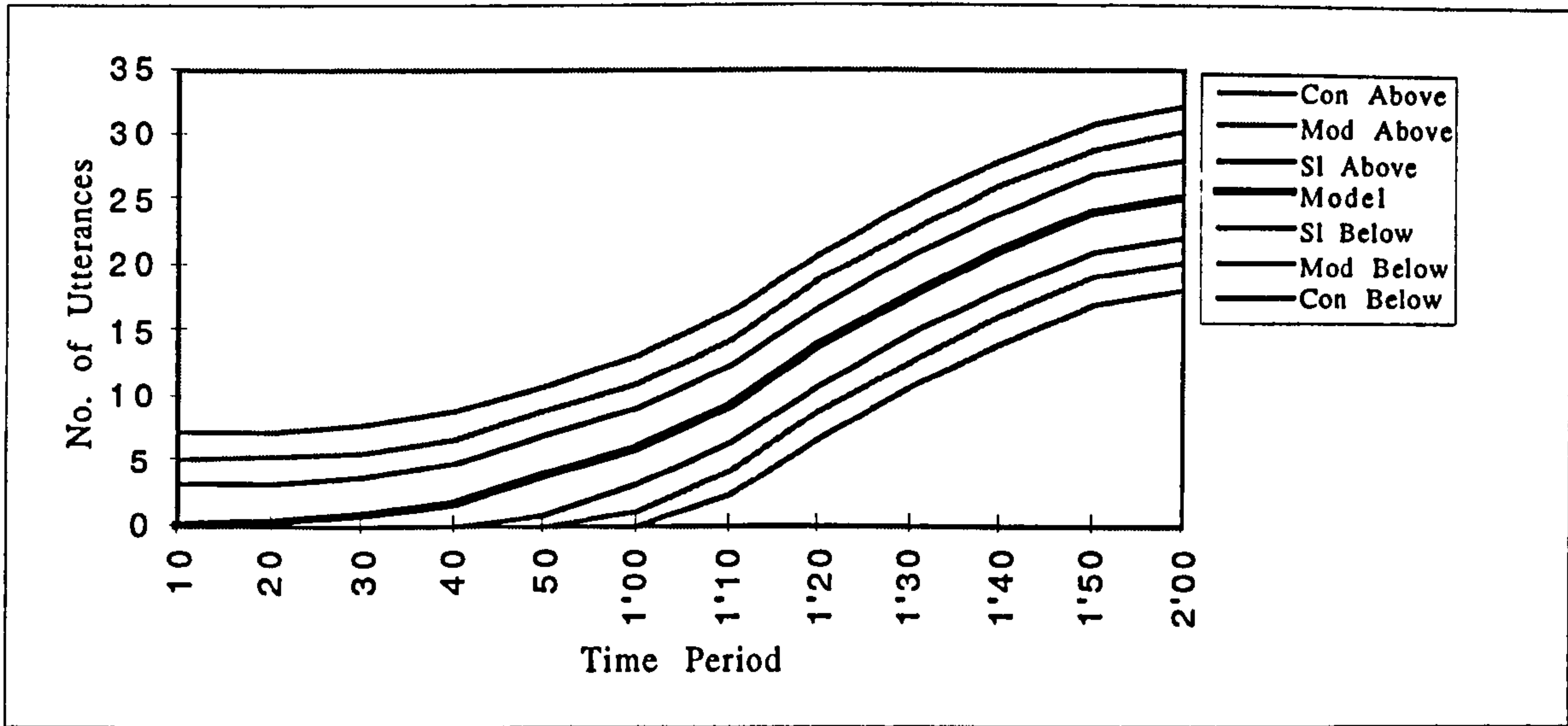
The following extract is taken from Ullman & Holt (1986: 2) and lists the functions available within the Intermail electronic mail application, Version 1.0.

“Intermail allows users on one or any number of local or remote networks to communicate with each other and transfer files quickly, easily and conveniently. And as you would expect, Intermail’s speed, power and flexibility are available from within all of your favourite applications. With Intermail you can:

- send messages to any user or group of users at any time.
- receive messages whether or not you are “signed in” on the network.
- send and receive files of any type.
- request help or report problems directly to your Network Manager.
- request “Return Receipts” to confirm that your messages have been read.
- generate automatic replies with the click of button.
- forward messages to other users.
- save messages as text files.
- print your messages.
- read, print or delete any number of messages at the same time.
- add password security for any user.
- create groups (custom mailing lists).
- print complete address (user) lists.
- set user preferences to customise your Message Centre’s operation.
- add optional message types and interfaces to meet your specific needs.
- have special message types custom designed to your specifications by Internet.”

Appendix A6: Deviation from Target Levels of Communication

The deviation from the target levels was based around the calculation of a series of bands of deviance. Although original intended to base these calculations around a complex algorithm utilising both the difference and the total number of utterances in any given category, a simple approach of static bands of deviance was adopted (Figure A6.1)



FigureA6.1: The target level of Citations of Case Fact (CIT) with critical deviation bands at slightly, moderately and considerably above and below the target.

As is argued elsewhere the critical factor is obtaining alterations in communication levels on the basis of the intervention, rather than the absolute levels provided by the target communication taken from the FTF communication levels. Figure A6.1 illustrates the critical regions for CIT. The central black line denotes the target levels of communication derived from FTF decision panels, the region beyond the blue lines indicates the region beyond which was considered a slight deviation, the green line marks the region at which deviation was considered to be of a moderate level and beyond the furthest (red) line indicates considerable deviation from the desired levels. Similar bands were employed for both PREF and PROC shown in Appendix A6.

The calculations of deviation from the target levels of communication were based around the use of a series of bands of deviance. Figure A6.2 shows the bands as calculation for the conveying of expressions of preference (PREF), the black line portrays the proportional levels of communication employed by FTF panels. Deviation between this level and that depicted by the blue band, were considered to be on or around the levels required by the target, however,

deviation beyond this would result in the sending of a support message containing feedback regarding the communication levels of the group.

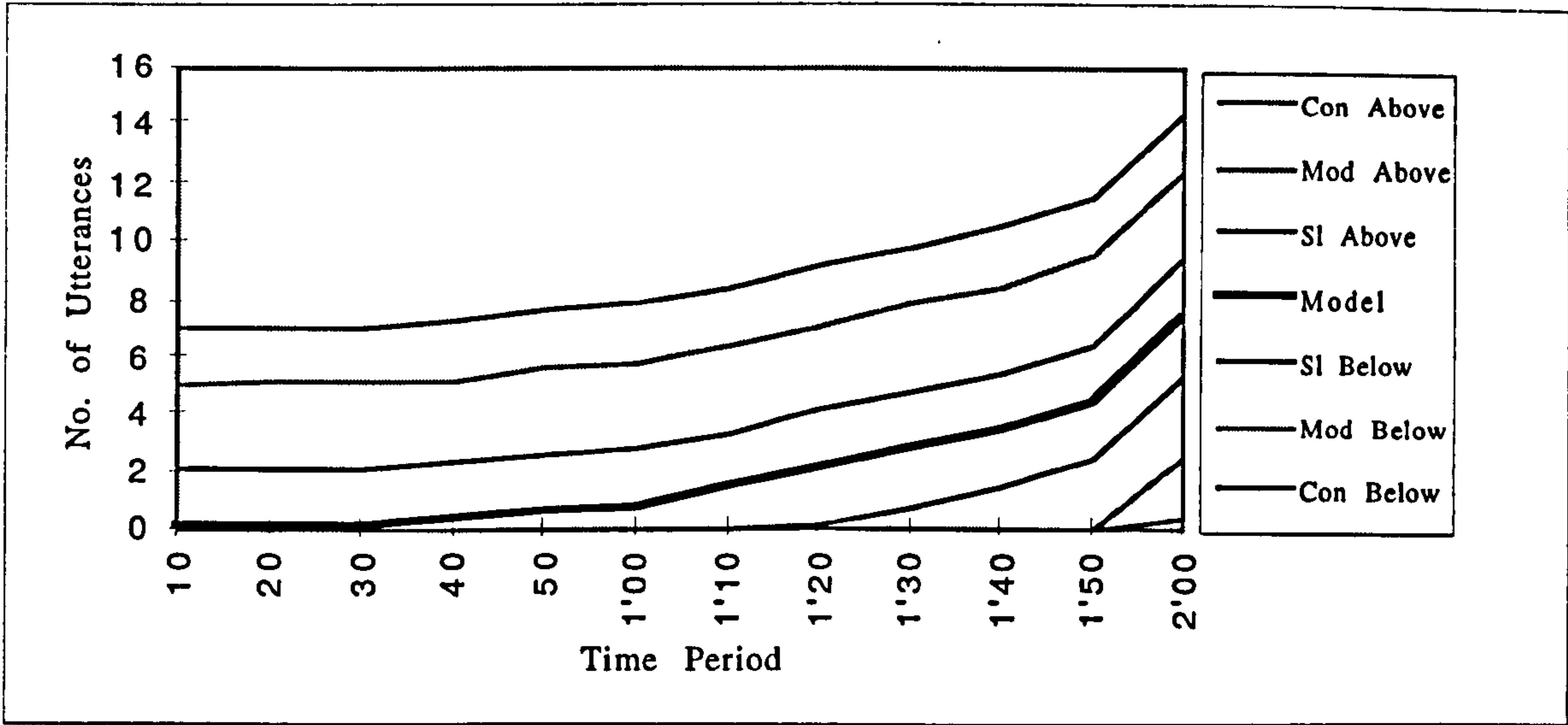


Figure A6.2: The target levels of Expressions of Preference (PREF) with critical deviation bands at slightly, moderately and considerably above and below the model

Between the blue and green bands on the figure the feedback would, if directive, convey a slight deviance from the target. Beyond this and up to the red band was considered to be moderate deviance from the target levels, and groups communicating at levels beyond this were considerably deviating from the target. Similar bands were employed for comparing existing with target levels of PROC (Figure A6.3 below).

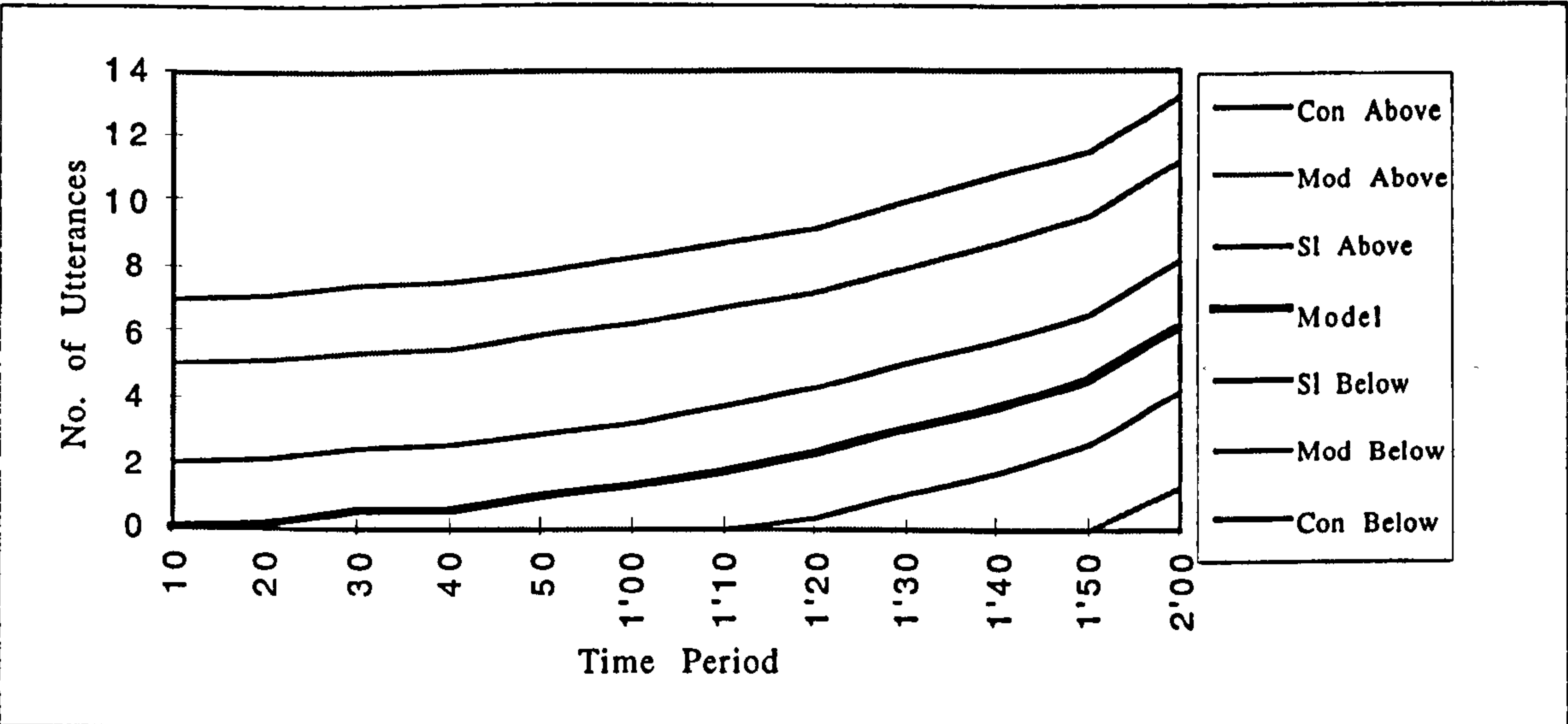


Figure A6.3: The target level of Procedures (PROC) with critical deviation bands at slightly, moderately and considerably above and below the model

Appendix A7: Group Communication Support System Feedback

A7.1 Directive (DCS) and Visual Directive Communication Support (VCS)

As a result of the pilot study, the levels of deviance were conveyed as “slightly”, “moderately” and “considerably.” with directions of deviance as either “too many” or “too few”. These were combined with the descriptions of categories to form the eighteen different forms of communication support tested.

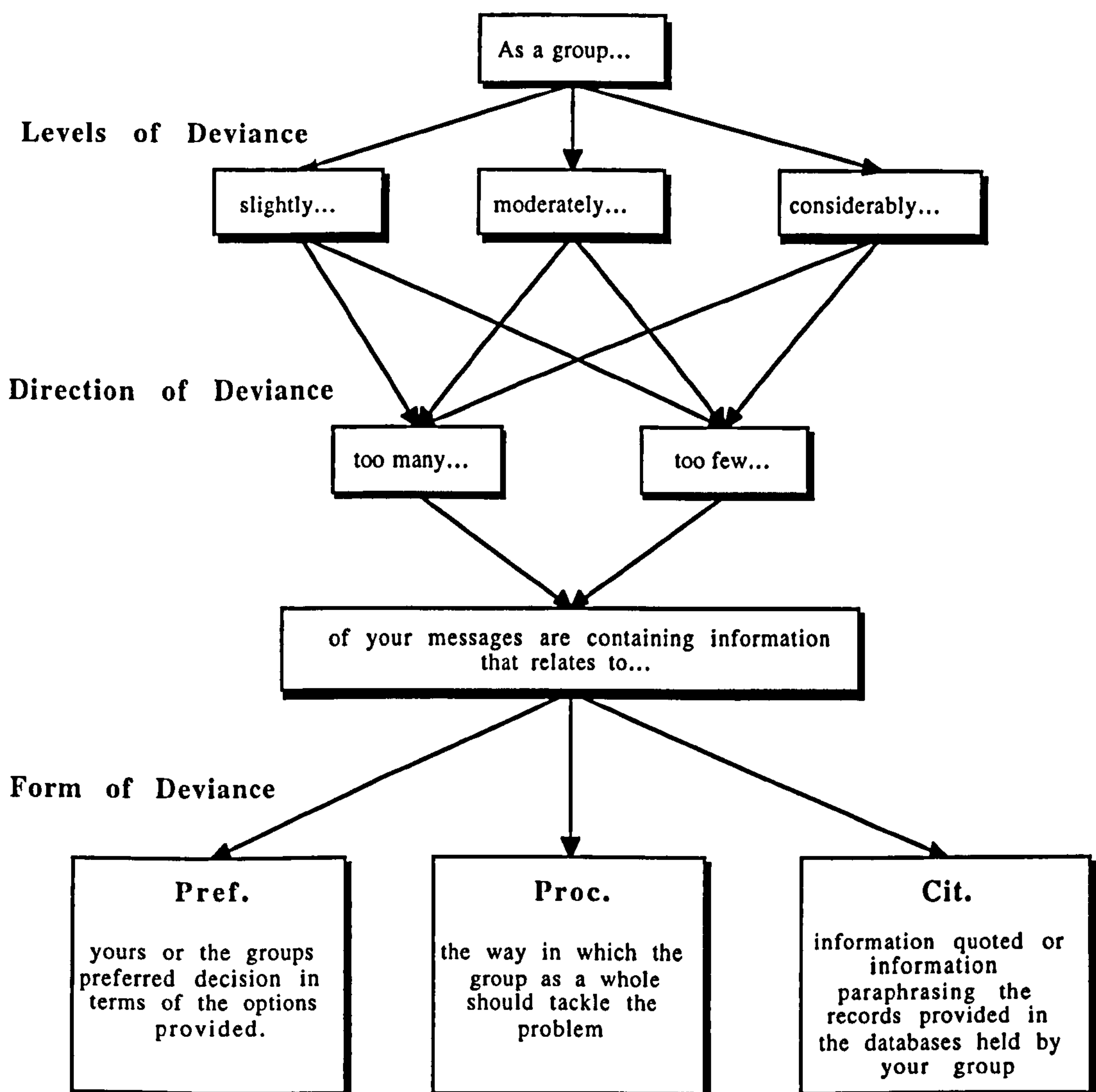


Figure A7.1: The phrases combined to create the eighteen forms of Directive Communication Support (DCS) feedback.

By following the flow chart (Figure A7i.1) the various forms of feedback can be reconstructed, for example a group communicating a fractionally higher level of statements of preference (PREF) than required than the model suggests would receive.

“As a group slightly too many of your messages are containing information that relates to yours of the groups preferred decision in terms of the options provided.”

where as a group communicating with at a much lower level of Citations of Case Fact (CIT) than the model would be sent a message stating:

“As a group considerably too few of your messages are containing information that relates to information quoted or information paraphrasing the records provided in the databases held by your group.”

further examples of the form of the communication support can be constructed by following through the flow chart and taking the text from the required boxes.

A7.2 Non-Directive (NDCS) and Non-Directive Visual Communication Support (NVCS)

Figure A7.2 (overleaf) provides similar information to that given in Figure A7.1 however, the construction here is for the feedback provided by the Non-Directive Communication Support system.

Again following through the flow-chart permits the construction of feedback for the decision-makers. Using the two examples related to Figure A7.1 of a group communicating a fractionally higher level of statements of preference (PREF) than required than the model suggests would receive:

“As a group the number of messages that contain information that relates to yours or the groups preferred decision in terms of the options provided is five percent above the levels of communication of this style used by groups who successfully complete the task.”

where as a group communicating with at a much lower level of Citations of Case Fact (CIT) than the model would be sent a message stating:

“As a group the number of messages that contain information that relates to information quoted or information paraphrasing the records provided in the databases held by your group is thirty percent below the levels of communication of this style used by groups who successfully complete the task.”

the differences here being the number of possible forms of feedback are considerably more than the 18 available in to groups in the DCS conditions, as the percentage figure is unrestricted in its variation.

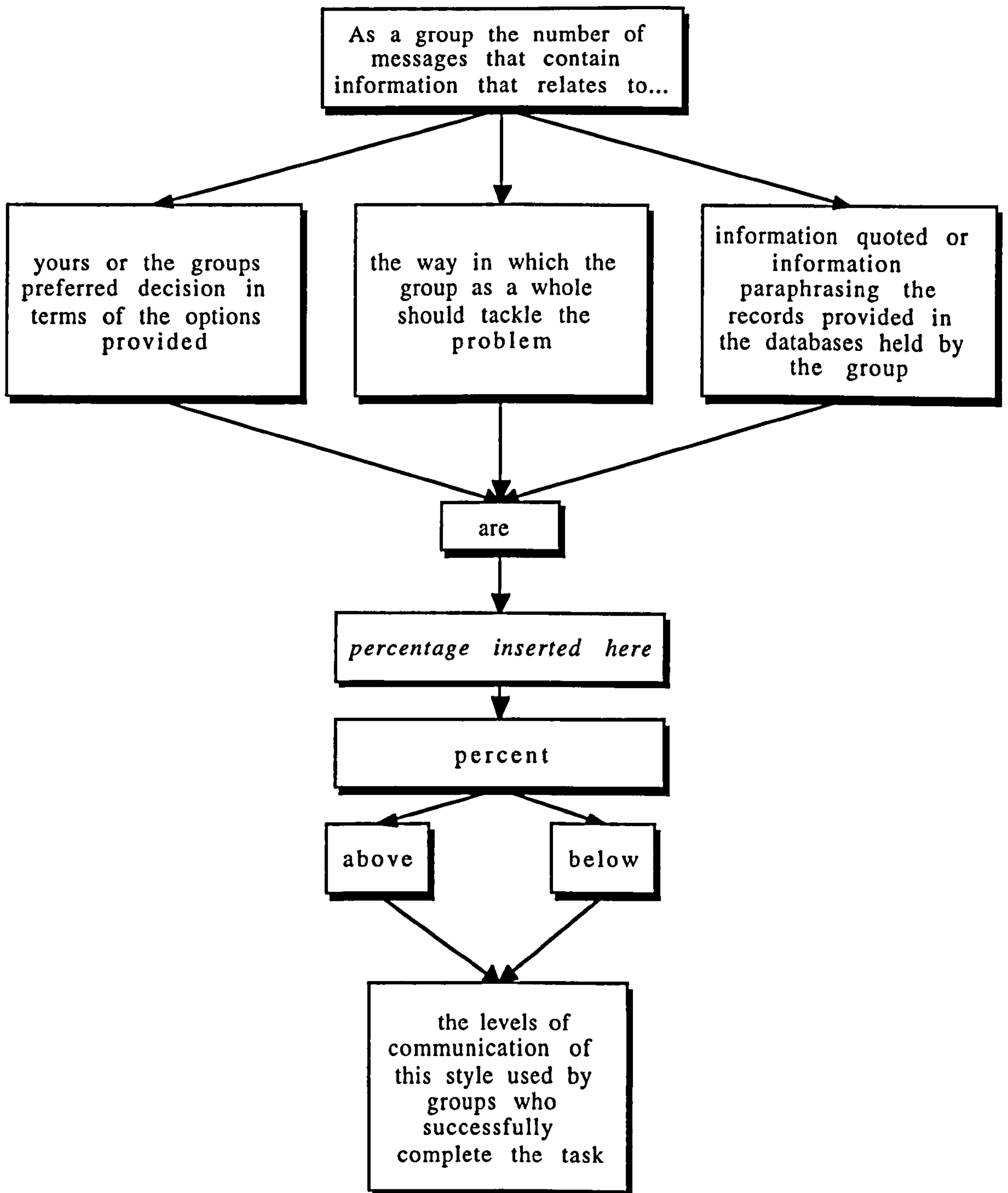


Figure A7.2: The phrases combined to various forms of Non-Directive Communication Support (NDCS) feedback.

A7.3 A summary of the differences between Directive Communication Support (DCS) and Non-Directive Communication Support

The following table provides a quick comparison of the key differences between the two forms of communication support system, these differences are retained in the visual (DVS and NDVS) forms of the support system.

| Directive Communication Support (DCS) | Non-Directive Communication Support (NDCS) |
|---|--|
| Provides information only on the category being deviated from | Provides information on three categories |
| Prompts only when the communication levels deviate from the norm | Prompts can show both deviance and compliance with the norm |
| The intervention implies that this is my choice, I want you to change your behaviour. | The intervention implies that this is the choice, it is up to you to change if you wish. |
| Prompts are irregular | Prompts are regular |
| Prompts are unexpected | Prompts are expected |
| Prompts are apparently unsystematic | Prompts are obviously systematic |
| Prompts are behaviour determined | Prompts are time determined |

Table A7.1: The key differences between the feedback provided by Directive (DCS) and Non-Directive (NDCS) Communication Support.

Appendix B1: Casenote Materials

B1.1 Overview

Five files constituted the original Rips Casebook files. Each file is presented here as one continuous file – typographical errors within Appendix B1 have been reproduced as per their presentation to decision makers – however, individual entries appeared as shown in Figure 2.1 in Chapter 2 and concluded with a line in brackets detailing the source of the information, for example, (Based on the records of Brook hospital) or (Based on the records of the Family Health Practice).

B1.2 The Common File

This information was contained in the reference file available to decision panel members regardless of their assigned role. Each date (or period of dates) formed a single case entry, the emphasis placed on certain is as seen in the databases. The separation of information not order by date is denoted by the page width underlining.

1. Introduction to The Common File

The following file comprises (1) an outline of the four major agencies involved in the Rips case, including descriptions of their organisation, responsibilities and powers, (2) a history of important events relating to the Rips family, and (3) a chronology of all periods of foster care for the Rips children.

It should be noted that this file was compiled prior to the case conference by a secretary who was not herself allied to any of the services that were involved. This secretary had been (1) permitted access to a wide range of documentation from all services, (2) instructed to include within this case file only factual information of significant events that concerned the Rips family, and (3) directed to forward a copy of the case history to all participating members of the forthcoming case inquiry.

2. Outline of Major Agencies Involved in The Rips Case

In global terms there were four agencies that played major roles in the lives of Linda Rips and her children, these being (1) the Social Work Section of the Bexley Social Services Department, (2) the Family Welfare Section of the Bexley Social Services Department, (3) the Health Visiting Section of the Bexley Area Health Authority and (4) the Hospital and Clinic Services of the Bexley Area Health Authority.

The Bexley Social Services Department was set up in 1969 as an organisation aimed at providing a high level of social and welfare support for families and individuals within the London borough of Bexley. The department itself was formed through an amalgamation of existing services and agencies within the borough, which up to that time served relatively autonomous functions relating to adoption, fostering, child guidance home help and the like. At the time of the organisation of these various independent agencies into the an integrated Social Services Department it was felt important to maintain something of the original sense of group responsibility and cohesion by implementing a hierarchical division of the Department into various Sections and Units relating to specialist areas of work. Two of these

high level Section which were closely involved with the Rips family were the Family Welfare Section and the Social Work Section. Each of these Sections was headed by a Section Director who acted in the capacity of a Deputy to the actual Director of the Bexley Social Services Department.

The Family Welfare Section was a major division of the Bexley Social Services Department and was primarily devoted to (1) providing advice and training in home management, (2) providing advice with the care of children (3) contributing general Home Help assistance for families and individuals in difficulty - especially the elderly and the handicapped (4) arranging temporary child care placements during periods of family difficulty or pregnancy and (5) arranging permanent adoptions for children who were unwanted, abused or neglected. The Family Welfare Section was itself subdivided into two units, both of which had considerable contact with Linda Rips and her children. These units were the Adoptions and Fostering Unit and the Home Help Unit, each of which was headed by a Principal Welfare Officer who delegated responsibilities through the lower ranks of the organisation. Considerable freedom in professional decision making was expected at all senior levels of the system and even Junior Welfare Officers were encouraged to take responsibility for day-to-day decisions relating to case individuals with whom they were closely involved. It should finally be noted that both the Adoptions and Fostering Unit and the Home Help Unit kept independent case records for all individuals and families to which they were providing on-going welfare support.

The Social Work Section was another large division of the Bexley Social Services Department. It is perhaps best viewed as an active "fieldwork" wing of the Department which was devoted to visiting individuals and families with the primary aim of providing on-the-spot advice, support and encouragement. The Social Workers also played important monitoring roles in assessing the general progress and future prospects of individuals and families. The Social Work Section frequently served overlapping functions to those of the Family Welfare Section and interaction between the two divisions of the Social Services Department was actively encouraged by higher management levels. The two sections were, however, housed in different annexes of the larger Department and also maintained independent sets of records of all case material. Considerable freedom in decision making was expected at all levels of the system right down to Junior Social Workers. It should be noted that the Social Work Section of the Bexley Social Services was itself divided into three teams of Social Workers and that each team was responsible for a geographical area within the borough of Bexley. Team were each presided by a Senior Social Worker and comprised both Social Workers and Trainee Social Workers.

The Greenwich and Bexley Area Health Authority came into existence in 1971 and assumed responsibility for the community health services previously provided by the Health Departments of the London Boroughs of Greenwich and Bexley. The total area subsumed by the Health Authority was itself divided into two districts co-terminous with the London boroughs of Bexley and Greenwich. Each District had a Principal Medical Officer who was attached to a Child Health Clinic and below whom there was a ranked structure of Clinical Officers. Each district also subsumed a number of Hospitals and Family Health Practices which fell within the jurisdiction of the Greenwich and Bexley Area Health Authority. Although, then, the Hospitals, Child Health Clinics and Health Practices were ultimately answerable to the Principal Area Physician who occupied the overriding managerial seat at the Area Health Headquarters, in practice all agencies were permitted a considerable degree of autonomy in professional matters.

The Brook Hospital at Shooters Hill in the London borough of Greenwich is the hospital that was most frequently attended by Linda Rips and her family. The children were under the care of a Consultant Paediatrician at this Hospital who saw them on a regular basis. From time to time the children were also seen by other doctors and consultants (surgical and orthopaedic) with regard to specific injuries that had suffered. The Child Health Clinic which served Linda Rips family was very closely allied professionally to the Brook Hospital but actually played only a peripheral role in the treatment and health monitoring of the Rips children.

The Health Visiting Section of the Greenwich and Bexley Area Health Authority was solely allied to the Family Health Practices. The Family Health Practice in Hook Lane, Welling, was a surgery occupying a large semi-detached house was the and four general practitioners and although patients were registered with only one of these they were

generally seen by whichever doctor was available when they called. This Family Health Practice was Linda's preferred surgery - presumably because it was the closest to where she lived. The Health Visitors who were attached to this Family Health Practice were very much the "field staff" for the borough of Bexley. Their role was to serve both counselling and monitoring functions in all matters of general health and welfare for families and individuals. The Health Visiting Section was actually a very small unit within the Area Health Authority and exhibited only a minimal hierarchical structure with all Health Visitors being directly answerable to the Senior Area Nursing Officer. Health Visitors were expected to carry full responsibility for any decisions that needed to be made regarding individuals covered within their geographical locale.

3. Chronology of Important Events and History of Foster Care

August 1950 to July 1969

Linda Rips and her twin sister were born on the 4th August 1950. The elder sister of the twins was two years old at this time. Linda's twin is understood to have been a pretty child and Linda was believed to have been much affected by the attention given to this sister. Linda Rips attended a child guidance clinic during her childhood but no further details could be obtained on this matter. On leaving school at sixteen, Linda worked as a clerk in the print department of the New Scotland Yard and when she was eighteen years old her mother died following a prolonged illness. From all accounts the indication is that Linda and her mother had a very close relationship. About the time of her mother's death Linda became pregnant.

19th July 1969

A baby boy was born to Linda Rips at *Farnborough Hospital*, Orpington. The baby was adopted immediately after birth.

12th March 1971

A baby boy, William, was born to Linda Rips at *Farnborough Hospital*, Orpington and Linda decided to keep the child.

March to June 1971

Linda Rips and her baby stayed with a nurse from the *Brook Hospital* who was also a mother so that Linda could receive guidance in child care skills.

15 June 1973

A baby girl, Mary, was born to Linda Rips at the *British Hospital for Mothers and Babies*, Woolwich. During the period of Linda Rips' confinement, William Rips was placed with Mrs. M., an aunt of Linda who was registered with *Bexley Social Services* as a foster parent. Following the birth of Mary, Linda Rips continued to live with her two children at her father's home.

1st February 1974

Linda Rips and her children were rehoused in a flat at *John Newton Court*. This was a Bexley Council estate and was situated close to shops in the centre of Welling. The estate comprised 132 flats and provided accommodation for the elderly as well as families with children. Some 30 single-parent families were housed in *John Newton Court* when the Rips family moved there. Linda's first floor flat included two bedrooms, a sitting-room with a balcony, a kitchen, a bathroom and a toilet. There was no central heating - only an open grate containing a free-standing electric fire.

March 1974

Mary Rips was admitted to Brook Hospital on the 18th March with what was diagnosed as an upper respiratory tract infection. She was detained at the hospital for six days. William Rips was seen at the hospital on the 28th March and the 31st of March - both times following head injuries sustained whilst playing. The second injury was recorded on the official injuries to children form.

11th April 1974

William Rips received a broken nose following a fall from scaffolding which he had been playing on outside the flat at *John Newton Court*.

25th April 1974

Linda Rips was admitted to *St Nicholas Hospital* with an undiagnosed illness. Mrs. McK. temporarily fostered William and Mary for a few weeks during Linda's stay at the hospital.

1st July 1974

Mary was brought in to the *Brook Hospital* with a laceration to her leg requiring three stitches. The accident had been caused by Mary falling from her cot onto a carpet sweeper.

30th October 1974

William and Mary were admitted into care. They were placed with an experienced foster mother (Mrs. O.) who was of the understanding that she and her husband were to have the children for a few weeks whilst their mother cleaned up her flat.

September to November 1975

William returned home from a prolonged stay with Mrs. O. on the 29th September whilst Mary returned home on the 14th November. During November Linda Rips became pregnant with her fourth child, Lucie, though this was unknown to anyone involved in the Gate's case until May 1976.

16th January 1976

Mary was admitted to the Brook Hospital for observation having swallowed half a bottle of Tryptizol tablets which had been prescribed for her mother.

26th May 1976

William Rips was seen at the Accident and Emergency Department of the *Brook Hospital* with a head injury. His mother said that he had been beaten up at school. William was also diagnosed as having mumps.

4th August 1976

On the 4th August William and Mary were received into care under Section 1 of the Child Act, 1948, in anticipation of their mother's pending confinement. Both children went to Mrs. K. The children remained with this family until 19th December 1976.

10th September 1976

A baby girl (Lucie) was born to Linda Rips at the *British Hospital for Mothers and Babies*, Woolwich. According to the mother, like Mary before her she was "an accident". Lucie seems to have been a healthy and normal baby at birth and gained weight well during the first few weeks of life following the 25th centile. The hospital records show that the staff were concerned about Linda's ability to mother the infant and they arranged an extended period of midwifery help to be provided at her flat.

12th October 1976

Lucie was detained at the Brook Hospital for three weeks with a probable diagnosis of gastroenteritis. She was discharged on the 2nd December having shown a consistent improvement in weight gain.

21st December 1976

Linda Rips was seen at the Accident and Emergency Department at *Brook Hospital* following an incident where she had been beaten up by her boyfriend. She was treated for broken facial bones and lacerations that required stitching.

14th January 1977

William had his stomach pumped at the *Brook Hospital* subsequent to ingesting phenobarbiturate tablets.

7th February 1977

Lucie was admitted to the *Brook Hospital* for observation, having apparently been dropped on her head whilst having been carried by a young child three days earlier.

24th April 1977

Mary Rips was seen at the Brook Hospital suffering with a painful laceration to her head which arose from her falling out of her bunk bed.

23rd August 1977

Lucie was admitted to *Brook Hospital* on 23rd August for an extended period of investigation since Health Visitor 2 and the Principal Medical Officer were concerned over her failure to thrive. Lucie remained in the hospital until 23rd September

4th October 1977

Mary was admitted to the Brook Hospital on the 4th October suffering with a fever and was diagnosed as having a severe upper respiratory tract infection

18th January 1979

William Rips was brought to the *Brook Hospital* by his mother after an incident in which he had been hit across the back with a broomstick by a teenage girl who had been staying at Linda Rips' flat.

9th February 1979

Linda Rips went into hospital to be sterilised, having agreed with Health Visitor 3 that this was advisable. She was in hospital for two days. William, Mary and Lucie were received into care on the 8th February 1979. They were all returned home on the 23rd February.

13th March 1979

Lucie was brought to the *Brook Hospital* by her mother in order to have an X-ray of her head following a bump she had sustained the previous day during a fall from her chair during her brother's birthday party. The X-ray showed no cranial damage.

B1.3 The Legal File

Like the common file this information was contained in the reference file available to decision panel members regardless of their assigned role. Designation of individual entries is as per the Common File, with page wide underlining.

Care Proceedings

The Children and Young Persons Act (1969)

Section 1: Care Proceedings in Juvenile Courts

(1) Any local authority, constable or authorised person who reasonably believes that there are grounds for making an order under this section in respect of a child or young person may... bring him before a juvenile court.

(2) If the court before which the young person or child is brought under this section is of opinion that any of the following conditions is satisfied with respect of him, that is to say:-

(a) his proper development is being avoidably prevented or neglected or his health is being avoidably impaired or neglected or he is being ill-treated; or

(b) it is probable that the condition set out in the preceding paragraph will be satisfied in his case, having regard to the fact that the court or another court has found that the condition is or was satisfied in the case of another child or young person who is or was a member of the household to which he belongs; or

(c) he is exposed to moral danger; or

(d) he is beyond the control of his parent or guardian; or

(e) he is of compulsory school age within the meaning of the Education Act (1944) and is not receiving efficient full-time education suitable to his age, ability and aptitude; or

(f) he is guilty of an offence, excluding homicide,

and also that he is in need of care and control which he is unlikely to receive unless the court makes an order under this section in respect of him, then... the court may if it thinks fit make such an order.

(3) The order which a court may make under this section in respect of a child or young person is -

(a) an order requiring his parent or guardian to enter into recognisance to take proper care of him and exercise proper control over him; or

(b) a supervision order; or

(c) a care order; or

(d) a hospital order within the meaning of Part V of the Mental Health Act (1959); or

(e) a guardianship order within then meaning of that Act.

Local Authority Responsibilities

The Children and Young Persons Act (1969)

Supplementary Provisions to Section 1

(1) If a local authority receive information suggesting that there are grounds for bringing care proceedings in respect of a child or young person who resides in or is found in their area, it shall be the duty of the authority to cause enquiries to be made into the case unless they are satisfied that such enquiries are unnecessary.

(2) If it appears to a local authority that there are grounds for bringing care proceedings in respect of a child or young person who resides in or is found in their area, it shall be the duty of the authority to exercise their power under the preceding section to bring care proceedings in respect of him...

Parental Rights

Children Act (1948)

A local authority is able to pass a resolution vesting parental rights in itself in respect of any child who has been received into care voluntarily if, in the authority's view, the parents are unfit to have care of the child.

Unless the parents consent in writing to the passing of such a resolution, the authority must give them notice and if within one month the parents serve a counter notice, the matter comes before the local juvenile court. The magistrates then have to determine whether the grounds on which the local authority purported to pass the resolution are made out.

Fostering Regulations

Statutory Instrument No 1377 (1955)

Duties on local authorities in respect of children in their care include:-

Regulation (9) requires the Visiting Officer to make written reports on the welfare and progress of the child and the condition of the foster home.

Regulation (10) obliges the local authority to maintain an up-dated case record on every child boarded out. Where placements are long term and the children are aged under 5, they have to be visited within one month and thereafter not less often than once every six weeks.

Regulation (11) requires the Social Services Departments to keep a register of all children boarded out, the foster parents with whom they are placed... and the dates of placements.

Place Of Safety

The Children and Young Persons Act (1969)

(1) if upon application to a justice by any person for authority to detain a child or young person and take him to a place of safety, the justice is satisfied that the applicant has reasonable cause to believe that-

(a) any of the conditions set out in Section 1 (Care Proceedings in Juvenile Courts) of this Act is satisfied in respect of the child or young person; or

(b) an appropriate court would find the condition set out in Section 1 of this Act satisfied in respect of him; ...

the justice may grant the application; and the child or young person in respect of whom an authorisation is issued under this subsection may be detained in place of safety by virtue of the authorisation for twenty-eight days beginning with the date of authorisation.

(2) Any constable may detain a child or young person as respects whom the constable has reasonable cause to believe any of the conditions set out in Section 1 (Care Proceedings in Juvenile Courts) of this Act is satisfied or that an appropriate court would find the condition set out in Section 1 of this Act satisfied...

Child Protection Procedures

(1) Special Injuries Recall Exercise (SIRE) 1967-1974

SIRE is a surveillance system intended to ensure that the Community Child Health Service is notified when there is concern about any injury to a child, whether accidental or not.

Notification of an injury is made to the Principal Medical Officer (Child Health) on a form known as SIRE Form I. The Principal Medical Officer then sends a form known as SIRE Form II to the health visitor from whose area a report has emanated so that the latter can report on subsequent developments.

(2) The Non-Accidental Injury Register (NAI Register) 1974-1977

In November 1974, a new system was introduced, following a DHSS circular and memorandum. Overall responsibility for the Area Health Authority's new NAI registration system rests with the Area Community Physician (Child Health). The master copy is retained at the Rea Health Authority's headquarters, but Health and Social Services Departments have their respective copies. The Principal Medical Officer (Child Health) and one of the Divisional Social Services Officers (acting as NAI register coordinator) have joint responsibility for keeping the register under review, and updating the several copies.

(3) DHSS Letter and Memorandum 1976

Further instructions regarding Child Protection from the DHSS include:-

(a) The importance of indicating clearly on the register whether a child had been the subject of actual NAI, or a suspicion of NAI, for whatever reason, including a failure to thrive.

(b) The involvement of the family GP in case conferences.

(c) Provision for the consideration of different points of view on the case.

(d) The need for all professionals involved, and particularly the primary care team of health and social workers, to be provided with updated copies of locally issued instructions.

(4) Revisions to the Non-Accidental Injury Register (NAI Register) 1977-1979

The NAI register Coordinator circulates a new memorandum for guidance, indicating that three classifications are now to be used in the central register:-

(a) children who had actually suffered NAI;

(b) those suspected to be suffering from NAI;

(c) those who had been threatened by NAI.

(5) NAI Procedures 1978

The Social Services Department issues the following procedural instructions as a guide to action in the event of NAI:-

- (a) Check the records including the NAI register with the NAI Coordinator and Principal Medical Officer (Child Health).
- (b) Refer the case to the Senior Social Worker.
- (c) Where satisfied that NAI has occurred, submit an immediate report.
- (d) Hold a cease conference within 24 hours.

B1.4 Individual Case Files

B1.4.1 Overview

The contents of each of the four individual casenotes files are given below. The two Health files, the Hospital Consultant and the Health Visitor presented a view opposing that contained in the Social Worker and Welfare Officer Files. Individual entries are denoted by the numbers 1 through to 50.

