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The Effects of Ageing, Individual Differences and Limited Resources on Consumer Decision Making

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Abstract

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Jennifer Marie Kerss

This thesis presents six original experiments investigating the relationship between age-related gains and losses in cognitive and emotional abilities and consumer decision making. Novel tasks designed to closely resemble real consumer decisions were used to assess how older and younger adults fare when making everyday decisions.

Experiments 1 and 2 examined the relationship between consumer decision making and measures of fluid intelligence, crystallised intelligence and numeric ability in older and younger adults. The data revealed that numeric ability and fluid intelligence independently predicted consumer decision making in older adults. In Experiment 1, participants made factual and inferential decisions about utility suppliers. Findings were corroborated in Experiment 2 using a larger sample and an additional consumer decision task based on selecting a mobile phone provider. Experiment 2 also revealed numeric ability as an independent predictor of young adult's consumer decision making.

Experiment 3 assessed the interplay between age, cognitive resources and emotion regulation. Cognitive resources were assessed by the number of times older and younger adults decided to stick with a pre-selected option, switch to an alternative option or decide in the future. Results suggested that older and younger adults required differing amounts of resources to regulate emotions in accordance with different emotion regulation strategies. Older adults made better consumer decisions when instructed to regulate their emotions by way of reappraisal and younger participants made better consumer decisions when instructed to regulate their emotions using suppression. These results were contrary to what was expected based on previous research on emotion regulation. Because of this, two exploratory experiments were conducted on young adults in an attempt to identify a reliable methodology for inducing and measuring affects more typically associated with self-regulation. These experiments revealed some surprising findings. Participants exposed to manipulations high in terms of cognitive demand made better subsequent consumer decisions than participants placed in less demanding conditions. It was hypothesised that participants exposed to demanding manipulations were primed to make more adaptive consumer decisions.

A final experiment tested the effect of age and instruction manipulation on consumer decision making. The relationships between cognitive measures of individual differences and decision making were again measured. Results substantiated previous findings revealed in Experiments 1 and 2 insofar that fluid intelligence was found to independently predict consumer decision making performance in older adults. Fluid intelligence and numeric ability predicted consumer decision making in younger adults. In terms of instruction effects, younger and older adults made better decisions when asked to do so in a rational manner compared to an intuitive manner.

It is believed that this work represents some of the first of its kind to study the impact of ageing on cognitive ability and decision making using tasks representative of existing consumer decisions in terms of context and response options. The findings presented provide a valid and unique insight into how cognitive and emotional ability changes with age and the subsequent implications this has when making consumer decisions. This thesis concludes with the theoretical and practical implications for the ageing consumer.

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Author's Declaration

At no time during the registration for the degree of Doctor of Philosophy has the author been registered for any other University award without prior agreement of the Graduate Committee.

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Chapter 1

1.1 Overview of Purposes and Aims

The UK population is ageing and is projected to continue ageing over the next few decades (Office for National Statistics, 2012). The ability to make good decisions for longer is important, particularly when old age is accompanied by major life-transitions such as retirement and poorer health. To date, research investigating how older adults fare when making everyday consumer choices has received little attention. This is surprising given the wealth of evidence suggesting that ageing is associated with declines in many abilities key to good decision making. Work which has been conducted is relatively limited in scope: studies have mostly been unrelated to real consumer decisions and have either concentrated on the impact of ageing on cognitive ability or decision performance.

This thesis attempted to address some of the limitations present in previous research and extend our understanding of the relationship between age and applied decision making. The current work presents a range of novel and unique tasks developed to closely resemble the types of decisions individuals are faced with in the real world, both in terms of decision environment (e.g. selecting a utility company) and structure (i.e. deciding to stick with a pre-selected option). The relationship between decision quality and age-related changes in cognitive variables (e.g. fluid intelligence, crystallised intelligence and numeric ability) in applied settings were assessed. Furthermore, it was observed that the reality of making a decision in a consumer environment often requires individuals to engage in some form of emotion regulation. A unique experiment studied the effects of self-regulation on consumer decision-making in younger and older adults. Taken together it is thought that this body of work represents an original and valid contribution by extending both the practical and theoretical range of previous research on age and decision-making.

1.2 Introduction to Decision Making

A decision can be characterised as a choice between two or more options or alternatives (e.g., choosing a car); these options may also include the decision to stick with the status quo (e.g., do nothing or make no change) (Samuelson and Zeckhauser, 1999). There is still some debate regarding how individuals make decisions. Normative models of decision-making assume that a decision is the product of conscious, deliberative processes. However, other researchers have proposed that some decision-making might be automatic (e.g. Ferreira, Garcie-Marques, Sherman & Sherman, 2006; Stanovich & West, 2000). Traditional models of decision-making are based on the idea that good decisions are made when individuals weigh up the costs and benefits against the probability of a given outcome. For example, Subjective Expected Utility model (SEU) provides a set of rules for combining beliefs (probabilities) and preferences (utilities) in order to make a decision. In other words, the SEU model states that individuals trade off the utility of a certain outcome (positive or negative) against its probability. This theory demonstrates how decisions should be made if people are rational and try to maximise their subjective expected utility (Fishburn, 1991).