B1.4.2 Health Visitor Casefile

Case Book For The Rips Family Based On The Records Of The Health Visiting Services

(1) March 1971

Arrangements were made by Health Visitor 1 for Linda Rips' second child (William) to be placed with foster parents after his birth. The fostering decision had been made by Linda Rips and had been fully endorsed by Health Visitor 1 who was of the opinion that "Linda will in all likelihood be totally unable to cope with looking after a baby. She is immature and skittish and barely seems able to take care of herself". Linda Rips, however, decided to keep baby William after he was born, and the child was identified by Health Visitor 1 as requiring close follow-up. (Based on records of Family Health Practice)

(2) March to November 1971

Baby William's progress was being monitored on a monthly basis. Health Visitor 1 noted that William's appearance was often "very grubby and unkempt" but apart from that he seemed to be "healthy - though perhaps a little underweight". (Based on records of Family Health Practice)

(3) 20th February 1972

A neighbour made a request for a health visitor to visit the Rips' home owing to her concern about the care of William. Health Visitor 1 described the house as being "in a state of neglect" and William as being "happy, though dirty". It was also noted that the child was receiving a course of treatment for his bronchitis which seemed to have arisen through the damp conditions in the home. Arrangements were made by the health visitor for Linda Rips and William to attend the Child Health Clinic on the 27th February 1972. (Based on records of Family Health Practice)

(4) March 1972 to June 1973

Repeated visits were made by Health Visitor 1 to Linda Rips' home but she always appeared to be out and failed to respond to any of the notes that were left. On one occasion Health Visitor 1 noted that she had heard a toddler babbling indoors but could get no answer from inside "even after twenty minutes of knocking and waiting". (Based on records of Family Health Practice)

(5) July 1973

Following the birth of Linda Rips' third child (Mary) in June 1973 it was known that Mr. Rips had agreed that his daughter could return to live at his home with her children. Doubts, however, were expressed by Health Visitor 1 over Linda Rips' ability to cope with the new

baby in addition to looking after William and the home. Health Visitor 1 therefore requested Home Help support from the *Home Help Unit* of the *Family Welfare Section*, though she noted her view that "even this measure is unlikely to do much good, as support with the house is not going to change Linda's lack of basic nurturing and caring skills". (Based on records of Family Health Practice)

(6) 5th July 1973

Health Visitor 1 received a telephone call from the Consultant Paediatrician at *Brook Hospital* and was told that William Rips had been admitted with a fractured elbow. The paediatrician also mentioned that Linda Rips had told the Hospital that "William had fallen downstairs, whilst being minded by one of her friends". (Based on records of Family Health Practice)

(7) August 1973

Health Visitor 1 noted some improvement in the cleanliness of Linda Rips' father's home, and reported that the baby Mary appeared to be making satisfactory progress "in spite of everything". The only concern that the Health Visitor expressed was over a bruise on the baby's forehead which Linda Rips claimed had resulted from the baby "hitting herself on the side of her cot". Health Visitor 1 noted that Linda Rips "seemed uncomfortable when asked about the baby's injury and seemed slow to provide an explanation". (Based on records of Family Health Practice)

(8) November 1973

Health Visitor 1 was informed in writing by the *Family Welfare Section* of the *Bexley Social Services* that Home Help had been withdrawn from Linda Rips for a trial period earlier in November. It was mentioned in the communication that Home Helper 1 had found Linda "childish, excitable, prone to temper tantrums, hysterical at times and inclined to be moody". It was also noted that Linda Rips had been witnessed to smack all of the children sometimes "rather too hard". The letter further stated that Home Helper 1 had chosen to withdraw her services primarily because "Linda Rips showed no inclination to participate in looking after the house or children and that she seemed to wilfully want to make life difficult for the Helper . . . Sometimes Linda expected her to make coffee for friends who were visiting the flat". (Based on records of Family Health Practice)

(9) February 1974

Health Visitor 1 sent a note to Social Worker 1 in which concern was expressed over the welfare of Linda Rips' children in their new accommodation at *John Newton Court*. Social Worker 1 replied with an agreement to contact the *Family Welfare Section* of the *Bexley Social Services* with a view to increasing Home Help support. Health Worker 1 filed a memo in which she expressed the belief that "whilst home help is all well and good for keeping the flat in a habitable state, it won't stop William and Mary having repeated accidents resulting from their mother's neglect". (Based on records of Family Health Practice)

(10) 18th March 1974

One year old Mary Rips was admitted to *Brook Hospital* for six days with what was diagnosed as an upper respiratory tract infection. A note was also sent to Health Visitor 1 from an Adoption Section Social Worker which expressed the view that "Linda Rips appears to be neglecting Mary". (Based on records of Family Health Practice)

(11) 25th March 1974

An evening visit was made by Health Visitor 2 to Linda Rips' flat following Mary's discharge from hospital. No reply was obtained but a neighbour let the Health Visitor in with a spare key that Linda had left her. Health Visitor 2 found William playing on his own in the lounge. Linda arrived home with Mary 15 minutes later and said that she had been down to the shop to get some cigarettes. (Based on records of Family Health Practice)

(12) 31st March 1974

William Rips was again seen by the Hospital Liaison Health Visitor at the Accident and Emergency Department at *Brook Hospital* following a head injury sustained following "a fall from a slide whilst playing". William was noted as "suffering from a headache and severe

vomiting". The incident was recorded on the official *Injuries to Children* form. (Based on Hospital Liaison Health Visitor's records at Brook Hospital)

(13) 1st April 1974

Health Visitor 1 together with Health Visitor 2 compiled a report in which they logged the various recent injuries that William Rips had sustained together with Linda Rips' explanations for them. Health Visitor 1 concluded the report by stating that "I am sure these injuries were not caused directly by the mother. They do, however, demonstrate her inability to supervise William adequately". (Based on records of Family Health Practice)

(14) 11th April 1974

Whilst visiting another family living at *John Newton Court*, Health Visitor 2 witnessed William Rips fall from scaffolding on which he had been playing, with the consequence that he banged his forehead and nose. The health visitor took William and his mother to the Accident and Emergency Department at *Brook Hospital*. William was seen by an Orthopaedic Surgeon and found to have a fracture of his nasal bones. (Based on records of Family Health Practice)

(15) 29th May 1974

Health Visitor 2 reported seeing Mary in her pram in a "dirty condition and without the pram straps fastened". She added that "Linda seems most reluctant to safeguard her youngest child". (Based on records of Family Health Practice)

(16) June 1974

Health Visitor 1 recorded that she had observed a burn upon William's abdomen which Linda said that she had noticed but had "no idea how it happened". (Based on records of Family Health Practice)

(17) 1st July 1974

The Hospital Liaison Health Visitor was called since Mary had been brought in to *Brook Hospital* by her mother with a laceration on her leg requiring three stitches. Linda Rips was recorded as saying that the "cut had been caused by Mary falling from her cot onto carpet sweeper". The Hospital Liaison Health Visitor was sceptical of this explanation and completed a *Special Injuries Recall Exercise* (SIRE) form in which it was stated that "Because this mother's supervision is so inadequate, the girl faces a childhood of accidents if nothing worse". A copy of this form was forwarded to Health Visitor 1 at the Family Health Practice. (Based on Hospital Liaison Health Visitor's records at Brook Hospital and records of Family Health Practice)

(18) 3rd July 1974

A Health Visitor (identity not recorded) reported to Health Visitor 1 that she had seen William Rips running around on path outside the flat at *John Newton Court* "in an absolutely filthy condition and without shoes or socks". (Based on records of Family Health Practice)

(19) 30th July 1974

Health Visitor 1 attended a case conference on the Rips' family which was held at *Brook Hospital* and was chaired by a colleague of the resident Consultant Paediatrician. There were no representatives present from the Child Health Clinic - none having been invited, though Health Visitor 1 and Social Worker 1 were present. The minutes of the conference indicate that reports had been prepared by both the Health Visitor and the Social Worker, but that only the latter's report had been read and considered.

Social Worker 1's conference report expressed the view that the children were developing normally and that "although frequently dirty they do not appear in the least unhappy". She expressed her belief that "Linda Rips tends to allow situations to develop because of passivity but there are no indications of Non-Accidental Injury or of Linda being a vicious person". Social Worker 1 concluded that "For the first time I feel more optimistic about Miss Rips' capacity to change and would hope that with continued supervision the improvement can be

maintained. Certainly I feel there is are strong mother-child ties and I would be reluctant to see these broken".

Health Visitor 1's report - which was not considered at the conference - expressed the view that "Linda is incapable of being educated to the needs of her children. She simply will not take the safety precautions which are constantly being demonstrated to her . . . Linda, one feels certain would not harm her children, but accidents happen because her sense of awareness is almost nil. I feel that the only way of giving William and Mary a stable home life is for her to have 24 hour supervision. Since it is impossible to provide such supervision the only solution is to take her children into care."

The minutes of the case conference indicate that the view of Social Worker 1 prevailed. The chairman concluded by stating that "Here we have children who are presented as being neglected rather than wilfully abused. The older boy William seems robust and healthy, though the younger child Mary does present grounds for careful monitoring because of her more fragile constitution. The mother should be encouraged to keep her children but should be provided with a high level of community support". (Based on records of Family Health Practice)

(20) 4th August 1974

Subsequent to the case conference on the 30th July, Health Visitor 1's concern over the Rips' children was not assuaged. She filed a report in which she noted that the state of the flat was appalling and that the children were filthy. (Based on records of Family Health Practice)

(21) September to October 1974

Health Visitor 1 decided to make a move toward placing the children with foster parents for a short time until Linda could "show a willingness to keep the flat clean and habitable". The Social Services agreed that this was a sensible idea and said that they would contact the *Adoption and Fostering Unit* of the *Family Welfare Section* in order to secure a temporary fostering placement for William and Mary.

William and Mary were admitted into care on 30th October. They were placed on a short-term basis with an experienced foster mother (Mrs. O.) who had been forewarned what to expect. Her understanding was that she and her husband were to have the children for a few weeks whilst their mother cleaned up her flat. (Based on records of Family Health Practice)

(22) 25th January 1975

Health Visitor 2 reported that Linda was very depressed and was very keen to get her children back. The Health Visitor noted that "although Linda wants the children returned she seems incapable of organising herself so as to make this possible". (Based on records of Family Health Practice)

(23) 26th September 1975

Social Worker 1 telephoned Health Visitor 2 to announce that William would be returning home on the 29th September. The Social Worker told the Health Visitor that "relations between mother and son are close but with the daughter they appear to be virtually nil at the moment". (Based on records of Family Health Practice)

(24) 14th November 1975

Social Worker 1 reported in writing to Health Visitor 2 that Mary had been returned home to Linda Rips. She further stated that "although conditions are far from perfect the standard of the house is fair and the level of care that Linda Rips is able to offer seems adequate to ensure Mary's health". Social Worker 1 added that Mary's condition should be monitored carefully to "ensure that the child is not subjected to any wilful abuse".

Health Visitor 2 filed the letter from Social Worker 1 with an additional note which stated her conviction that "Linda Rips, I am sure, will continue to neglect Mary since she seems to have no clue how to care for very young children." She added that she was "very worried about the welfare of the child". (Based on records of Family Health Practice)

(25) January 1976

Linda Rips had flu and Health Visitor 2 found her flat in a state of chaos and the children without anything to eat. She reported the situation to Social Worker 1. Two days later in her follow-up of the family, the Health Visitor noted that Linda Rips' father had brought food for the family and had told her that "Linda just doesn't seem to care whether the kids eat or starve". (Based on records of Family Health Practice)

(26) February 1976

Health Visitor 2 sent a letter to the Principal Medical Officer (*Child Health Clinic*) expressing concern for Linda Rips' children. The Health Visitor stated that "Linda has almost returned to the state she was in before William and Mary went into care last time . . . Sometimes she and the children are still undressed by lunchtime and frequently there is no food in the house." (Based on records of Family Health Practice and records of Child Health Clinic)

(27) 12th March 1976

Health Visitor 2 recorded a conversation with one of Linda Rips' neighbours who had reported that she had witnessed Linda and her son William squabbling outside the flat. The neighbour said that the argument had eventually culminated in Linda slapping William across the face and William had retaliated by kicking his mother. He had then run away crying but was seen with his mother again later in the day and everything seemed OK". (Based on records of Family Health Practice)

(28) May to July 1976

An incident (undated) was recorded by Health Visitor 2 in which Mary fell down some stone steps leading to the flat. The Health Visitor noted that Linda Rips (who was now known to be pregnant again) appeared "totally unconcerned about the accident and the fact that Mary was obviously in a lot of pain". (Based on records of Family Health Practice)

(29) 24th August 1976

Relieved of her children (who had been taken into care prior to the birth of Linda Rips' fourth child) Health Visitor 2 reported signs of improvement in Linda's own cleanliness as well as in the general state of the flat. She noted that "Linda seems to have prepared well for her forthcoming confinement and the flat is looking neat and tidy." Health Visitor 1 also reported that "the children have settled in well with their foster parents and seem very happy though disciplined. William's manners have improved considerably and Mary seems sociable and cheerful." (Based on records of Family Health Practice)

(30) 15th September 1976

Subsequent to the birth of Linda Rips' fourth child (Lucie) at the *British Hospital for Mothers and Babies*, Woolwich, the hospital staff told Health Visitor 2 that Linda "does not appear to know the basics of motherhood, particularly how to feed the baby, despite having had three other children". Social Worker 2, who had visited the hospital to see Linda, sent a note to Health Visitor 2 expressing some concern over the welfare of the new baby. The Social Worker reported that "Linda does not seem to be taking to Lucie at all. She is a small and fragile looking baby whom Linda appears to be frightened of and is reluctant to pick up". (Based on records of Family Health Practice)

(31) 16th December 1976

Health Visitor 2 went with Linda Rips and Lucie to see the Consultant Paediatrician at the Brook Hospital. Lucie's health was reported as being satisfactory though her weight gain was reported as being below the 3rd centile. (Based on records of Family Health Practice)

(32) 22nd December 1976

According to a report filed by Health Visitor 2, Linda Rips was beaten up by her boyfriend just before Christmas and received broken facial bones as well as lacerations that required stitching. It was also noted that the boyfriend, who had been staying with Linda Rips for some weeks, was wanted by the police on a number of counts of suspected theft in the *John Newton Court* area. (Based on records of Family Health Practice)

(33) 7th January 1977

Health Visitor 2, in a report to the Principal Medical Officer at the Child Health Clinic, observed "I am visiting Linda several times a week . . . I do not feel I am making much headway with her at all. The children are as dirty and uncared for as ever and so is the flat". (Based on records of Family Health Practice)

(34) 3rd February 1977

Health Visitor 2 noted that Linda was having difficulty feeding the baby and seemed to be attempting to give her solid foods. Health Visitor 2 also reported having seen scratches on Lucie's face which Linda had said had been caused by a fall from her cot. (Based on records of Family Health Practice)

(35) 24th February 1977

Health Visitor 2 called on the Rips' home and found that there was no food. Two neighbours also complained to that Health Visitor that Linda was leaving the children unattended - sometimes for many hours at a time. (Based on records of Family Health Practice)

(36) 24th April 1977

The Hospital Liaison Health Visitor telephoned Health Visitor 2 to say that Mary had been brought in to the *Brook Hospital* with a bad cut to her head. Linda Rips had claimed that the injury had resulted from Mary "falling out of her bunk bed". (Based on records of Family Health Practice)

(37) 29th May 1977

Social Worker 2 wrote to Health Visitor 2 and stated her opinion that "Linda Rips' mothering of the baby still leaves a lot to be desired." She suspected that Lucie's feeding patterns were irregular and noted that "sometimes it is evident that Linda has not changed the baby for hours". She also seemed bothered by Linda's tendency to "treat Lucie as a play thing".

Social Worker 2 further noted to Health Visitor 2 that she had communicated these views to her Senior who "agrees that it is necessary to continue with a high intensity of support as the baby is 'At Risk' in regard to thriving". (Based on records of Family Health Practice)

(38) 20th July 1977

Health Visitor 2, in a routine report to the Principal Medical Officer (*Child Health Clinic*), expressed concern about Lucie who had not gained weight in the last month. The Health Visitor recorded "I am not convinced that Linda is feeding the baby adequately". (Based on records of Family Health Practice)

(39) 22nd August 1977

Health Visitor 2 was notified by the Senior Nursing Officer at *Brook Hospital* that Linda Rips had brought Lucie in at three o'clock in the morning complaining that she would not stop crying. The Nursing Officer said that she had questioned Linda about a bruise on the baby's forehead and her explanation had been that the child had "banged her head on the side of her cot". (Based on records of Family Health Practice)

(40) 23rd August 1977

After visiting the Rips' flat, Health Visitor 2's concern over Lucie's failure to thrive led to the baby being admitted to the *Brook Hospital* for an extended period of observation. She remained in the hospital until 23rd September. During her month at the hospital Lucie started feeding better and gained some weight. (Based on records of Family Health Practice)

(41) 14th March 1978

Health Visitor 2 prepared a report for the Principal Medical Officer (*Child Health Clinic*) in which she said that she had been visiting the family weekly but rarely found them all well. She wrote that in her opinion "Linda is totally unable to cope, even with the assistance of a Home Help". She added that "Possibly if Lucie were in care until she made marked

improvement in her growth and health, it might help the family situation". (Based on records of Family Health Practice)

(42) 25th March 1978

Health Visitor 2 advised Social Worker 2 that Mary and Lucie were due for check-ups at the *Child Health Clinic*. She had been unable to follow this up with Linda since the family was out every time that she had called at the flat. (Based on records of Family Health Practice)

(43) November 1978

There was a change in health visitors to the Rips family during November which occurred when Health Visitors 2 and 3 re-organised their work loads so that they were each responsible for a geographical patch within the area covered by the *Family Health Practice*. Health Visitor 3 already knew the Rips' family, having seen them on occasions when they had visited the Practice. Health Visitor 3 began by tabulating existing information on the Rips' family and she also called on the family and noted areas of particular concern. Her preliminary assessment of the situation was that "however much time and effort is put into supporting, motivating and advising Miss Rips on child care and standards of hygiene, improvement is rarely seen to be maintained". (Based on records of Family Health Practice)

(44) September 1978

Having noticed from the records the frequency with which the children had been taken to the surgery and the local hospital with injuries, Health Visitor 3 concluded that they were 'At Risk'. She discussed with Social Worker 2 the possibility of putting them on the Central Register of children suspected of Non-Accidental Injury but Social Worker 2 thought that she should get to know the family better before taking such a major step. It was agreed that they should review the situation at a full case conference that would be held at some later date. (Based on records of Family Health Practice)

(45) 13th September 1978

Health Visitor 3 noted that she had seen Mary and Lucie at the flat in the care of an eleven year old girl. She informed Social Worker 2 of this incident. (Based on records of Family Health Practice)

(46) October to December 1978

During the autumn of 1978 Linda Rips was known to have taken in an unemployed teenage girl who had family problems. Linda also befriended the girl's brother-in-law whose marriage had broken up. Health Visitor 3 recorded her belief that "Linda formed friendships with people who were prone to take advantage of her". Prior to Christmas the Police telephoned Health Visitor 3 and told her that the teenage girl had been arrested at Linda Rips' flat and had been charged with being in possession of a prohibited drug. The Health Visitor was later informed that the girl had been placed on probation for one year and had resumed living at Linda Rips' flat. (Based on records of Family Health Practice)

(47) 13th September 1978

Health Visitor 3 visited Linda Rips' flat and found it in a terrible state of untidiness. She noted that there was broken glass on the floor and reported that Mary had a sliver of glass in her foot which was turning septic. (Based on records of Family Health Practice)

(48) 13th March 1979

Health Visitor 3 saw Linda Rips and Lucie at the Family Health Practice. She recorded Linda as saying that Lucie had sustained a bump to her head the previous day having "fallen from her chair during William's birthday party". Linda Rips was also noted as saying that Lucie had vomited during the night and fallen over since getting up in the morning. The General Practitioner at the Family Health Practice sent Lucie to the *Brook Hospital* for an X-ray. (Based on records of Family Health Practice)

(49) 15th March 1979

Health Visitor 3 received a report back from the *Brook Hospital* which informed that Lucie had been kept in overnight for observation, though the X-ray had shown no cranial damage. In the view of the Paediatric Senior House Officer, Linda Rips' explanation of how Lucie had come by her injuries was plausible and he did not think there was any evidence of Non-Accidental Injury. He further added that "it is clearly necessary for Lucie's progress at home to be closely followed up by district social workers and health visitors alike to ensure that she is not the subject of any wilful harm by her mother".

Health Visitor 3 filed a note along with the letter from the *Brook Hospital* and stated that she was not reassured by the House Officer's report since she felt that "accidents to the Rips children and visits to the hospital were too frequent". Health Visitor 3 further noted that "unless a change can be wrought in Linda Rips, then the long term prospects of the children look bleak indeed". (Based on records of Family Health Practice)

(50) 18th March 1979

Health Visitor 3 visited Linda Rips' flat and found it in a squalid condition with the children untidy and unwashed. She reported that on leaving *John Newton Court*, a neighbour of Linda Rips had mentioned that earlier in the week she had gone round Linda's flat at 10.30 p.m. and had found the children on their own. She said that when she asked the children where their mother was they replied that she was down the pub. (Based on records of Family Health Practice)

B1.4.3 Hospital Consultant Casefile

The following information was available to the participant designated as the hospital consultant.

Case Book For The Rips Family Based On The Records Of The Hospital Services

(1) March to May 1971

Arrangements were known to have been made for Linda Rips' second child (William) to be placed with foster parents after his birth. Linda, however, decided to keep the child and the *Brook General Hospital* decided that Linda should be given child care guidance because of "her immaturity and clear lack of ability to understand her baby's needs". The hospital decided that Linda and William could be placed for a few months in the home of a nurse who was also a mother. The hospital records indicate, however, that the nurse asked Linda to leave her home because of "her dirty habits and her tendency to go out drinking all of the time". (Based on records of Brook Hospital)

(2) 26th August 1972

William was admitted to Brook Hospital having "ingested rat poison". Linda Rips told the Consultant Paediatrician that she "had no idea how William managed to get hold of the poison which she was sure she kept on a high shelf in the kitchen". (Based on records of Brook Hospital)

(3) 12th September 1972

William was seen by the Consultant Paediatrician, having been admitted to the hospital with a chest infection. He recorded on file the fact that he had noticed some "bad bruising on William's arms as well as some longitudinal bruising on his buttocks". The Consultant Paediatrician further noted that the origins of these bruises were "not well explained by Linda Rips who seemed unconcerned about the matter". (Based on records of Brook Hospital)

(4) 30th November 1972

William was treated at the Outpatient ward of the Brook Hospital for a discharge from his ears. He was also noted to have a "severe rash over his back and napkin area" for which treatment was also prescribed. (Based on records of Brook Hospital)

(5) 9th November 1972

Linda Rips brought William to the Outpatient ward at Brook Hospital following a fit that he had suffered earlier in the day. It was noted that William "seemed in a distressed and disoriented state and was reluctant to be held by his mother". The House Doctor at the Outpatient ward filed a report in which she expressed concern over the welfare of William. She further stated her doubt over about "the nature of the so-called fits". A copy of the report was forwarded to Social Worker 1 at the Bexley Social Services department who was asked to look into the case further. (Based on records of Brook Hospital)

(6) December 1972 to June 1973

Unknown to anyone but herself, Linda Rips became pregnant for the third time in the latter part of 1972. She did not seek any medical advice and therefore had no antenatal care until a fortnight before her confinement in June 1973. When Linda Rips finally visited the *Brook Hospital* she saw a social worker (unidentified) who made the necessary arrangements for her forthcoming stay at the hospital. (Based on records of Brook Hospital)

(7) 5th July 1973

The Consultant Paediatrician recorded that he had seen William Rips at the hospital with a fracture to his right elbow. According to the Paediatricians report, Linda Rips had told him that "William fell downstairs whilst being minded by one of my friends when I was out shopping". (Based on records of Brook Hospital)

(8) 18th March 1974

On this day - one and a half months after the Rips family had been rehoused in a flat at *John Newton Court* - Mary was admitted to *Brook Hospital* for six days with what was diagnosed as an upper respiratory tract infection. The Consultant Paediatrician who treated Mary recorded that she had been brought into the hospital a "distressingly dirty state, smelling terrible, with her hair matted and her clothes covered in old food and vomit". The Paediatrician additionally expressed concern over Mary's "poor state of health" and felt that there "might be grounds for taking Mary away from Linda and into care if the apparent negligent treatment of the baby persists". (Based on records of Brook Hospital)

(9) 28th March 1974

Three-year old William Rips was seen at the *Brook Hospital*. The Hospital Liaison Health Visitor filed a hospital report which described William as having a "painful laceration to his forehead, the origins of which are not clear since neither William nor his mother expressed any knowledge of how it happened". The Hospital Liaison Health Visitor passed on copies of the report to the Consultant Paediatrician at the Hospital as well as to the Principal Medical Officer at the *Child Health Clinic*. (Based on records of Brook Hospital & the Child Health Clinic)

(10) 31st March 1974

William was seen at the Accident and Emergency Department of *Brook Hospital* - this time by both the Hospital Liaison Health Visitor and the Consultant Paediatrician. The latter recorded that William had a head injury "which his mother claimed occurred as a result of him falling from a slide in the park". It was also noted that William had "a severe headache as well as nausea and vomiting". The Hospital Liaison Health Visitor was believed to have filed an official *Injuries to Children* report which recorded the incident. (Based on records of Brook Hospital)

(11) 2nd April 1974

Mary was taken to the *Child Health Clinic* by Linda Rips suffering with a sore throat which was diagnosed as being tonsillitis. Mary was also noted as being a "terribly dirty state" and as having a severe nappy rash which was "seemingly being due the infrequency with which Linda Rips changes and washes the baby" (Based on records of Child Health Clinic)

(12) 11th April 1974

William and Linda Rips were brought into the Accident and Emergency Department at *Brook Hospital* by Health Visitor 2 who told the Duty Nurse that William had fallen from some scaffolding and had banged his forehead and nose. William was noted to be complaining of a

painful nose and, when examined by an Orthopaedic Surgeon was discovered to have a fracture to his nasal bones. (Based on records of Brook Hospital)

(13) 1st July 1974

Mary was brought in to Brook Hospital by her mother suffering with a laceration to her leg that required three stitches. Linda Rips was noted as saying that the "cut had been caused by Mary falling from her cot on to the carpet sweeper". Mary was noted to be in a severely distressed and anxious state when she was initially brought in - being described as "screaming and hysterical". A heavy dose of sedatives had to be administered by the House Doctor in order to calm her down. Linda Rips was noted as seemingly being "totally unconcerned about the whole business". (Based on records of Brook Hospital)

(14) 18th July 1974

Linda Rips took Mary to the *Child Health Clinic* with a "gaping wound and bruising on her face". The Principal Medical Officer at the Clinic advised that the child be taken to the Accident and Emergency Department at the *Brook Hospital* where she was admitted for investigation. An unsigned hospital report that was filed indicates that Mary had "a cut to the left eye, a bruise on her back and another on her left iliac crest". These injuries were the subject of a *Special Injuries Recall Exercise* (SIRE) report that was written by the Principal Medical Officer. Mary was detained at the hospital until the 1st August. (Based on records of Brook Hospital & the Child Health Clinic)

(15) 19th July 1974

The Consultant Paediatrician at Brook Hospital filed a report in which he expressed the suspicion that "Mary might be a battered baby". Within this report he stated his decision to convene a case conference as soon as possible in order to look into the welfare of both William and Mary Rips and to establish whether it was necessary to issue a compulsory care order on the children. The Consultant Paediatrician wrote to both the *Social Work Section* of the *Bexley Social Services* and the *Family Health Practice* with requests for reports to be prepared and submitted at the forthcoming case conference. (Based on records of Brook Hospital & the Child Health Clinic)

(16) 30th July 1974

The case conference on the Rips children was held at *Brook Hospital* and was chaired by the deputy of the resident Consultant Paediatrician (who was himself unable to attend). There were no representatives present from the Child Health Clinic - none having been invited. Health Visitor 1 and Social Worker 1 were at the conference. The minutes of the conference indicate that reports had been prepared by both the Health Visitor and the Social Worker, but that only the latter's report had been read and considered.

Social Worker 1's conference report expressed the view that the children were developing normally and that "although frequently dirty they do not appear in the least unhappy". She expressed her belief that "Linda Rips tends to allow situations to develop because of passivity but there are no indications of Non-Accidental Injury or of Linda being a vicious person". Social Worker 1 concluded that "For the first time I feel more optimistic about Miss Rips' capacity to change and would hope that with continued supervision the improvement can be maintained. Certainly I feel there is are strong mother-child ties and I would be reluctant to see these broken".

Health Visitor 1's report - which for some reason appears not to have been considered at the conference but which was attached to the minutes - expressed the view that "Linda is incapable of being educated to the needs of her children. She simply will not take the safety precautions which are constantly being demonstrated to her . . . Linda, one feels certain would not harm her children, but accidents happen because her sense of awareness is almost nil. I feel that the only way of giving William and Mary a stable home life is for her to have 24 hour supervision. Since it is impossible to provide such supervision the only solution is to take her children into care."

The minutes of the case conference indicate that the view of Social Worker 1 prevailed. The chairman concluded by stating that "Here we have children who are presented as being neglected rather than wilfully abused. The older boy William seems robust and healthy, though the younger child Mary does present grounds for careful monitoring because of her more fragile constitution. The mother should be encouraged to keep her children but should

be provided with a high level of community support". (Based on records of Brook Hospital)

(17) 1st August 1974

A Consultant colleague of the normal Consultant Paediatrician took Mary home following her two-week stay at the Brook Hospital. Upon returning to the hospital the Consultant filed a memo which stated that he had spoken to Linda Rips about the poor quality of care that she appeared to be providing her children. He noted that he had told Linda of the general concern which had been expressed at the case conference about the welfare of William and Mary and that it was "now clearly up to her to show that she was able to look after them properly". (Based on records of Brook Hospital)

(18) 2nd August 1974

The Consultant colleague of the normal Consultant Paediatrician at *Brook Hospital* wrote a letter to the Director of the *Family Welfare Section* of the *Social Services Department* which exhorted them to increase the home help for Linda Rips as soon as possible. The Consultant noted in this letter that during his visit to Linda's flat the previous day he had found it in an "intolerably filthy condition" and stated that "Linda Rips clearly needs considerable Welfare assistance if the flat is to be kept hygienic and the children are to stay healthy". (Based on records of Brook Hospital)

(19) 9th September 1974

The Area Nursing Officer associated with the *Brook Hospital* visited Linda Rips' flat and found it in "a filthy state". She reported seeing broken glass on the lounge floor as well as dirty nappies and a dead mouse in the kitchen. The Nursing Officer made a decision to place the family on Local Area Health Authority's 'At Risk' Register since she felt that the "family's social and living conditions are very poor indeed". (Based on records of Brook Hospital)

(20) 21st September 1974

The Principal Medical Officer at the *Child Health Clinic* filed a letter that she had received from Senior NSPCC Inspector (Mrs. K). The Senior Inspector stated in this letter that she had just had a complaint from a neighbour of Linda Rips who had said that "Linda is living it up and having continual late night parties whilst her two children are left starving hungry and in a filthy state". The neighbour had also mentioned that "Linda joked that she only changed Mary's nappies on alternate days". The Senior Inspector stated her concern that William and Mary were being subjected to "neglect by their mother" and that "their health and safety appear to be severely at risk". She added that she would be sending a colleague to visit Linda Rips in order to confirm the picture that had been painted by the neighbour. (Based on records of Child Health Clinic)

(21) 25th September 1974

The Principal Medical at the Child Health Clinic received a telephone call from Mr. L. of the NSPCC which informed her that he had visited Linda Rips' flat and found it in a very untidy and dirty condition but felt that the children were "in a satisfactory state of well being and health". The Inspector noted that a Social Worker had been present at the flat who appeared to have a good relationship with Linda. In light of the Social Services' supervision of the family the Inspector stated that the NSPCC would not get involved until they received any further complaints concerning Linda's treatment of her children. (Based on records of Child Health Clinic)

(22) 29th October 1974

The Consultant Paediatrician at the Brook Hospital noted that he had received a phone call from Health Visitor 1 who had informed him that the children were being taken into care on a temporary basis until "Linda can show that she is willing and able to look after the flat". The Consultant Paediatrician stated on record his belief that "the fostering decision is very sound since it will give Linda a chance to show that she is capable of organising herself into being a good mother".

William and Mary were admitted into care on 30th October. They were placed on a short-term basis with an experienced foster mother (Mrs. O.) who had been forewarned what to expect.

Her understanding was that she and her husband were to have the children for a few weeks whilst their mother cleaned up her flat. (Based on records of Brook Hospital)

(23) 2nd February 1975

The Area Nursing Officer visited Linda Rips at her home whilst on another call at *John Newton Court*. She reported finding Linda in "an extremely depressed and lethargic state - looking dirty and unkempt". She also noted that the flat was "even filthier than it was at my previous visit". (Based on records of Brook Hospital)

(24) 26th September 1975

Social Worker 1 telephoned the Consultant Paediatrician at Brook Hospital and announced that William would be returning home on the 29th September. The Social Worker told the him that "relations between mother and son seem to be close but with the daughter they appear to be close to nil at the moment". (Based on records of Brook Hospital)

(25) 14th November 1975

Social Worker 1 again telephoned the Consultant Paediatrician - this time to say that Mary Rips had left the foster care and been returned to her mother. The Consultant Paediatrician noted on file that he had indicated to Social Worker 1 the "clear need to monitor carefully the welfare of Mary and William over the following months since it was likely that Linda would lapse toward her former tendency to neglect the welfare of the children". (Based on records of Brook Hospital)

(26) 16th January 1976

Mary was admitted to the Brook Hospital for observation having swallowed half a bottle of Tryptizol tablets which had been prescribed for her mother. When the child was discharged three days later, the Paediatric Registrar wrote to the Principal Medical Officer at the *Child Health Clinic* to inform her regarding the incident. The *Social Work Section* of the *Social Services* were similarly notified. (Based on records of Brook Hospital)

(27) 2nd February 1976

A neighbour telephoned the Child Health Clinic and stated that she had witnessed Linda Rips "violently dragging Mary along the street by her collar". The child was reported as "looking petrified and sounding like she was choking". (Based on records of Child Health Clinic)

(28) 26th May 1976

William was seen at the Accident and Emergency Department of the *Brook Hospital* with a head injury. His mother alleged that he had been beaten up at school. Whilst assessing this injury the Consultant Paediatrician noted that William was suffering from mumps. (Based on records of Brook Hospital)

(29) 16th August 1976

The Consultant Paediatrician at the *Brook Hospital* filed a letter from Health Visitor 2 which informed him that William and Mary had been taken into care on the 4th August in anticipation of Linda Rips' approaching confinement with her fourth child. The Health Visitor stated that "Linda has tidied up the flat which was now looking clean and habitable". Health Visitor 2 also noted that "the children have settled in well with their foster parents . . . Mary has put on some weight and seems happy". (Based on records of Brook Hospital)

(30) 15th September 1976

Subsequent to the birth of Linda Rips' fourth child (Lucie) at the *British Hospital for Mothers and Babies*, Woolwich, the Ward Sister noted on record that Linda "does not appear to know the basics of motherhood - particularly how to feed the baby - despite having had three other children". It was also recorded that "Linda does not seem to be very fond of Lucie and seems reluctant to have the baby near her . . . she sometimes looks likes she is actually frightened of the child". Such was the concern of the staff at the maternity ward over the future welfare of Lucie that an extended period of midwifery help was arranged for Linda Rips following her return home". (Based on records of Woolwich Hospital)

(31) 11th October 1976

A routine check-up at the Child Health Clinic showed that Lucie had lost 6oz. Whilst the Principal Medical Officer felt this was quite a normal weight fluctuation with a new born baby she requested that Lucie be taken to the *Brook Hospital* the next day for a more thorough examination. (Based on records of Child Health Clinic)

(32) 12th October 1976

Lucie was detained at the Brook Hospital for three weeks with a probable diagnosis of gastroenteritis. She was discharged on the 2nd December having shown a consistent improvement in weight gain. During Lucie's stay at the hospital it was noted that Linda Rips visited only twice and both times "seemed rather unconcerned about the baby's progress" The staff always found Linda "pleasant enough though dirty and scruffy" and it was noted that her main topics of conversations were "the pub that she's been to the night before and her latest boyfriend". (Based on records of Brook Hospital).

(33) 16th December 1976

Health Visitor 2, accompanied by Linda Rips, took Lucie to see the Consultant Paediatrician at the *Brook Hospital*. The Consultant Paediatrician recorded Lucie's health as being satisfactory though her weight gain was noted as being below the 3rd centile and presenting some grounds for concern. (Based on records of Brook Hospital).

(34) 21st December 1976

Linda Rips was seen at the Accident and Emergency Department at Brook Hospital following an incident where she had been beaten up by her boyfriend. She was treated for broken facial bones and lacerations that required stitching. Later that day the Hospital were informed by the Police that Linda Rips' boyfriend had been staying at her flat and that he was wanted for questioning regarding some thefts at *John Newton Court*. (Based on records of Brook Hospital).

(35) 7th January 1977

The Principal Medical Officer at the *Child Health Clinic* received a report from Health Visitor 2 which said "I am visiting Linda several times a week . . . I do not feel I am making much headway with her at all. The children are as dirty and uncared for as ever and so is the flat". (Based on records of Child Health Clinic).

(36) 14th January 1977

William helped himself to phenobarbiturate tablets that Linda Rips had left within reach of the children. Linda took William to the Brook Hospital where he had his stomach pumped and he was kept in overnight for observation. The House Doctor recorded on file that she gave Linda Rips a "strong warning about the danger of leaving tablets lying around the house but Linda seemed little concerned". (Based on records of Brook Hospital).

(37) 18th January 1977

The Consultant Paediatrician at the Brook Hospital recorded Lucie's weight as having gone up and stated that he was now satisfied that Linda was coping with the care of the child and that the baby's progress could now be charted by the Child Health Clinic. The Consultant further noted seeing a bruise on the baby's forehead but stated that he was reasonably satisfied by Linda's explanation that this was caused by Lucie banging her head on her cot. (Based on records of Brook Hospital).

(38) 7th February 1977

Lucie was admitted to the *Brook Hospital* for observation, having apparently been dropped on her head whilst having been carried by a young child three days earlier. The Consultant Paediatrician also noted the presence of blisters on the index finger and thumb of Lucie's left hand and reported that "these were not well explained by Linda Rips". He noted that he had considered the possibility of Non-Accidental Injury but had ruled this out. He stated his assessment of the situation as being that "Linda seems to be attached to her children but

seems terribly slow to recognise potentially harmful situations, such as allowing a small child to carry Lucie". (Based on records of Brook Hospital).

(39) 10th March 1977

The sixth months assessment of Lucie at the Child Health Clinic recorded her as "underweight, a poor specimen". Her hearing, vision and motor development appeared to be satisfactory but her social development was considered to be delayed for her age. (Based on records of Child Health Clinic).

(40) 24th April 1977

Mary Rips was seen at the Brook Hospital suffering with a painful laceration to her head. Mary was noted as being in a distressed state and as being uncomfortable with her mother. The injury was explained to have happened as a result of the child "falling out of her bunk bed whilst playing around". (Based on records of Brook Hospital).

(41) 20th July 1977

The Principal Medical Officer (*Child Health Clinic*) received a report from Health Visitor 2 which stated that "Lucie has failed to gain any weight over the last month . . . I am not convinced that Linda is feeding the baby adequately". The Health Visitor also stated her belief that "Linda seems to sometimes leave the baby unchanged for days on end". The Principal Medical Officer forwarded a copy of the Health Visitor's report to the *Brook Hospital* and added a note which indicated her own "deep concern over Lucie's condition", adding that "Linda Rips sounds as if she is wilfully neglecting the baby . . . it may well be time to take some drastic measures in regard to this woman". The records at *Brook Hospital* show no indication that this correspondence was ever received. (Based on records of Child Health Clinic).

(42) 22nd August 1977

The Senior Nursing Officer at the Brook Hospital reported that Linda Rips had brought Lucie in at three o'clock in the morning saying that the baby would not stop crying. The Nursing Officer treated the baby for a bruise on her forehead and recorded Linda's explanation of the incident as being that Lucie had "banged her head on the side of her cot". Later on in the day the Nursing Officer notified the Social Services Duty Officer and Health Visitor 2 about this accident. (Based on records of Brook Hospital).

(43) August to September 1977

Lucie was admitted to *Brook Hospital* on 23rd August for an extended period of investigation since Health Visitor 2 and the Principal Medical Officer were concerned over her failure to thrive. Lucie remained in the hospital until 23rd September and during her month at the hospital Lucie started feeding better and gained some weight. As at other times when the baby had stayed at the hospital her mother was noted as visiting infrequently, though when she did come it was observed that she always seemed "pleased to see Lucie". During this period several tests were undertaken on Lucie to determine if there was any indication of a pathological cause for her poor weight. All of these tests, however, were recorded as proving negative. A summary note in the Hospital records written on the day of Lucie's discharge indicated that "her failure to thrive does not appear to be due to mal-absorption but seems to be caused by her mother not managing to feed her properly . . . Whenever Lucie is cared for by the hospital staff her condition seems to improve". (Based on records of Brook Hospital).

(44) 4th October 1977

Mary was admitted to the *Brook Hospital* suffering with a fever and was diagnosed as having a severe upper respiratory tract infection. She was detained at the hospital for three days. (Based on records of Brook Hospital).

(45) 29th October 1977

When Mary was seen at Outpatients the Consultant Paediatrician found Mary in a poor condition and considered that she must have been suffering from frequent respiratory infection during the previous weeks. He recorded his surprise that Linda Rips hadn't brought the child in again sooner. (Based on records of Brook Hospital).

(46) April 1978

The Principal Medical Officer at the *Child Health Centre* noted that Linda Rips had failed to bring in William and Mary for their routine check-ups. She sent her Deputy Medical Officer around to Linda Rips' flat in order to arrange a new date for attendance at the clinic. The Deputy noted that the flat was "messy and unhygienic" but that all the children seemed well enough. The following week Linda brought the children to the Clinic and they were deemed to be "dirty but healthy". (Based on records of Child Health Clinic)

(47) 15th September 1978

The Principal Medical Officer's observation of Lucie's on her two year birthday check indicated that she was a "very understimulated child . . . not very interested in her surroundings". Lucie was also noted as "still providing grounds for concern with respect to her inadequate weight and growth". The Principal Medical Officer reported her belief that "Linda Rips, I am sure, is a bad mother and cares little for the well being of this child". (Based on records of Child Health Clinic)

(48) 18th January 1979

William Rips was brought to the *Brook Hospital* by his mother after an incident in which he had been hit across the back with a broomstick by a teenage girl who had been staying at Linda Rips' flat. William had apparently tried to come between his mother and the girl. He was seen by the Consultant Paediatrician who recorded the injury as "severe weals and bruising across the back". The Consultant Paediatrician considered placing William on the Non-Accidental Injuries register but the Bexley Social Services Department indicated that it would be a misuse of this register since someone other than the mother had been responsible for the injuries. (Based on records of Brook Hospital).

(49) 13th March 1979

Lucie was brought to the *Brook Hospital* by her mother in order to have an X-ray of her head following a bump she had sustained the previous day. Lucie had apparently fallen from her chair during her brother's birthday party. She had vomited during the night and was wobbly on her feet in the morning. The X-ray showed no cranial damage, though it was decided to keep Lucie in overnight for observation. (Based on records of Brook Hospital).

(50) 14th March 1979

The Paediatric Senior House Officer who had attended to Lucie filed a report which he also copied to the Principal Medical Officer (*Child Health Clinic*) and Health Visitor 3 (*Family Practice*). This House Officer stated his view that Linda Rips' explanation of how Lucie had come by her injuries was plausible and he did not think there was any evidence of Non-Accidental Injury. He further added that "it is clearly necessary for Lucie's progress at home to be closely followed up by district social workers and health visitors alike to ensure that she is not the subject of any wilful harm by her mother". (Based on records of Brook Hospital and the Child Health Clinic).

B1.4.4 Social Worker Casefile

Case Book For The Rips Family Based On The Records Of The Social Work Section Of The Social Services Department

(1) November to June 1969

Soon after her mother's death, Linda Rips was known to have become pregnant. In the months before the birth of the baby, Linda made the decision to have the child adopted. Social Worker 1 - who had met Linda several times and had developed a good relationship with her - reported that "Linda contends that she has been continually depressed throughout her pregnancy and though wanting to keep the baby she feels she would be unable to cope". Social Worker 1 stated that she had repeatedly indicated to Linda that considerable welfare assistance would be provided should she wish to keep her child, but "Linda has become emphatic about the adoption decision and won't even consider any other option". (Based on records of the Social Work Section of the Social Services Department)

(2) July 1969

A baby boy was born to Linda Rips at *Farnborough Hospital*, Orpington just before her nineteenth birthday and the child was adopted immediately after his birth. Social Worker 1 recorded her belief that "the adoption of the baby is a pity since Linda, though rather immature, would certainly make a good mother with the help of welfare support". (Based on records of the Social Work Section of the Social Services Department)

(3) August 1969 to September 1970

After the birth and adoption of her first child, Linda Rips returned to live with her father, with whom she was understood to have a good relationship. Social Worker 1 visited Linda twice over this period and always found her "pleasant and friendly" and the house "rather untidy but clean enough". (Based on records of the Social Work Section of the Social Services Department)

(4) October 1970

Linda Rips informed Social Worker 1 that she was pregnant again and that she had submitted an application for the adoption of the baby with the help of the Health Visiting Services. Social Worker 1 filed a memo which stated her belief that "Linda, I am sure, is having the child adopted because the Health Visitor has convinced her that this is the best thing to do. I feel that Linda is a kind and caring person who would greatly benefit by having a child to care for". A copy of this memo was recorded as having been passed on to Welfare Officer 1 in the *Fostering and Adoptions Unit* of the *Family Welfare Section* of the Social Services Department. (Based on records of the Social Work Section of the Social Services Department)

(5) 13th March 1971

After the birth of Linda Rips' second child (William), Social Worker 1 received a telephone call from Health Visitor 1 which informed her that Linda had withdrawn the adoption application and had decided to keep the child. Social Worker 1 recorded on file that "Health Visitor 1 seems rather negative about Linda's decision to keep the baby . . . I believe that Linda has made the right decision since the child will give her life a sense of focus that has so far been dramatically lacking . . . With the right help, Linda, I am sure will make a fine mother". (Based on records of the Social Work Section of the Social Services Department)

(6) 14th March 1971

Social Worker 1 visited Linda Rips at the hospital and recorded finding her "happy and well . . . she couldn't stop talking about the baby and seemed pleased that it was a boy". Social Worker 1 also noted that Linda had mentioned her worries about how to feed and change the baby but had added that she would surely pick it all up in no time. (Based on records of the Social Work Section of the Social Services Department)

(7) 15th March 1971

Social Worker 1 was informed by the Brook Hospital that arrangements had been made for Linda and William to stay for a few months with a nurse who was also a mother. The idea behind this, they said, was that Linda could be given child care guidance because of her obvious lack of ability with the baby. Social Worker 1 noted that she firmly endorsed this idea since it would "serve to expel Linda's fears about how to look after William". (Based on records of the Social Work Section of the Social Services Department)

(8) 8th June 1971

Social Worker 1 called on Linda Rips' father's house on the assumption that the placement with the nurse was ended. She found Linda Rips and William at home and recorded that the house was "in a bit of a state". She further noted that "Linda seems to relate well with William, who, though rather grubby, appears happy and healthy". (Based on records of the Social Work Section of the Social Services Department)

(9) July 1971 to July 1972

During this period Social Worker 1 made two routine visits to the Rips' home. On the first occasion Linda was recorded as being friendly but looking a bit scruffy and dirty. William was said to be out with one of Linda's friend's who sometimes looked after the baby for a morning a week. On the second visit, Social Worker 1 saw Linda's father as well as Linda and William. She noted that "William relates well with his grandfather who like playing with him". It was also recorded that there was an improvement in Linda's appearance though the house was still in quite a state of chaos. (Based on records of the Social Work Section of the Social Services Department)

(10) 30th November 1972

Social Worker 1 received a letter from the House Doctor at the *Brook Hospital* which stated that William had been seen at Outpatients following a fit that Linda Rips said he had suffered earlier in the day. The House Doctor noted in the letter that "William seemed distressed and reluctant to be held by his mother . . . I am concerned over the welfare of William and am dubious about these so called fits". Social Worker 1 filed a memo noting that she had telephoned the House Doctor and had indicated that William was prone to having temper tantrums when he didn't get his own way. She further noted that these temper tantrums were what Linda certainly meant when she described William as having fits. (Based on records of the Social Work Section of the Social Services Department)

(11) December 1972 to May 1973

Unknown to anyone but herself, Linda Rips became pregnant for the third time in the latter part of 1972. During a visit to the Rips' house in January 1973 Linda told Social Worker 1 that she wanted to move into a place of her own since her father made her to do everything for him and wouldn't even let her have friends come in the house. An application for council accommodation was submitted by Linda Rips with the support of Social Worker 1 who at this time was visiting every week. Social Worker 1 attached a memo to the application form which stated that "Linda Rips has shown her ability to care for her baby and clearly deserves an opportunity to lead a life away from the demands of her father". (Based on records of the Social Work Section of the Social Services Department)

(12) June 1973

A fortnight before her confinement with her third child, Linda Rips visited the *Brook Hospital* and saw a Social Worker 1 who made the necessary arrangements for her forthcoming stay at the hospital. The Social Worker also arranged for William to be placed for a two-week period with registered foster parents at the time of Linda's confinement. Social Worker 1 noted Linda as saying that she was "looking forward to having the baby and would definitely keep the child this time". (Based on records of the Social Work Section of the Social Services Department)

(13) 19th September 1973

Social Worker 1 visited Linda Rips and noted finding the house in a reasonably tidy condition. Linda was reported as being cheerful and the baby Mary was noted to be progressing satisfactorily though "in a bit of a dirty state". All in all Social Worker 1 felt there were no real grounds for concern over the welfare of the children and that the family situation seemed very stable. (Based on records of the Social Work Section of the Social Services Department)

(13) 1st February 1974

Linda Rips and her two children were rehoused in a block of flats at *John Newton Court*. Social Worker 1 helped Linda move in with the children and noted that "Linda was understandably excited about moving and seemed eager to make a home for herself and her children". Social Worker 1 also noted that "Linda's excitement had clearly rubbed off on to William who was having a great time helping with the moving . . . William seems very attached to his mother and couldn't do enough to help her." (Based on records of the Social Work Section of the Social Services Department)

(14) 17th February 1974

Social Worker 1 received a note from Health Visitor 1 expressing concern over the welfare of William and Mary Rips in their new accommodation at *John Newton Court*. The Health Visitor

stated her belief that "Linda seems to be neglecting to care for both the children and the flat . . . She has no understanding of what it takes to make a home look habitable and shows little concern over the safety of William and Mary who are continually having accidents". Social Worker 1 replied with an agreement to increase Home Help support for Linda Rips and stated that she would make the necessary arrangements with the *Family Welfare Section*. Social Worker 1 recorded her belief that "with the right help and encouragement, Linda will prove to everyone that she can learn to cope". (Based on records of the Social Work Section of the Social Services Department)

(15) 16th March

Social Worker 1 reported that she had visited Linda Rips' flat and was concerned over the state of Mary "whose clothes were filthy". Social Worker 1 noted that Linda seemed a bit under the weather. Linda admitted she had felt unwell the last week and said she had "found it hard to keep on top of everything". Social Worker 1 reported giving Linda strong encouragement to clean up the baby. She further felt that Linda had clearly appreciated the need for this for she had joked that "the Health Visitor would go potty if she saw Mary looking like this". (Based on records of the Social Work Section of the Social Services Department)

(16) 25th April 1974

Linda Rips was admitted for a fortnight to the *St. Nicholas Hospital* with an undiagnosed illness. Social Worker 1 made immediate arrangements with the *Adoptions and Fostering Unit* of the *Family Welfare Section* for William and Mary to be received into care for this period. Social Worker 1 noted that the children "were sad to leave their mother to whom they are clearly very attached". William and Mary were placed with Mrs. McK. - an approved foster parent - where they stayed until the 20th May. (Based on records of the Social Work Section of the Social Services Department)

(17) 20th July 1974

Social Worker 1 received a letter from the Consultant Paediatrician at the *Brook Hospital* which informed that a case conference would be convened at the hospital on the 30th July to look into the welfare of William and Mary Rips. The Consultant requested that Social Worker 1 prepare a case report on the children for presentation at this conference. The Consultant also stated that "The prevalence of Mary's 'so called' accidents suggest to me that she may be a battered baby . . . It may well be necessary to issue a compulsory care order on the children if it can be determined that their injuries are non-accidental in origin". (Based on records of the Social Work Section of the Social Services Department)

(18) 30th July 1974

Health Visitor 1 attended a case conference on the Rips' family which was held at *Brook Hospital* and was chaired by a colleague of the resident Consultant Paediatrician. There were no representatives present from the Child Health Clinic - none having been invited, though Social Worker 1 and Health Visitor 1 and were present. The minutes of the conference indicate that reports had been prepared by both the Health Visitor and the Social Worker, but that only the latter's report had been read and considered.

Social Worker 1 stated in a report that she visited Linda Rips at least once a week. She also noted that after the move to John Newton Court, Linda Rips had made a good attempt to keep the house clean and tidy, though the state of the flat had recently deteriorated quite badly. Social worker 1 further stated that in her opinion the children were developing normally and that "although frequently dirty they did not appear in the least unhappy". She expressed her belief that "Linda Rips tends to allow situations to develop because of passivity but that there was no indications of non-accidental injury or that Linda was a vicious person". Social Worker 1 concluded that "For the first time I feel more optimistic about Miss Rips' capacity to change and would hope that with continued supervision the improvement can be maintained. Certainly I feel there is a strong mother-child tie and I would be reluctant to see this broken".

Health Visitor 1's report - which was not considered at the conference - expressed the view that "Linda is incapable of being educated to the needs of her children. She simply will not take the safety precautions which are constantly being demonstrated to her . . . Linda, one feels certain would not harm her children, but accidents happen because her sense of awareness is almost nil. I feel that the only way of giving William and Mary a stable home life is for her to have 24 hour supervision. Since it is impossible to provide such supervision the only solution is to take her children into care."

The minutes of the case conference indicate that the view of Social Worker 1 prevailed. The chairman concluded by stating that "Here we have children who are presented as being neglected rather than wilfully abused. The older boy William seems robust and healthy, though the younger child Mary does present grounds for careful monitoring because of her more fragile constitution. The mother should be encouraged to keep her children but should be provided with a high level of community support". (Based on records of the Social Work Section of the Social Services Department)

(19) 7th August 1974

Subsequent to the case conference, Social Worker 1 visited Linda Rips and found her depressed and frustrated. Social Worker 1 recorded Linda as telling her that she loved her children and didn't want them taken away. Linda was also noted as saying that no matter how hard she tried to take care of William and Mary "something always seemed to go wrong". Social Worker 1 recorded that "Linda Rips is clearly a good person who is trying her best to be a competent mother . . . with the right help I believe that she can succeed". (Based on records of the Social Work Section of the Social Services Department)

(20) 21st September 1974

Social Worker 1 filed a letter that she had received from Senior NSPCC Inspector (Mrs. K). The Senior Inspector stated in this letter that she had just had a complaint from a neighbour of Linda Rips who had said that "Linda is living it up and having continual late night parties whilst her two children are left starving hungry and in a filthy state". The neighbour had also mentioned that "Linda joked that she only changed Mary's nappies on alternate days". The Senior Inspector stated her concern over the welfare of the children and added that she would be sending a colleague to visit Linda Rips in order look into the situation.

Social Worker 1 sent a reply to the Mrs. K. and stated that she would like to represent Linda's case to the NSPCC and would be present Linda's flat on the 24th September. Social Worker further expressed that "Linda is continually being harassed by her neighbours because of her scruffy and unkempt appearance . . . Linda appears to be the subject of a witch-hunt by those who don't like her. Although she is rather dirty and untidy she is a good person who would never wilfully harm her children". (Based on records of the Social Work Section of the Social Services Department)

(21) 24th September 1974

Social Worker 1 visited Linda Rips and reported finding the flat "in a very untidy condition" but the children "healthy and happy - playing and laughing with their mother". Social Worker 1 also noted that Mr. L. from the NSPCC had subsequently met her at the flat and seemed to find the state of the children satisfactory. (Based on records of the Social Work Section of the Social Services Department)

(22) 26th September 1974

Social Worker 1 received a letter from Mr. L. of the NSPCC which informed that he had found "Linda Rips' friendly and amenable and the children in a satisfactory state of care and development". He also remarked that the "the general standard of the house leaves a lot to be desired" but added that this presented only minimal grounds for concern since the predominant issue of importance was whether Linda Rips was wilfully abusing her children. Mr. L. expressed that there was no clear evidence that this was the case and that "Linda seems to genuinely love her children and they relate to her very well". Mr. L. concluded by saying "in light of the Social Services' supervision of the family, the NSPCC will refrain from getting involved unless they receive any further complaints concerning Linda Rips treatment of her children". (Based on records of the Social Work Section of the Social Services Department)

(23) 12th October 1974

Social Worker 1 filed an internal memo in which she stated that she had noted a tremendous deterioration in the state of Linda Rips' flat which was "becoming unhygienic for the children to live in". She further recorded that "Linda is very depressed at the moment and seems to be doing very little to look after the house or the children . . . She claims that she is being persecuted and abused by her neighbours, who she says hate her". Social Worker 1 added that "the situation with Linda seems to be reaching a crisis point and I am wondering if Health Visitor 1 is right about the option of taking the children into care for a few weeks so as

to relieve the burden from Linda for a while". (Based on records of the Social Work Section of the Social Services Department)

(24) 15th October 1974

Social Worker 1 contacted Health Visitor 1 and confirmed that there was no improvement in the cleanliness of Linda Rips' flat. She stated that although she was reluctant to pursue the option of placing the children in short-term care this seemed to be "the most sensible course of action" and would give Linda "a chance to make the flat more habitable". (Based on records of the Social Work Section of the Social Services Department)

(25) 30th October 1974

William and Mary were admitted into care on 30th October. They were placed on a short-term basis with an experienced foster mother (Mrs. O.) who had been forewarned what to expect. Her understanding was that she and her husband were to have the children for a few weeks whilst their mother cleaned up her flat. Later in the day, Social Worker 1 visited Linda Rips - who had not been present at the handover - and recorded finding her "in a distressed and unhappy state". (Based on records of the Social Work Section of the Social Services Department)

(26) December 15th 1974

Social Worker 1 recorded that she had visited Linda Rips and had found her in a depressed state, missing her children yet seemingly "unable to pull herself together such that they might be returned". Social Worker 1 noted that she had "never before seen Linda at such a low ebb". (Based on records of the Social Work Section of the Social Services Department)

(27) January 1975 to August 1975

Social Worker 1 made repeated visits to Linda Rips' flat and noticed a gradual improvement in its general condition of the house as well as Linda's own appearance. It was also noted that Linda frequently visited her children at their foster home and was maintaining an affectionate relationship with them. (Based on records of the Social Work Section of the Social Services Department)

(28) 26th September 1975

Social Worker 1 noted that she had telephoned Health Visitor 1 as well as the Consultant Paediatrician at *Brook Hospital* in order to announce that William would be returning home on the 29th September. Social Worker 1 also recorded that she felt "relations between mother and son are clearly very close but with the daughter they seem close to nil but will probably improve when the child is returned" (Based on records of the Social Work Section of the Social Services Department)

(29) 14th November 1975

Social Worker 1 again telephoned the Consultant Paediatrician - this time to say that Mary Rips had also left the foster care and been returned to her mother. Social Worker imparted the same information in writing to Health Visitor 1 and added that Linda was "delighted at having her children back" and was "seemingly making every effort to maintain the reasonable standard that the flat was now in". Social Worker 1 also stressed that there was a clear need to monitor Mary's condition to "ensure that the child is not subjected to any neglect since the girl does seem to be rather less preferred than William." (Based on records of the Social Work Section of the Social Services Department)

(30) 16th January 1976

Social Worker 1 was informed in writing by the Paediatric Registrar at the *Brook Hospital* that Mary Rips had been admitted for observation following the ingestion of half a bottle of Tryptizol tablets. This medication had been prescribed for Mary's mother but had been left lying around the flat. The Paediatric Registrar noted that he was distressed by Linda Rips' stupidity at leaving dangerous pills accessible to children. Mary was noted to be well enough and out of danger. (Based on records of the Social Work Section of the Social Services Department)

(31) 25th January 1976

Social Worker recorded seeing Linda Rips' father at the flat and noted that he had brought the children fish and chips and was annoyed that there was so little food in the house. Linda was noted as having called him "an interfering old meddler" Social Worker 1 recorded that the relationship between Linda and her father was clearly strained, though the children seemed to love seeing him. (Based on records of the Social Work Section of the Social Services Department)

(32) 26th February 1976

Social Worker 1 noted that the condition of Linda's flat was gradually deteriorating again and that she wished that she could spend more time with Linda in order to help her get on top of things. Social Worker 1 added that the children seemed well and had settled in quickly after their extended period of adoption and that William and Mary were clearly glad to be back home with their mother. (Based on records of the Social Work Section of the Social Services Department)

(33) August 1976

Social Worker 1 recorded that the *Fostering and Adoption Unit* of the *Family Welfare Section* were making arrangements for William and Mary to be taken into temporary foster care on this 4th August in anticipation of Linda Rips' approaching confinement with her fourth child. Social worker 1 noted that Linda was looking forward to having the baby and was hoping that it would be a boy. It was also reported that "Linda has tidied up the flat which was now looking clean and habitable". (Based on records of the Social Work Section of the Social Services Department)

(34) September 1976

In September 1976 Social Worker 2 - who was newly qualified - took over the Rips case from Social Worker 1. On 2nd September they both met and discussed their transfer arrangements. They then went to *John Newton Court* and Social Worker 1 introduced her successor to Linda who was now heavily pregnant. Social Worker 2 noted that "Linda seems friendly" and expressed the view "the state of the flat was nowhere near as bad as I had been expecting". (Based on records of the Social Work Section of the Social Services Department)

(35) 15th September 1976

Subsequent to the birth of Linda Rips' fourth child (Lucie) at the *British Hospital for Mothers and Babies*, Woolwich, Social Worker 1 visited the hospital to see Linda and the new baby. Social Worker 2 filed a memo in which noted that "Lucie is a small and fragile looking baby whom Linda appears to be frightened of and is reluctant to pick up". Social Worker 2 wrote a letter to Health Visitor 2 at the *Family Health Practice* expressing her concern over the fact that Linda seemed not to be taking to Lucie very readily. (Based on records of the Social Work Section of the Social Services Department)

(36) October to December 1976

Social Worker 2 visited Linda Rips several times in October and repeatedly noted a deterioration in the state of the flat. She also reported her concern over Lucie's development since the baby seemed like she was putting on very little weight and looked almost as small as when she had been newly born. William and Mary remained with their foster parents until 19th December at which time they were known to have been returned to Linda Rips by an officer from the *Family Welfare Services*. Social Worker 2 visited Linda's flat on the day of the children's return and reported that Linda had made a real effort to make it look nice for Christmas. It was noted that there was a Christmas tree and presents for all of the children. William and Mary were recorded as looking very well and pleased to be home with their mother. The baby was noted as looking clean, though was thought by Social Worker 2 to have not gained any extra weight. (Based on records of the Social Work Section of the Social Services Department)

(37) January to March 1977

In her January-March summary, Social Worker 1 noted that the Rips children generally appeared healthy and that Linda seemed to be relating much better to Mary now that the child was getting older. Social Worker 2 also referred to "continuing feeding difficulties that

Linda was having with Lucie" and that the mother was getting frustrated over the baby's reluctance to take food. Social Worker 2 further noted that Lucie had a number of small scratches on her face which Linda said had been caused by the baby falling from her cot. (Based on records of the Social Work Section of the Social Services Department)

(38) 24th April 1977

Social Worker 2 reported that whilst on a routine visit to the *Brook Hospital* to meet the Hospital Liaison Health Visitor she had seen Mary Rips being treated for a cut head. Linda Rips had explained that the injury was caused by the child "falling off her bunk bed whilst playing around". Social Worker 2 noted that Mary seemed in a distressed state and thought that she had probably suffered mild shock as a result of the accident. (Based on records of the Social Work Section of the Social Services Department)

(39) 29th May 1977

Social Worker 2 wrote to Health Visitor 2 and stated her opinion that "Linda Rips' mothering of the baby still leaves a lot to be desired." She said that she suspected Lucie's feeding patterns were irregular and indicated that "sometimes it is evident that Linda has not changed the baby for hours". She also claimed that she was troubled by Linda's tendency to "treat Lucie as a play thing". Social Worker 2 explained to Health Visitor 2 that she had communicated her views to her Senior who "agrees that it is necessary to continue with a high intensity of support as the baby is 'At Risk' in regard to thriving". (Based on records of the Social Work Section of the Social Services Department)

(40) 23rd June 1977

Social Worker 2 received a letter from a neighbour of Linda Rips which expressed a complaint over Linda's care of her children. The neighbour described an incident in which William had put his head through a loop of rope hanging from the balcony. She stated that "if I had not noticed what he was about to do and stopped him he would have hung himself". She further noted that William's mother was present at the time but took no action. The letter concluded: "It is a Social Injustice that Linda gets all the help like she gets and carries on the way she does". Social Worker 2 noted in a report that although some of the neighbour's account clearly had an element of validity, on the whole there was a lot of prejudice against Linda and in her view the letter was "vindictive in tone". Social Worker 2 replied to the neighbour in writing thanking her for her concern and requesting that she contact the Social Work Section of the Social Work Section of the Social Services Department or the Police if she thought the children were being left unsupervised at any time. (Based on records of the Social Work Section of the Social Services Department)

(41) 20th July 1977

Social Worker 2 wrote to the Head Teacher at *Hook Lane Primary School* expressing concern over William's supposed unhappiness at school. Social Worker 2 noted in this letter that Linda Rips was having extreme difficulty getting William to school and had said that he frequently "kicks, screams and runs off". (Based on records of the Social Work Section of the Social Services Department)

(42) 11th August 1977

Social Worker 2 reported that she had reviewed all past records of the Rips case that the *Social Work Section of the Social Work Section of the Social Work Section of the Social Services Department* had in their possession. She concluded "It is evident that Linda has had trouble coping with each of her children when they are babies but it is clear that everything turns out all right as they get older . . . I am sure Linda is having similar problems with Lucie and that everything will sort itself out sooner or later". (Based on records of the Social Work Section of the Social Services Department)

(43) 22nd August 1977

Social Worker 2 received a telephone call from the Senior Nursing Officer at the *Brook Hospital* who reported that Linda Rips had brought Lucie in at three o'clock in the morning saying that the baby would not stop crying. The Nursing Officer said that she had treated the baby for a bruise on her forehead and recorded Linda's explanation of the incident as being that Lucie had "banged her head on the side of her cot". Social Worker 2 noted that it was indeed the case that the baby's cot was rather old and worn and she stated that she would

make a move to obtain a replacement bed for Lucie. (Based on records of the Social Work Section of the Social Services Department)

(44) 23rd August 1977

Lucie was known to have been admitted to *Brook Hospital* on 23rd August for an extended period of investigation since Health Visitor 2 and the Principal Medical Officer were concerned over her failure to thrive. Lucie remained in the hospital until 23rd September and during her month at the hospital Lucie started feeding better and gained some weight. As at other times when the baby had stayed at the hospital her mother was noted as visiting infrequently, though when she did come it was observed that she always seemed "pleased to see Lucie". (Based on records of the Social Work Section of the Social Services Department)

(45) January to May 1978

In a detailed summary report written at the end of this period, Social Worker 2 stated that "Miss Rips' personal Hygiene leaves much to be desired but she is keeping her flat tidier at the and moment with the assistance of Home Help. Linda also has made friends with some neighbours in the John Newton Court area - two of which seem to be exerting a positive influence on her life . . . She also has a boyfriend and has visited his house in Coventry with the children". Social Worker 2 concluded by stating that "The Rips family maintains its pattern of living on a precipice and demanding considerable support from the agencies involved. There are, however, no indications in the social area for care proceedings being needed for any of the children. Indeed if Linda did have any of her children taken away she would in all likelihood simply start another family". (Based on records of the Social Work Section of the Social Services Department)

(46) 28th June 1978

Social Worker 2 recorded that Mary Rips had a cut on her chin which her mother said had been caused by her falling from the bath. Mary was also noted to have other very minor cuts and grazes as well as nits. Since the child's general state of health appeared to be satisfactory none of these factors was felt to provide any grounds for concern to Social Worker 2. On this day Social Worker 2 also took Mary and her mother to the Child Guidance Clinic for Mary to be assessed prior to her admittance to the *Hook Lane Infants School*. The Medical Director of the Clinic who undertook the assessment of Mary was noted to have found her "of above average verbal ability for her age . . . well balanced, warm and responsive to adults . . . showing no fear of her mother". (Based on records of the Social Work Section of the Social Services Department)

(47) 12th September 1978

Social worker 2 noted receiving a telephone call from Health Visitor 3 at the Family Health Practice, who had just taken over the Rips' case from her predecessor. The Health Visitor vehemently expressed the view that William, Mary and Lucie were 'At Risk' and should be placed on the Central Register of children suspected of Non-Accidental Injury. Social Worker 2 suggested that the Health Visitor get to know the Rips family better before she took such a major step. It was agreed that they should review the situation at a full case conference that would be held at some later date. (Based on records of the Social Work Section of the Social Services Department)

(48) 18th January 1979

Social Worker 2 recorded receiving a telephone call from the Consultant Paediatrician at the *Brook Hospital* who stated that William Rips had been brought in by his mother after an incident in which he had been hit across the back with a broomstick by a teenage girl who had been staying at Linda Rips' flat. The Consultant Paediatrician stated that he was considering the possibility of placing William on the Non-Accidental Injuries (NAI) register. Social Worker 2 replied that to do this would be a misuse of the NAI register since someone other than the mother had been responsible for the injuries. Later on this day Social Worker 2 recorded that she had visited Linda Rips and had found her "very distressed over the whole incident . . . and worrying that her children were going to be taken away from her". (Based on records of Brook Hospital).

(49) 12th March 1979

Social Worker 2 reported that Lucie had sustained a bump to her head at William's eighth birthday party. The Social Worker, who had just happened to visit the house soon after the party, noted that Linda had immediately told her about Lucie's accident which had apparently arisen from Lucie falling from a chair. Social Worker 2 recommended that Linda take Lucie to the *Family Health Practice* the next day. Social Worker 2 recorded that she felt "somewhat sceptical about Linda's explanation of this accident . . . Somehow I think she was hiding something about Lucie's fall" (Based on records of the Social Work Section of the Social Services Department)

(50) 14th March 1979

Social Worker 2, having made some telephone calls to discover Lucie's condition, was informed by the *Brook Hospital* that she had been kept in for observation overnight though the X-ray had shown no cranial damage. In the view of the Paediatric Senior House Officer, Linda Rips' explanation of how Lucie had come by her injuries was plausible and he did not think there was any evidence of Non-Accidental Injury. The Senior House Officer was also noted as requesting that Lucie's progress be closely followed up at home to ensure that she was not the subject of any wilful harm by her mother. Social Worker 2 recorded on file that "Lucie's welfare is causing me great concern at the moment for whilst I firmly believe that Linda is not wilfully harming the child these continual minor accidents are a major source of worry. Unless Linda Rips can develop the capacity to look after Lucie more attentively then the long term prospects the child who is weak and fragile seem grim to me indeed". (Based on records of the Social Work Section of the Social Services Department)

B1.4.5 Welfare Officer Casefile

Case Book For The Rips Family Based On The Records Of The Family Welfare Section Of The Social Services Department

(1) 27th April 1969

Welfare Officer 1 received a letter from Social Worker 1 which stated that Linda Rips was pregnant and resolutely wanted to have the prospective child adopted because of "her continuing depression and belief that she will be unable to cope with the baby". Social Worker 1 further noted in this letter that she had repeatedly indicated to Linda Rips that considerable welfare assistance would be provided should she wish to keep her child, but "Linda has become emphatic about the adoption decision and won't even consider any other option". Social Worker 1 requested that the *Family Welfare Section* take up the matter and proceed with the necessary adoption arrangements. (Based on records of Fostering & Adoptions Unit of the Family Welfare Section)

(2) May to June 1969

Welfare Officer 1 visited Linda Rips twice during this period and each time noted finding Linda "friendly and welcoming" though clearly "rather depressed". Subsequent to the second visit, Welfare Officer 1 reported that "Linda is rather immature for an eighteen year old, but would certainly make a good mother if she chose to keep the child. Since she is so adamant about her desire to have the baby adopted, however, I have to proceed with the necessary arrangements". (Based on records of Fostering & Adoptions Unit of the Family Welfare Section)

(3) July 1969

A baby boy was born to Linda Rips at *Farnborough Hospital*, Orpington just before her nineteenth birthday and the child was adopted immediately after his birth. Welfare Officer 1 recorded her belief that "the adoption the baby boy is a pity since I get the feeling that Linda would really like to keep him but just doesn't have the confidence that she would be able to cope if she did". (Based on records of Fostering & Adoptions Unit of the Family Welfare Section)

(4) August 1969 to September 1970

After the birth and adoption of her first child, Linda Rips returned to live with her father, with whom she was understood to have a good relationship. Welfare Officer 1 visited Linda twice during this period and found her friendly and cheerful on both occasions and providing no indication that she regretted the adoption decision. (Based on records of Fostering & Adoptions Unit of the Family Welfare Section)

(5) 24th October 1970

Social Worker 1 wrote a memo to Welfare Officer 1 and stated that Linda Rips was pregnant again and was planning to have this second child adopted. Social Worker 1 added that she was of the belief that "Linda I am sure, is having the child adopted because the Health Visitor has convinced her that this is the best thing to do. I feel that Linda is a kind and caring person who would greatly benefit by having a child to care for". (Based on records of Fostering & Adoptions Unit of the Family Welfare Section)

(6) 28th November 1970

Welfare Officer 1 visited Linda prior to the birth of the baby to discuss adoption arrangements and recorded finding her "subdued and uncommunicative . . . seemingly not so sure this time that she wanted the child adopted". Welfare Officer 1 reported her intention to go through with the adoption arrangements even though there was a distinct likelihood that Linda might decide to keep the child. (Based on records of Fostering & Adoptions Unit of the Family Welfare Section)

(7) 13th March 1971

After the birth of Linda Rips' second child (William), Welfare Officer 1 received a telephone call from Health Visitor 1 which informed her that Linda wanted to withdraw the adoption application since she had decided to keep the child. Welfare Officer 1 recorded that she was pleased about Linda's decision for she was of the view that "Linda will prove to be an able mother providing she was given an adequate level of welfare support and assistance to begin with". (Based on records of Fostering & Adoptions Unit of the Family Welfare Section)

(8) 14th March 1971

Welfare Officer 1 noted that she had visited Linda Rips in hospital and was pleased to see that Linda had taken to the baby well. Linda was noted to be being "pleased as punch . . . she just kept saying how glad she was that she had decided to keep the child". (Based on records of Fostering & Adoptions Unit of the Family Welfare Section)

(9) 16th March 1971

Welfare Officer 1 was informed by Social Worker 1 that the *Brook Hospital* had made arrangements for Linda and William to stay for a few months with a nurse who was also a mother. The idea behind this was apparently for Linda to be given child care guidance because of her lack of ability with the baby. Welfare Officer 1 recorded Social Worker 1's approval of this placement since it would "serve to expel Linda's fears about how to care for William". Welfare Officer 1, however, recorded her personal opinion as being that "the Hospital are over-responding to the situation . . . all Linda needs is some welfare assistance at her own home rather than the upheaval of having to live with another family". (Based on records of Fostering & Adoptions Unit of the Family Welfare Section)

(10) 26th September 1971

Welfare Officer 1 visited Linda Rips, who was now known to have resumed living at her father's home. Linda was noted as being "happy and sociable" and it was recorded that "William seems contented and appears to be developing normally". Welfare Officer 1 concluded that "there are no grounds for concern in my mind relating to Linda's ability to look after the baby. Whilst I was there she changed the child with care and consideration and responded to William warmly at all times". (Based on records of Fostering & Adoptions Unit of the Family Welfare Section)

(11) 11th June 1972

Welfare Officer 1 visited Linda Rips and noted that "Linda, though in a terribly scruffy state was highly amenable and is clearly taking care of William more than adequately". William was recorded by Welfare Officer 1 as being "healthy, well and very boisterous . . . relating to his mother with a great deal of affection". (Based on records of Fostering & Adoptions Unit of the Family Welfare Section)

(12) December 1972 to May 1973

Unknown to anyone but herself, Linda Rips became pregnant for the third time in the latter part of 1972. In the early part of 1972 Welfare Officer 1 was informed by Social Worker 1 that Linda wanted to move into a place of her own since her father was making demands on her and placing restrictions on her independence. Welfare Officer 1 noted her sympathy with Linda Rips' situation and commended Social Worker 1 to do her utmost to secure a council flat for Linda and the baby. (Based on records of Fostering & Adoptions Unit of the Family Welfare Section)

(13) 1st June 1973

Welfare Officer 1 received a letter from Social Worker 1 which informed her that "Linda is about to have a third child which she is very keen to keep. Social Worker 1 added that "William will clearly need to be placed with foster parents for at the time of Linda's confinement" and she requested that the *Family Welfare Section* make immediate arrangements to secure this temporary fostering placement. (Based on records of Fostering & Adoptions Unit of the Family Welfare Section)

(14) 10th June 1973

Welfare Officer 1, having made the necessary fostering arrangements for William, took the child to stay with Mrs. M who had considerable experience of short-term care placements. Mrs. M. - who was registered as a foster parent with the *Family Welfare Section* - also happened to be an aunt of Linda Rips who William had already met on several occasions was known to get on with well. Welfare Officer 1 noted that William showed acute distress at having to leave his mother and was clearly very strongly attached to her. (Based on records of Fostering & Adoptions Unit of the Family Welfare Section)

(15) 12th June 1973

Welfare Officer 1 took Linda Rips to visit William at Mrs. M.'s home and recorded that "William was clearly overjoyed at seeing his mother and they responded to each other warmly". Welfare Officer 1 noted Mrs. M. as saying that "William gets into everything and needs close watching for fear of what he might do". Welfare Officer 1 added however that Mrs. M. had said that "she enjoyed looking after William even though he was a bit of a handful". (Based on records of Fostering & Adoptions Unit of the Family Welfare Section)

(16) 17th July 1973

Welfare Officer 2 - who was attached to the *Home Help Unit* of the *Family Welfare Section* - received a letter from Health Visitor 1 which outlined the recent case history of Linda Rips' and her family and which finished with an urgent request for Home Help be provided. The Health Visitor expressed that without such support "Linda Rips will, I believe, be totally unable to cope with looking after her father's home as well as her two children. At the moment the house is an extremely dirty and untidy state and the children are going around unwashed for days on end". (Based on records of Home Help Unit of the Family Welfare Section)

(17) 19th July 1973

Welfare Officer 2 visited Linda Rips and reported finding the house "in a state of total chaos but no where near as dirty as the Health Visitor had implied". She added that the children "were grubby but seemed happy and well all the same". It was further noted that neither Linda nor her father were keen about having a stranger to help with the cleaning, though they were both finally persuaded to give the idea a go. Welfare Officer 2 reported that she was designating 8 hours of welfare assistance per week to the family - subject to revision -

and arranged for Home Helper 1 to provide immediate support. (Based on records of Home Help Unit of the Family Welfare Section)

(18) 31st July 1973

Home Help 1 who had recently started work with the *Family Welfare Section* stated in a routine report that "Linda has not taken very well to having me in the home and is very reluctant to contribute in any way. I think that she feels I am intruding and snooping around . . . All the same, though, the house is looking much better than when I started". Home Help 1 further noted in her report that "Linda is generally good with the children and they are very attached to her . . . Sometimes she leaves them get very grubby, though, and I have tried to persuade her to keep them clean for the sake of their health . . . Linda doesn't take kindly to being told what to do and can get very abusive". (Based on records of Home Help Unit of the Family Welfare Section)

(19) 30th September 1973

Home Help 1 filed a report that stated that she was not getting on very well with Linda Rips and felt that it might be better if someone more experienced took over from her. She commented that "Linda is kind-hearted as far as her children are concerned . . . she loves them and they clearly love her. However, she is continually rude to me and seems to want to make my time with her as difficult as possible . . . I think it may well be just conflict of personalities rather than any real maliciousness on her part.". (Based on records of Home Help Unit of the Family Welfare Section)

(20) 23rd November 1973

Welfare Officer 2 informed Health Visitor 1 that Home Help had been withdrawn from Linda Rips for a trial period earlier in November. It was mentioned in the communication that Home Helper 1 had found Linda "childish, excitable, prone to temper tantrums, hysterical at times and inclined to be moody". It was also noted that Linda Rips had been witnessed to smack the children - especially Mary - sometimes "rather too hard even though she clearly loved them very much". The letter further stated that Home Helper 1 had chosen to withdraw her services primarily because "Linda Rips showed no inclination to participate in looking after the house or children and that she seemed to wilfully want to make life difficult for the Helper . . . Sometimes Linda expected her to make coffee for friends who were visiting the flat". (Based on records of Home Help Unit of the Family Welfare Section)

(21) February 1974

In early February it was known that Linda Rips and her family were re-housed in a block of council flats at *John Newton Court*. On the 28th February Welfare Officer 2 received a note from Social Worker 1 which requested that Home Help support be re-instigated to Linda Rips in her new accommodation. The Social Worker stated that "Linda needs all the help that she can get at the moment in order to make a new start for herself and her children . . . With the right encouragement I believe that Linda's life will take a turn for the better". Welfare Officer 2 recorded her agreement with this assessment and assigned Home Helper 2 to the case. This Home Help was highly experienced and Welfare Officer 2 felt that Linda would relate to her positively because of her easy-going nature. (Based on records of Home Help Unit of the Family Welfare Section)

(22) 29th March 1974

In a routine report Home Helper 2 stated that Linda seemed to have taken to her well and they were making good progress in getting the flat cleaned up and furnished. Home Helper 2 commented that "William and Mary are a bit of a handful but are very good-natured and adore their mother". (Based on records of Home Help Unit of the Family Welfare Section)

(23) 5th April 1974

Home Helper 2 filed memo relating to an incident in which Linda appeared not to have changed Mary's nappy for "certainly two days". Linda had claimed that she had been feeling "too ill to do anything" and Home Helper 2 noted that "although Linda did seem rather unwell, I expressed my extreme displeasure about Mary being left unchanged . . . I think Linda got the message". (Based on records of Home Help Unit of the Family Welfare Section)

(24) 25th April 1974

Welfare Officer 1 received an emergency call from Social Worker 1 which stated that Linda Rips was being admitted to the Brook Hospital with an undiagnosed illness and that William and Mary needed to be placed in immediate care. A temporary placement was arranged for the children with Mrs. Mc.K. (an approved foster parent) with whom the children stayed until 20th May. (Based on records of Home Help Unit of the Family Welfare Section)

(25) June 1974

Home Helper 2 filed a routine report which stated that Linda Rips and the children were getting much more used to her coming in to help out and were relating to her well. She noted that "Linda treats me like a favourite aunt and does her best to help out with the cleaning". She further stated that "Linda is sometimes inclined to let Mary get into all kinds of mischief when it would be better to stop the child for her own good . . . I feel that this isn't so much negligence on Linda's part but is rather that she doesn't want to tell the children off when they're having fun. I am trying to encourage Linda to be a bit firmer with the kids at times when their safety is at stake". (Based on records of Home Help Unit of the Family Welfare Section)

(26) 6th July 1974

Home Helper 2 reported that it was proving difficult to maintain Linda's flat at a good standard of tidiness for any length of time since "the children are inclined to be rather untidy and accident prone and Linda tends to let them get away with just about anything - though sometimes she will get into a temper and send the fear of god into them . . . Linda is a bit inconsistent with her discipline, though by no means a bad mother". (Based on records of Home Help Unit of the Family Welfare Section)

(27) 2nd August 1974

The Director of the *Family Welfare Section* received a letter from a Consultant at the *Brook Hospital*. This letter made a strong request for the Department to increase the level of support that they were providing Linda Rips. The Consultant noted in his letter that during a visit to Linda's flat the previous day he had found it in an "intolerably filthy condition" and he further stated his belief that "Linda Rips clearly needs considerable Welfare assistance if the flat is to be kept hygienic and the children are to stay healthy". The Director passed on this letter to Welfare Officer 2 via internal mail and asked for her to deal with the Consultant's request as she felt appropriate. (Based on records of the Family Welfare Section)

(28) 3rd August 1974

Welfare Officer 2 recorded her view that the Consultant's letter was "far too negative about the whole situation that was called for" and that the Consultant's tone was "both autocratic and over-ardent concerning a situation in which he was least able to be a good judge". She added, however, that extra Home Help would "not go amiss" and made arrangements for Home Helper 2's schedule of assistance at the Rips flat to be temporarily increased by three hours per week (Based on records of Home Help Unit of the Family Welfare Section)

(29) 10th August 1974

Home Helper 2 stated her belief that "Linda is going through a bad patch at the moment but will certainly get over it with a bit of support and encouragement". Home Helper 2 noted that "Linda quite often claims that she misses her mother and that she finds her father increasingly more difficult to get along with . . . I think she actually feels quite lonely a lot of the time and seems to brighten up when I come round". (Based on records of Home Help Unit of the Family Welfare Section)

(30) 15th October 1974

Welfare Officer 1 received a memo from Social Worker 1 which stated that the condition of Linda's flat was steadily deteriorating and that the general situation of the family seemed "to be reaching a crisis point". Social Worker 1 added that "although I am loath to take the option of removing Linda's children into care - even on a temporary basis - I feel that this might well be the only sensible thing to do in the present circumstances. This course of action will

relieve the burden of the children from Linda and will give her a chance to tidy up the flat so the Health Services stop their continuous complaining". (Based on records of Fostering & Adoptions Unit of the Family Welfare Section)

(31) 27th October 1974

In a special report Home Helper 2 stated that "Linda is terribly depressed at the moment about the prospect of having her children taken into care . . . she seems to have totally lost the will to look after the flat though she is continuing to care for the children at a satisfactory level. (Based on records of Fostering & Adoptions Unit of the Family Welfare Section)

(32) 30th October 1974

William and Mary Rips were admitted into temporary foster care with an experienced foster mother (Mrs. O.). Her understanding was that she and her husband were to have the children for a few weeks whilst their mother cleaned up her flat. Welfare Officer 1 reported that Linda had not been present at the actual handover of the children because of the "terribly distressed state" that she was in. William and Mary were also described as being very upset at having to leave their mother. (Based on records of Fostering & Adoptions Unit of the Family Welfare Section)

(33) 19th November 1974

Welfare Officer 1 reported that Linda Rips was very despondent and was showing no signs of trying to improve the state of the flat. Linda was also noted as saying that she felt continually unwell and just felt like sleeping all the time. Welfare Officer 1 reported that although she had given Linda considerable encouragement to tidy up the flat she felt there would be little improvement in the immediate term since Linda seemed "too unhappy to do anything at the moment". (Based on records of Fostering & Adoptions Unit of the Family Welfare Section)

(34) December 1974 to August 1975

Welfare Officer 1 visited Linda Rips twice during this period and noted on both occasions that the flat was looking much improved from the last visit. It was also recorded that Linda Rips' was gradually. It was also noted that Linda frequently visited her children at their foster home and was maintaining an affectionate relationship with them, especially William. According to the foster parents, Mary had apparently been disturbed by Linda's initial visits and would wake up at night crying. After about three months, however, Mary received visits from her mother without disturbance, though it was noted that Linda seemed to respond less positively to Mary than to William. By the middle of August Linda was reported to be getting excited about the possibility of having her children returned and started to make a concerted effort toward making the flat look tidy - even being reported to have painted the dining room and bedrooms. (Based on records of Fostering & Adoptions Unit of the Family Welfare Section)

(35) 26th September 1975

Welfare Officer 1 visited Linda Rips and decided that Linda was ready to have the children come back to live at the flat. She recorded that "Linda has recently shown her extreme willingness to get the flat looking tidy . . . She clearly deserves to have her children returned to her as soon as possible". Welfare Officer 1 also noted that she had telephoned Social Worker 1 to explain that William would be returning home on the 29th September and that Mary would follow some few weeks later. (Based on records of Fostering & Adoptions Unit of the Family Welfare Section)

(36) 14th November 1975

Welfare Officer 1 telephoned Social Worker 1- this time to say that Mary Rips had also left the foster care and been returned to her mother. Welfare Officer 1 stated that "Mary was delighted to be back at home with her mother and Linda seemed to relate well to the child". Welfare Officer 1 further noted that the standard of the flat was being maintained and that Linda seemed to be taking far more care of her own physical appearance. (Based on records of Fostering & Adoptions Unit of the Family Welfare Section)

(37) 16th March 1976

Welfare Officer 1 took Linda and the children to visit Mrs. O. - their last foster parent. Mrs. O. was recorded on file as having commented privately to Welfare Officer 1 that she was "shocked by the appearance of the little girl" who she described as being "thin, pale and withdrawn". Welfare Officer 1 felt that Mrs. O. - who was known to have wanted to adopt Mary - was "making trouble over nothing . . . Mary genuinely looks very well to me". (Based on records of Fostering & Adoptions Unit of the Family Welfare Section)

(38) 1st August 1976

Welfare Officer 1 received a request from Social Worker 1 to make arrangements for William and Mary to be taken into temporary foster care on this 4th August in anticipation of Linda Rips' approaching confinement with her fourth child. Welfare Officer 1 recorded Social Worker 1 as mentioning that Linda was apparently looking forward to having the baby and was hoping that it would be a boy. It was also reported that Linda has tidied up the flat which was now looking very clean and tidy. (Based on records of Fostering & Adoptions Unit of the Family Welfare Section)

(39) 4th August 1976

William and Mary were received into care under Section 1 of the Child Act, 1948, in anticipation of their mother's pending confinement. Both children went to Mrs. K. who was a registered foster parent. Welfare Officer 1 noted in a report that "Linda seems to have matured considerably over the last year . . . I feel very hopeful indeed about the future prospects of the Rips family - even with the additional strain on Linda of the forthcoming baby". (Based on records of Fostering & Adoptions Unit of the Family Welfare Section)

(40) 16th September 1976

Subsequent to the birth of Linda Rips' fourth child (Lucie) at the *British Hospital for Mothers and Babies*, Woolwich, Welfare Officer 1 visited the hospital to see Linda and the new baby. Welfare Officer 1 filed a memo in which noted that "Lucie is a small baby and Linda seems disappointed that she has another girl. With time, though, I am positive that Linda will take to the child . . . The initial uncertainty by mothers over their new born children is something I have seen far too often to be concerned about. Linda has proved to me again and again that she is an able and caring mother". (Based on records of Fostering & Adoptions Unit of the Family Welfare Section)

(41) 28th September 1976

Welfare Officer 1, having received information that the Health Visitors were concerned over the welfare of Linda Rips' new baby, decided to go and visit the family at *John Newton Court*. She recorded finding that the condition of the flat had deteriorate somewhat but that the baby seemed healthy and well. Welfare Officer 1 stated on file that "Everyone seems to be worried over Lucie being so small . . . From my experience with newborn babies there appears to be considerable variability in their initial weight and size . . . I feel there is absolutely nothing amiss with Lucie in terms of her health or the quality of care that Linda is providing . . . Still, however, the condition of Lucie clearly requires continual and careful monitoring to ensure that she progresses satisfactorily". (Based on records of the Fostering & Adoptions Unit of the Family Welfare Section)

(42) 29th October 1976

Mrs. K. - the foster mother who was looking after William and Mary - contacted Welfare Officer 1 and stated that the children were missing their mother terribly and desperately wanted to go back home. Welfare Officer 1 agreed that they should be returned to their mother in the near future, and stated that the only reason this had not yet been done was to give Linda a good chance to get going with the new baby. (Based on records of the Fostering & Adoptions Unit of the Family Welfare Section)

(43) 19th December 1976

William and Mary remained with their foster mother until 19th December at which time Welfare Office 1 returned the children to Linda Rips. Welfare Officer 1 noted that "Linda is over the moon at having William and Mary back, and the children are equally as pleased to be with their mother again . . . The level of bonding between the children and their mum is

clearly very strong indeed". Welfare Officer 1 additionally stated some grounds for concern over the fact that Lucie appeared not to have gained any weight since she had seen her in September. Welfare Officer 1 recorded on file that "sometimes a baby's weight will fluctuate considerably but in this case there may well be some problems with Lucie's absorption of food". (Based on records of the Fostering & Adoptions Unit of the Family Welfare Section)

(44) January to July 1977

At this time Welfare Officer 1 also spoke to Welfare Officer 2 from the *Home Help Unit* and requested that a low level of home assistance be re-instigated to Linda Rips for a short period of time. The records of the *Home Help Unit* indicate that Welfare Officer 2 immediately designated that Home Helper 3 provide weekly support to the Rips family. In a routine report on the 4th March, Home Helper 3 stated that "Linda and the children seem to have taken to me quite well, and the state of the flat is generally stable with the minimal assistance that I am providing". The Home Helper also noted that "Linda Rips tends to be rather inconsistent in her treatment of the baby - sometimes showering Lucie with love and affection and other times seeming rather hostile and aggressive toward to the child". (Based on records of the Fostering & Adoptions Unit and the Home Help Unit of the Family Welfare Section)

(45) 23rd August 1977

Lucie was known to have been admitted to *Brook Hospital* on 23rd August for an extended period of investigation since the Health Visitors at the *Family Health Practice* as well as the Principal Medical Officer (*Child Health Clinic*) were concerned over her failure to thrive. Lucie remained in the hospital until 23rd September and during her month at the hospital she started feeding better and gained some weight. (Based on records of the Home Help Unit of the Family Welfare Section)

(46) October 1977 to March 1978

The *Home Help Unit* records indicate that Home Helper 3 expressed some concern over Lucie's development to Welfare Officer 2, stating that "the baby seems to have lost weight again subsequent to leaving the hospital". Welfare Officer 2 noted her own view that Lucie's weight problems were proving a worry but that she felt that this was no reflection on Linda's mothering ability. The Home Helper was recorded as agreeing with this assessment and was noted as saying that "Linda seems to feed Lucie on a regular basis and the child's failure to put on weight is a total mystery to me". Welfare Officer 2 recorded on file that there appeared to be no evidence that Lucie was being in any way neglected by her mother and that there were therefore no grounds for taking the child into care. (Based on records of the Home Help Unit of the Family Welfare Section)

(47) 8th May 1978

Home Helper 3 recorded in a routine report that Linda's flat was being maintained in a satisfactory state. It was further noted that William and Mary were generally healthy and well, though Lucie, whilst being a happy child, was still failing to gain much weight. Home Helper 3 noted that Linda had become good friends with two of her neighbours and that this seemed to be having a constructive effect on her since she seemed to be taking more care of the way she looked and dressed. (Based on records of the Home Help Unit of the Family Welfare Section)

(48) October 1978 to February 1979

Welfare Officer 1 visited Linda Rips in October with a view to discussing the possibility of Linda being sterilised in the near future. The interview was recorded as going very positively and Linda agreed to be sterilised in the early part of the new year. On 9th February Linda Rips went in to Hospital for the operation and stayed in for two days. A temporary foster mother looked after the children at Linda's flat for this two day period. (Based on records of the Fostering & Adoptions Unit of the Family Welfare Section)

(49) 12th March 1979

Welfare Officer 2 received a note from Social Worker 2 which reported that Lucie had sustained a bump to her head at William's eighth birthday party. The Social Worker noted that the accident had apparently arisen from Lucie falling from a chair. The Social Worker

further stated that she felt "somewhat sceptical about Linda's explanation of this incident."
(Based on records of the Home Help Unit of the Family Welfare Section)

(50) 15th March 1979

Welfare Officer 2 heard from Social Worker 2 that Lucie had been kept in for observation at the Brook Hospital subsequent to the bump she had sustained two days earlier. It was known that an X-ray had shown no cranial damage and that the Paediatric Senior House Officer was of the opinion that there was no real evidence of any Non-Accidental Injury. The Senior House Officer was also noted as requesting that Lucie's progress be closely followed up at home by the *Social Services Department* to ensure that she was not the subject of any wilful harm by her mother. Welfare Officer 2 noted that Social Worker 3 seemed particularly concerned over the welfare of Lucie and stated her own opinion that "the situation with this youngest child is a continual worry . . . Lucie is very fragile and Linda really must be encouraged to ensure that the child does have accidents around the home - no matter how trivial they are". (Based on records of the Home Help Unit of the Family Welfare Section)

Appendix B2: Item weightings of casenote materials entries

B2.1 General Overview of the casenote weightings

The case entry number refers to the page of the relevant casenotes files, as detailed in Appendix B1, alongside each entry is the mean rating from the pilot study to rate the casenotes conveying the degree to which the entry supports the decision option. These scores are based upon the completion of a 100 point Likert scale, where 1 indicates no support and 100 indicates complete support for the given option; Option 1 being the provision of Home Help, Option 2 the removal of the youngest child and Option 3 the removal of all three children. The ranking data indicates the order of preference, for example, the first entry indicates a 3-1-2 preference, such that this entry adds strongest to the arguments for the removal of the youngest child, and is less likely to be interpreted as conveying evidence for the provision of home help.

B2.2 Hospital Consultant Casefiles

| Case Entry Number | Rating | | | Ranking | | |
|-------------------|----------|----------|----------|----------|----------|----------|
| | Option 1 | Option 2 | Option 3 | Option 1 | Option 2 | Option 3 |
| 1 | 28 | 73 | 63.5 | 3 | 1 | 2 |
| 2 | 34 | 73.5 | 80.5 | 3 | 2 | 1 |
| 3 | 32.5 | 71 | 81.5 | 3 | 2 | 1 |
| 4 | 36.5 | 67.5 | 70.5 | 3 | 2 | 1 |
| 5 | 44 | 59 | 67.5 | 3 | 2 | 1 |
| 6 | 46.5 | 52 | 57.5 | 3 | 2 | 1 |
| 7 | 46.5 | 60.5 | 74 | 3 | 2 | 1 |
| 8 | 30.5 | 72 | 72.5 | 3 | 2 | 1 |
| 9 | 30 | 62 | 80.5 | 3 | 2 | 1 |
| 10 | 31.5 | 59 | 80 | 3 | 2 | 1 |
| 11 | 32 | 68 | 64 | 3 | 1 | 2 |
| 12 | 36 | 52 | 76 | 3 | 2 | 1 |
| 13 | 33 | 73.5 | 72 | 3 | 1 | 2 |
| 14 | 33 | 81.5 | 86 | 3 | 2 | 1 |
| 15 | 34.5 | 74.5 | 68.5 | 3 | 1 | 2 |
| 16 | 68 | 68 | 67.5 | 1.5 | 1.5 | 3 |
| 17 | 42 | 48.5 | 60 | 3 | 2 | 1 |
| 18 | 68.5 | 50 | 59.5 | 1 | 3 | 2 |
| 19 | 45 | 73.5 | 89.5 | 3 | 2 | 1 |

| Case Entry Number | Rating | | | Ranking | | |
|-------------------|----------|----------|----------|----------|----------|----------|
| | Option 1 | Option 2 | Option 3 | Option 1 | Option 2 | Option 3 |
| 20 | 38 | 70.5 | 84.5 | 3 | 2 | 1 |
| 21 | 52 | 41 | 47.5 | 1 | 3 | 2 |
| 22 | 53.5 | 56.5 | 70.5 | 3 | 2 | 1 |
| 23 | 52 | 57 | 59.5 | 3 | 2 | 1 |
| 24 | 48 | 69 | 49.5 | 3 | 1 | 2 |
| 25 | 69 | 50 | 56 | 1 | 3 | 2 |
| 26 | 39.5 | 72.5 | 83.5 | 3 | 2 | 1 |
| 27 | 39 | 74.5 | 82.5 | 3 | 2 | 1 |
| 28 | 37.5 | 66.5 | 84 | 3 | 2 | 1 |
| 29 | 64 | 65.5 | 69.5 | 3 | 2 | 1 |
| 30 | 63 | 74.5 | 52 | 2 | 1 | 3 |
| 31 | 60.5 | 63 | 51 | 2 | 1 | 3 |
| 32 | 31.5 | 79.5 | 55.5 | 3 | 1 | 2 |
| 33 | 52.5 | 62 | 50 | 2 | 1 | 3 |
| 34 | 43 | 65.5 | 75.5 | 3 | 2 | 1 |
| 35 | 25 | 63.5 | 72.5 | 3 | 2 | 1 |
| 36 | 18.5 | 53.5 | 87.5 | 3 | 2 | 1 |
| 37 | 60 | 42 | 50.5 | 1 | 3 | 2 |
| 38 | 40 | 82.5 | 56 | 3 | 1 | 2 |
| 39 | 56.5 | 57 | 50 | 2 | 1 | 3 |
| 40 | 41.5 | 74.5 | 92 | 3 | 2 | 1 |
| 41 | 31.5 | 83.5 | 52 | 3 | 1 | 2 |
| 42 | 39 | 76.5 | 52.5 | 3 | 1 | 2 |
| 43 | 37.5 | 76 | 51.5 | 3 | 1 | 2 |
| 44 | 32.5 | 51.5 | 73 | 3 | 2 | 1 |
| 45 | 30 | 69.5 | 86 | 3 | 2 | 1 |
| 46 | 29.5 | 61 | 76 | 3 | 2 | 1 |
| 47 | 34 | 69 | 62.5 | 3 | 1 | 2 |
| 48 | 32 | 59 | 83 | 3 | 2 | 1 |
| 49 | 35.5 | 74.5 | 54 | 3 | 1 | 2 |
| 50 | 68 | 65.5 | 52 | 1 | 2 | 3 |

B2.3 Health Visitor Casefiles

| Case Entry Number | Rating | | | Ranking | | |
|-------------------|----------|----------|----------|----------|----------|----------|
| | Option 1 | Option 2 | Option 3 | Option 1 | Option 2 | Option 3 |
| 1 | 42.5 | 68 | 66.5 | 3 | 1 | 2 |
| 2 | 50.5 | 59 | 46 | 3 | 1 | 2 |
| 3 | 61.5 | 63 | 47 | 2 | 1 | 3 |
| 4 | 37.5 | 73 | 76 | 3 | 2 | 1 |
| 5 | 37.5 | 52 | 61.5 | 3 | 2 | 1 |
| 6 | 38.5 | 70 | 85 | 3 | 2 | 1 |
| 7 | 36 | 73.5 | 90.5 | 3 | 2 | 1 |
| 8 | 8.5 | 58.5 | 83 | 3 | 2 | 1 |
| 9 | 38 | 51.5 | 75.5 | 3 | 2 | 1 |
| 10 | 39 | 68 | 79.5 | 3 | 2 | 1 |
| 11 | 27.5 | 56 | 84.5 | 3 | 2 | 1 |
| 12 | 35.5 | 54 | 79.5 | 3 | 2 | 1 |
| 13 | 37 | 56.5 | 81.5 | 3 | 2 | 1 |
| 14 | 36 | 43.5 | 80.5 | 3 | 2 | 1 |
| 15 | 42 | 71.5 | 70 | 3 | 1 | 2 |
| 16 | 35.5 | 58.5 | 77.5 | 3 | 2 | 1 |
| 17 | 35 | 73.5 | 86.5 | 3 | 2 | 1 |
| 18 | 48 | 50 | 61 | 3 | 2 | 1 |
| 19 | 66 | 43.5 | 54.5 | 1 | 3 | 2 |
| 20 | 34 | 50.5 | 83.5 | 3 | 2 | 1 |
| 21 | 28 | 41 | 69 | 3 | 2 | 1 |
| 22 | 46.5 | 24 | 39 | 1 | 3 | 2 |
| 23 | 46.5 | 46.5 | 70.5 | 2.5 | 2.5 | 1 |
| 24 | 40 | 79.5 | 72 | 3 | 1 | 2 |
| 25 | 34 | 69 | 82.5 | 3 | 2 | 1 |
| 26 | 29.5 | 61 | 82.5 | 3 | 2 | 1 |
| 27 | 32 | 55 | 85.5 | 3 | 2 | 1 |
| 28 | 32.5 | 70 | 77.5 | 3 | 2 | 1 |
| 29 | 51.5 | 64.5 | 78.5 | 3 | 2 | 1 |
| 30 | 41.5 | 87 | 51.5 | 3 | 1 | 2 |
| 31 | 50 | 57.5 | 51 | 3 | 1 | 2 |
| 32 | 27.5 | 76 | 87.5 | 3 | 2 | 1 |
| 33 | 13.5 | 48.5 | 76.5 | 3 | 2 | 1 |
| 34 | 29 | 72 | 53 | 3 | 1 | 2 |

| Case Entry Number | Rating | | | Ranking | | |
|-------------------|----------|----------|----------|----------|----------|----------|
| | Option 1 | Option 2 | Option 3 | Option 1 | Option 2 | Option 3 |
| 35 | 28 | 73 | 86 | 3 | 2 | 1 |
| 36 | 30 | 47 | 77.5 | 3 | 2 | 1 |
| 37 | 28 | 87 | 65 | 3 | 1 | 2 |
| 38 | 31 | 81.5 | 53.5 | 3 | 1 | 2 |
| 39 | 33 | 65 | 52 | 3 | 1 | 2 |
| 40 | 37 | 76 | 50 | 3 | 1 | 2 |
| 41 | 16 | 82 | 68 | 3 | 1 | 2 |
| 42 | 50 | 63 | 59 | 3 | 1 | 2 |
| 43 | 16.5 | 56.5 | 70 | 3 | 2 | 1 |
| 44 | 34.5 | 42.5 | 76.5 | 3 | 2 | 1 |
| 45 | 30.5 | 66.5 | 71.5 | 3 | 2 | 1 |
| 46 | 34.5 | 56.5 | 67 | 3 | 2 | 1 |
| 47 | 21 | 74.5 | 90.5 | 3 | 2 | 1 |
| 48 | 31 | 72.5 | 52.5 | 3 | 1 | 2 |
| 49 | 47 | 62 | 76 | 3 | 2 | 1 |
| 50 | 27.5 | 76.5 | 83 | 3 | 2 | 1 |

B2.4 Social Welfare Casefiles

| Case Entry Number | Rating | | | Ranking | | |
|-------------------|----------|----------|----------|----------|----------|----------|
| | Option 1 | Option 2 | Option 3 | Option 1 | Option 2 | Option 3 |
| 1 | 52.50 | 51.5 | 50 | 1 | 2 | 3.0 |
| 2 | 68 | 37.5 | 38 | 1 | 2 | 3.0 |
| 3 | 51.5 | 50 | 50.5 | 1 | 3 | 1.0 |
| 4 | 56 | 36.5 | 35 | 1 | 2 | 3.0 |
| 5 | 68.5 | 20 | 20 | 1 | 2.5 | 2.5 |
| 6 | 62.5 | 16 | 15.5 | 1 | 3 | 2.0 |
| 7 | 62.5 | 20 | 34 | 1 | 3 | 2.0 |
| 8 | 68 | 24 | 19 | 1 | 2 | 3.0 |
| 9 | 70.5 | 30.5 | 30 | 1 | 2 | 3.0 |
| 10 | 41 | 52.5 | 46 | 3 | 1 | 2.0 |
| 11 | 68 | 19.5 | 28 | 1 | 3 | 2.0 |
| 12 | 57.5 | 15 | 14.5 | 1 | 2 | 3.0 |
| 13 | 57.5 | 37 | 20 | 1 | 2 | 3.0 |
| 14 | 79.5 | 58.5 | 51.5 | 1 | 2 | 3.0 |
| 15 | 67 | 37.5 | 35 | 1 | 2 | 3.0 |
| 16 | 52.5 | 37.5 | 33.5 | 1 | 2 | 3.0 |
| 17 | 47 | 81 | 62.5 | 3 | 1 | 2.0 |
| 18 | 73.5 | 76.5 | 57 | 2 | 1 | 3.0 |
| 19 | 81.5 | 18.5 | 17 | 1 | 2 | 3.0 |
| 20 | 56.5 | 65 | 49 | 2 | 1 | 3.0 |
| 21 | 68.5 | 21.5 | 20.5 | 1 | 2 | 3.0 |
| 22 | 72.5 | 11.5 | 11 | 1 | 2 | 3.0 |
| 23 | 48.5 | 72.5 | 69.5 | 3 | 1 | 2.0 |
| 24 | 48 | 68.5 | 69 | 3 | 2 | 1.0 |
| 25 | 48 | 33.5 | 34.5 | 1 | 3 | 2.0 |
| 26 | 54 | 27.5 | 27.5 | 1 | 2.5 | 2.5 |
| 27 | 70 | 20.5 | 29 | 1 | 3 | 2.0 |
| 28 | 53.5 | 62.5 | 51 | 2 | 1 | 3.0 |
| 29 | 72.5 | 69 | 37 | 1 | 2 | 3.0 |
| 30 | 54 | 65.5 | 50 | 2 | 1 | 3.0 |
| 31 | 54 | 49 | 45 | 1 | 2 | 3.0 |
| 32 | 67 | 22.5 | 24.5 | 1 | 3 | 2.0 |
| 33 | 59 | 30.5 | 15.5 | 1 | 2 | 3.0 |
| 34 | 60 | 13 | 13.5 | 1 | 3 | 2.0 |
| 35 | 74.5 | 67.5 | 29 | 1 | 2 | 3.0 |

| Case Entry Number | Rating | | | Ranking | | |
|-------------------|----------|----------|----------|----------|----------|----------|
| | Option 1 | Option 2 | Option 3 | Option 1 | Option 2 | Option 3 |
| 36 | 78 | 23.5 | 7 | 1 | 2 | 3.0 |
| 37 | 75 | 22.5 | 7.5 | 1 | 2 | 3.0 |
| 38 | 53 | 45.5 | 47 | 1 | 3 | 2.0 |
| 39 | 70.5 | 75 | 28 | 2 | 1 | 3.0 |
| 40 | 52 | 43.5 | 50 | 1 | 3 | 2.0 |
| 41 | 52 | 27.5 | 35 | 1 | 3 | 2.0 |
| 42 | 60 | 34.5 | 19 | 1 | 2 | 3.0 |
| 43 | 59 | 67.5 | 31.5 | 2 | 1 | 3.0 |
| 44 | 55 | 63.5 | 27 | 2 | 1 | 3.0 |
| 45 | 86 | 13.5 | 14 | 1 | 3 | 2.0 |
| 46 | 60.5 | 18.5 | 10.5 | 1 | 2 | 3.0 |
| 47 | 53.5 | 56.5 | 56 | 3 | 1 | 2.0 |
| 48 | 53 | 37 | 35 | 1 | 2 | 3.0 |
| 49 | 51.5 | 77.5 | 40.5 | 2 | 1 | 3.0 |
| 50 | 74.5 | 60.5 | 28.5 | 1 | 2 | 3.0 |

B2.5 Welfare Officer Casefiles

| Case Entry Number | Rating | | | Ranking | | |
|-------------------|----------|----------|----------|----------|----------|----------|
| | Option 1 | Option 2 | Option 3 | Option 1 | Option 2 | Option 3 |
| 1 | 55 | 62.5 | 57 | 3 | 1 | 2 |
| 2 | 61 | 33.5 | 28.5 | 1 | 2 | 3 |
| 3 | 66 | 32.5 | 42.5 | 1 | 3 | 2 |
| 4 | 50 | 55.5 | 50 | 2.5 | 1 | 2.5 |
| 5 | 60.5 | 25.5 | 25 | 1 | 2 | 3 |
| 6 | 62.5 | 42.5 | 42.5 | 1 | 2.5 | 2.5 |
| 7 | 73 | 27 | 38 | 1 | 3 | 2 |
| 8 | 66 | 17 | 18 | 1 | 3 | 2 |
| 9 | 76.5 | 53 | 32.5 | 1 | 2 | 3 |
| 10 | 57.5 | 10.5 | 9.5 | 1 | 2 | 3 |
| 11 | 58.5 | 14 | 14 | 1 | 2.5 | 2.5 |
| 12 | 62.5 | 45.5 | 46 | 1 | 3 | 2 |
| 13 | 56.5 | 27.5 | 27 | 1 | 2 | 3 |
| 14 | 61 | 10 | 10 | 1 | 2.5 | 2.5 |
| 15 | 64 | 14 | 13 | 1 | 2 | 3 |
| 16 | 80.5 | 48.5 | 48 | 1 | 2 | 3 |
| 17 | 78.5 | 32.5 | 33 | 1 | 3 | 2 |
| 18 | 67 | 43 | 41 | 1 | 2 | 3 |
| 19 | 63 | 14 | 14 | 1 | 2.5 | 2.5 |
| 20 | 47.5 | 65.5 | 54 | 3 | 1 | 2 |
| 21 | 81.5 | 17 | 17.5 | 1 | 3 | 2 |
| 22 | 78 | 13.5 | 13.5 | 1 | 2.5 | 2.5 |
| 23 | 72 | 51.5 | 20.5 | 1 | 2 | 3 |
| 24 | 60.5 | 50 | 50 | 1 | 2.5 | 2.5 |
| 25 | 77 | 42.5 | 28.5 | 1 | 2 | 3 |
| 26 | 69 | 41.5 | 24 | 1 | 2 | 3 |
| 27 | 56.5 | 47.5 | 48.5 | 1 | 3 | 2 |
| 28 | 72.5 | 24.5 | 24 | 1 | 2 | 3 |
| 29 | 86 | 27 | 26.5 | 1 | 2 | 3 |
| 30 | 54 | 67.5 | 67 | 3 | 1 | 2 |
| 31 | 70 | 37 | 11.5 | 1 | 2 | 3 |
| 32 | 64 | 14.5 | 13 | 1 | 2 | 3 |
| 33 | 62 | 38.5 | 30 | 1 | 2 | 3 |
| 34 | 60.5 | 40 | 7 | 1 | 2 | 3 |
| 35 | 57.5 | 17.5 | 11 | 1 | 2 | 3 |

| Case Entry Number | Rating | | | Ranking | | |
|-------------------|----------|----------|----------|----------|----------|----------|
| | Option 1 | Option 2 | Option 3 | Option 1 | Option 2 | Option 3 |
| 36 | 59 | 14.5 | 14.5 | 1 | 2.5 | 2.5 |
| 37 | 50 | 44 | 23 | 1 | 2 | 3 |
| 38 | 67.5 | 41 | 21.5 | 1 | 2 | 3 |
| 39 | 70.5 | 12 | 12 | 1 | 2.5 | 2.5 |
| 40 | 58 | 53.5 | 28 | 1 | 2 | 3 |
| 41 | 74 | 48.5 | 28 | 1 | 2 | 3 |
| 42 | 66.5 | 15 | 13.5 | 1 | 2 | 3 |
| 43 | 59.5 | 44 | 11.5 | 1 | 2 | 3 |
| 44 | 76 | 68 | 27 | 1 | 2 | 3 |
| 45 | 64.5 | 69.5 | 25.5 | 2 | 1 | 3 |
| 46 | 55.5 | 49.5 | 26.5 | 1 | 2 | 3 |
| 47 | 57.5 | 40 | 26.5 | 1 | 2 | 3 |
| 48 | 62 | 20 | 19.5 | 1 | 2 | 3 |
| 49 | 57.5 | 74 | 26.5 | 2 | 1 | 3 |
| 50 | 71 | 75 | 26 | 2 | 1 | 3 |

Appendix B3: Choice-Dilemma Questionnaire from Experiment 1

B3.1 Overview of the Choice Dilemma Questionnaire

The Choice Dilemma Questionnaire used to assign participants to roles in the experiment that constitutes the data corpus. The following dilemmas were presented as a pre-test to participants recruited for the study

B3.2 Dilemma 1: Handicapped Child

You have been married for five years and have a four year-old child, Jo, who is severely handicapped and needs constant care and attention. Neither you nor your spouse have any other close family. Caring for Jo has been deeply regarding for both you and your spouse, but has also created intense emotional strains on your relationship. An opportunity has arisen for you to take a month's holiday for two, during which you and your spouse would hope to re-establish your relationship. However, suitable foster parents would need to be found to look after Jo whilst you are on holiday. The services of a fostering agency have been employed, but the agency has warned that whether foster parents with experience of caring for a handicapped child will be found in time is uncertain.

Please indicate the lowest probability of the agency finding foster parents with experience of handicapped children that you would consider acceptable before making plans to go on holiday.

- ☐ The chances are 1 in 10 that the agency will find foster parents with experience of handicapped children.
- ☐ The chances are 1 in 10 that the agency will find foster parents with experience of handicapped children.
- ☐ The chances are 2 in 10 that the agency will find foster parents with experience of handicapped children.
- ☐ The chances are 3 in 10 that the agency will find foster parents with experience of handicapped children.
- ☐ The chances are 4 in 10 that the agency will find foster parents with experience of handicapped children.
- ☐ The chances are 5 in 10 that the agency will find foster parents with experience of handicapped children.
- ☐ The chances are 6 in 10 that the agency will find foster parents with experience of handicapped children.
- ☐ The chances are 7 in 10 that the agency will find foster parents with experience of handicapped children.
- ☐ The chances are 8 in 10 that the agency will find foster parents with experience of handicapped children.
- ☐ The chances are 9 in 10 that the agency will find foster parents with experience of handicapped children.
- ☐ Tick here if you think Jo should **not** be fostered whatever the chances of the agency finding foster parents with experience of handicapped children.

B3.2 Dilemma 2: Possible Sexual Abuse

You are a paediatrician working in a local hospital. During a routine examination of a four-year old child, you have discovered what could be signs of sexual abuse. However, careful interviews with the child as well as separate interviews with the parents reveal no evidence whatsoever of sexual abuse. On the contrary, the family appears to be entirely normal and the relationship between parents and child quite healthy. In the light of the Cleveland scandal, you would wish to avoid incorrect diagnosis in this case. As you have had no previous experience of this kind of case you have therefore requested

the second opinion of a paediatric consultant in another hospital. Unfortunately, it will be several hours before the consultant arrives, and in the meantime the parents are insisting that the child be allowed to go home with them. You decide to perform one further, but highly unreliable and controversial test before deciding whether to discharge the child. This test attempts to quantify the probability that the physical symptoms often linked to sexual abuse could actually have arisen from normal, non-sexual causes.

Please indicate the lowest probability of the symptoms having a non-sexual cause that you would consider acceptable before deciding to keep the child in hospital.

- ☐ Tick here if you would keep the child in hospital no matter what the results of the test.
- ☐ The chances are 9 in 10 that the symptoms have a non-sexual cause.
- ☐ The chances are 8 in 10 that the symptoms have a non-sexual cause.
- ☐ The chances are 7 in 10 that the symptoms have a non-sexual cause.
- ☐ The chances are 6 in 10 that the symptoms have a non-sexual cause.
- ☐ The chances are 5 in 10 that the symptoms have a non-sexual cause.
- ☐ The chances are 4 in 10 that the symptoms have a non-sexual cause.
- ☐ The chances are 3 in 10 that the symptoms have a non-sexual cause.
- ☐ The chances are 2 in 10 that the symptoms have a non-sexual cause.
- ☐ The chances are 1 in 10 that the symptoms have a non-sexual cause.

B3.3 Dilemma 3: Anorexia Nervosa

You are a clinical psychologist working within a National Health Service clinic. You have had weekly appointments for some months now with a highly anxious young woman client suffering from anorexia nervosa. Her body weight at the start of treatment was so dangerously low that she had just spent a period in hospital on a special diet. You have already succeeded in establishing her weight and psychological state. It is now apparent that only a permanent and emotionally rewarding relationship will cure her condition. Over the course of the treatment, however, this client has built up a strong emotional dependency on you and the weekly appointments. On the few occasions that you have missed appointments, she has reacted by excessive fasting necessitating emergency admission to hospital. You have discussed this case with your colleagues and have agreed that her dependency on you is preventing her forming permanent relationships outside the clinic, making the termination of treatment progressively more difficult. You agree to encourage and monitor her attempts to establish positive relationships with other people, with a view to terminating her treatment.

Please indicate the lowest probability of your client's relationship succeeding that you would consider acceptable before terminating treatment.

- ☐ The chances are 1 in 10 that your client's relationship will succeed.
- ☐ The chances are 2 in 10 that your client's relationship will succeed.
- ☐ The chances are 3 in 10 that your client's relationship will succeed.
- ☐ The chances are 4 in 10 that your client's relationship will succeed.
- ☐ The chances are 5 in 10 that your client's relationship will succeed.
- ☐ The chances are 6 in 10 that your client's relationship will succeed.

- ☐ The chances are 7 in 10 that your client's relationship will succeed.
- ☐ The chances are 8 in 10 that your client's relationship will succeed.
- ☐ The chances are 9 in 10 that your client's relationship will succeed.
- ☐ Tick here if you think treatment should not be terminated whatever your client's success in forming relationships with other people.

B3.4 Dilemma 4: Continued Probation

You are a probation officer preparing a report for a Magistrate's Court hearing involving one of your clients, an impressionable but aggressive young man presently on probation following a series of minor assault offences. Progress had been promising; he was getting on well at home and at work, and was even considering a training scheme placement at a local college. However, he is now facing serious criminal charges and a possible prison sentence for what witnesses describe as a particularly vicious and unprovoked attack on another youth outside a dance club. Because of the extent of his injuries, this second youth is still in hospital and will not be present to testify at the hearing. The evidence does suggest that, with continued supervision and encouragement, this young man could respond favourably to a further period of probation, although his violent history also suggests some risk that he will offend. On the other hand, you fear the worse would follow if he were to be sent to prison - he would soon be socialised into the criminal subculture, and this would turn a hot-tempered, but potentially honest, young man into a hardened and violent criminal.

Please indicate the lowest probability of success of further probation period that you would consider acceptable before recommending a new supervision order to the court.

- ☐ Tick here if you would not recommend a further probation period for this client under any circumstances.
- ☐ The chances are 9 in 10 that a further period of probation will be successful.
- ☐ The chances are 8 in 10 that a further period of probation will be successful.
- ☐ The chances are 7 in 10 that a further period of probation will be successful.
- ☐ The chances are 6 in 10 that a further period of probation will be successful.
- ☐ The chances are 5 in 10 that a further period of probation will be successful.
- ☐ The chances are 4 in 10 that a further period of probation will be successful.
- ☐ The chances are 3 in 10 that a further period of probation will be successful.
- ☐ The chances are 2 in 10 that a further period of probation will be successful.
- ☐ The chances are 1 in 10 that a further period of probation will be successful.

B3.5 Dilemma 5: Continuation of Pregnancy

You are an obstetric consultant to a maternity ward in a local hospital, and have been asked to give urgent advice on an emergency case. A 28 year-old woman is mid-way through her pregnancy, but a serious complication has arisen that could threaten the survival of the foetus, or at least cause physical damage to the unborn child if it is born alive. Under the terms of the new abortion law, a decision whether or not to terminate the pregnancy must be made now. Furthermore, the condition is now so severe that it is unlikely that she will ever conceive again. Her case notes indicate that she has been pregnant several times before, but on each occasion the pregnancy was terminated due to this complication. Repeated applications by the couple to local authority agencies to register as foster parents have been unsuccessful, principally because of their unmarried status. You have personally interviewed the couple, and it is clear that they are desperate to start a family; they have made every preparation at home to receive a

baby, and the termination of this pregnancy could permanently damage their relationship. At a case conference with the senior midwife and nursing staff, you agree to carry out one final test to assess the chances that the foetus will survive the full term of pregnancy. Unfortunately, this test cannot tell you whether the baby will be physically damaged at birth.

Please indicate the lowest probability of the baby being born alive that you consider acceptable before recommending continuation of the pregnancy.

- ☐ The chances are 1 in 10 that the baby will be born alive.
- ☐ The chances are 2 in 10 that the baby will be born alive.
- ☐ The chances are 3 in 10 that the baby will be born alive.
- ☐ The chances are 4 in 10 that the baby will be born alive.
- ☐ The chances are 5 in 10 that the baby will be born alive.
- ☐ The chances are 6 in 10 that the baby will be born alive.
- ☐ The chances are 7 in 10 that the baby will be born alive.
- ☐ The chances are 8 in 10 that the baby will be born alive.
- ☐ The chances are 9 in 10 that the baby will be born alive.
- ☐ Tick here if you think that the pregnancy should be terminated whatever the outcome of this test.

The data collected suggested no immediate systematic method of allocating participants to roles within the decision making panels. As is apparent from Table B3.1 little variance in the data was visible as participants clustered quite closely around the mean, which predominantly indicated a predisposition to the best interests of the child. Although this is by no means a clear cut situation.

| Dilemma | Mean | Standard Deviation | Median | High Score | Low Score |
|--------------|------|--------------------|--------|--------------------|-------------------------|
| Foster | 7.38 | 2.11 | 8 | Child's Interest | Family's Interest |
| Sexual | 6.65 | 2.45 | 6 | Child's Interest | Family's Interest |
| Relationship | 7.04 | 1.71 | 7 | Client's Interest | Psychologist's Interest |
| Probation | 5.1 | 2.15 | 5 | Society's Interest | Client's Interest |
| Baby | 4.06 | 2.60 | 4 | Nobody's Interest | Family's Interest |
| All Dilemmas | 30.2 | 5.41 | 30 | N/A | N/A |

Table B3.1: Descriptive statistics of participant responses to each Experiment 1 choice dilemma questionnaire

Correlation's of the scores on individual items with one another and the total score of all items on the CDQ (Table B3.2) offered little insight into the predisposition of the participants towards the child's interests or those of the family.

| | Sexual | Relationship | Probation | Baby | Total |
|--------------|--------|--------------|-----------|-------|-------|
| Foster | 0.089 | 0.000 | 0.107 | 0.055 | 0.502 |
| Sexual | | 0.079 | 0.021 | 0.013 | 0.527 |
| Relationship | | | -0.073 | 0.025 | 0.336 |
| Probation | | | | 0.111 | 0.479 |
| Baby | | | | | 0.560 |

Table B3.2: Item Total Correlation's and Cross-Dilemma Correlation's

However given the poor inter-correlation's between responses to the third dilemma 'relationship' and the other four dilemmas (0.000 - 0.079) each participant's total score was recalculated omitting their responses from the third dilemma. This provided a wider spread of data (SD = 5.1) with a mean and median of 23.2 and 23.0 respectively. The decision was then taken to divide the participants at the median and assign all participants scoring above the median to the two medical roles (Hospital Consultant (HC) and Health Visitor (HV)) and those scoring below the median to the social service roles (Social Worker (SW) and Welfare Officer (WO)) within each panel. In doing this it was hoped that participants would find some natural affinity to the position presented by their case notes, and not find themselves arguing against a position that they themselves would advocate.

Appendix B4 Experimental Briefings

B4.1 Experiment 1 Briefing

Declaration: This information is unavailable, however the general nature of the briefing was along the lines of those presented in the remainder of Appendix B4.

B4.2: Experiment 2 Briefing

B4.2.1 General Overview

The instructions were standardised where possible, with differences existing only where the nature of the communication medium, or feedback channels required. As such the first three paragraphs were the same for all participants, with paragraphs four and five changing as required. The only other difference between instructions was the opening line of the second paragraph, which informed participants of the role to which they were assigned.

B4.2.2 Standardised opening for All Computer-Mediated Groups

Over recent years various local authorities have had contact with the Rips family who live in the London Borough of Bexley. After several well documented events, by several agencies a case conference has been called at which a final decision must be made on the welfare of the family.

You are the elected representative of one of the agencies; The Department of Social Services (DSS) unfortunately due to the tight schedule of both yourself and the other agency involved; The Local Health Authority (LHA), a meeting cannot be scheduled at which both parties can attend, however the decision must be made soon, as such the agencies have agreed to use the local authorities computer system to communicate their ideas and make the decision. The system is in high demand and the only time available is a two hour time slot, the situation is not ideal, however, you are both determined to make the correct decision based upon the information available.

Your task is to make a decision based upon the evidence provided in the databases on the computer in front of you and also on the strength of the information provided to your colleague. You are linked by an electronic mail system Intermail™ through which you should communicate. Each machine has two databases; a 'reference file' common to you both and a

file containing information unique to you, this is the sole source of information on which you must base your decision on the welfare of the family involved.

Within the two hours allowed for this meeting you must reach a joint decision, which you should then convey to the administrator via the electronic mail system. At several points during the course of this meeting, a computerised decision panel will arrive through Intermail™ at this point you should immediately enter the electronic mail system and record your current preferences for the options provided. This voting panel is important as it serves as a focus to assist with your decision making, it is important that you complete this panel and then return to the task on which you are working.

If you have any questions then please ask them now, once the meeting has begun you can ask the administrator through the Intermail™ system.

B4.2.3 Additions to briefing for groups with Computer Support

Before the final paragraph, a passage was inserted describing the nature of the support system. This consisting of the following passages.

B4.2.4 Additional paragraph for Directive Communication Support (DCS) groups

There is also a system in operation that has been designed to assist your work through the computer, your levels of communication are monitored and useful hints provided on how you might proceed. It has been designed to give information about certain types of communication that you are using and make suggestions about how you might like to proceed. The computer will make suggestions and if these are met then the system will slip into the background and continue to monitor, if the recommendations are not met then the system will continue to send messages. It is to your own benefit to try to comply with the messages, as they have been designed to assist you and you colleague.

B4.2.5 Additional paragraph for Non-Directive Communication Support (NDCS) groups

There is also a system in operation that has been designed to assist your work through the computer. Your levels of communication are monitored and feedback given in the form of the percentage difference between your communication levels and the common levels of

successful groups performing this task. It is to your own benefit to try to comply with the messages, as they have been designed to assist you and you colleague.

B4.2.6 Face-to-Face Groups

Groups operating in the face-to-face condition received the standardised instructions for CMC groups with the lines in paragraph two from

“a meeting cannot be scheduled at which both parties can attend...”

to the line,

“...the system is in high demand”

were removed so that it read:

“The only time available is a two hour time slot, the situation is not ideal however you are both determined to make the correct decision based upon the information available.”

B4.2.7 Concluding Comments

In addition to these briefings, which were available throughout the experimental task, the participants were given a verbal briefing that reinforced the key points of the briefing and any questions that they had were answered.

B4.3 Experiment 3 Briefing

B4.3.1 General Overview

A standardised briefing was issued to all groups regardless of the communication conditions under which they operated. In addition to the briefing received by the CMC groups, groups operating with communication support received an additional paragraph explaining the nature of the Group Communication Support System.

B4.3.2 Standardised opening for both unsupported (CMC) and those supported with yoked communication support (CMCY)

Over recent years various local authorities have had contact with the Davis family who live in Bedford after several well documented events, by several agencies a case conference has been called at which a final decision must be made on the welfare of the family.

You are the elected representative of one of the agencies; The Community Services Department (CS) unfortunately due to the tight schedule of both yourself and the other agency involved; The Bedford Health Trust (HT), a meeting can not be scheduled at which both parties can attend, however, the decision must be made soon. As such the agencies have agreed to use the local authorities computer system to communicate their ideas and make the decision. However, the system is in high demand and the only time available is a two hour time slot, the situation is not ideal however you are both determined to make the correct decision based upon the information available.

Your task is to make a decision based upon the evidence provided in the databases on the computer in front of you and also on the strength of the information provided to your colleague. You are linked by an electronic mail system Intermail™ through which you should communicate. Each machine has two databases; a 'reference file' common to you both and a file containing information unique to you, this is the sole source of information on which you must base your decision on the welfare of the family involved.

Within the two hours allowed for this meeting you must reach a joint decision, which you should then convey to the administrator via the electronic mail system. At several points during the course of this meeting, a computerised decision panel will arrive through Intermail™ at this point you should immediately enter the electronic mail system and record your current preferences for the options provided. This voting panel is important as it serves

as a focus to assist with your decision making, it is important that you complete this panel and then return to the task on which you are working.

B4.3.3 Additional briefing for Yoked Communication Support (CMCY) condition

There is also a system in operation that has been designed to assist your work through the computer, your levels of communication are monitored and useful hints provided on how you might proceed. It has been designed to give information about certain types of communication that you are using and make suggestions about how you might like to proceed. The computer will make suggestions and if these are met then the system will slip into the background and continue to monitor, if the recommendations are not met then the system will continue to send messages. It is to your own benefit to try to comply with the messages, as they have been designed to assist you and you colleague.

B4.4 Experiment 4 Task 1 Briefing

B4.4.1 General Overview

Where possible the three conditions received the same briefing, alterations were made only to explain the additional features present in some of the conditions. This appendix gives the briefing received by the Visual Communication Support (VCS) condition, followed by the additions made for those operating under Non-Directive Visual Communication Support (NDVCS), before concluding with the briefing received by both of these conditions and the unsupported condition (CMC). *NOTE: All the briefings in this section were given verbally*

B4.4.2 Visual Communication Support (VCS) Briefing

As you are unlikely to have used electronic mail before let alone made a decision through it there is a system in place to help you make the decision in the time allowed. Every message you send will be coded by two computers, it will look at what you are saying in general terms and give you feedback to help you. You can say anything you want, you can talk about the weather if you wish and the computer won't stop you, but two of the things that you might talk about are shown here on this monitor.

The top graph refers to the amount of information that as a group you quote directly from the database, so things like, "William was seen playing on the swings and he fell over and grazed his knee" would add to this chart.

The bottom one refers to the amount of group communication that you send that relates to the three decision options. So if you said "I think option 1 is the best" it would add one to your score. It would also add one to your score if you said "What do you think is the best option?".

Now there are two lines on each graph the green one is the communication levels used by groups who are successful in this task. A sort of target level of successful groups who finish on time. The red line shows your current level of communication. The graphs are cumulative so you don't need to send lots of messages all the time.

The X-axis is marked off in six minute intervals so you can see here that a successful group sends a quote between here and here, and then two more before this point in time.

Where the line falls back to zero doesn't mean to say that you are not communicating merely that you haven't reached that point in time yet, when you do the line will alter to show you how much communication you have sent.

Do you understand that or do you want me to run through it again?

Any questions about the interpretation of the feedback system were answered and the participants questioned about their understanding of the feedback system and how to read the graphs.

B4.4.3 Directive Visual Communication Support (DVCS) Briefing

In addition to the briefing given to the VCS condition the following was added to those receiving written prompts regarding their communication support:

Additionally the system will monitor your levels in comparison to the target provided by successful groups and when it feels that your communication is deviating from those levels it will mail you both and tell you so. This will consist of a message headed 'System Message - Communication' and it will tell you whether you are slightly, moderately or considerably above or below the levels of communication that it is expecting.

Do you understand that or do you want me to run through it again?

As with the DVS condition, any questions about the interpretation of the feedback system were answered and the participants questioned about their understanding of the feedback system and how to read the graphs.

B4.4.4 All Conditions Briefing

Participants in both of the supported conditions (VCS, DVCS) and those in the unsupported (CMC) condition all received the following briefing:

The pack on your desk gives you the three options from which you must select a joint group decision with which you both agree. It doesn't have to be one that you both consider to be the right answer but it has to be one that you are both happy to compromise on. The options are... *options read out according to condition.*

When you reach a joint decision, you send a message with the header "Final Decision (Joint)" and the experiment will end, you then get a short break before completing a second task.

If you get a problem or a question at any time during the experiment just wave at the camera and I'll come in and help you.

The one thing that I do ask before you send a final decision is that it is one with which you both agree and that you have both read your case notes. Remember that these are different for each of you, although you both have the same reference file.

Finally, because the information is about a mother and her family of three children there is the possibility that you might find the information distressing. If you do so then signal to the cameras, and when I come in let me know that you wish to withdraw. Don't worry about me, I am not having any problems recruiting subjects. I'd rather you withdrew than got distressed.

Having said that, don't expect the information to be really horrible, I've run nearly two hundred subjects and no one has wanted to withdraw yet. But that doesn't mean to say that it won't remind you of a friend from school, or something. If it does, just withdraw.

OK, any final questions?

Any questions that the participants had were answered, and again, if required, explanations were given about the task, the system and what the participants were expected to do. The final section of the briefing was as follows:

Good, you have seventy minutes, any messages you send will go straight through to the other person, any message arriving for you will have come from them unless it begins with the words "System Message" in which case it will have come from the central machine, and will be either a reminder of how long is left or a request for how you feel about the options at that particular moment in time. When the first message arrives for you I'll pop in and explain, other than that I see you in seventy minutes or when you send your final decision. If you double click on the files highlighted it will open up the case notes.

B4.5 Experiment 4 Task 2 Briefing

B4.5.1 General Overview

All participants had previously participated in Task 1 of Experiment 4, and had thus received one of the briefings outlined previously in Appendix B4.4. All groups in phase 2 of the experiment operated without communication support, and were given the following briefing.

The roles which you undertook for the first experiment have been reversed, so if you were the Local Health Authority, for this case you will have the information from the Department of Social Services and vice versa. The decision outcomes available are different for this experiment...

At this point, the decision outcomes; either those suggesting various custody orders or degrees of home help were outlined.

...the pack on your desk contains the three options from which you must select a joint, group decision with which you both agree. As with the previous task, when you reach a joint decision, you should send a message with the header "Final Decision (Joint)" and the experiment will end. If you get a problem or a question at any time during the experiment just wave at the camera and I'll come in and help you.

Again for the decision to be accepted as a group decision, you must have read all your case notes and you must both agree that it is an acceptable outcome. Remember that although you both have the same reference file, the case notes before you are different, again you have the right to withdraw at any point, and should you wish to do so, please let me know.

Any questions that the participants had were answered, and again, if required, explanations were given about the task, the system and what the participants were expected to do. The final section of the briefing was as follows:

Good, you have seventy minutes, any messages you send will go straight through to the other person, any message arriving for you will have come from them unless it begins with the words "System Message" in which case it will have come from the central machine, and will be either a reminder of how long is left or a request for how you feel

about the options at that particular moment in time. If you double click on the files highlighted it will open up the case notes, and you may begin.

Appendix B5 Post-Experimental Questionnaires

B5.1 Experiment 1 Post-Experimental Questionnaire

Please answer the following questions about the case conference in which you have just participated:

1. Please Print your name

2. What role did you play? (Please tick)

☐ Hospital Consultant

☐ Welfare Officer

☐ Health Visitor

☐ Social Worker

3. What decision did the panel reach? (Please tick)

☐ The panel was unable to reach a unanimous decision

☐ The panel decided to leave the family together but provide more home assistance

☐ The panel decided to remove only the youngest child (Lucie) into care.

☐ The panel decided to remove all three children (William, Mary, and Lucie) into care.

4. How much influence did each participant exert on the panel's thinking? (Rank from 1 = most influential to 4 = least influential)

☐ Hospital Consultant

☐ Welfare Officer

☐ Health Visitor

☐ Social Worker

5. If the panel was unable to achieve unanimity, what was the preference of the majority? (Please tick)

☐ To leave the family together but provide more home assistance

☐ To remove only the youngest child (Lucie) into care.

☐ To remove all three children (William, Mary, and Lucie) into care.

6. How satisfied are you with the decision reached by the panel (please tick)

☐ Very Dissatisfied

☐ Mildly Dissatisfied

☐ Indifferent

☐ Mildly Satisfied

☐ Very Satisfied

7. Were you able to get your ideas across to other members of the panel (Please tick)

☐ With Considerable difficulty

☐ With some difficulty

☐ Barely satisfactorily

☐ Moderately easily

☐ Very Easily

8. What are your final and personal thoughts on this case? (Please rank from 1 = most preferred to 3 = least preferred)

- ☐ To leave the family together but provide more home assistance
- ☐ To remove only the youngest child (Lucie) into care.
- ☐ To remove all three children (William, Mary, and Lucie) into care.

B5.2 Experiment 2 Post-Experimental Questionnaire

The post-experimental questionnaire contained a standardised set of questions relating to user perceptions of the task, and the time permitted to complete it. These questions were then supplemented by a series of condition specific questions relating to the support system provided.

B5.2.1 Standardisation Questions

The following questions were issued to the face-to-face and unsupported computer-mediated decision making groups with appropriate spaces for responses. These questions were also given to all computer-mediated groups.

Thank-you for your time and effort, before you are debriefed I would be grateful if you could complete the following questionnaire.

1. Which role did you play?

- ☐ The Local Health Authority (LHA)
- ☐ The Department of Social Services (DSS)

2. What decision did your group reach?

- ☐ The group was unable to reach a decision.
- ☐ The group decided to keep the family together and provide more home help.
- ☐ The group decided to remove Lucie from the family into care.
- ☐ The group decided to remove Lucie & Mary from the family and into care.
- ☐ The group decided to remove all the children from the family and into care.

3. Please indicate below what you believe best indicates the influence on the group exerted by yourself and your colleague.

- ☐ I was considerably more influential in the making of the decision.
- ☐ I was slightly more influential in the making of the decision.
- ☐ My colleague and I were equally influential in the making of the decision.
- ☐ My colleague was slightly more influential in the making of the decision.
- ☐ My colleague was considerably more influential in the making of the decision.

4. Please indicate how satisfied are you with the decision reached by the group.

- ☐ Very Dissatisfied
- ☐ Mildly Dissatisfied
- ☐ Indifferent
- ☐ Mildly Satisfied
- ☐ Very Satisfied

5. Please indicate how easily you could communicate you ideas to the group.

- ☐ With Considerable Difficulty
- ☐ With Some Difficulty
- ☐ Barely Satisfactorily

☐ Moderately Easily

☐ Very Easily

6. Please indicate how obstructive you found the voting panels.

☐ Considerably Obstructive

☐ Slightly Obstructive

☐ Barely Obstructive

☐ Occasionally Obstructive

☐ Not Obstructive at all

7. Please indicate how you felt about the time limit allowed to complete the task.

☐ I Needed Considerably Longer

☐ I Needed Slightly Longer

☐ The Time Limit Was About Right

☐ I Needed Slightly Less Time

☐ I Needed Considerably Less Time

8. Was the decision made because it was the correct decision or because it was a compromise position.

☐ The Correct Decision ☐ A Compromise Decision

9. If you had to make the decision alone, what would it be?

☐ I would be unable to reach a decision

☐ I would decide to keep the family together and provide more home help.

☐ I would decide to remove Lucie from the family into care.

☐ I would decide to remove Lucie & Mary from the family and into care.

☐ I would decide to remove all the children from the family and into care.

10. What did *you* interpret 'care' to mean?

11. Do you have any questions that you would like answered or are there any comments that you wish to make?

B5.2.1 Additional questions for Computer-Mediated Groups

B5.2.1.1 Additional questions for groups operating with support from the Directive Communication Support (DCS) System

For groups in the DCS conditions, the following questions were inserted between questions 7 and 8, with the other questions shuffled further through the questionnaire.

8. Please indicate how useful you found the feedback information.

- ☐ Not Useful at all
- ☐ Occasionally Useful
- ☐ Barely Useful
- ☐ Slightly Useful
- ☐ Considerably Useful

9a. Please indicate the effects of the feedback information upon your communication.

- ☐ I always altered my communication according to the feedback
- ☐ I frequently altered my communication according to the feedback
- ☐ I occasionally altered my communication according to the feedback
- ☐ I rarely altered my communication according to the feedback
- ☐ I never altered my communication according to the feedback

9b. I paid attention to feedback when it indicated that communication should be... (Please tick where necessary)

Relating to quoting from, or requests for information quoting the database.

| | | | | | | | |
|---|---|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Always, regardless of size of change | Never, regardless of size of change. | Slightly More | Slightly Less | Moderately More | Moderately Less | Considerably More | Considerably Less |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

Relating to the decision in terms of the options available.

| | | | | | | | |
|---|---|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Always, regardless of size of change | Never, regardless of size of change. | Slightly More | Slightly Less | Moderately More | Moderately Less | Considerably More | Considerably Less |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

Relating to how the group should tackle the task.

| | | | | | | | |
|---|---|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Always, regardless of size of change | Never, regardless of size of change. | Slightly More | Slightly Less | Moderately More | Moderately Less | Considerably More | Considerably Less |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

9c. I considered it

- ☐ More important to decrease rather than increase communication.
- ☐ As equally important to decrease communication as much as increase communication.
- ☐ More important to rather increase than decrease communication.

B5.2.1.2 Additional questions for groups operating with support from the Non-Directive Communication Support (NDCS) System

All groups in the NDCS condition, had the following questions inserted into the PEQ in place of those used for the DCS condition.

8. Please indicate how useful you found the feedback information.

- ☐ Not Useful at all
- ☐ Occasionally Useful
- ☐ Barely Useful
- ☐ Slightly Useful
- ☐ Considerably Useful

9a. Please indicate the effects of the feedback information upon your communication.

- ☐ I always altered my communication according to the feedback.
- ☐ I frequently altered my communication according to the feedback.
- ☐ I occasionally altered my communication according to the feedback.
- ☐ I rarely altered my communication according to the feedback.
- ☐ I never altered my communication according to the feedback.

9b. I paid attention to messages when they indicated that they should be increased. (Please indicate as many as necessary)

Relating to quoting from, or requests for information quoting the database.

| Always, regardless of size of change | Never, regardless of size of change. | When the changes were 0 - 25% | When the changes were 26 - 50% | When the changes were 51 - 75% | When the changes were 76 - 100% | When the changes were 101 - 150% | When the changes were 151 - 200% | When the changes greater than 200% |
|--------------------------------------|--------------------------------------|-------------------------------|--------------------------------|--------------------------------|---------------------------------|----------------------------------|----------------------------------|------------------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

Relating to the decision in terms of the options available

| Always, regardless of size of change | Never, regardless of size of change. | When the changes were 0 - 25% | When the changes were 26 - 50% | When the changes were 51 - 75% | When the changes were 76 - 100% | When the changes were 101 - 150% | When the changes were 151 - 200% | When the changes greater than 200% |
|--------------------------------------|--------------------------------------|-------------------------------|--------------------------------|--------------------------------|---------------------------------|----------------------------------|----------------------------------|------------------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

Relating to how the group should tackle the task

| Always, regardless of size of change | Never, regardless of size of change. | When the changes were 0 - 25% | When the changes were 26 - 50% | When the changes were 51 - 75% | When the changes were 76 - 100% | When the changes were 101 - 150% | When the changes were 151 - 200% | When the changes greater than 200% |
|--------------------------------------|--------------------------------------|-------------------------------|--------------------------------|--------------------------------|---------------------------------|----------------------------------|----------------------------------|------------------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

9c. I paid attention to messages when they indicated that they should be decreased. (Please indicate as many as necessary)

Relating to quoting from, or requests for information quoting the database.

| | | | | | | | | |
|---|---|--|---|---|--|---|---|---|
| Always, regardless of size of change | Never, regardless of size of change. | When the changes were 0 - 25% | When the changes were 26 - 50% | When the changes were 51 - 75% | When the changes were 76 - 100% | When the changes were 101 - 150% | When the changes were 151 - 200% | When the changes greater than 200% |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

Relating to the decision in terms of the options available

| | | | | | | | | |
|---|---|--|---|---|--|---|---|---|
| Always, regardless of size of change | Never, regardless of size of change. | When the changes were 0 - 25% | When the changes were 26 - 50% | When the changes were 51 - 75% | When the changes were 76 - 100% | When the changes were 101 - 150% | When the changes were 151 - 200% | When the changes greater than 200% |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

Relating to how the group should tackle the task

| | | | | | | | | |
|---|---|--|---|---|--|---|---|---|
| Always, regardless of size of change | Never, regardless of size of change. | When the changes were 0 - 25% | When the changes were 26 - 50% | When the changes were 51 - 75% | When the changes were 76 - 100% | When the changes were 101 - 150% | When the changes were 151 - 200% | When the changes greater than 200% |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

9d. I considered it

- ☐ More important to decrease rather than increase communication.
- ☐ As equally important to decrease communication as much as increase communication.
- ☐ More important to rather increase than decrease communication.

B 5.3 Experiment 3 Post-Experimental Questionnaire

The questionnaires (CMC & YDCS) given to participants upon completing Experiment 3 were the same as those given to participants at the end of Experiment 2 (CMC & DCS) with one alteration. Question 2: What decision did your group reach? was altered so that the names of the children (William, Lucie & Mary) were replaced with Emily, Richard & Paul to reflect the change in case from the Rips to Davies family

B5.4: Experiment 4 Task 1 Post-Experimental Questionnaire

Participants received the same questionnaires as those received by participants in the earlier experiments matched to decision options and casenotes, with one addition. The additional question, which was given to participants after the DVS condition related to the utility of the visual feedback and asked:

I considered the

- ☐ Visual feedback more useful than the written feedback.
- ☐ Visual and written feedback to be of the same use.
- ☐ Visual feedback less useful than the written feedback.

B5.5 Experiment 4 Task 2 Post-Experimental Questionnaire

The questionnaires issued to participants after they had completed the decision task for Experiment 5 contained the standard questionnaires for unsupported (CMC) conditions from the previous experiments, with one addition. The additional question, included after assessing the decision that the participant would make alone, concerned the extent to which they made a comparison between the case they judged in Experiment 4 and the case before them for Experiment 5:

How conscious were you of making a comparison between the decisions on the two cases

- ☐ I compared the cases considerably.
- ☐ I compared the cases moderately.
- ☐ I compared the cases slightly.
- ☐ I compared the cases only occasionally.
- ☐ I did not compare the cases at all.

Appendix B6.1: Materials for Experiment 1 - Rips Casebook One

The full set of materials presented in Appendix B1 were used for the first experiment. Four files were constructed, one for each of the four roles; Hospital Consultant (HC), Health Visitor (HV), Social Worker (SW) and Welfare Officer (WO), in addition to the help file, and the common reference file available to all.

Appendix B6.2: Modifications of materials for Experiment 2 - Rips Casebook Two

The reference file "The Common File" (Appendix B1) and the help file from the full set of materials were retained, and presented in conjunction with a reduced set of materials the selection of which is detailed in Chapter Four. This selection process resulted in two casenotes files: The Local Health Authority (LHA) and the Department of Social Services (DSS), ordered chronologically and containing the following entries:

Local Health Authority (LHA):

HV3, HC3, HC4, HC5, HC6, HV5, HC7, HV7, HV9, HC8, HV11, HC9, HC10, HV13, HV14, HV16, HV17, HV18, HC14, HC16, SW18, HV21, SW20, SW22, SW24, HC23, HV24, HV25, HV26, HC27, HV27, HV28, HC28, HC29, HC30, HC31, HV31, HC36, HV35, HC39, HV36, HV37, HV39, WO45, HC44, HC46, HV44, HV46, HC48, SW49, WO50.

Department of Social Services (DSS):

SW1, SW2, SW4, WO9, SW8, SW9, WO10, WO13, WO15, WO16, SW12, WO18, SW13, SW15, WO23, WO24, WO25, WO26, WO28, SW19, WO29, WO31, WO32, WO35, WO33, WO34, SW21, SW22, SW29, SW31, WO37, WO38, SW33, SW35, WO40, WO41, WO42, SW36, WO43, SW37, WO44, SW42, WO46, WO47, SW46, WO48, SW48, SW50.

Each code consists of two letters that refer to the original case notes (HC - Hospital Consultant, HV - Health Visitor, SW - Social Worker, WO - Welfare Officer) and a number referring to the entry given in Appendix A1i. Thus W024 is entry 24 of the Welfare Officer casenotes which reads

(24) 25th April 1974

Welfare Officer 1 received an emergency call from Social Worker 1 which stated that Linda Rips was being admitted to the Brook Hospital with an undiagnosed illness and that William and Mary needed to be placed in immediate care. A temporary placement was arranged for the children with Mrs. Mc.K. (an approved foster parent) with whom the children stayed until 20th May. (Based on records of Home Help Unit of the Family Welfare Section)

Appendix B6.3: Modifications of materials for Experiment 3 - Davies Casebook One

Two changes were made to the original case materials, the first was to select the entries not used in Experiment 2 and to create two casebooks; Health Trust (HT) and Community Services (CS) containing the following entries

Health Trust (HT):

HC1, HV2, HC2, HC4, HV6, HV8, HV10, HV12, HC11, HC12, HV15, HC13, HC15, HC16, HC17, HC18, HV20, HC19, HC21, HC22, HV22, HV23, HC25, HV26, HV29, HV30, HC32, HC33, HC34, HV32, HV33, HC37, HV34, HC38, HC40, HV38, HC42, HV40, HC43, HC45, HC41, HV42, HV43, HV45, HV47, HC47, HV48, HC50, HV49, HV50.

Community Services (CS):

WO1, WO3, WO4, SW3, WO5, SW5, WO7, SW6, WO8, SW7, WO11, SW10, SW11, XXXX, WO14, WO17, WO19, WO20, SW17, HV19, WO21, WO22, WO24, WO27, SW23, WO30, SW25, SW26, SW27, SW28, WO36, SW30, SW32, WO39, SW34, HC35, SW28, HC41, SW39, SW40, SW41, HC42, SW44, SW45, HV42, SW47, HV45, WO49, HC49.

The second was to alter the time scale of events along with the location and names of the family members (Table B6.1)

| Original Entries | This Experiment |
|--|--|
| (Rips Casebook, Experiment 1) | (Davies Casebook, Experiment 3) |
| 1950 - 1979 | 1962 - 1991 |
| London | Bedfordshire |
| John Newton Court | John Bunyan Court |
| Bexley Social Services | Bedford Community Services |
| Brooke Hospital | Swan Hospital |
| Sliver of glass in foot | Sliver of wood in hand |
| Slide | Roundabout |
| Scaffolding | Fencing |
| Carpet Sweeper | Hoover |
| Mr. L | Mr. W |
| Tryptizol | Paracetamol |
| British Hospital for Mothers & Babies, Woolwich | United Counties Hospital for Mothers & Babies, Huntingdon |
| Visits to Lucie times two | Visits to times four |
| Linda Rips | Cathrine Davies |
| William | Emily |
| Mary | Richard |
| Lucie | Paul |
| Bexley | Bedford |
| Brook Hospital | Swan Hospital |

Table B6.1: A summary of the changes made to the database content when altering the files from Rips to Davies

Appendix B6.4: Modifications of materials for Experiment 4

Two new modified casenotes were constructed, Rips Casebook Three is a reduced size version of Rips Casebook Two (Experiment 2) whilst Davies Casebook Two is a simliarly reduced version of Davies Casebook One. Full details of the selection of these materials are provided in Chapter Six. The casenotes contained the following entries:

Rips Casebook Three

Local Health Authority (LHA)

HC3, HC4, HC5, HC6, HV5, HV6, HV7, HV9, HC8, HV11, HC9, HC10, HV13, HC12, HV16, HV17, HV18, HC14, HV21, SW20, WO24, HC23, HV25, HV26, HC27, HV27, HV28, HC28, HC29, HC36, HV35, HC36, HC44, HC46, HV44, HV48, HC48, WO50.

Department of Social Services (DSS)

SW4, WO9, SW8, SW9, WO10, SW13, WO15, WO16, SW12, WO18, SW13, SW13, SW14, WO23, SW16, WO28, WO25, WO26, SW19, WO29, SW25, WO36, WO33, SW21, SW22, SW29, SW31, WO30, SW33, SW41, WO42, SW36, SW37, SW42, WO47, SW46, WO48, SW48.

Davies Casebook Two

Health Trust (HT):

HV1, HV2, HC2, HV3, HC7, HV8, HV10, HV12, HC11, HV15, HC13, HC15, HC17, HV20, HC19, HC22, HC25, HV24, HC26, HV29, HV30, HC32, HC34, HV32, HV33, HV34, HC38, HC40, HV38, HC43, HC45, HV41, HV42, HV43, HV45, HV47, , HV48, HV50.

Community Services (CS):

SW2, SW3, WO4, WO6, SW5, WO7, SW6, WO9, SW7, WO11, WO12, SW11, WO14, WO17, WO19, SW18, WO21, WO22, WO24, WO27, WO32, SW26, SW27, SW28, SW29, SW30, SW32, WO39, SW34, HC35, SW38, SW39, SW40, SW41, WO45, SW45, HV45, SW49.

Contents of Appendix C

This appendix contains details of the main analysis of communication styles from the experimental chapters of the thesis, section C1 contains the analysis of normative and informational influence from Experiment 1. Section C2 contains similar analyses for Experiment 2, with section C3 and C4 containing the relevant analysis for Experiments 3 and 4.

Appendix C1: Normative and Informational Influence Experiment 1

Analysis of CIT communication

| | CIT | |
|------------------------------|-------|-------|
| | CMC | FTF |
| Mean | 0.163 | 0.214 |
| Variance | 0.002 | 0.003 |
| Observations | 10 | 10 |
| Pooled Variance | 0.002 | |
| Hypothesised Mean Difference | 0 | |
| df | 18 | |
| t Stat | -2.41 | |
| P(T<=t) one-tail | 0.013 | |
| t Critical one-tail | 1.734 | |
| P(T<=t) two-tail | 0.027 | |
| t Critical two-tail | 2.101 | |

Table C1.1: Student t-test results for Experiment 1 informational communication categories.

Type III Sums of Squares

| Source | df | Sum of Squares | Mean Square | F-Value | P-Value |
|-------------------|----|----------------|-------------|---------|---------|
| Condition | 2 | 1556.467 | 778.233 | 12.790 | .0001 |
| Residual | 27 | 1642.900 | 60.848 | | |
| Dependent: Totals | | | | | |

Table C1.2: One-way ANOVA for Experiment 1 total CIT across conditions.

| | | | | |
|---|------------|--------------|--------------------|---|
| Tukey-Kramer Effect: Condition Dependent: Totals Significance level: .05 | | | | |
| | Vs. | Diff. | Crit. diff. | |
| NDCS | CMC | 1.100 | 8.658 | |
| | DCS | 15.800 | 8.658 | S |
| CMC | DCS | 14.700 | 8.658 | S |
| S = Significantly different at this level. | | | | |

Table C1.3: Tukey HSD follow-up analysis one-way ANOVA examining the total number of CITS for Experiment 1 CM conditions.

| | | | | | | | |
|---------------------------------|-----------|-----------------------|--------------------|----------------|----------------|------------|------------|
| Type III Sums of Squares | | | | | | | |
| Source | df | Sum of Squares | Mean Square | F-Value | P-Value | G-G | H-F |
| Comms Mode | 1 | 78.070 | 78.070 | 13.368 | .0018 | | |
| Subject(Group) | 18 | 105.119 | 5.840 | | | | |
| Quarters | 3 | 417.562 | 139.187 | 18.025 | .0001 | .0001 | .0001 |
| Quarters * Comms Mode | 3 | 38.211 | 12.737 | 1.650 | .1888 | .2089 | .2039 |
| Quarters * Subject(Group) | 54 | 416.973 | 7.722 | | | | |
| Dependent: CIT | | | | | | | |

Table C1.4: Analysis of the use of Experiment 1 CIT over time(Quarters).

| | | | | |
|-----|--------------|-------------|------------------|-------------------|
| | Count | Mean | Std. Dev. | Std. Error |
| FTF | 40 | 4.368 | 4.080 | .645 |
| CMC | 40 | 2.392 | 2.902 | .459 |

Table C1.5: Descriptive Statistics for Experiment 1 CIT usage of FTF and CM groups regardless of time.

| | | | | |
|--------|--------------|-------------|------------------|-------------------|
| | Count | Mean | Std. Dev. | Std. Error |
| First | 20 | .605 | 1.588 | .355 |
| Second | 20 | 2.426 | 3.048 | .681 |
| Third | 20 | 6.875 | 3.796 | .849 |
| Forth | 20 | 3.615 | 2.716 | .607 |

Table C1.6: Descriptive Statistics for Experiment 1 CIT usage over for time periods regardless of condition.

| | Count | Mean | Std. Dev. | Std. Error |
|-------------|-------|-------|-----------|------------|
| First, FTF | 10 | .472 | .901 | .285 |
| First, CMC | 10 | .739 | 2.116 | .669 |
| Second, FTF | 10 | 3.409 | 4.010 | 1.268 |
| Second, CMC | 10 | 1.444 | 1.176 | .372 |
| Third, FTF | 10 | 8.331 | 3.316 | 1.049 |
| Third, CMC | 10 | 5.418 | 3.836 | 1.213 |
| Forth, FTF | 10 | 5.261 | 2.835 | .896 |
| Forth, CMC | 10 | 1.969 | 1.230 | .389 |

Table C1.7: Descriptive Statistics for Experiment 1 CIT usage dependent upon condition and time period.

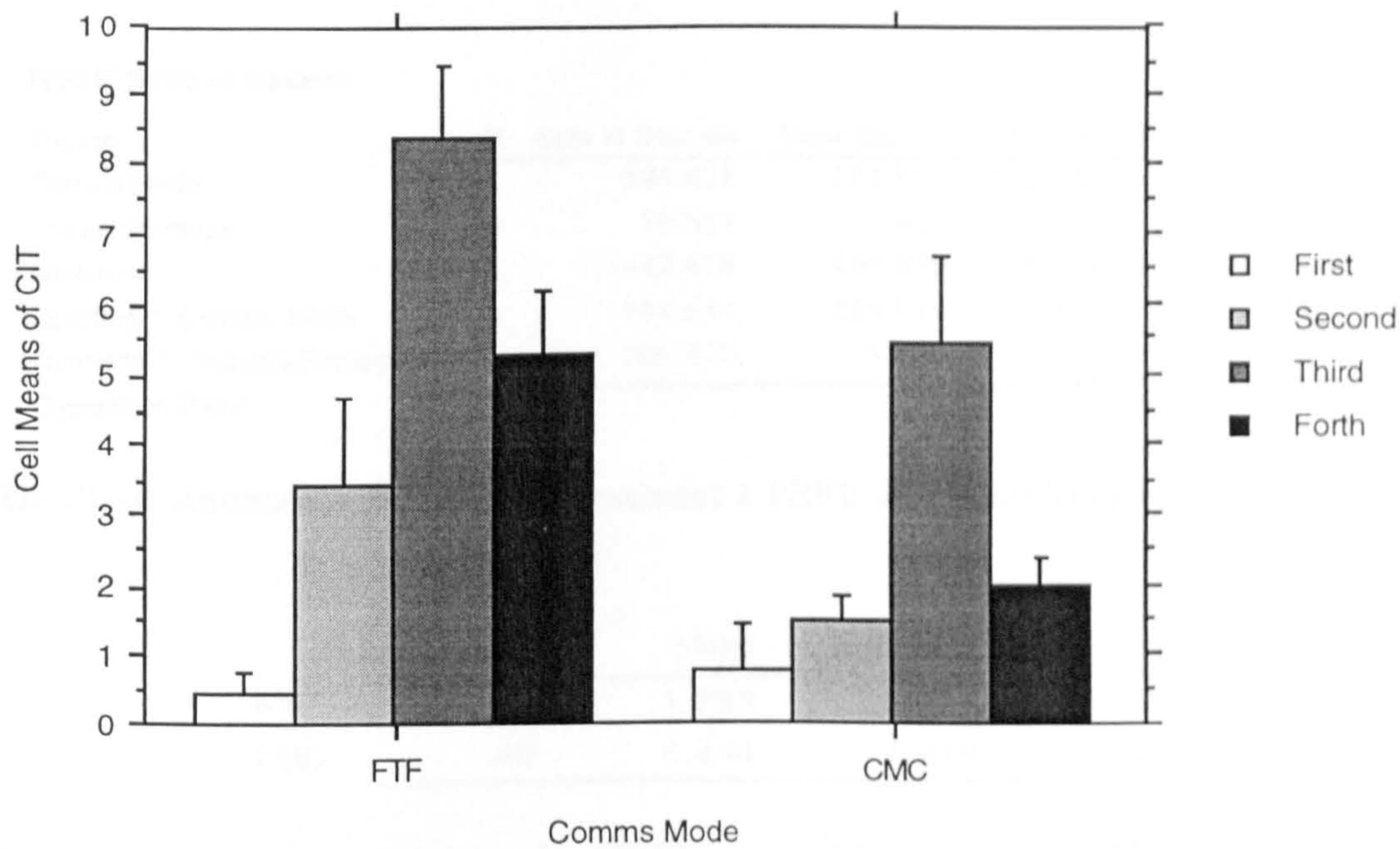


Figure C1.1: The interaction between time period and Condition in Experiment 1 CIT usage.

Analysis of INF communication

| | CMC | FTF |
|------------------------------|-------|-------|
| Mean | 0.362 | 0.359 |
| Variance | 0.006 | 0.008 |
| Observations | 10 | 10 |
| Pooled Variance | 0.007 | |
| Hypothesised Mean Difference | 0 | |
| df | 18 | |
| t Stat | 0.093 | |
| P(T<=t) one-tail | 0.464 | |
| t Critical one-tail | 1.734 | |
| P(T<=t) two-tail | 0.927 | |
| t Critical two-tail | 2.101 | |

Table C1.8: Student t-test comparing level of INF in Experiment 1 CMC and FTF groups.

Analysis of PREF communication

| | Pref | |
|------------------------------|-------|-------|
| | CMC | FTF |
| Mean | 0.184 | 0.031 |
| Variance | 0.003 | 4E-04 |
| Observations | 10 | 10 |
| Pooled Variance | 0.002 | |
| Hypothesised Mean Difference | 0 | |
| df | 18 | |
| t Stat | 8.6 | |
| P(T<=t) one-tail | 4E-08 | |
| t Critical one-tail | 1.734 | |
| P(T<=t) two-tail | 9E-08 | |
| t Critical two-tail | 2.101 | |

Table C1.9: Analysis of use of PREF by Experiment 1 CMC & FTF panels.

Type III Sums of Squares

| Source | df | Sum of Squares | Mean Square | F-Value | P-Value | G-G | H-F |
|---------------------------|----|----------------|-------------|---------|---------|-------|-------|
| Comms Mode | 1 | 531.632 | 531.632 | 135.632 | .0001 | | |
| Subject(Group) | 18 | 70.554 | 3.920 | | | | |
| Quarters | 3 | 1442.425 | 480.808 | 86.692 | .0001 | .0001 | .0001 |
| Quarters * Comms Mode | 3 | 751.541 | 250.514 | 45.169 | .0001 | .0001 | .0001 |
| Quarters * Subject(Group) | 54 | 299.493 | 5.546 | | | | |

Dependent: PREF

Table C1.10: Analysis of the use of Experiment 1 PREF over time(Quarters).

| | Count | Mean | Std. Dev. | Std. Error |
|-----|-------|-------|-----------|------------|
| FTF | 40 | 1.289 | 1.744 | .276 |
| CMC | 40 | 6.444 | 7.918 | 1.252 |

Table C1.11: Descriptive Statistics for PREF usage of Experiment 1 FTF and CM groups regardless of time.

| | Count | Mean | Std. Dev. | Std. Error |
|--------|-------|--------|-----------|------------|
| First | 20 | .108 | .345 | .077 |
| Second | 20 | 1.888 | 2.773 | .620 |
| Third | 20 | 2.398 | 2.390 | .534 |
| Forth | 20 | 11.072 | 8.573 | 1.917 |

Table C1.12: Descriptive Statistics for Experiment 1 PREF usage over for time periods regardless of condition.

| | Count | Mean | Std. Dev. | Std. Error |
|-------------|-------|--------|-----------|------------|
| First, FTF | 10 | .073 | .200 | .063 |
| First, CMC | 10 | .144 | .456 | .144 |
| Second, FTF | 10 | .460 | .568 | .180 |
| Second, CMC | 10 | 3.315 | 3.374 | 1.067 |
| Third, FTF | 10 | 1.363 | 1.817 | .575 |
| Third, CMC | 10 | 3.432 | 2.526 | .799 |
| Forth, FTF | 10 | 3.259 | 1.671 | .528 |
| Forth, CMC | 10 | 18.886 | 4.085 | 1.292 |

Table C1.13: Descriptive Statistics for Experiment 1 PREF usage dependent upon condition and time period.

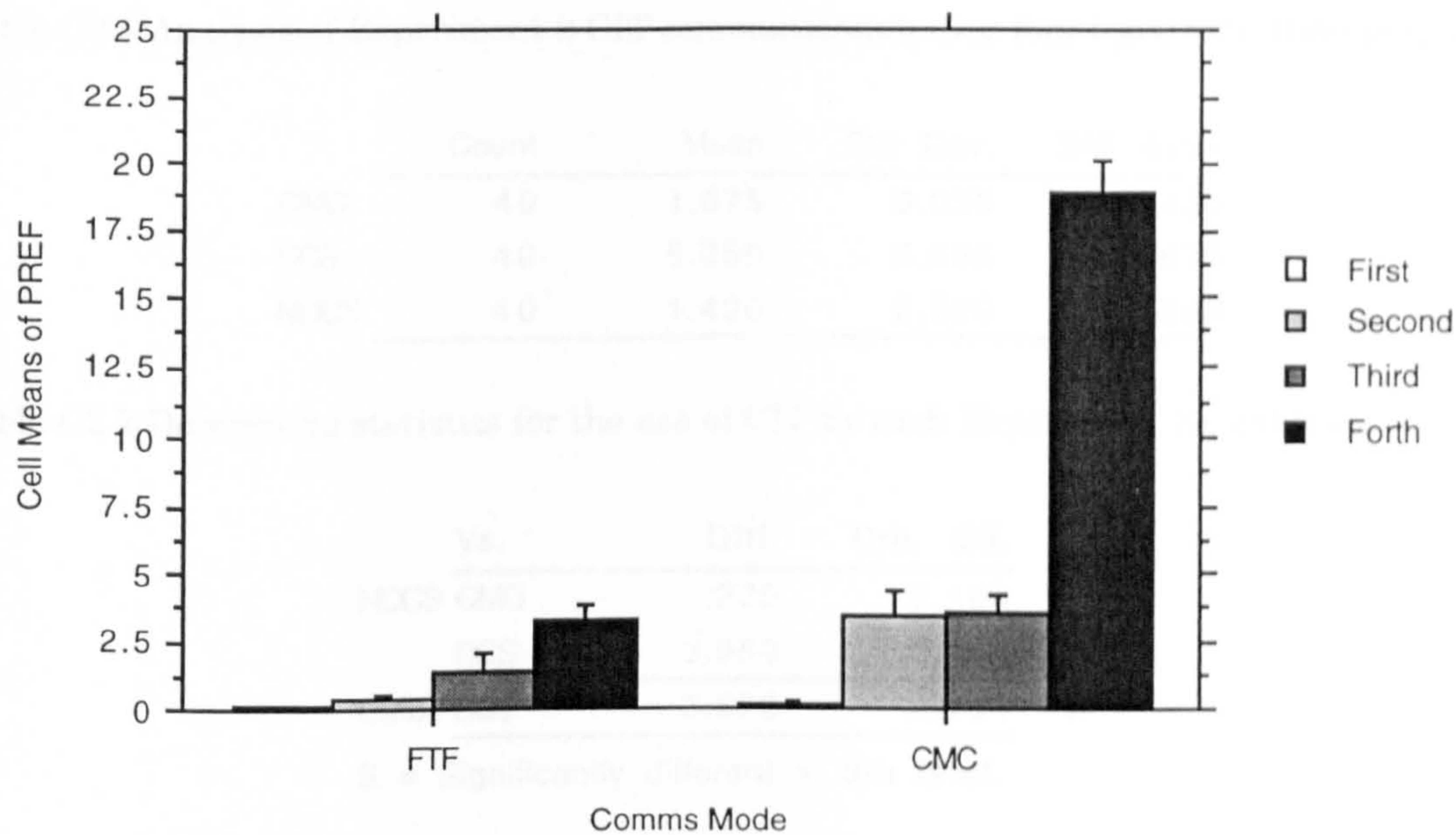


Figure C1.2: The interaction between time period and Condition in Experiment 1 PREF usage.

Analysis of VAL communication

| | CMC | FTF |
|------------------------------|-------|-------|
| Mean | 0.097 | 0.047 |
| Variance | 0.003 | 5E-04 |
| Observations | 10 | 10 |
| Pooled Variance | 0.002 | |
| Hypothesised Mean Difference | 0 | |
| df | 18 | |
| t Stat | 2.848 | |
| P(T<=t) one-tail | 0.005 | |
| t Critical one-tail | 1.734 | |
| P(T<=t) two-tail | 0.011 | |
| t Critical two-tail | 2.101 | |

Table C1.14: Student t-test comparing VAL levels in Experiment 1 CMC and FTF groups.

Appendix C2: Normative and Informational Influence Experiment 2

Analysis of CIT Communication

Type III Sums of Squares

| Source | df | Sum of Squares | Mean Square | F-Value | P-Value | G-G | H-F |
|---------------------------|----|----------------|-------------|---------|---------|-------|-------|
| Condition | 2 | 389.117 | 194.558 | 12.790 | .0001 | | |
| Subject(Group) | 27 | 410.725 | 15.212 | | | | |
| Quarters | 3 | 393.158 | 131.053 | 14.594 | .0001 | .0001 | .0001 |
| Quarters * Condition | 6 | 234.217 | 39.036 | 4.347 | .0007 | .0018 | .0008 |
| Quarters * Subject(Group) | 81 | 727.375 | 8.980 | | | | |

Dependent: Cit

Table C2.1 Analysis of Experiment 2 CIT communication over four (quarters) time periods.

| | Count | Mean | Std. Dev. | Std. Error |
|------|-------|-------|-----------|------------|
| CMC | 40 | 1.675 | 3.033 | .480 |
| DCS | 40 | 5.350 | 5.536 | .875 |
| NDCS | 40 | 1.400 | 2.329 | .368 |

Table C2.2 Descriptive statistics for the use of CIT by each Experiment 2 condition.

| | Vs. | Diff. | Crit. diff. | |
|------|-----|-------|-------------|---|
| NDCS | CMC | .275 | 2.164 | |
| | DCS | 3.950 | 2.164 | S |
| CMC | DCS | 3.675 | 2.164 | S |

S = Significantly different at this level.

Table C2.3 Tukey-Kramer HSD for Experiment 2 CIT usage.

| | Count | Mean | Std. Dev. | Std. Error |
|----|-------|-------|-----------|------------|
| Q1 | 30 | .100 | .548 | .100 |
| Q2 | 30 | 2.500 | 4.455 | .813 |
| Q3 | 30 | 5.067 | 5.044 | .921 |
| Q4 | 30 | 3.567 | 3.892 | .711 |

Table C2.4 Experiment 2 CIT usage over four (quarters) time periods regardless of condition.

| | Count | Mean | Std. Dev. | Std. Error |
|----------|-------|--------|-----------|------------|
| Q1, CMC | 10 | 0.000 | 0.000 | 0.000 |
| Q1, DCS | 10 | .300 | .949 | .300 |
| Q1, NDCS | 10 | 0.000 | 0.000 | 0.000 |
| Q2, CMC | 10 | 2.000 | 4.989 | 1.578 |
| Q2, DCS | 10 | 3.900 | 4.557 | 1.441 |
| Q2, NDCS | 10 | 1.600 | 3.864 | 1.222 |
| Q3, CMC | 10 | 2.700 | 2.497 | .790 |
| Q3, DCS | 10 | 10.500 | 4.882 | 1.544 |
| Q3, NDCS | 10 | 2.000 | 1.563 | .494 |
| Q4, CMC | 10 | 2.000 | 2.055 | .650 |
| Q4, DCS | 10 | 6.700 | 5.012 | 1.585 |
| Q4, NDCS | 10 | 2.000 | 1.764 | .558 |

Table C2.5 Experiment 2 CIT usage over four (quarters) time periods for group in each condition

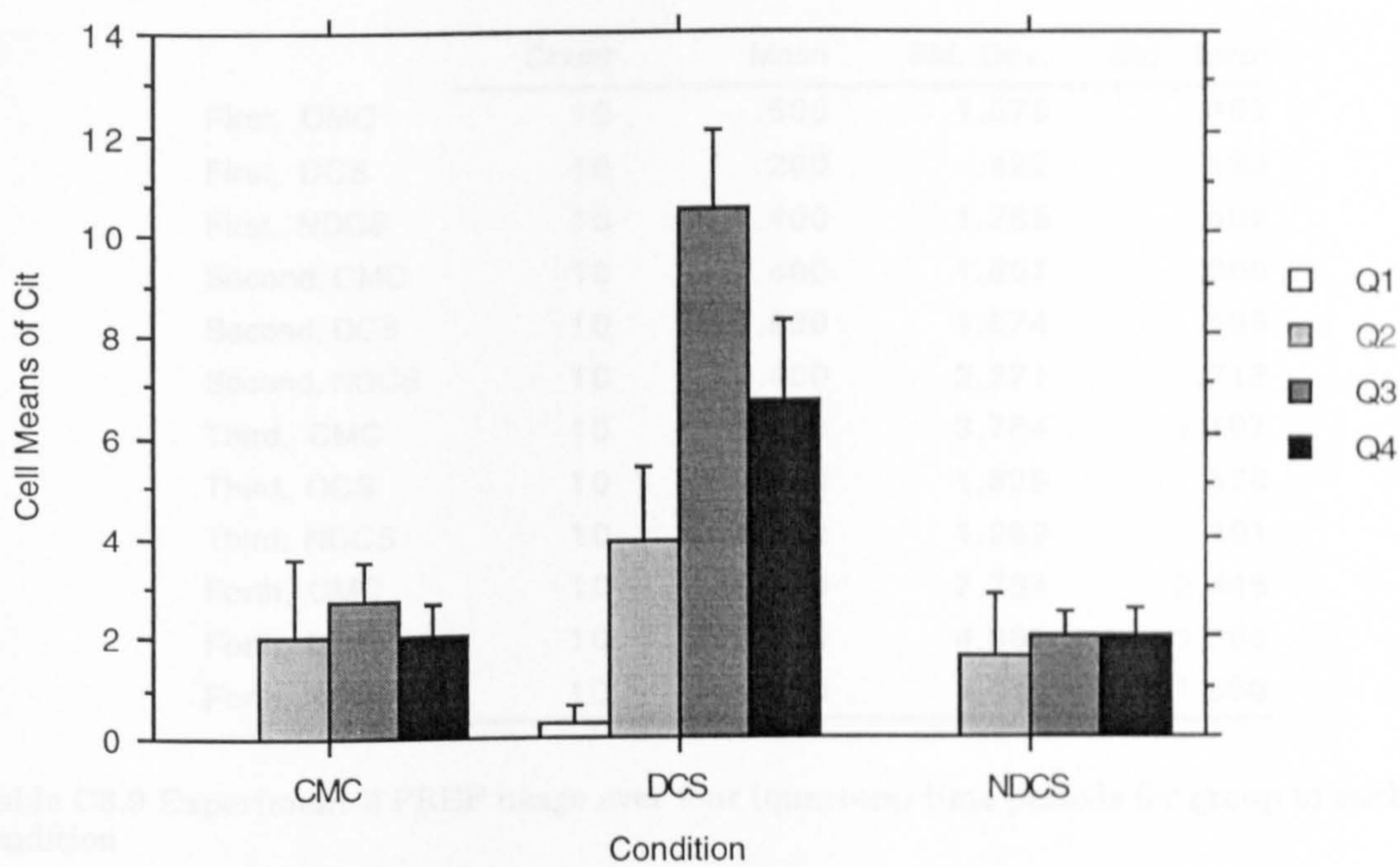


Figure C2.1 The interaction between condition and time period for Experiment 2

Analysis of PREF Communication

Type III Sums of Squares

| Source | df | Sum of Squares | Mean Square | F-Value | P-Value | G-G | H-F |
|---------------------------|----|----------------|-------------|---------|---------|-------|-------|
| Condition | 2 | 10.117 | 5.058 | .302 | .7418 | | |
| Subject(Group) | 27 | 452.250 | 16.750 | | | | |
| Quarters | 3 | 1846.867 | 615.622 | 64.347 | .0001 | .0001 | .0001 |
| Quarters * Condition | 6 | 9.683 | 1.614 | .169 | .9844 | .9219 | .9381 |
| Quarters * Subject(Group) | 81 | 774.950 | 9.567 | | | | |

Dependent: PREF

Table C2.6 Analysis of PREF communication over four (quarters) time periods.

| | Count | Mean | Std. Dev. | Std. Error |
|------|-------|-------|-----------|------------|
| CMC | 40 | 4.375 | 5.759 | .911 |
| DCS | 40 | 3.725 | 4.739 | .749 |
| NDCS | 40 | 3.800 | 4.842 | .766 |

Table C2.7 Descriptive statistics for the use of Experiment 2 PREF by each condition.

| | Count | Mean | Std. Dev. | Std. Error |
|--------|-------|--------|-----------|------------|
| First | 30 | .400 | 1.163 | .212 |
| Second | 30 | 1.867 | 1.995 | .364 |
| Third | 30 | 3.033 | 2.526 | .461 |
| Forth | 30 | 10.567 | 5.594 | 1.021 |

Table C2.8 Experiment 2 PREF usage over four (quarters) time periods regardless of condition

| | Count | Mean | Std. Dev. | Std. Error |
|--------------|-------|--------|-----------|------------|
| First, CMC | 10 | .600 | 1.578 | .499 |
| First, DCS | 10 | .200 | .422 | .133 |
| First, NDCS | 10 | .400 | 1.265 | .400 |
| Second, CMC | 10 | 2.400 | 1.897 | .600 |
| Second, DCS | 10 | 1.800 | 1.874 | .593 |
| Second, NDCS | 10 | 1.400 | 2.271 | .718 |
| Third, CMC | 10 | 3.900 | 3.784 | 1.197 |
| Third, DCS | 10 | 2.700 | 1.829 | .578 |
| Third, NDCS | 10 | 2.500 | 1.269 | .401 |
| Forth, CMC | 10 | 10.600 | 7.734 | 2.446 |
| Forth, DCS | 10 | 10.200 | 4.962 | 1.569 |
| Forth, NDCS | 10 | 10.900 | 4.012 | 1.269 |

Table C3.9 Experiment 2 PREF usage over four (quarters) time periods for group in each condition

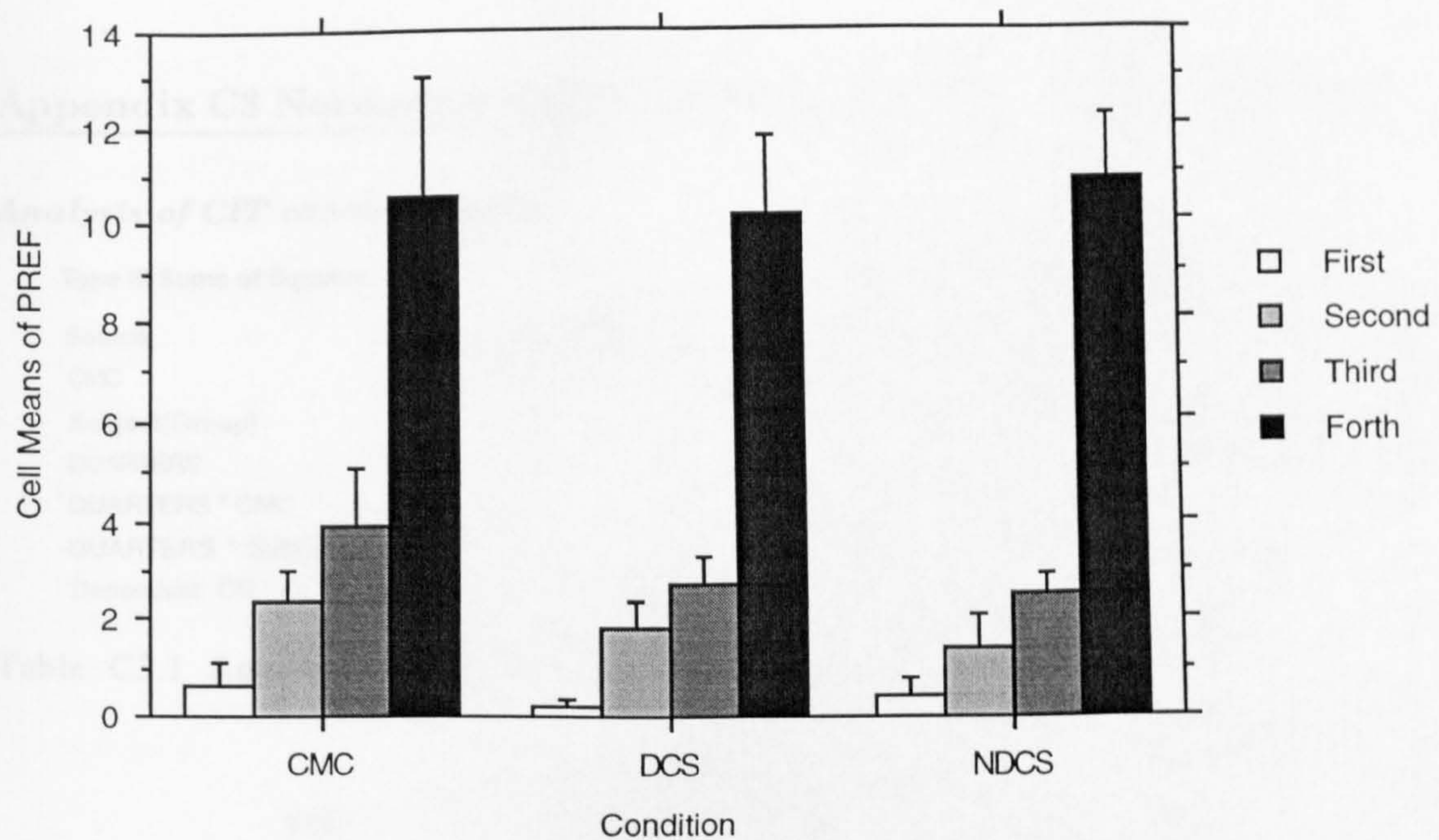


Figure C3.2 The interaction between condition and time period for Experiment 2 PREF

Appendix C3 Normative and Informational Influence Experiment 3

Analysis of CIT communication

Type III Sums of Squares

| Source | df | Sum of Squares | Mean Square | F-Value | P-Value | G-G | H-F |
|---------------------------|----|----------------|-------------|---------|---------|-------|-------|
| CMC | 1 | 6.728 | 6.728 | .557 | .4700 | | |
| Subject(Group) | 12 | 145.022 | 12.085 | | | | |
| QUARTERS | 3 | 18.934 | 6.311 | 1.443 | .2463 | .2576 | .2567 |
| QUARTERS * CMC | 3 | 4.267 | 1.422 | .325 | .8071 | .6706 | .7116 |
| QUARTERS * Subject(Group) | 36 | 157.441 | 4.373 | | | | |

Dependent: CIT

Table C3.1 Analysis of the use of Experiment 3 CIT over time(Quarters)

| | Count | Mean | Std. Dev. | Std. Error |
|--------|-------|-------|-----------|------------|
| Expt 2 | 40 | 1.463 | 2.874 | .454 |
| Expt 3 | 16 | .696 | .986 | .246 |

Table C3.2: Descriptive Statistics for CIT usage of Experiment 2 and 3 groups regardless of time.

| | Count | Mean | Std. Dev. | Std. Error |
|--------|-------|-------|-----------|------------|
| First | 14 | 0.000 | 0.000 | 0.000 |
| Second | 14 | 1.490 | 4.191 | 1.120 |
| Third | 14 | 1.881 | 1.996 | .534 |
| Forth | 14 | 1.606 | 1.602 | .428 |

Table C3.3: Descriptive Statistics for CIT usage over for time periods regardless of experiment.

| | Count | Mean | Std. Dev. | Std. Error |
|----------------|-------|-------|-----------|------------|
| First, Expt 2 | 10 | 0.000 | 0.000 | 0.000 |
| First, Expt 3 | 4 | 0.000 | 0.000 | 0.000 |
| Second, Expt 2 | 10 | 1.900 | 4.942 | 1.563 |
| Second, Expt 3 | 4 | .465 | .930 | .465 |
| Third, Expt 2 | 10 | 2.251 | 2.172 | .687 |
| Third, Expt 3 | 4 | .957 | 1.235 | .618 |
| Forth, Expt 2 | 10 | 1.703 | 1.821 | .576 |
| Forth, Expt 3 | 4 | 1.362 | 1.033 | .517 |

Table C3.4: Descriptive Statistics for CIT usage dependent upon experiment and time period.

Appendix C4 Normative and Informational Influence Experiment 4

Analysis of CIT usage over the two tasks by the three communication defined conditions.

Type III Sums of Squares

| Source | df | Sum of Squares | Mean Square | F-Value | P-Value | G-G | H-F |
|-----------------------|----|----------------|-------------|---------|---------|-------|-------|
| Condition | 2 | 288.583 | 144.292 | 1.455 | .2480 | | |
| Subject(Group) | 33 | 3272.792 | 99.176 | | | | |
| Task | 1 | 245.681 | 245.681 | 4.905 | .0338 | .0338 | .0338 |
| Task * Condition | 2 | 71.861 | 35.931 | .717 | .4955 | .4955 | .4955 |
| Task * Subject(Group) | 33 | 1652.958 | 50.090 | | | | |

Dependent: Total CIT

Table C4.1 Analysis of the use of CIT by condition (DVS, NDVS, CMC) over the two tasks of Experiment 4.

| | Count | Mean | Std. Dev. | Std. Error |
|------|-------|--------|-----------|------------|
| CMC | 24 | 10.500 | 8.792 | 1.795 |
| NDVS | 24 | 11.667 | 9.421 | 1.923 |
| DVS | 24 | 15.208 | 7.868 | 1.606 |

Table C4.2: Descriptive Statistics for Experiment 4 CIT usage of groups regardless of task.

| | Count | Mean | Std. Dev. | Std. Error |
|-----|-------|--------|-----------|------------|
| One | 36 | 10.611 | 7.658 | 1.276 |
| Two | 36 | 14.306 | 9.612 | 1.602 |

Table C4.3: Descriptive Statistics for Experiment 4 CIT usage over task regardless of condition.

| | Count | Mean | Std. Dev. | Std. Error |
|-----------|-------|--------|-----------|------------|
| One, CMC | 12 | 7.333 | 4.793 | 1.384 |
| One, NDVS | 12 | 10.917 | 8.328 | 2.404 |
| One, DVS | 12 | 13.583 | 8.533 | 2.463 |
| Two, CMC | 12 | 13.667 | 10.807 | 3.120 |
| Two, NDVS | 12 | 12.417 | 10.723 | 3.096 |
| Two, DVS | 12 | 16.833 | 7.133 | 2.059 |

Table C4.4: Descriptive Statistics for Experiment 4 CIT usage dependent upon condition and task.

Type III Sums of Squares

| Source | df | Sum of Squares | Mean Square | F-Value | P-Value | G-G | H-F |
|-----------------------|----|----------------|-------------|---------|---------|-------|-------|
| Condition | 2 | 497.444 | 248.722 | .971 | .3893 | | |
| Subject(Group) | 33 | 8455.042 | 256.213 | | | | |
| Task | 1 | 159.014 | 159.014 | 1.219 | .2775 | .2775 | .2775 |
| Task * Condition | 2 | 67.444 | 33.722 | .259 | .7737 | .7737 | .7737 |
| Task * Subject(Group) | 33 | 4304.042 | 130.426 | | | | |

Dependent: Total INF

Table C4.5 Analysis of the use of INF by condition (DVS, NDVS, CMC) over two tasks of Experiment 4.

| | Count | Mean | Std. Dev. | Std. Error |
|------|-------|--------|-----------|------------|
| CMC | 24 | 25.708 | 13.833 | 2.824 |
| NDVS | 24 | 28.458 | 14.359 | 2.931 |
| DVS | 24 | 32.125 | 12.926 | 2.638 |

Table C4.6: Descriptive Statistics for INF usage of groups regardless of Experiment 4 task.

| | Count | Mean | Std. Dev. | Std. Error |
|-----|-------|--------|-----------|------------|
| One | 36 | 27.278 | 13.837 | 2.306 |
| Two | 36 | 30.250 | 13.756 | 2.293 |

Table C4.7: Descriptive Statistics for Experiment 4 INF usage over task regardless of condition.

| | Count | Mean | Std. Dev. | Std. Error |
|-----------|-------|--------|-----------|------------|
| One, CMC | 12 | 25.583 | 13.970 | 4.033 |
| One, NDVS | 12 | 26.417 | 14.228 | 4.107 |
| One, DVS | 12 | 29.833 | 14.160 | 4.088 |
| Two, CMC | 12 | 25.833 | 14.314 | 4.132 |
| Two, NDVS | 12 | 30.500 | 14.817 | 4.277 |
| Two, DVS | 12 | 34.417 | 11.720 | 3.383 |

Table C4.8: Descriptive Statistics for Experiment 4 INF usage dependent upon condition and task

Type III Sums of Squares

| Source | df | Sum of Squares | Mean Square | F-Value | P-Value | G-G | H-F |
|-----------------------|----|----------------|-------------|---------|---------|-------|-------|
| Condition | 2 | 82.111 | 41.056 | 1.076 | .3527 | | |
| Subject(Group) | 33 | 1259.375 | 38.163 | | | | |
| Task | 1 | 13.347 | 13.347 | .729 | .3994 | .3994 | .3994 |
| Task * Condition | 2 | 21.778 | 10.889 | .595 | .5576 | .5576 | .5576 |
| Task * Subject(Group) | 33 | 604.375 | 18.314 | | | | |

Dependent: Total PREF

Table C4.9 Analysis of the use of Experiment 4 PREF by condition (DVS, NDVS, CMC) over two tasks.

| | Count | Mean | Std. Dev. | Std. Error |
|------|-------|--------|-----------|------------|
| CMC | 24 | 9.542 | 4.263 | .870 |
| NDVS | 24 | 11.458 | 6.136 | 1.253 |
| DVS | 24 | 8.958 | 5.171 | 1.055 |

Table C4.10: Descriptive Statistics for Experiment 4 PREF usage of groups regardless of task.

| | Count | Mean | Std. Dev. | Std. Error |
|-----|-------|--------|-----------|------------|
| One | 36 | 10.417 | 4.252 | .709 |
| Two | 36 | 9.556 | 6.176 | 1.029 |

Table C4.11: Descriptive Statistics for Experiment 4 PREF usage over task regardless of condition.

| | Count | Mean | Std. Dev. | Std. Error |
|-----------|-------|--------|-----------|------------|
| One, CMC | 12 | 10.083 | 3.655 | 1.055 |
| One, NDVS | 12 | 11.167 | 4.569 | 1.319 |
| One, DVS | 12 | 10.000 | 4.729 | 1.365 |
| Two, CMC | 12 | 9.000 | 4.899 | 1.414 |
| Two, NDVS | 12 | 11.750 | 7.593 | 2.192 |
| Two, DVS | 12 | 7.917 | 5.583 | 1.612 |

Table C4.12: Descriptive Statistics for Experiment 4 PREF usage dependent upon condition and task

Type III Sums of Squares

| Source | df | Sum of Squares | Mean Square | F-Value | P-Value | G-G | H-F |
|-----------------------|----|----------------|-------------|---------|---------|-------|-------|
| Condition | 2 | 8.028 | 4.014 | .363 | .6983 | | |
| Subject(Group) | 33 | 364.792 | 11.054 | | | | |
| Task | 1 | .347 | .347 | .030 | .8633 | .8633 | .8633 |
| Task * Condition | 2 | 46.361 | 23.181 | 2.009 | .1502 | .1502 | .1502 |
| Task * Subject(Group) | 33 | 380.792 | 11.539 | | | | |

Dependent: Total VAL

Table C4.13 Analysis of the use of Experiment 4 VAL by condition (DVS, NDVS, CMC) over two tasks.

| | Count | Mean | Std. Dev. | Std. Error |
|------|-------|-------|-----------|------------|
| CMC | 24 | 2.417 | 3.752 | .766 |
| NDVS | 24 | 2.417 | 2.339 | .477 |
| DVS | 24 | 3.125 | 3.860 | .788 |

Table C4.14: Descriptive Statistics for Experiment 4 VAL usage of groups regardless of task.

| | Count | Mean | Std. Dev. | Std. Error |
|-----|-------|-------|-----------|------------|
| One | 36 | 2.722 | 3.352 | .559 |
| Two | 36 | 2.583 | 3.409 | .568 |

Table C4.15: Descriptive Statistics for VAL usage over task regardless of condition in Experiment 4.

| | Count | Mean | Std. Dev. | Std. Error |
|-----------|-------|-------|-----------|------------|
| One, CMC | 12 | 3.417 | 4.981 | 1.438 |
| One, NDVS | 12 | 2.583 | 2.151 | .621 |
| One, DVS | 12 | 2.167 | 2.329 | .672 |
| Two, CMC | 12 | 1.417 | 1.564 | .452 |
| Two, NDVS | 12 | 2.250 | 2.598 | .750 |
| Two, DVS | 12 | 4.083 | 4.870 | 1.406 |

Table C4.16: Descriptive Statistics for VAL usage dependent upon condition and task in Experiment 4.

Analysis of Proportional CIT Communication.

Type III Sums of Squares

| Source | df | Sum of Squares | Mean Square | F-Value | P-Value | G-G | H-F |
|---------------------|----|----------------|-------------|---------|---------|-------|-------|
| Condition | 2 | 366.189 | 183.094 | 1.430 | .2538 | | |
| Subject(Group) | 33 | 4226.276 | 128.069 | | | | |
| Task | 1 | 301.530 | 301.530 | 3.938 | .0556 | .0556 | .0556 |
| Task * Condition | 2 | 222.036 | 111.018 | 1.450 | .2492 | .2492 | .2492 |
| Task * Subject(G... | 33 | 2527.103 | 76.579 | | | | |

Dependent: Prop CIT

Table C4.17 Analysis of the Experiment 4 proportional use of CIT by condition (DVS, NDVS, CMC) over two tasks.

| | Count | Mean | Std. Dev. | Std. Error |
|------|-------|--------|-----------|------------|
| CMC | 24 | 15.606 | 12.857 | 2.624 |
| NDVS | 24 | 15.166 | 8.406 | 1.716 |
| DVS | 24 | 20.155 | 8.967 | 1.830 |

Table C4.18: Descriptive Statistics for Experiment 4 proportional CIT usage of groups regardless of task.

| | Count | Mean | Std. Dev. | Std. Error |
|-----|-------|--------|-----------|------------|
| One | 36 | 14.929 | 7.978 | 1.330 |
| Two | 36 | 19.022 | 12.088 | 2.015 |

Table C4.19: Descriptive Statistics for Experiment 4 proportional CIT usage over task regardless of condition.

| | Count | Mean | Std. Dev. | Std. Error |
|-----------|-------|--------|-----------|------------|
| One, CMC | 12 | 11.397 | 7.783 | 2.247 |
| One, NDVS | 12 | 15.258 | 7.861 | 2.269 |
| One, DVS | 12 | 18.133 | 7.432 | 2.146 |
| Two, CMC | 12 | 19.815 | 15.698 | 4.532 |
| Two, NDVS | 12 | 15.074 | 9.270 | 2.676 |
| Two, DVS | 12 | 22.178 | 10.197 | 2.944 |

Table C4.20: Descriptive Statistics for Experiment 4 proportional CIT usage dependent upon condition and task

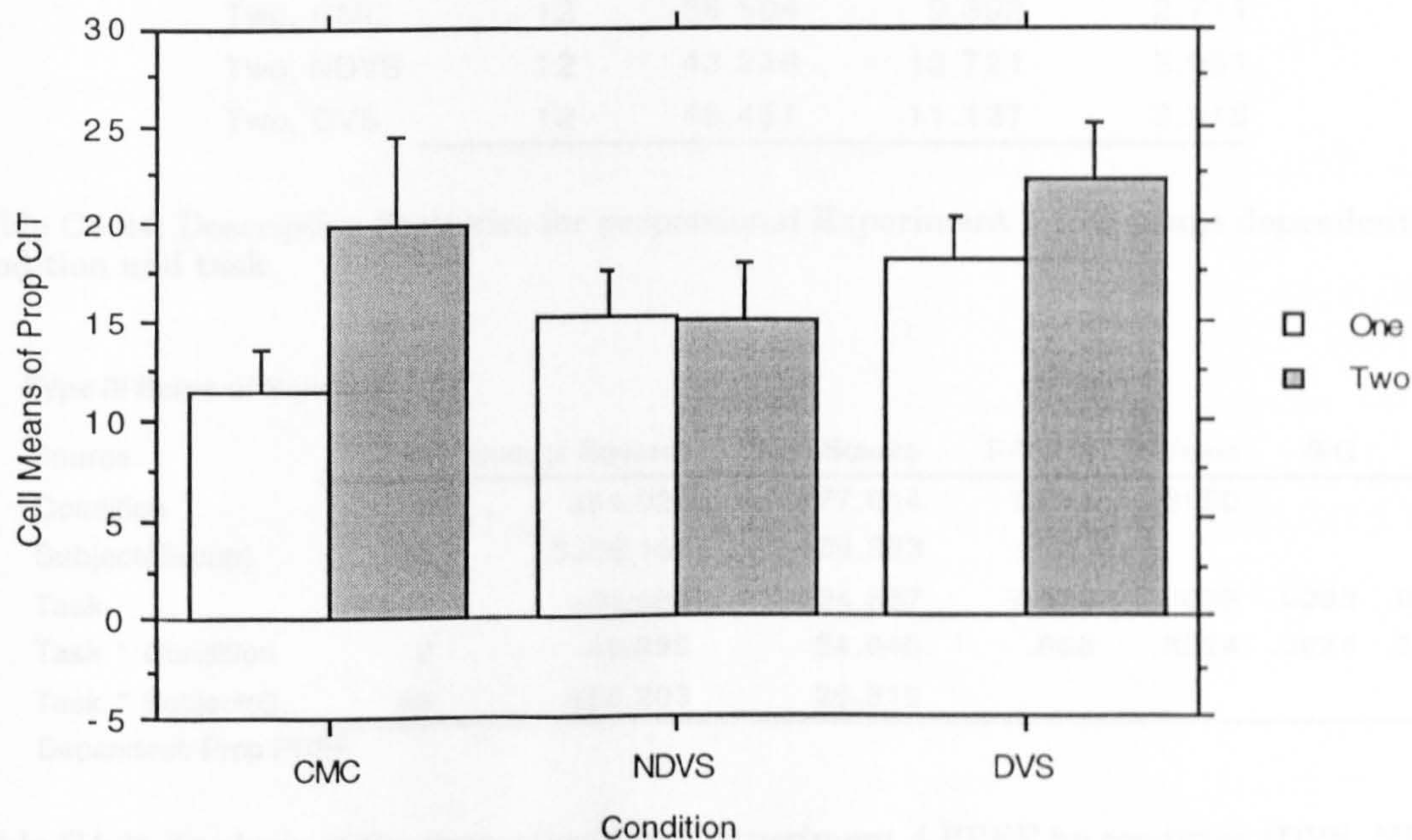


Figure 4.1: The interaction between condition and task upon Experiment 4 proportional CIT usage

Type III Sums of Squares

| Source | df | Sum of Squares | Mean Square | F-Value | P-Value | G-G | H-F |
|----------------------|----|----------------|-------------|---------|---------|-------|-------|
| Condition | 2 | 308.685 | 154.342 | .792 | .4614 | | |
| Subject(Group) | 33 | 6432.076 | 194.911 | | | | |
| Task | 1 | 89.262 | 89.262 | 1.015 | .3211 | .3211 | .3211 |
| Task * Condition | 2 | 229.144 | 114.572 | 1.302 | .2855 | .2855 | .2855 |
| Task * Subject(G...) | 33 | 2903.224 | 87.976 | | | | |

Dependent: Prop INF

Table C4.21 Analysis of the proportional use Experiment 4 INF by condition (DVS, NDVS, CMC) over two tasks.

| | Count | Mean | Std. Dev. | Std. Error |
|------|-------|--------|-----------|------------|
| CMC | 24 | 37.905 | 10.678 | 2.180 |
| NDVS | 24 | 41.143 | 13.743 | 2.805 |
| DVS | 24 | 42.904 | 10.809 | 2.206 |

Table C4.22: Descriptive Statistics for Experiment 4 proportional INF usage of groups regardless of task.

| | Count | Mean | Std. Dev. | Std. Error |
|-----|-------|--------|-----------|------------|
| One | 36 | 39.537 | 11.884 | 1.981 |
| Two | 36 | 41.764 | 11.869 | 1.978 |

Table C4.23: Descriptive Statistics for proportional Experiment 4 INF usage over task regardless of condition

| | Count | Mean | Std. Dev. | Std. Error |
|-----------|-------|--------|-----------|------------|
| One, CMC | 12 | 39.306 | 12.079 | 3.487 |
| One, NDVS | 12 | 38.948 | 14.005 | 4.043 |
| One, DVS | 12 | 40.358 | 10.302 | 2.974 |
| Two, CMC | 12 | 36.504 | 9.392 | 2.711 |
| Two, NDVS | 12 | 43.338 | 13.721 | 3.961 |
| Two, DVS | 12 | 45.451 | 11.137 | 3.215 |

Table C4.24: Descriptive Statistics for proportional Experiment 4 INF usage dependent upon condition and task

Type III Sums of Squares

| Source | df | Sum of Squares | Mean Square | F-Value | P-Value | G-G | H-F |
|---------------------|----|----------------|-------------|---------|---------|-------|-------|
| Condition | 2 | 354.028 | 177.014 | 1.611 | .2150 | | |
| Subject(Group) | 33 | 3626.150 | 109.883 | | | | |
| Task | 1 | 194.887 | 194.887 | 7.520 | .0098 | .0098 | .0098 |
| Task * Condition | 2 | 49.893 | 24.946 | .963 | .3924 | .3924 | .3924 |
| Task * Subject(G... | 33 | 855.203 | 25.915 | | | | |

Dependent: Prop PREF

Table C4.25 Analysis of the proportional use Experiment 4 PREF by condition (DVS, NDVS, CMC) over two tasks.

| | Count | Mean | Std. Dev. | Std. Error |
|------|-------|--------|-----------|------------|
| CMC | 24 | 17.803 | 9.762 | 1.993 |
| NDVS | 24 | 17.469 | 6.956 | 1.420 |
| DVS | 24 | 12.941 | 7.861 | 1.605 |

Table C4.26: Descriptive Statistics for Experiment 4 proportional PREF usage of groups regardless of task.

| | Count | Mean | Std. Dev. | Std. Error |
|-----|-------|--------|-----------|------------|
| One | 36 | 17.716 | 8.158 | 1.360 |
| Two | 36 | 14.426 | 8.545 | 1.424 |

Table C4.27: Descriptive Statistics for Experiment 4 proportional PREF usage over task regardless of condition.

| | Count | Mean | Std. Dev. | Std. Error |
|-----------|-------|--------|-----------|------------|
| One, CMC | 12 | 19.807 | 9.535 | 2.752 |
| One, NDVS | 12 | 17.964 | 6.834 | 1.973 |
| One, DVS | 12 | 15.378 | 7.960 | 2.298 |
| Two, CMC | 12 | 15.799 | 9.980 | 2.881 |
| Two, NDVS | 12 | 16.975 | 7.344 | 2.120 |
| Two, DVS | 12 | 10.504 | 7.273 | 2.100 |

Table C4.28: Descriptive Statistics for Experiment 4 proportional PREF usage dependent upon condition and task.

Type III Sums of Squares

| Source | df | Sum of Squares | Mean Square | F-Value | P-Value | G-G | H-F |
|-----------------------|----|----------------|-------------|---------|---------|-------|-------|
| Condition | 2 | 3.460 | 1.730 | .119 | .8878 | | |
| Subject(Group) | 33 | 478.094 | 14.488 | | | | |
| Task | 1 | 4.538 | 4.538 | .242 | .6263 | .6263 | .6263 |
| Task * Condition | 2 | 56.130 | 28.065 | 1.494 | .2392 | .2392 | .2392 |
| Task * Subject(Group) | 33 | 619.780 | 18.781 | | | | |

Dependent: Prop VAL

Table C4.29 Analysis of the Experiment 4 proportional use VAL by condition (DVS, NDVS, CMC) over two tasks.

| | Count | Mean | Std. Dev. | Std. Error |
|------|-------|-------|-----------|------------|
| CMC | 24 | 3.303 | 4.512 | .921 |
| NDVS | 24 | 3.481 | 3.474 | .709 |
| DVS | 24 | 3.830 | 4.237 | .865 |

Table C4.30: Descriptive Statistics for Experiment 4 proportional VAL usage of groups regardless of task.

| | Count | Mean | Std. Dev. | Std. Error |
|-----|-------|-------|-----------|------------|
| One | 36 | 3.789 | 4.238 | .706 |
| Two | 36 | 3.287 | 3.887 | .648 |

Table C4.31: Descriptive Statistics for Experiment 4 proportional VAL usage over task regardless of condition.

| | Count | Mean | Std. Dev. | Std. Error |
|-----------|-------|-------|-----------|------------|
| One, CMC | 12 | 4.445 | 5.743 | 1.658 |
| One, NDVS | 12 | 4.044 | 3.822 | 1.103 |
| One, DVS | 12 | 2.878 | 2.850 | .823 |
| Two, CMC | 12 | 2.161 | 2.595 | .749 |
| Two, NDVS | 12 | 2.917 | 3.152 | .910 |
| Two, DVS | 12 | 4.782 | 5.238 | 1.512 |

Table C4.32: Descriptive Statistics for Experiment 4 proportional VAL usage dependent upon condition and task.

Analysis of Proportional CIT Usage for conditions over two tasks and four time periods.

| Type III Sums of Squares | | | | | | | |
|----------------------------------|----|----------------|-------------|---------|---------|-------|-------|
| Source | df | Sum of Squares | Mean Square | F-Value | P-Value | G-G | H-F |
| Condition | 2 | 181.516 | 90.758 | 1.910 | .1641 | | |
| Subject(Group) | 33 | 1567.951 | 47.514 | | | | |
| Task | 1 | 185.707 | 185.707 | 5.549 | .0246 | .0246 | .0246 |
| Task * Condition | 2 | 30.443 | 15.222 | .455 | .6385 | .6385 | .6385 |
| Task * Subject(Group) | 33 | 1104.311 | 33.464 | | | | |
| Quarters | 3 | 1534.870 | 511.623 | 19.859 | .0001 | .0001 | .0001 |
| Quarters * Condition | 6 | 38.501 | 6.417 | .249 | .9586 | .9270 | .9435 |
| Quarters * Subject(Group) | 99 | 2550.505 | 25.763 | | | | |
| Task * Quarters | 3 | 249.830 | 83.277 | 2.782 | .0450 | .0603 | .0521 |
| Task * Quarters * Condition | 6 | 277.200 | 46.200 | 1.543 | .1720 | .1906 | .1812 |
| Task * Quarters * Subject(Group) | 99 | 2963.855 | 29.938 | | | | |
| Dependent: Prop CIT | | | | | | | |

Table C4.33 Analysis of the Experiment 4 proportional use CIT by condition (DVS, NDVS, CMC) over two tasks divided into four time periods (Quarters).

| | Count | Mean | Std. Dev. | Std. Error |
|------|-------|-------|-----------|------------|
| CMC | 96 | 3.911 | 6.588 | .672 |
| DVS | 96 | 5.597 | 6.788 | .693 |
| NDVS | 96 | 3.916 | 4.592 | .469 |

Table C4.34: Descriptive Statistics for Experiment 4 proportional CIT usage of groups regardless of task or time period (Quarters).

| | Count | Mean | Std. Dev. | Std. Error |
|-----|-------|-------|-----------|------------|
| One | 144 | 3.672 | 4.609 | .384 |
| Two | 144 | 5.278 | 7.223 | .602 |

Table 4.35: Descriptive Statistics for Experiment 4 proportional CIT usage over task regardless of condition or time period (Quarters).

| | Count | Mean | Std. Dev. | Std. Error |
|--------|-------|-------|-----------|------------|
| First | 72 | .804 | 3.051 | .360 |
| Second | 72 | 4.341 | 6.460 | .761 |
| Third | 72 | 6.918 | 7.189 | .847 |
| Forth | 72 | 5.837 | 5.114 | .603 |

Table C4.36: Descriptive Statistics for Experiment 4 proportional CIT usage over time period (quarters) regardless of condition or task.

| | Count | Mean | Std. Dev. | Std. Error |
|-----------|-------|-------|-----------|------------|
| One, CMC | 48 | 2.849 | 3.979 | .574 |
| One, DVS | 48 | 4.594 | 5.204 | .751 |
| One, NDVS | 48 | 3.572 | 4.489 | .648 |
| Two, CMC | 48 | 4.972 | 8.341 | 1.204 |
| Two, DVS | 48 | 6.601 | 8.000 | 1.155 |
| Two, NDVS | 48 | 4.260 | 4.713 | .680 |

Table C4.37: The interaction between task and condition upon Experiment 4 CIT usage.

| | Count | Mean | Std. Dev. | Std. Error |
|--------------|-------|-------|-----------|------------|
| First, CMC | 24 | .448 | 1.496 | .305 |
| First, DVS | 24 | 1.531 | 4.889 | .998 |
| First, NDVS | 24 | .432 | 1.331 | .272 |
| Second, CMC | 24 | 3.449 | 4.283 | .874 |
| Second, DVS | 24 | 6.341 | 9.483 | 1.936 |
| Second, NDVS | 24 | 3.232 | 3.776 | .771 |
| Third, CMC | 24 | 6.427 | 10.607 | 2.165 |
| Third, DVS | 24 | 7.779 | 5.146 | 1.050 |
| Third, NDVS | 24 | 6.547 | 4.402 | .899 |
| Forth, CMC | 24 | 5.319 | 4.975 | 1.016 |
| Forth, DVS | 24 | 6.739 | 5.086 | 1.038 |
| Forth, NDVS | 24 | 5.453 | 5.369 | 1.096 |

Table C4.38: The interaction between condition and time period upon Experiment 4 CIT usage.

| | Count | Mean | Std. Dev. | Std. Error |
|-------------|-------|-------|-----------|------------|
| One, First | 36 | .119 | .717 | .119 |
| One, Second | 36 | 2.470 | 3.042 | .507 |
| One, Third | 36 | 5.623 | 4.666 | .778 |
| One, Forth | 36 | 6.474 | 5.368 | .895 |
| Two, First | 36 | 1.488 | 4.172 | .695 |
| Two, Second | 36 | 6.211 | 8.258 | 1.376 |
| Two, Third | 36 | 8.212 | 8.923 | 1.487 |
| Two, Forth | 36 | 5.200 | 4.838 | .806 |

Table C4.39: The interaction between task and time period upon Experiment 4 CIT usage.

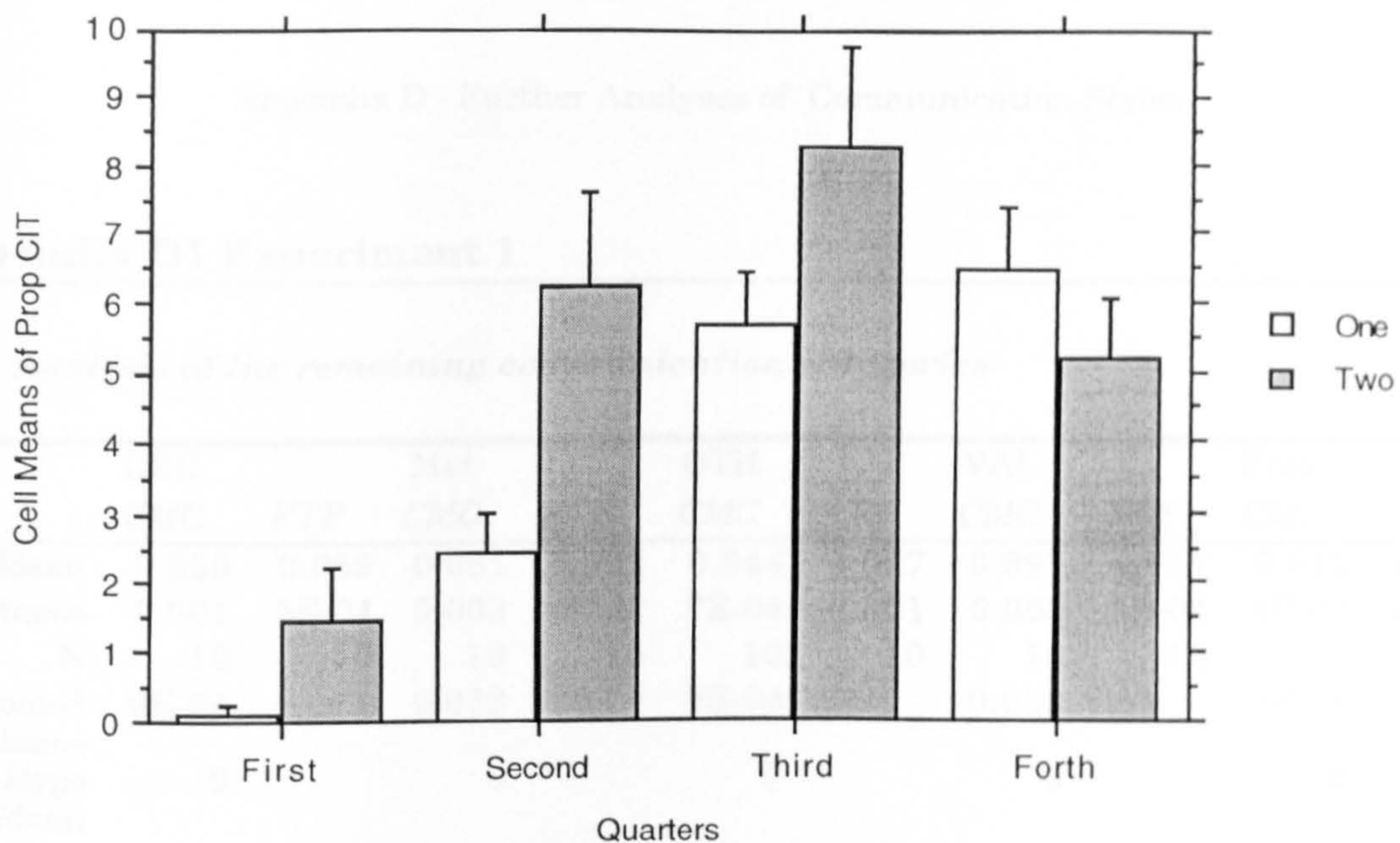


Figure C4.3: The interaction between task and time period upon Experiment 4 CIT usage.

| | Count | Mean | Std. Dev. | Std. Error |
|-------------------|-------|--------|-----------|------------|
| One, First, CMC | 12 | 0.000 | 0.000 | 0.000 |
| One, First, DVS | 12 | 0.000 | 0.000 | 0.000 |
| One, First, NDVS | 12 | .358 | 1.242 | .358 |
| One, Second, CMC | 12 | 2.478 | 3.220 | .929 |
| One, Second, DVS | 12 | 2.629 | 3.146 | .908 |
| One, Second, NDVS | 12 | 2.304 | 3.020 | .872 |
| One, Third, CMC | 12 | 3.151 | 3.925 | 1.133 |
| One, Third, DVS | 12 | 7.886 | 4.812 | 1.389 |
| One, Third, NDVS | 12 | 5.832 | 4.291 | 1.239 |
| One, Forth, CMC | 12 | 5.768 | 4.846 | 1.399 |
| One, Forth, DVS | 12 | 7.862 | 5.653 | 1.632 |
| One, Forth, NDVS | 12 | 5.792 | 5.751 | 1.660 |
| Two, First, CMC | 12 | .896 | 2.059 | .594 |
| Two, First, DVS | 12 | 3.062 | 6.697 | 1.933 |
| Two, First, NDVS | 12 | .505 | 1.466 | .423 |
| Two, Second, CMC | 12 | 4.420 | 5.092 | 1.470 |
| Two, Second, DVS | 12 | 10.053 | 12.169 | 3.513 |
| Two, Second, NDVS | 12 | 4.161 | 4.337 | 1.252 |
| Two, Third, CMC | 12 | 9.703 | 14.015 | 4.046 |
| Two, Third, DVS | 12 | 7.672 | 5.673 | 1.638 |
| Two, Third, NDVS | 12 | 7.262 | 4.581 | 1.322 |
| Two, Forth, CMC | 12 | 4.870 | 5.275 | 1.523 |
| Two, Forth, DVS | 12 | 5.616 | 4.402 | 1.271 |
| Two, Forth, NDVS | 12 | 5.113 | 5.192 | 1.499 |

Table C4.40: The interaction between time period, task and condition upon Experiment 4 CIT usage.

Appendix D1 Experiment 1

D1.1 Analysis of the remaining communication categories

| | LEG | | Mat | | OTH | | VAL | | Press | |
|----------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| | CMC | FTF | CMC | FTF | CMC | FTF | CMC | FTF | CMC | FTF |
| Mean | 0.036 | 0.059 | 0.081 | 0.202 | 0.044 | 0.047 | 0.097 | 0.047 | 0.012 | 0.008 |
| Variance | 0.001 | 5E-04 | 0.003 | 0.003 | 7E-04 | 0.001 | 0.003 | 5E-04 | 5E-04 | 4E-05 |
| N | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| Pooled Variance | 9E-04 | | 0.003 | | 9E-04 | | 0.002 | | 2E-04 | |
| Hypo Mean Difference | 0 | | 0 | | 0 | | 0 | | 0 | |
| df | 18 | | 18 | | 18 | | 18 | | 18 | |
| t Stat | -1.63 | | -4.6 | | -0.25 | | 2.848 | | 0.492 | |
| P(T<=t) 1-tail | 0.06 | | 1E-04 | | 0.403 | | 0.005 | | 0.314 | |
| t Critical 1-tail | 1.734 | | 1.734 | | 1.734 | | 1.734 | | 1.734 | |
| P(T<=t) 1-tail | 0.12 | | 2E-04 | | 0.807 | | 0.011 | | 0.629 | |
| t Critical 1-tail | 2.101 | | 2.101 | | 2.101 | | 2.101 | | 2.101 | |

Table D1.1: Student t-test results for first three miscellaneous communication categories in Experiment 1.

| PROC | | | |
|------------------------------|-------|-------|--|
| | CMC | FTF | |
| Mean | 0.021 | 0.032 | |
| Variance | 3E-04 | 2E-04 | |
| Observations | 10 | 10 | |
| Pooled Variance | 2E-04 | | |
| Hypothesised Mean Difference | 0 | | |
| df | 18 | | |
| t Stat | -1.6 | | |
| P(T<=t) one-tail | 0.063 | | |
| t Critical one-tail | 1.734 | | |
| P(T<=t) two-tail | 0.127 | | |
| t Critical two-tail | 2.101 | | |

Table D1.2: Student t-test results for Experiment 1 PROC usage by both communication modes.

| | LEG | | Mat | | Press | | OTH | |
|---------------------|-------|-------|-------|-------|-------|-------|-------|----|
| | CMC | FTF | CMC | FTF | CMC | FTF | CMC | FT |
| Mean | 0.036 | 0.059 | 0.081 | 0.202 | 0.012 | 0.008 | 0.044 | 0. |
| Variance | 0.001 | 5E-04 | 0.003 | 0.003 | 5E-04 | 4E-05 | 7E-04 | 0. |
| Observations | 10 | 10 | 10 | 10 | 10 | 10 | 10 | |
| Pooled Variance | 9E-04 | | 0.003 | | 2E-04 | | 9E-04 | |
| Hypoth Mean Diff | 0 | | 0 | | 0 | | 0 | |
| df | 18 | | 18 | | 18 | | 18 | |
| t Stat | -1.63 | | -4.6 | | 0.492 | | -0.25 | |
| P(T<=t) one-tail | 0.06 | | 1E-04 | | 0.314 | | 0.403 | |
| t Critical one-tail | 1.734 | | 1.734 | | 1.734 | | 1.734 | |
| P(T<=t) two-tail | 0.12 | | 2E-04 | | 0.629 | | 0.807 | |
| t Critical two-tail | 2.101 | | 2.101 | | 2.101 | | 2.101 | |

Table D1.3: Student t-test results for the remaining four miscellaneous communication categories from Experiment 1.

Type III Sums of Squares

| Source | df | Sum of Squares | Mean Square | F-Value | P-Value | G-G | H-F |
|---------------------------|----|----------------|-------------|---------|---------|-------|-------|
| Comms Mode | 1 | 9.011 | 9.011 | 12.783 | .0022 | | |
| Subject(Group) | 18 | 12.689 | .705 | | | | |
| Quarters | 3 | 20.239 | 6.746 | 13.352 | .0001 | .0002 | .0001 |
| Quarters * Comms Mode | 3 | 4.464 | 1.488 | 2.945 | .0410 | .0766 | .0681 |
| Quarters * Subject(Group) | 54 | 27.285 | .505 | | | | |

Dependent: PROC

Table D1.4: Analysis of the use in Experiment 1 of PROC over time (Quarters).

| | Count | Mean | Std. Dev. | Std. Error |
|-----|-------|-------|-----------|------------|
| FTF | 40 | 1.038 | 1.091 | .173 |
| CMC | 40 | .366 | .684 | .108 |

Table D1.5: Descriptive Statistics for Experiment 1 PROC usage of FTF and CM groups regardless of time.

| | Count | Mean | Std. Dev. | Std. Error |
|--------|-------|-------|-----------|------------|
| First | 20 | .263 | .505 | .113 |
| Second | 20 | .311 | .398 | .089 |
| Third | 20 | .716 | .775 | .173 |
| Forth | 20 | 1.518 | 1.341 | .300 |

Table D1.6: Descriptive Statistics for Experiment 1 PROC usage over for time periods regardless of condition.

| | Count | Mean | Std. Dev. | Std. Error |
|-------------|-------|-------|-----------|------------|
| First, FTF | 10 | .294 | .392 | .124 |
| First, CMC | 10 | .231 | .619 | .196 |
| Second, FTF | 10 | .506 | .464 | .147 |
| Second, CMC | 10 | .117 | .189 | .060 |
| Third, FTF | 10 | 1.198 | .622 | .197 |
| Third, CMC | 10 | .235 | .604 | .191 |
| Forth, FTF | 10 | 2.153 | 1.437 | .455 |
| Forth, CMC | 10 | .884 | .914 | .289 |

Table D1.7: Descriptive Statistics for Experiment 1 PROC usage dependent upon condition and time period.

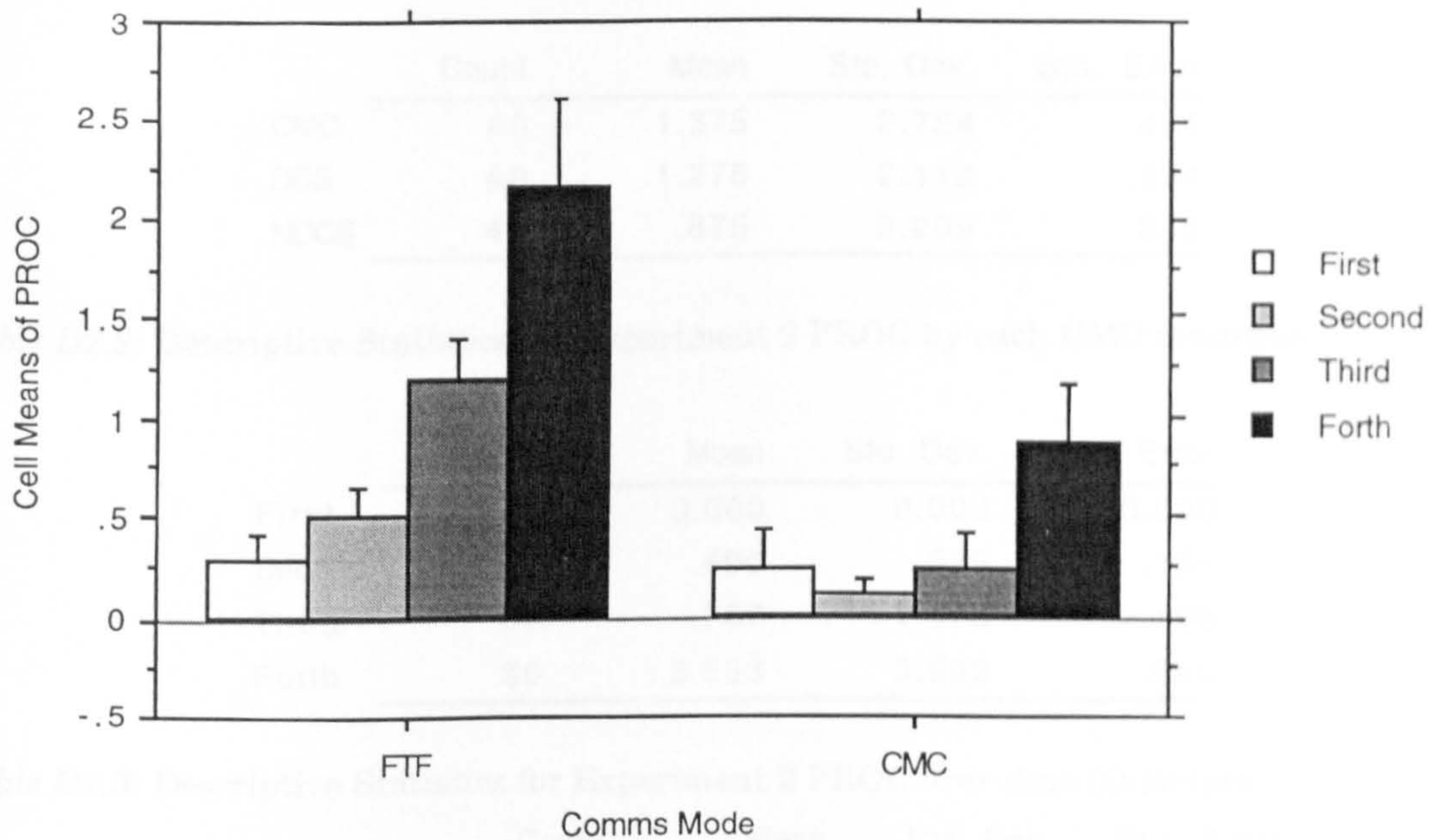


Figure D1.1 The interaction between time period and Condition in Experiment 1 PROC usage.

Appendix D2 Experiment 2

Procedural Utterances

Type III Sums of Squares

| Source | df | Sum of Squares | Mean Square | F-Value | P-Value | G-G | H-F |
|---------------------------|----|----------------|-------------|---------|---------|-------|-------|
| Condition | 2 | 5.600 | 2.800 | .655 | .5277 | | |
| Subject(Group) | 27 | 115.475 | 4.277 | | | | |
| Quarters | 3 | 231.292 | 77.097 | 20.690 | .0001 | .0001 | .0001 |
| Quarters * Condition | 6 | 5.133 | .856 | .230 | .9659 | .8349 | .8530 |
| Quarters * Subject(Group) | 81 | 301.825 | 3.726 | | | | |

Dependent: PROC

Table D2.1: Analysis of Experiment 2 PROC usage over time (Quarters) by CMC groups.

| | Count | Mean | Std. Dev. | Std. Error |
|------|-------|-------|-----------|------------|
| CMC | 40 | 1.375 | 2.724 | .431 |
| DCS | 40 | 1.275 | 2.112 | .334 |
| NDCS | 40 | .875 | 2.209 | .349 |

Table D2.2: Descriptive Statistics for Experiment 2 PROC by each CMC condition.

| | Count | Mean | Std. Dev. | Std. Error |
|--------|-------|-------|-----------|------------|
| First | 30 | 0.000 | 0.000 | 0.000 |
| Second | 30 | .400 | .855 | .156 |
| Third | 30 | .767 | 1.073 | .196 |
| Forth | 30 | 3.533 | 3.589 | .655 |

Table D2.3: Descriptive Statistics for Experiment 2 PROC over time (Quarters).

| | Count | Mean | Std. Dev. | Std. Error |
|--------------|-------|-------|-----------|------------|
| First, CMC | 10 | 0.000 | 0.000 | 0.000 |
| First, DCS | 10 | 0.000 | 0.000 | 0.000 |
| First, NDCS | 10 | 0.000 | 0.000 | 0.000 |
| Second, CMC | 10 | .700 | 1.059 | .335 |
| Second, DCS | 10 | .500 | .972 | .307 |
| Second, NDCS | 10 | 0.000 | 0.000 | 0.000 |
| Third, CMC | 10 | .700 | .949 | .300 |
| Third, DCS | 10 | 1.000 | 1.247 | .394 |
| Third, NDCS | 10 | .600 | 1.075 | .340 |
| Forth, CMC | 10 | 4.100 | 4.332 | 1.370 |
| Forth, DCS | 10 | 3.600 | 2.875 | .909 |
| Forth, NDCS | 10 | 2.900 | 3.695 | 1.169 |

Table D2.4: Descriptive Statistics for Experiment 2 PROC over time (Quarters) by CMC condition.

Appendix D3 Experiment 3

Type III Sums of Squares

| Source | df | Sum of Squares | Mean Square | F-Value | P-Value | G-G | H-F |
|---------------------------|----|----------------|-------------|---------|---------|-------|-------|
| CMCY | 1 | 1.461 | 1.461 | .852 | .3682 | | |
| Subject(Group) | 18 | 30.867 | 1.715 | | | | |
| Quarters | 3 | 112.609 | 37.536 | 22.395 | .0001 | .0001 | .0001 |
| Quarters * CMCY | 3 | 2.371 | .790 | .472 | .7033 | .5581 | .5781 |
| Quarters * Subject(Group) | 54 | 90.509 | 1.676 | | | | |

Dependent: PROC

Table D3.1: Analysis of Experiment 3 PROC over time (Quarters) by supported groups in Experiment 2 and 3. NOTE: CMCY was early code for YDCS

| | Count | Mean | Std. Dev. | Std. Error |
|--------|-------|-------|-----------|------------|
| Expt 2 | 40 | .915 | 1.675 | .265 |
| Expt 3 | 40 | 1.186 | 1.804 | .285 |

Table D3.2: Descriptive Statistics for PROC usage of supported groups in Experiment 2 and 3 regardless of time.

| | Count | Mean | Std. Dev. | Std. Error |
|--------|-------|-------|-----------|------------|
| First | 20 | .141 | .437 | .098 |
| Second | 20 | .294 | .716 | .160 |
| Third | 20 | .691 | 1.017 | .228 |
| Forth | 20 | 3.076 | 2.203 | .493 |

Table D3.3: Descriptive Statistics for Experiment 3 PROC usage over for time periods regardless of condition

| | Count | Mean | Std. Dev. | Std. Error |
|----------------|-------|-------|-----------|------------|
| First, Expt 2 | 10 | .283 | .599 | .189 |
| First, Expt 3 | 10 | 0.000 | 0.000 | 0.000 |
| Second, Expt 2 | 10 | .104 | .329 | .104 |
| Second, Expt 3 | 10 | .484 | .945 | .299 |
| Third, Expt 2 | 10 | .360 | .583 | .184 |
| Third, Expt 3 | 10 | 1.022 | 1.266 | .400 |
| Forth, Expt 2 | 10 | 2.915 | 2.320 | .734 |
| Forth, Expt 3 | 10 | 3.237 | 2.191 | .693 |

Table D3.4: Descriptive Statistics for PROC usage dependent upon experiment and time period.

Appendix D4 Experiment 4

Miscellaneous Categories of Communication

Type III Sums of Squares

| Source | df | Sum of Squares | Mean Square | F-Value | P-Value | G-G | H-F |
|-----------------------|----|----------------|-------------|---------|---------|-------|-------|
| Condition | 2 | 1.028 | .514 | .872 | .4277 | | |
| Subject(Group) | 33 | 19.458 | .590 | | | | |
| Task | 1 | .681 | .681 | 2.604 | .1161 | .1161 | .1161 |
| Task * Condition | 2 | 1.194 | .597 | 2.285 | .1176 | .1176 | .1176 |
| Task * Subject(Group) | 33 | 8.625 | .261 | | | | |

Dependent: Total LEG

Table D4.1 Analysis of Experiment 4 LEG usage by condition (DVS, NDVS, CMC) over two tasks.

| | Count | Mean | Std. Dev. | Std. Error |
|------|-------|------|-----------|------------|
| CMC | 24 | .083 | .408 | .083 |
| NDVS | 24 | .375 | .824 | .168 |
| DVS | 24 | .250 | .676 | .138 |

Table D4.2: Descriptive Statistics for Experiment 4 LEG usage of groups regardless of task.

| | Count | Mean | Std. Dev. | Std. Error |
|-----|-------|------|-----------|------------|
| One | 36 | .333 | .793 | .132 |
| Two | 36 | .139 | .487 | .081 |

Table D4.3: Descriptive Statistics for Experiment 4 LEG usage over task regardless of condition.

| | Count | Mean | Std. Dev. | Std. Error |
|-----------|-------|-------|-----------|------------|
| One, CMC | 12 | 0.000 | 0.000 | 0.000 |
| One, NDVS | 12 | .583 | .996 | .288 |
| One, DVS | 12 | .417 | .900 | .260 |
| Two, CMC | 12 | .167 | .577 | .167 |
| Two, NDVS | 12 | .167 | .577 | .167 |
| Two, DVS | 12 | .083 | .289 | .083 |

Table D4.4: Descriptive Statistics for Experiment 4 LEG usage dependent upon condition and task.

Type III Sums of Squares

| Source | df | Sum of Squares | Mean Square | F-Value | P-Value | G-G | H-F |
|---------------------|----|----------------|-------------|---------|---------|-------|-------|
| Condition | 2 | 33.694 | 16.847 | .144 | .8667 | | |
| Subject(Group) | 33 | 3870.125 | 117.277 | | | | |
| Task | 1 | 17.014 | 17.014 | .488 | .4897 | .4897 | .4897 |
| Task * Condition | 2 | 329.861 | 164.931 | 4.730 | .0156 | .0156 | .0156 |
| Task * Subject(G... | 33 | 1150.625 | 34.867 | | | | |

Dependent: Total MAT

Table D4.5 Analysis of Experiment 4 MAT usage by condition (DVS, NDVS, CMC) over two tasks.

| | Count | Mean | Std. Dev. | Std. Error |
|------|-------|--------|-----------|------------|
| CMC | 24 | 12.333 | 10.565 | 2.157 |
| NDVS | 24 | 11.167 | 8.176 | 1.669 |
| DVS | 24 | 10.708 | 7.410 | 1.513 |

Table D4.6: Descriptive Statistics for Experiment 4 MAT usage of groups regardless of task.

| | Count | Mean | Std. Dev. | Std. Error |
|-----|-------|--------|-----------|------------|
| One | 36 | 10.917 | 6.855 | 1.143 |
| Two | 36 | 11.889 | 10.337 | 1.723 |

Table D4.7: Descriptive Statistics for Experiment 4 MAT usage over task regardless of condition.

| | Count | Mean | Std. Dev. | Std. Error |
|-----------|-------|--------|-----------|------------|
| One, CMC | 12 | 9.417 | 6.244 | 1.803 |
| One, NDVS | 12 | 10.333 | 5.805 | 1.676 |
| One, DVS | 12 | 13.000 | 8.323 | 2.403 |
| Two, CMC | 12 | 15.250 | 13.261 | 3.828 |
| Two, NDVS | 12 | 12.000 | 10.225 | 2.952 |
| Two, DVS | 12 | 8.417 | 5.838 | 1.685 |

Table D4.8: Descriptive Statistics for Experiment 4 MAT usage dependent upon condition and task.

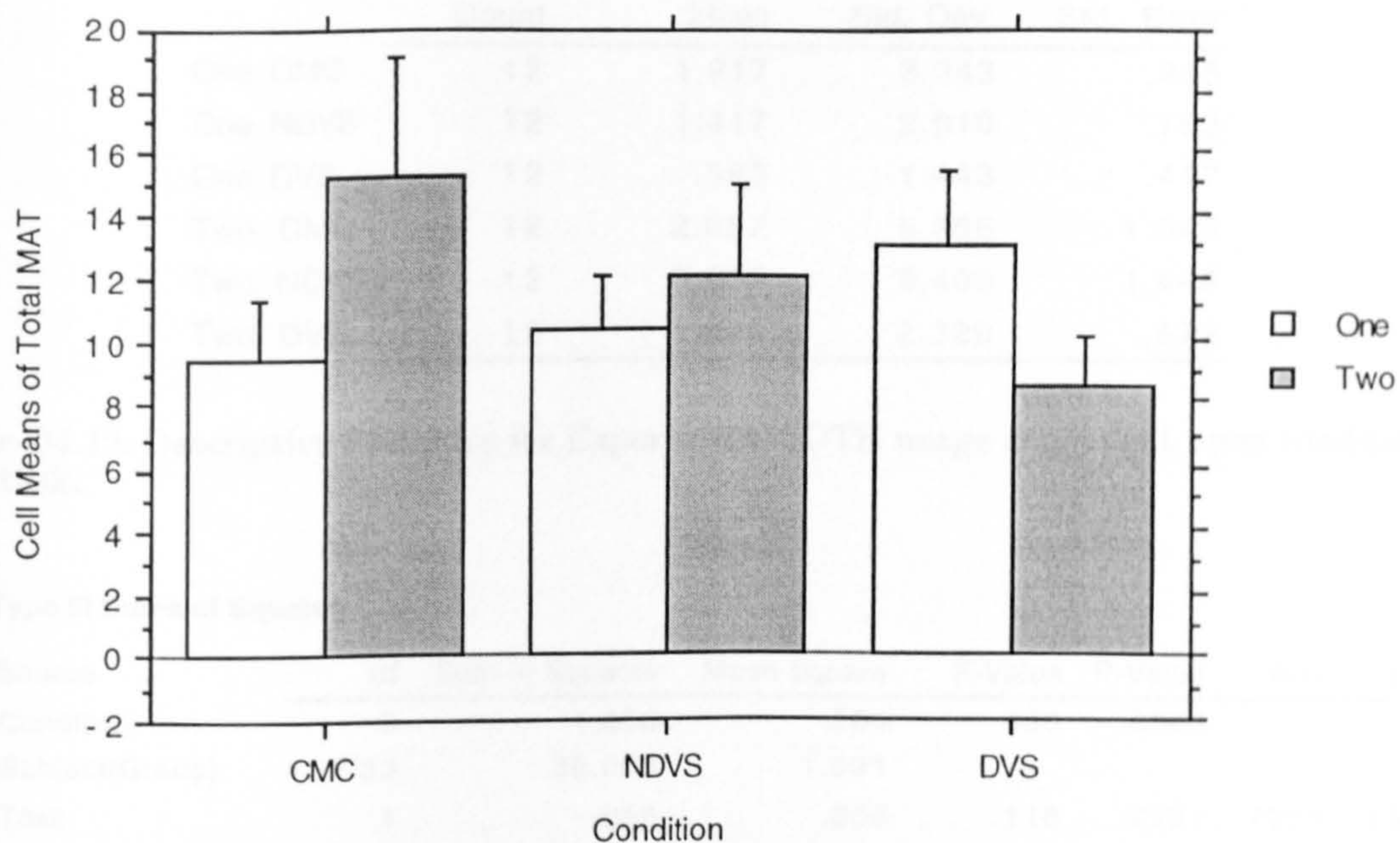


Figure D4.1: The interaction of condition and task upon Experiment 4 MAT usage.

Type III Sums of Squares

| Source | df | Sum of Squares | Mean Square | F-Value | P-Value | G-G | H-F |
|-----------------------|----|----------------|-------------|---------|---------|-------|-------|
| Condition | 2 | 23.083 | 11.542 | .499 | .6115 | | |
| Subject(Group) | 33 | 762.917 | 23.119 | | | | |
| Task | 1 | 34.722 | 34.722 | 4.019 | .0532 | .0532 | .0532 |
| Task * Condition | 2 | 6.194 | 3.097 | .359 | .7014 | .7014 | .7014 |
| Task * Subject(Group) | 33 | 285.083 | 8.639 | | | | |

Dependent: Total OTH

Table D4.9 Analysis of Experiment 4 OTH usage by condition (DVS, NDVS, CMC) over two tasks.

| | Count | Mean | Std. Dev. | Std. Error |
|------|-------|-------|-----------|------------|
| CMC | 24 | 2.292 | 4.389 | .896 |
| NDVS | 24 | 2.500 | 4.908 | 1.002 |
| DVS | 24 | 1.208 | 2.000 | .408 |

Table D4.10: Descriptive Statistics for Experiment 4 OTH usage of groups regardless of task.

| | Count | Mean | Std. Dev. | Std. Error |
|-----|-------|-------|-----------|------------|
| One | 36 | 1.306 | 2.573 | .429 |
| Two | 36 | 2.694 | 4.915 | .819 |

Table D4.11: Descriptive Statistics for Experiment 4 OTH usage over task regardless of condition.

| | Count | Mean | Std. Dev. | Std. Error |
|-----------|-------|-------|-----------|------------|
| One, CMC | 12 | 1.917 | 3.343 | .965 |
| One, NDVS | 12 | 1.417 | 2.610 | .753 |
| One, DVS | 12 | .583 | 1.443 | .417 |
| Two, CMC | 12 | 2.667 | 5.365 | 1.549 |
| Two, NDVS | 12 | 3.583 | 6.403 | 1.848 |
| Two, DVS | 12 | 1.833 | 2.329 | .672 |

Table D4.12: Descriptive Statistics for Experiment 4 OTH usage dependent upon condition and task.

Type III Sums of Squares

| Source | df | Sum of Squares | Mean Square | F-Value | P-Value | G-G | H-F |
|---------------------|----|----------------|-------------|---------|---------|-------|-------|
| Condition | 2 | 1.000 | .500 | .458 | .6363 | | |
| Subject(Group) | 33 | 36.000 | 1.091 | | | | |
| Task | 1 | .056 | .056 | .118 | .7331 | .7331 | .7331 |
| Task * Condition | 2 | 1.444 | .722 | 1.538 | .2299 | .2299 | .2299 |
| Task * Subject(G... | 33 | 15.500 | .470 | | | | |

Dependent: Total PRESS

Table D4.13 Analysis of Experiment 4 PRESS usage by condition (DVS, NDVS, CMC) over two tasks.

| | Count | Mean | Std. Dev. | Std. Error |
|------|-------|------|-----------|------------|
| CMC | 24 | .250 | .608 | .124 |
| NDVS | 24 | .250 | .737 | .150 |
| DVS | 24 | .500 | 1.180 | .241 |

Table D4.14: Descriptive Statistics for Experiment 4 PRESS usage of groups regardless of task.

| | Count | Mean | Std. Dev. | Std. Error |
|-----|-------|------|-----------|------------|
| One | 36 | .306 | .749 | .125 |
| Two | 36 | .361 | .990 | .165 |

Table D4.15: Descriptive Statistics for Experiment 4 PRESS usage over task regardless of condition.

| | Count | Mean | Std. Dev. | Std. Error |
|-----------|-------|------|-----------|------------|
| One, CMC | 12 | .417 | .793 | .229 |
| One, NDVS | 12 | .083 | .289 | .083 |
| One, DVS | 12 | .417 | .996 | .288 |
| Two, CMC | 12 | .083 | .289 | .083 |
| Two, NDVS | 12 | .417 | .996 | .288 |
| Two, DVS | 12 | .583 | 1.379 | .398 |

Table D4.16: Descriptive Statistics for Experiment 4 PRESS usage dependent upon condition and task.

Type III Sums of Squares

| Source | df | Sum of Squares | Mean Square | F-Value | P-Value | G-G | H-F |
|-----------------------|----|----------------|-------------|---------|---------|-------|-------|
| Condition | 2 | 8.361 | 4.181 | .782 | .4659 | | |
| Subject(Group) | 33 | 176.458 | 5.347 | | | | |
| Task | 1 | .014 | .014 | .005 | .9425 | .9425 | .9425 |
| Task * Condition | 2 | 4.861 | 2.431 | .926 | .4062 | .4062 | .4062 |
| Task * Subject(Group) | 33 | 86.625 | 2.625 | | | | |

Dependent: Total PROC

Table D4.17 Analysis of Experiment 4 PROC usage by condition (DVS, NDVS, CMC) over two tasks.

| | Count | Mean | Std. Dev. | Std. Error |
|------|-------|-------|-----------|------------|
| CMC | 24 | 2.500 | 2.126 | .434 |
| NDVS | 24 | 2.667 | 2.334 | .477 |
| DVS | 24 | 1.875 | 1.296 | .265 |

Table D4.18: Descriptive Statistics for Experiment 4 PROC usage of groups regardless of task.

| | Count | Mean | Std. Dev. | Std. Error |
|-----|-------|-------|-----------|------------|
| One | 36 | 2.333 | 1.852 | .309 |
| Two | 36 | 2.361 | 2.113 | .352 |

Table D4.19: Descriptive Statistics for Experiment 4 PROC usage over task regardless of condition.

| | Count | Mean | Std. Dev. | Std. Error |
|-----------|-------|-------|-----------|------------|
| One, CMC | 12 | 2.833 | 2.167 | .626 |
| One, NDVS | 12 | 2.583 | 1.929 | .557 |
| One, DVS | 12 | 1.583 | 1.240 | .358 |
| Two, CMC | 12 | 2.167 | 2.125 | .613 |
| Two, NDVS | 12 | 2.750 | 2.768 | .799 |
| Two, DVS | 12 | 2.167 | 1.337 | .386 |

Table D4.20: Descriptive Statistics for Experiment 4 PROC usage dependent upon condition and task.

D4.2 Analysis of Proportional Communication

Type III Sums of Squares

| Source | df | Sum of Squares | Mean Square | F-Value | P-Value | G-G | H-F |
|-----------------------|----|----------------|-------------|---------|---------|-------|-------|
| Condition | 2 | 2.244 | 1.122 | 1.408 | .2590 | | |
| Subject(Group) | 33 | 26.302 | .797 | | | | |
| Task | 1 | 2.496 | 2.496 | 4.810 | .0355 | .0355 | .0355 |
| Task * Condition | 2 | 3.019 | 1.510 | 2.909 | .0686 | .0686 | .0686 |
| Task * Subject(Group) | 33 | 17.123 | .519 | | | | |

Dependent: Prop LEG

Table D4.21 Analysis of Experiment 4 LEG usage by condition (DVS, NDVS, CMC) over two tasks.

| | Count | Mean | Std. Dev. | Std. Error |
|------|-------|------|-----------|------------|
| CMC | 24 | .090 | .439 | .090 |
| NDVS | 24 | .521 | 1.137 | .232 |
| DVS | 24 | .326 | .802 | .164 |

Table D4.22: Descriptive Statistics for Experiment 4 proportional LEG usage of groups regardless of task.

| | Count | Mean | Std. Dev. | Std. Error |
|-----|-------|------|-----------|------------|
| One | 36 | .499 | 1.091 | .182 |
| Two | 36 | .126 | .449 | .075 |

Table D4.23: Descriptive Statistics for Experiment 4 proportional LEG usage over task regardless of condition.

| | Count | Mean | Std. Dev. | Std. Error |
|-----------|-------|-------|-----------|------------|
| One, CMC | 12 | 0.000 | 0.000 | 0.000 |
| One, NDVS | 12 | .922 | 1.475 | .426 |
| One, DVS | 12 | .574 | 1.066 | .308 |
| Two, CMC | 12 | .179 | .621 | .179 |
| Two, NDVS | 12 | .121 | .418 | .121 |
| Two, DVS | 12 | .079 | .272 | .079 |

Table D4.24: Descriptive Statistics for proportional Experiment 4 LEG usage dependent upon condition and task.

Type III Sums of Squares

| Source | df | Sum of Squares | Mean Square | F-Value | P-Value | G-G | H-F |
|---------------------|----|----------------|-------------|---------|---------|-------|-------|
| Condition | 2 | 122.236 | 61.118 | .479 | .6239 | | |
| Subject(Group) | 33 | 4214.557 | 127.714 | | | | |
| Task | 1 | 95.903 | 95.903 | 2.655 | .1128 | .1128 | .1128 |
| Task * Condition | 2 | 419.580 | 209.790 | 5.807 | .0069 | .0069 | .0069 |
| Task * Subject(G... | 33 | 1192.164 | 36.126 | | | | |

Dependent: Prop MAT

Table D4.25 Analysis of the proportional Experiment 4 MAT use by condition (DVS, NDVS, CMC) over two tasks.

| | Count | Mean | Std. Dev. | Std. Error |
|------|-------|--------|-----------|------------|
| CMC | 24 | 17.690 | 9.299 | 1.898 |
| NDVS | 24 | 15.104 | 7.795 | 1.591 |
| DVS | 24 | 14.777 | 10.500 | 2.143 |

Table D4.26: Descriptive Statistics for proportional Experiment 4 MAT usage of groups regardless of task.

| | Count | Mean | Std. Dev. | Std. Error |
|-----|-------|--------|-----------|------------|
| One | 36 | 17.011 | 9.777 | 1.630 |
| Two | 36 | 14.703 | 8.624 | 1.437 |

Table D4.27: Descriptive Statistics for proportional Experiment 4 MAT usage over task regardless of condition.

| | Count | Mean | Std. Dev. | Std. Error |
|-----------|-------|--------|-----------|------------|
| One, CMC | 12 | 16.035 | 8.474 | 2.446 |
| One, NDVS | 12 | 15.982 | 7.906 | 2.282 |
| One, DVS | 12 | 19.016 | 12.777 | 3.688 |
| Two, CMC | 12 | 19.345 | 10.150 | 2.930 |
| Two, NDVS | 12 | 14.226 | 7.929 | 2.289 |
| Two, DVS | 12 | 10.538 | 5.297 | 1.529 |

Table D4.28: Descriptive Statistics for proportional Experiment 4 MAT usage dependent upon condition and task.

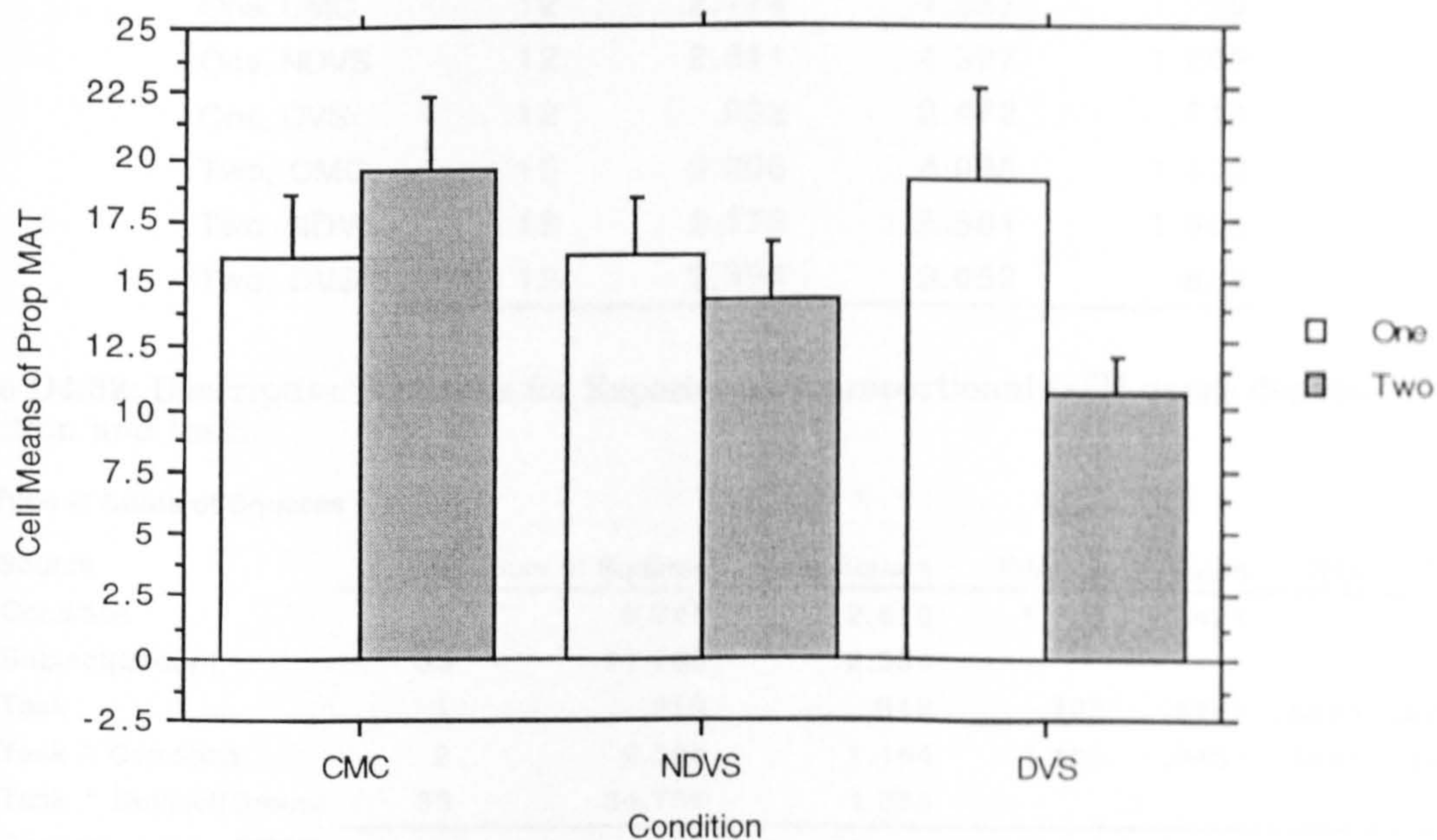


Figure D4.2: The interaction of condition and task upon proportional Experiment 4 MAT usage.

Type III Sums of Squares

| Source | df | Sum of Squares | Mean Square | F-Value | P-Value | G-G | H-F |
|-----------------------|----|----------------|-------------|---------|---------|-------|-------|
| Condition | 2 | 25.379 | 12.690 | .473 | .6271 | | |
| Subject(Group) | 33 | 884.794 | 26.812 | | | | |
| Task | 1 | 17.470 | 17.470 | 1.858 | .1821 | .1821 | .1821 |
| Task * Condition | 2 | 3.247 | 1.623 | .173 | .8422 | .8422 | .8422 |
| Task * Subject(Group) | 33 | 310.323 | 9.404 | | | | |

Dependent: Prop OTH

Table D4.29 Analysis of the proportional Experiment 4 OTH usage by condition (DVS, NDVS, CMC) over two tasks.

| | Count | Mean | Std. Dev. | Std. Error |
|------|-------|-------|-----------|------------|
| CMC | 24 | 2.989 | 4.539 | .926 |
| NDVS | 24 | 2.842 | 4.932 | 1.007 |
| DVS | 24 | 1.663 | 2.817 | .575 |

Table D4.30: Descriptive Statistics for Experiment 4 proportional OTH usage of groups regardless of task.

| | Count | Mean | Std. Dev. | Std. Error |
|-----|-------|-------|-----------|------------|
| One | 36 | 2.006 | 3.784 | .631 |
| Two | 36 | 2.991 | 4.543 | .757 |

Table D4.31: Descriptive Statistics for Experiment 4 proportional OTH usage over task regardless of condition.

| | Count | Mean | Std. Dev. | Std. Error |
|-----------|-------|-------|-----------|------------|
| One, CMC | 12 | 2.774 | 4.257 | 1.229 |
| One, NDVS | 12 | 2.311 | 4.397 | 1.269 |
| One, DVS | 12 | .932 | 2.472 | .714 |
| Two, CMC | 12 | 3.205 | 4.985 | 1.439 |
| Two, NDVS | 12 | 3.373 | 5.561 | 1.605 |
| Two, DVS | 12 | 2.394 | 3.052 | .881 |

Table D4.32: Descriptive Statistics for Experiment 4 proportional OTH usage dependent upon condition and task.

Type III Sums of Squares

| Source | df | Sum of Squares | Mean Square | F-Value | P-Value | G-G | H-F |
|-----------------------|----|----------------|-------------|---------|---------|-------|-------|
| Condition | 2 | 5.221 | 2.610 | 1.108 | .3421 | | |
| Subject(Group) | 33 | 77.736 | 2.356 | | | | |
| Task | 1 | .318 | .318 | .302 | .5865 | .5865 | .5865 |
| Task * Condition | 2 | 2.328 | 1.164 | 1.105 | .3431 | .3431 | .3431 |
| Task * Subject(Group) | 33 | 34.755 | 1.053 | | | | |

Dependent: Prop PROC

Table D4.33 Analysis of the Experiment 4 proportional PROC usage by condition (DVS, NDVS, CMC) over two tasks

| | Count | Mean | Std. Dev. | Std. Error |
|------|-------|------|-----------|------------|
| CMC | 24 | .272 | .644 | .131 |
| NDVS | 24 | .222 | .677 | .138 |
| DVS | 24 | .817 | 2.033 | .415 |

Table D4.34: Descriptive Statistics for proportional PROC usage of groups regardless of task.

| | Count | Mean | Std. Dev. | Std. Error |
|-----|-------|------|-----------|------------|
| One | 36 | .370 | 1.015 | .169 |
| Two | 36 | .503 | 1.549 | .258 |

Table D4.35 Descriptive Statistics for Experiment 4 proportional PROC usage over task regardless of condition.

| | Count | Mean | Std. Dev. | Std. Error |
|-----------|-------|-------|-----------|------------|
| One, CMC | 12 | .455 | .835 | .241 |
| One, NDVS | 12 | .075 | .260 | .075 |
| One, DVS | 12 | .581 | 1.536 | .443 |
| Two, CMC | 12 | .090 | .310 | .090 |
| Two, NDVS | 12 | .368 | .919 | .265 |
| Two, DVS | 12 | 1.052 | 2.482 | .717 |

Table D4.36: Descriptive Statistics for Experiment 4 proportional PROC usage dependent upon condition and task.

Type III Sums of Squares

| Source | df | Sum of Squares | Mean Square | F-Value | P-Value | G-G | H-F |
|-----------------------|----|----------------|-------------|---------|---------|-------|-------|
| Condition | 2 | 42.498 | 21.249 | 1.294 | .2878 | | |
| Subject(Group) | 33 | 541.958 | 16.423 | | | | |
| Task | 1 | 16.749 | 16.749 | 1.584 | .2170 | .2170 | .2170 |
| Task * Condition | 2 | 42.221 | 21.110 | 1.997 | .1518 | .1518 | .1518 |
| Task * Subject(Group) | 33 | 348.843 | 10.571 | | | | |

Dependent: Prop PRESS

Table D4.37: Descriptive Statistics for Experiment 4 proportional PRESS usage of groups regardless of task.

| | Count | Mean | Std. Dev. | Std. Error |
|------|-------|-------|-----------|------------|
| CMC | 24 | 4.342 | 5.134 | 1.048 |
| NDVS | 24 | 4.051 | 3.336 | .681 |
| DVS | 24 | 2.587 | 1.949 | .398 |

Table D4.38: Descriptive Statistics for Experiment 4 proportional PRESS usage over task regardless of condition.

| | Count | Mean | Std. Dev. | Std. Error |
|-----|-------|-------|-----------|------------|
| One | 36 | 4.142 | 4.729 | .788 |
| Two | 36 | 3.178 | 2.347 | .391 |

Table D4.39: Descriptive Statistics for Experiment 4 proportional PRESS usage dependent upon condition and task.

| | Count | Mean | Std. Dev. | Std. Error |
|-----------|-------|-------|-----------|------------|
| One, CMC | 12 | 5.781 | 6.725 | 1.941 |
| One, NDVS | 12 | 4.495 | 3.937 | 1.137 |
| One, DVS | 12 | 2.151 | 1.739 | .502 |
| Two, CMC | 12 | 2.903 | 2.318 | .669 |
| Two, NDVS | 12 | 3.608 | 2.710 | .782 |
| Two, DVS | 12 | 3.022 | 2.123 | .613 |

Table D4.40 Analysis of the Experiment 4 proportional usage of PRESS by condition (DVS, NDVS, CMC) over two tasks.

Appendix E - Other Statistical Analysis

Appendix E1 Experiment 1

E1.1 Analysis of Decision Outcome

| Source | DF | SS | MS | F | p |
|-----------------------|-----|--------|-------|---------|-------|
| Mode of Communication | 1 | .000 | .000 | -.542 | 1.000 |
| Error | 18 | .000 | .000 | | |
| Role | 3 | .000 | .000 | .000 | 1.000 |
| Mode*Role | 3 | .000 | .000 | -34.857 | 1 |
| Error | 54 | .000 | .000 | | |
| Decision | 2 | 8.294 | 4.147 | 1.901 | .1642 |
| Mode*Decision | 2 | 1.406 | .703 | .322 | .7266 |
| Error | 36 | 78.550 | 2.182 | | |
| Role*Decision | 6 | 8.006 | 1.334 | 2.696 | .0177 |
| Mode*Role*Decision | 6 | 6.294 | 1.049 | 2.120 | .0568 |
| Error | 108 | 53.450 | .495 | | |

Table E1.1: The effects of the Communication Mode (between), role of participant (within) and decision option (within) upon the participants ranking of the three options for Experiment 1
NOTE: Some violation of assumptions of test, however, the test is robust and the conclusions drawn are only used as a guide.

Appendix E2 Experiment 2

Type III Sums of Squares

| Source | df | Sum of Squares | Mean Square | F-Value | P-Value | G-G | H-F |
|----------------------|----|----------------|-------------|---------|---------|-------|-------|
| Condition | 2 | 12.033 | 6.017 | 2.497 | .1011 | | |
| Subject(Group) | 27 | 65.050 | 2.409 | | | | |
| Role | 1 | 7.350 | 7.350 | 4.291 | .0480 | .0480 | .0480 |
| Role * Condition | 2 | 1.900 | .950 | .555 | .5807 | .5807 | .5807 |
| Role * Subject(Gr... | 27 | 46.250 | 1.713 | | | | |

Dependent: Satis

Table E2.1 Experiment 2 Participant Levels of Satisfaction with Decision Outcome.

Type III Sums of Squares

| Source | df | Sum of Squares | Mean Square | F-Value | P-Value | G-G | H-F |
|----------------------|----|----------------|-------------|------------|---------|--------|--------|
| Condition | 2 | .033 | .017 | .046 | .9547 | | |
| Subject(Group) | 27 | 9.700 | .359 | | | | |
| Role | 1 | -1.388E-17 | -1.388E-17 | -1.941E-17 | 1.0000 | 1.0000 | 1.0000 |
| Role * Condition | 2 | 6.700 | 3.350 | 4.687 | .0179 | .0179 | .0179 |
| Role * Subject(Gr... | 27 | 19.300 | .715 | | | | |

Dependent: Infl

Table E2.2: Within Subjects ANOVA for Experiment 2 Influence.

Type III Sums of Squares

| Source | df | Sum of Squares | Mean Square | F-Value | P-Value | G-G | H-F |
|----------------------|----|----------------|-------------|---------|---------|-------|-------|
| Condition | 1 | .067 | .067 | .083 | .7774 | | |
| Subject(Group) | 13 | 10.400 | .800 | | | | |
| Role | 1 | 1.067 | 1.067 | .950 | .3476 | .3476 | .3476 |
| Role * Condition | 1 | .267 | .267 | .237 | .6342 | .6342 | .6342 |
| Role * Subject(Gr... | 13 | 14.600 | 1.123 | | | | |

Dependent: Ease of Communicating

Table E2.3: Ease of Communicating in FTF and CMC groups in Experiment 2.

Type III Sums of Squares

| Source | df | Sum of Squares | Mean Square | F-Value | P-Value | G-G | H-F |
|----------------------|----|----------------|-------------|---------|---------|-------|-------|
| Condition | 2 | 11.700 | 5.850 | 3.553 | .0427 | | |
| Subject(Group) | 27 | 44.450 | 1.646 | | | | |
| Role | 1 | .417 | .417 | .309 | .5831 | .5831 | .5831 |
| Role * Condition | 2 | .633 | .317 | .235 | .7925 | .7925 | .7925 |
| Role * Subject(Gr... | 27 | 36.450 | 1.350 | | | | |

Dependent: Votes Ob

Table E2.4: Within Subjects ANOVA for Obstructiveness of Votes in Experiment 2.

| Vs. | | Diff. | Crit. diff. | S |
|------|-----|-------|-------------|---|
| NDCS | CMC | .300 | 1.007 | |
| | DCS | 1.050 | 1.007 | |
| CMC | DCS | .750 | 1.007 | |

S = Significantly different at this level.

Table E2.6: Tukey HSD for Obstructiveness of Votes in Experiment 2 .

Type III Sums of Squares

| Source | df | Sum of Squares | Mean Square | F-Value | P-Value | G-G | H-F |
|----------------------|----|----------------|-------------|---------|---------|-------|-------|
| Condition | 1 | 14.400 | 14.400 | 9.708 | .0060 | | |
| Subject(Group) | 18 | 26.700 | 1.483 | | | | |
| Role | 1 | 3.600 | 3.600 | 2.541 | .1283 | .1283 | .1283 |
| Role * Condition | 1 | .900 | .900 | .635 | .4358 | .4358 | .4358 |
| Role * Subject(Gr... | 18 | 25.500 | 1.417 | | | | |

Dependent: Fb Obstruction

Table E2.7: Obstruction Levels of Support System Feedback in Experiment 2.

Appendix E3 Experiment 3

Type III Sums of Squares

| Source | df | Sum of Squares | Mean Square | F-Value | P-Value |
|-----------|----|----------------|-------------|---------|---------|
| Condition | 3 | 4938.875 | 1646.292 | 4.325 | .0105 |
| Residual | 36 | 13702.500 | 380.625 | | |

Dependent: Duration

Table E3.1: One-Way ANOVA examining the task duration under each of the four conditions in Experiment 3.

Tukey-Kramer
Effect: Condition
Dependent: Duration
Significance level: .05

| | Vs. | Diff. | Crit. diff. | |
|------|------|--------|-------------|---|
| FTF | DCS | 24.800 | 23.505 | S |
| | NDCS | 25.900 | 23.505 | S |
| | CMC | 26.200 | 23.505 | S |
| DCS | NDCS | 1.100 | 23.505 | |
| | CMC | 1.400 | 23.505 | |
| NDCS | CMC | .300 | 23.505 | |

S = Significantly different at this level.

Table E3.2: Tukey HSD follow-up analysis with Alpha at 5% for One-Way ANOVA examining the task duration under each of the four conditions in Experiment 3.

Total Level of Communication in Unsupported groups from Experiments 2 and 3

| | CMC Expt 2 | CMC Expt 3 |
|------------------------------|------------|-------------|
| Mean | 116.8 | 82.3 |
| Variance | 3147.7 | 910.6777778 |
| Observations | 5 | 10 |
| Hypothesised Mean Difference | 0 | |
| df | 5 | |
| t Stat | 1.29 | |
| P(T<=t) one-tail | 0.13 | |
| t Critical one-tail | 2.02 | |
| P(T<=t) two-tail | 0.26 | |
| t Critical two-tail | 2.57 | |

Table E3.3: Student t-test (assuming unequal variances) comparing total communication levels in unsupported CMC conditions from Experiment Two and Three.

Satisfaction with Outcome

Type III Sums of Squares

| Source | df | Sum of Squares | Mean Square | F-Value | P-Value | G-G | H-F |
|----------------------|----|----------------|-------------|---------|---------|-------|-------|
| Condition | 1 | .817 | .817 | .881 | .3650 | | |
| Subject(Group) | 13 | 12.050 | .927 | | | | |
| Role | 1 | .817 | .817 | .911 | .3572 | .3572 | .3572 |
| Role * Condition | 1 | 4.817 | 4.817 | 5.375 | .0374 | .0374 | .0374 |
| Role * Subject(Gr... | 13 | 11.650 | .896 | | | | |

Dependent: Satisfaction

Table E3.4: Repeated Measures ANOVA for Experiment 3 Satisfaction ratings.

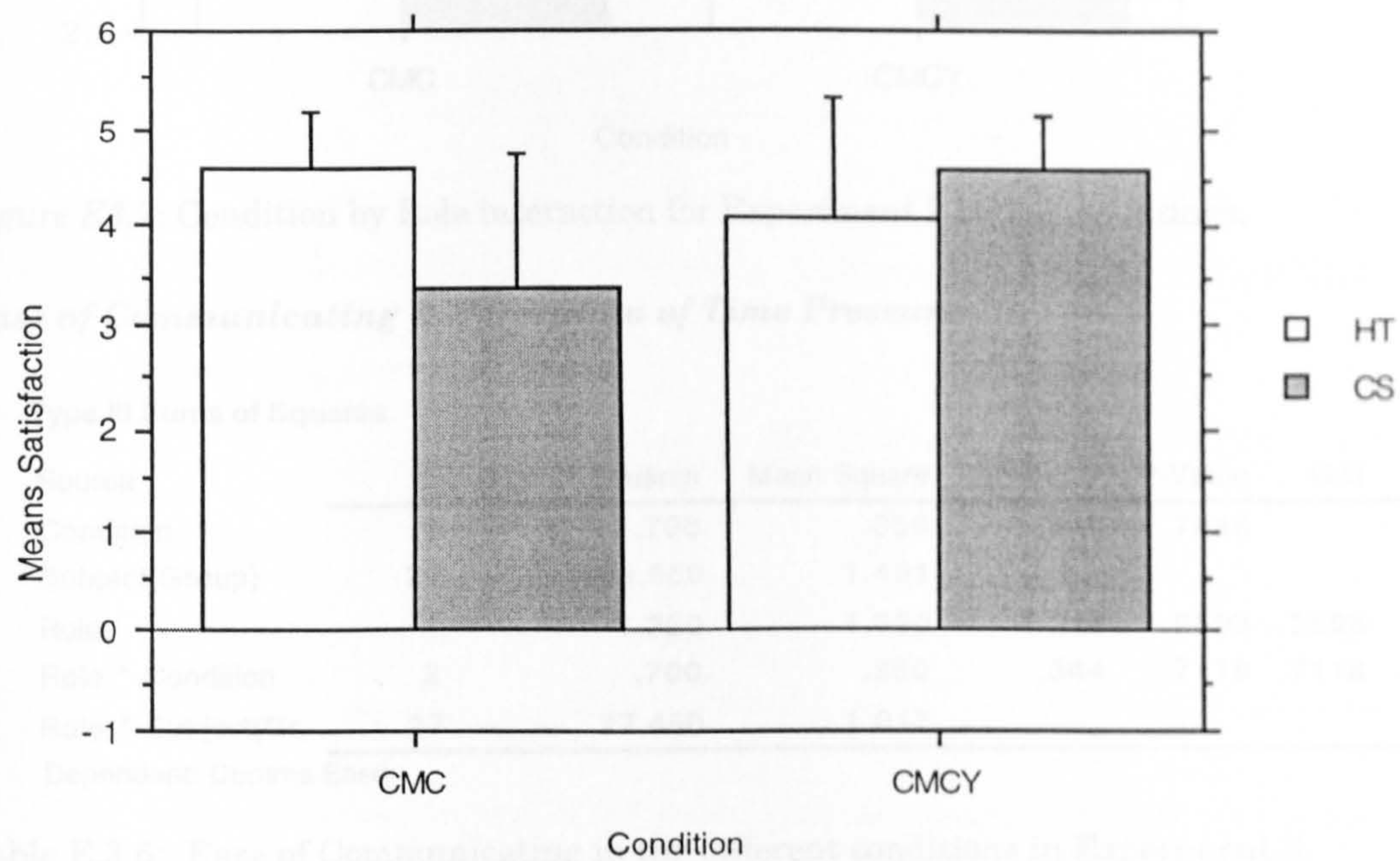


Figure E3.1: Condition by Role Interaction for Experiment 3 Satisfaction with decision outcome ratings.

Participant Influence

Type III Sums of Squares

| Source | df | Sum of Squares | Mean Square | F-Value | P-Value | G-G | H-F |
|----------------------|----|----------------|-------------|---------|---------|-------|-------|
| Condition | 1 | .417 | .417 | 1.776 | .2055 | | |
| Subject(Group) | 13 | 3.050 | .235 | | | | |
| Role | 1 | .017 | .017 | .082 | .7794 | .7794 | .7794 |
| Role * Condition | 1 | .817 | .817 | 4.006 | .0667 | .0667 | .0667 |
| Role * Subject(Gr... | 13 | 2.650 | .204 | | | | |

Dependent: Influence

Table E3.5: Analysis of Influence of Roles in Experiment 3.

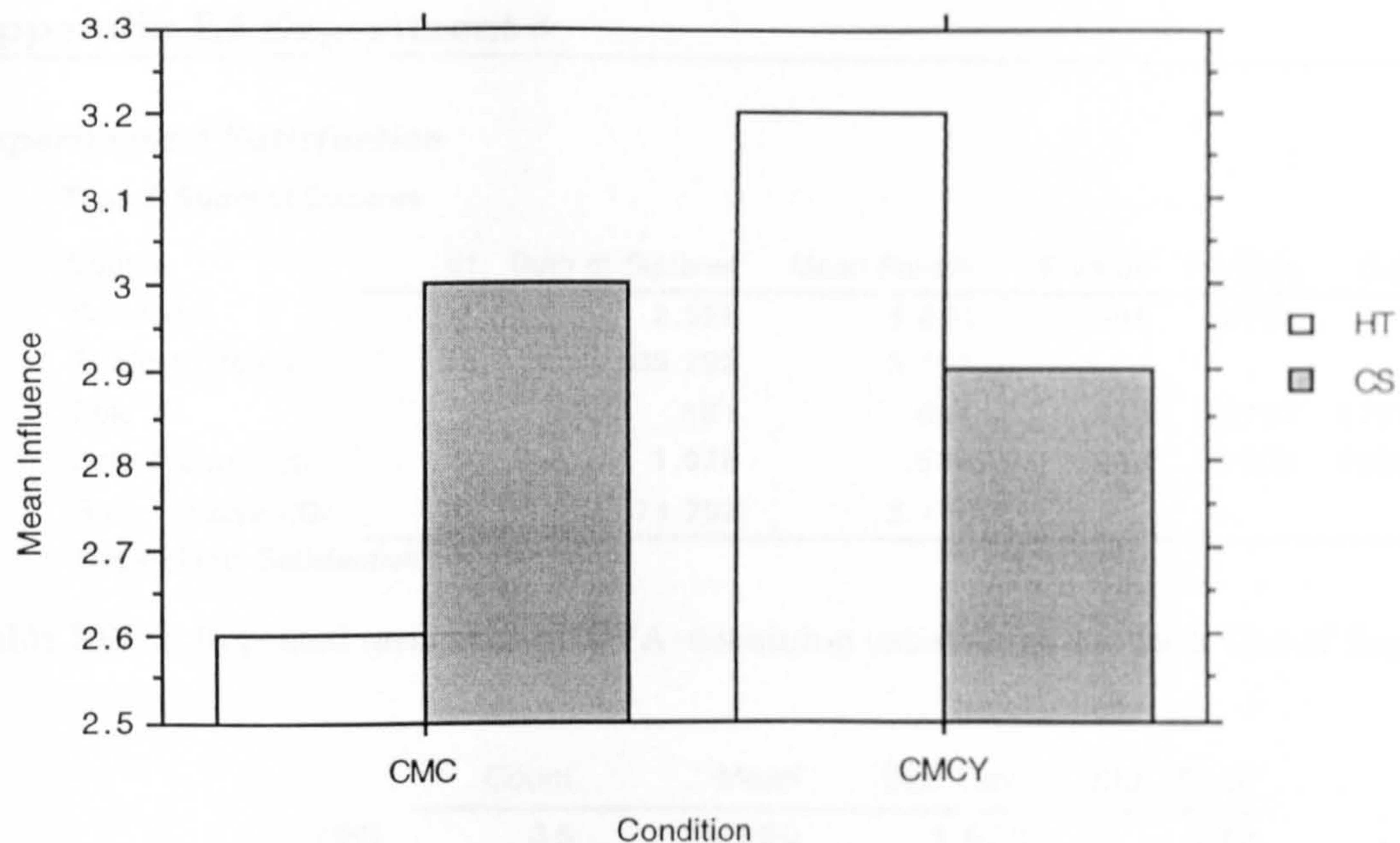


Figure E3.2: Condition by Role interaction for Experiment 3 Influence ratings.

Ease of Communicating & Perception of Time Pressure

Type III Sums of Squares

| Source | df | Sum of Squares | Mean Square | F-Value | P-Value | G-G | H-F |
|----------------------|----|----------------|-------------|---------|---------|-------|-------|
| Condition | 2 | .700 | .350 | .245 | .7848 | | |
| Subject(Group) | 27 | 38.650 | 1.431 | | | | |
| Role | 1 | 1.350 | 1.350 | 1.328 | .2593 | .2593 | .2593 |
| Role * Condition | 2 | .700 | .350 | .344 | .7118 | .7118 | .7118 |
| Role * Subject(Gr... | 27 | 27.450 | 1.017 | | | | |

Dependent: Comms Ease

Table E.3.6: Ease of Communicating in the different conditions in Experiment 3.

Type III Sums of Squares

| Source | df | Sum of Squares | Mean Square | F-Value | P-Value | G-G | H-F |
|----------------------|----|----------------|-------------|---------|---------|-------|-------|
| Condition | 2 | .486 | .243 | .210 | .8120 | | |
| Subject(Group) | 26 | 30.100 | 1.158 | | | | |
| Role | 1 | .579 | .579 | .813 | .3755 | .3755 | .3755 |
| Role * Condition | 2 | 1.879 | .940 | 1.321 | .2843 | .2843 | .2843 |
| Role * Subject(Gr... | 26 | 18.500 | .712 | | | | |

Dependent: Time

Table E3.7: Participant perceptions of time pressure in Experiment 3.

| | Count | Mean | Std. Dev. | Std. Error |
|------|-------|-------|-----------|------------|
| CMC | 20 | 2.650 | .671 | .150 |
| DCS | 18 | 2.667 | 1.029 | .243 |
| NDCS | 20 | 2.850 | 1.137 | .254 |

Table E3.8: Condition means table for Time Available (one panel excluded due to no-response being given by one panel member) in Experiment 3.

| | Count | Mean | Std. Dev. | Std. Error |
|-----|-------|-------|-----------|------------|
| LHA | 29 | 2.828 | 1.104 | .205 |
| DSS | 29 | 2.621 | .775 | .144 |

Table E3.9 Role means table for Time Available (one panel excluded due to no-response being given by one panel member) in Experiment 3.

Appendix E4 Experiment 4

Experiment 4 Satisfaction

Type III Sums of Squares

| Source | df | Sum of Squares | Mean Square | F-Value | P-Value | G-G | H-F |
|----------------------|----|----------------|-------------|---------|---------|-------|-------|
| Condition | 2 | 2.528 | 1.264 | .396 | .6761 | | |
| Subject(Group) | 33 | 105.292 | 3.191 | | | | |
| Role | 1 | .681 | .681 | .313 | .5797 | .5797 | .5797 |
| Role * Condition | 2 | 1.028 | .514 | .236 | .7909 | .7909 | .7909 |
| Role * Subject(Gr... | 33 | 71.792 | 2.176 | | | | |

Dependent: Satisfaction

Table EE4.1: Repeated measures ANOVA examining satisfaction for Task One of Experiment 4.

| | Count | Mean | Std. Dev. | Std. Error |
|-----|-------|-------|-----------|------------|
| DSS | 36 | 3.500 | 1.630 | .272 |
| LHA | 36 | 3.694 | 1.582 | .264 |

Table EE4.2: Descriptive statistics of satisfaction ratings of each role for Task One of Experiment 4.

Type III Sums of Squares

| Source | df | Sum of Squares | Mean Square | F-Value | P-Value | G-G | H-F |
|----------------------|----|----------------|-------------|---------|---------|-------|-------|
| Condition | 2 | .861 | .431 | .140 | .8700 | | |
| Subject(Group) | 33 | 101.583 | 3.078 | | | | |
| Role | 1 | 1.389 | 1.389 | .894 | .3512 | .3512 | .3512 |
| Role * Condition | 2 | 5.361 | 2.681 | 1.726 | .1937 | .1937 | .1937 |
| Role * Subject(Gr... | 33 | 51.250 | 1.553 | | | | |

Dependent: Satisfaction

Table EE4.3: Repeated measures ANOVA examining satisfaction for Task Two of Experiment 4.

| | Count | Mean | Std. Dev. | Std. Error |
|-----|-------|-------|-----------|------------|
| DSS | 36 | 3.861 | 1.457 | .243 |
| LHA | 36 | 3.583 | 1.556 | .259 |

Table EE4.4: Descriptive statistics of satisfaction ratings of each role for Task Two of Experiment 4.

Experiment 4 Influence

Type III Sums of Squares

| Source | df | Sum of Squares | Mean Square | F-Value | P-Value | G-G | H-F |
|----------------------|----|----------------|-------------|---------|---------|-------|-------|
| Condition | 2 | .755 | .378 | .965 | .3919 | | |
| Subject(Group) | 32 | 12.530 | .392 | | | | |
| Role | 1 | .045 | .045 | .071 | .7919 | .7919 | .7919 |
| Role * Condition | 2 | .791 | .396 | .628 | .5399 | .5399 | .5399 |
| Role * Subject(Gr... | 32 | 20.152 | .630 | | | | |

Dependent: Influence

Table E4.5: Repeated measures ANOVA examining influence for Task One of Experiment 4.

| | Count | Mean | Std. Dev. | Std. Error |
|------|-------|-------|-----------|------------|
| CMC | 24 | 2.583 | .717 | .146 |
| VCS | 22 | 2.727 | .827 | .176 |
| NVCS | 24 | 2.833 | .565 | .115 |

Table E4.6: Descriptive statistics of influence ratings of each condition for Task One of Experiment 4.

| | Count | Mean | Std. Dev. | Std. Error |
|-----|-------|-------|-----------|------------|
| DSS | 35 | 2.743 | .780 | .132 |
| LHA | 35 | 2.686 | .631 | .107 |

Table E4.7: Descriptive statistics of influence ratings of each role for Task One of Experiment 4.

Type III Sums of Squares

| Source | df | Sum of Squares | Mean Square | F-Value | P-Value | G-G | H-F |
|----------------------|----|----------------|-------------|---------|---------|-------|-------|
| Condition | 2 | 2.083 | 1.042 | .853 | .4353 | | |
| Subject(Group) | 33 | 40.292 | 1.221 | | | | |
| Role | 1 | 5.014 | 5.014 | 9.569 | .0040 | .0040 | .0040 |
| Role * Condition | 2 | 2.194 | 1.097 | 2.094 | .1393 | .1393 | .1393 |
| Role * Subject(Gr... | 33 | 17.292 | .524 | | | | |

Dependent: Influence

Table E4.8: Repeated measures ANOVA examining influence for Task Two of Experiment 4.

| | Count | Mean | Std. Dev. | Std. Error |
|------|-------|-------|-----------|------------|
| CMC | 24 | 2.833 | .761 | .155 |
| VCS | 24 | 2.417 | 1.176 | .240 |
| NVCS | 24 | 2.625 | .924 | .189 |

Table E4.9: Descriptive statistics of influence ratings of each condition for Task Two of Experiment 4.

| | Count | Mean | Std. Dev. | Std. Error |
|-----|-------|-------|-----------|------------|
| DSS | 36 | 2.889 | .919 | .153 |
| LHA | 36 | 2.361 | .961 | .160 |

Table E4.10: Descriptive statistics of influence ratings of each role for Task Two of Experiment 4.

Ease of Communicating

Type III Sums of Squares

| Source | df | Sum of Squares | Mean Square | F-Value | P-Value | G-G | H-F |
|----------------------|----|----------------|-------------|---------|---------|-------|-------|
| Condition | 2 | 1.694 | .847 | .861 | .4319 | | |
| Subject(Group) | 33 | 32.458 | .984 | | | | |
| Role | 1 | .014 | .014 | .011 | .9162 | .9162 | .9162 |
| Role * Condition | 2 | 4.694 | 2.347 | 1.899 | .1657 | .1657 | .1657 |
| Role * Subject(Gr... | 33 | 40.792 | 1.236 | | | | |

Dependent: Ease of Comms

Table E4.11: Repeated measures ANOVA examining Ease of Communicating for Task One of Experiment 4.

| | Count | Mean | Std. Dev. | Std. Error |
|------|-------|-------|-----------|------------|
| CMC | 24 | 3.375 | .970 | .198 |
| VCS | 24 | 3.583 | 1.176 | .240 |
| NVCS | 24 | 3.750 | 1.032 | .211 |

Table E4.12: Descriptive statistics of Ease of Communicating ratings of each condition for Task One of Experiment 4.

| | Count | Mean | Std. Dev. | Std. Error |
|-----|-------|-------|-----------|------------|
| DSS | 36 | 3.583 | 1.105 | .184 |
| LHA | 36 | 3.556 | 1.027 | .171 |

Table E4.13: Descriptive statistics of Ease of Communicating ratings of each role for Task One of Experiment 4.

Type III Sums of Squares

| Source | df | Sum of Squares | Mean Square | F-Value | P-Value | G-G | H-F |
|----------------------|----|----------------|-------------|---------|---------|-------|-------|
| Condition | 2 | 2.111 | 1.056 | .452 | .6402 | | |
| Subject(Group) | 33 | 77.042 | 2.335 | | | | |
| Role | 1 | .014 | .014 | .021 | .8862 | .8862 | .8862 |
| Role * Condition | 2 | 1.444 | .722 | 1.081 | .3509 | .3509 | .3509 |
| Role * Subject(Gr... | 33 | 22.042 | .668 | | | | |

Dependent: Ease of Comms

Table E4.14: Repeated measures ANOVA examining Ease of Communicating for Task Two of Experiment 4.

| | Count | Mean | Std. Dev. | Std. Error |
|------|-------|-------|-----------|------------|
| CMC | 24 | 4.125 | 1.076 | .220 |
| VCS | 24 | 3.708 | 1.574 | .321 |
| NVCS | 24 | 3.958 | .859 | .175 |

Table E4.15: Descriptive statistics of Ease of Communicating ratings of each condition for Task Two of Experiment 4.

| | Count | Mean | Std. Dev. | Std. Error |
|-----|-------|-------|-----------|------------|
| DSS | 36 | 3.944 | 1.120 | .187 |
| LHA | 36 | 3.917 | 1.296 | .216 |

Table E4.16: Descriptive statistics of Ease of Communicating ratings of each role for Task Two of Experiment 4.

Perceptions of Time

Type III Sums of Squares

| Source | df | Sum of Squares | Mean Square | F-Value | P-Value | G-G | H-F |
|----------------------|----|----------------|-------------|---------|---------|-------|-------|
| Condition | 2 | 1.028 | .514 | .486 | .6196 | | |
| Subject(Group) | 33 | 34.917 | 1.058 | | | | |
| Role | 1 | .056 | .056 | .116 | .7351 | .7351 | .7351 |
| Role * Condition | 2 | .194 | .097 | .204 | .8167 | .8167 | .8167 |
| Role * Subject(Gr... | 33 | 15.750 | .477 | | | | |

Dependent: Time Limit

Table E4.17: Repeated measures ANOVA examining Perception Of Time Allowed for Task One of Experiment 4.

| | Count | Mean | Std. Dev. | Std. Error |
|------|-------|-------|-----------|------------|
| CMC | 24 | 2.667 | .868 | .177 |
| VCS | 24 | 2.375 | .924 | .189 |
| NVCS | 24 | 2.542 | .779 | .159 |

Table E4.18: Descriptive statistics of Perception Of Time Allowed ratings of each condition for Task Two of Experiment 4.

| | Count | Mean | Std. Dev. | Std. Error |
|-----|-------|-------|-----------|------------|
| DSS | 36 | 2.556 | .909 | .151 |
| LHA | 36 | 2.500 | .811 | .135 |

Table E4.19: Descriptive statistics of Perception Of Time Allowed of each role for Task Two of Experiment 4.

Type III Sums of Squares

| Source | df | Sum of Squares | Mean Square | F-Value | P-Value | G-G | H-F |
|----------------------|----|----------------|-------------|---------|---------|--------|--------|
| Condition | 2 | 4.750 | 2.375 | 1.445 | .2503 | | |
| Subject(Group) | 33 | 54.250 | 1.644 | | | | |
| Role | 1 | 0.000 | 0.000 | 0.000 | 1.0000 | 1.0000 | 1.0000 |
| Role * Condition | 2 | 1.583 | .792 | 1.345 | .2743 | .2743 | .2743 |
| Role * Subject(Gr... | 33 | 19.417 | .588 | | | | |

Dependent: Time Limit

Table E4.20: Repeated measures ANOVA examining Perception Of Time Allowed for Task Two of Experiment 4.

| | Count | Mean | Std. Dev. | Std. Error |
|------|-------|-------|-----------|------------|
| CMC | 24 | 3.042 | .999 | .204 |
| VCS | 24 | 2.667 | 1.239 | .253 |
| NVCS | 24 | 3.292 | .859 | .175 |

Table E4.21: Descriptive statistics of Perception Of Time Allowed ratings of each condition for Task Two of Experiment 4.

| | Count | Mean | Std. Dev. | Std. Error |
|-----|-------|-------|-----------|------------|
| DSS | 36 | 3.000 | 1.014 | .169 |
| LHA | 36 | 3.000 | 1.121 | .187 |

Table E4.22: Descriptive statistics of Perception Of Time Allowed of each role for Task Two of Experiment 4.

Obstruction of Voting Panels

Type III Sums of Squares

| Source | df | Sum of Squares | Mean Square | F-Value | P-Value | G-G | H-F |
|----------------------|----|----------------|-------------|---------|---------|-------|-------|
| Condition | 2 | .361 | .181 | .098 | .9066 | | |
| Subject(Group) | 33 | 60.583 | 1.836 | | | | |
| Role | 1 | .222 | .222 | .116 | .7353 | .7353 | .7353 |
| Role * Condition | 2 | 9.694 | 4.847 | 2.536 | .0945 | .0945 | .0945 |
| Role * Subject(Gr... | 33 | 63.083 | 1.912 | | | | |

Dependent: Votes Obstruction

Table E4.23: Repeated measures ANOVA examining Perception Of Obstruction caused by votes for Task One of Experiment 4.

| | Count | Mean | Std. Dev. | Std. Error |
|-----|-------|-------|-----------|------------|
| DSS | 36 | 2.917 | 1.317 | .220 |
| LHA | 36 | 3.028 | 1.444 | .241 |

Table E4.24 Descriptive statistics of Perception Of Obstruction caused by voting each role for Task One of Experiment 4.

Type III Sums of Squares

| Source | df | Sum of Squares | Mean Square | F-Value | P-Value | G-G | H-F |
|----------------------|----|----------------|-------------|---------|---------|-------|-------|
| Condition | 2 | 2.694 | 1.347 | .640 | .5335 | | |
| Subject(Group) | 33 | 69.417 | 2.104 | | | | |
| Role | 1 | .222 | .222 | .110 | .7418 | .7418 | .7418 |
| Role * Condition | 2 | .361 | .181 | .090 | .9144 | .9144 | .9144 |
| Role * Subject(Gr... | 33 | 66.417 | 2.013 | | | | |

Dependent: Votes Obstruction

Table E4.25: Repeated measures ANOVA examining Perception Of Obstruction caused by votes for Task Two of Experiment 4.

| | Count | Mean | Std. Dev. | Std. Error |
|------|-------|-------|-----------|------------|
| CMC | 24 | 3.083 | 1.442 | .294 |
| VCS | 24 | 2.625 | 1.439 | .294 |
| NVCS | 24 | 2.958 | 1.334 | .272 |

Table E4.26: Descriptive statistics of Perception Of Obstruction caused by voting each condition for Task Two of Experiment 4.

| | Count | Mean | Std. Dev. | Std. Error |
|-----|-------|-------|-----------|------------|
| DSS | 36 | 2.833 | 1.464 | .244 |
| LHA | 36 | 2.944 | 1.351 | .225 |

Table E4.27: Descriptive statistics of Perception Of Obstruction caused by voting each role for Task Two of Experiment 4.