Normative models of decision-making such as SEU can be seen as demanding in terms of cognitive resources, and evidence suggests that individuals are often unable to meet these demands to make decisions in this way. For example, Lichtenstein, Slovic and Zink (1969) found that participants ignored expected utility when making decisions even after the experimenters had carefully explained the concept to them. One explanation for this finding is that combining the assumed, and often substantial, quantities of information may simply exceed the individual's computational capacity.

This explanation illustrates a fundamental problem inherent with SEU models; they do not account for individual's limited processing capabilities. In response to this, Simon (1947) developed a model of Bounded Rationality in an attempt to more accurately explain decision-making processes. The model of Bounded Rationality takes into account the cognitive limitations of the decision maker. Instead of assuming that individuals are able to make all the computations assumed in SEU, Bounded Rationality proposes that people make decisions based on simpler mechanisms known as satisficing. Satisficing creates mental 'short cuts' that allow the decision maker to end the search once an alternative that meets or succeeds a specific aspiration level has been found (Earl, 1983) (see also Gigerenzer and the ABC Research Group, 1999).

In terms of the type of decisions an individual can make, people have a number of choice options available to them. This includes the opportunity to stick with a current option, select an alternative, or decide not to make a choice. Dahr (1997) proposed that each of these options varied in terms of the cognitive resources needed to implement it whereby the least demanding strategies can be viewed as either sticking with a pre-selected option or opting not to make a choice.

It is thought that individuals who may be limited in terms of cognitive resources (due to age-related cognitive decline or fatigue) will select less demanding strategies when faced with making a decision (Gigerenzer & Selten, 2002; Mata, Schooler and Rieskamp, 2007).

Many of the deliberative processes needed to make decisions are affected by executive function. For example, research has shown that executive function is involved with cognitive functions such as planning and problem solving (Ward & Allport, 1997), switching from one task to another (Baddeley & Della Sala, 1996), directing mental attention (Baddeley & Della Sala, 1996), resisting interference (Engle & Holiman, 2002), performing novel tasks, response inhibition, strategy generation and application, and flexible action (Denckla, 1996).

A central theme of the current thesis is the assumption that both younger and older adults have limited resources with which to deal with complex decisions. How people make decisions, particularly when age-related cognitive declines place restrictions on available cognitive reserves, is investigated. Traditional models of decision-making propose that cognitive resources are critical for making optimal decisions, therefore it seems reasonable to expect that as individuals age, their decision-making may become worse. In what follows, literature on age differences in consumer decision-making is reviewed. Thereafter, cognitive changes associated with ageing are considered and finally, research linking differences in decision-making ability to age-related cognitive changes is outlined.

1.3 Ageing and Consumer Decision-Making

This thesis examines age differences in consumer decision-making, and specifically how cognitive functions and numeric ability influence quality of choice. Despite variations in context, many consumer decisions place similar demands on the decision maker. For example, consumers are often faced with choices that require them to compare two or more options. Furthermore, Hibbard and Peters (2003) point out that many decisions share similar features such as the use of information that includes technical terms and complex ideas, comparisons of multiple options on several variables, and/or the decision-maker to weight factors according to individual values, preferences and needs. Making a good decision may be further compounded because the information provided to the decision-maker is unfamiliar and the amount of information may exceed his or her processing capacity. This section outlines studies that focus on three processes assumed to be key to decision making; comprehension, strategy selection and information search.

Good comprehension in a decision-making context means that an individual understands the available options and how each option rates on one or more dimensions (Hibbard, Slovic, Peters, & Finucane, 2002; Radvansky, 1999). Comprehension is essential to competent decision-making because information must be understood before it can be used sensibly in a judgement or decision (March & Heath 1994).

Schaie and Willis (1993) found that increasing the complexity of stimuli and questions can lead to decreased understanding amongst older adults. In their study, they assessed older adults' comprehension of prescription drug labels and medication charts by asking participants factual questions (e.g. 'what are the side effects of this medication?') and inferential questions (e.g. 'for how many days will this supply of medication last, if taken according to directions?'). Results showed that fewer errors were made by older adults in the factual questions (3%) compared with the inferential questions (16%). When presented with a slightly more complex stimulus (a 4 x 4 medication chart), comprehension errors increased to 13% for factual questions and 23% for inferential questions.

In another study, Hibbard, et al., (2002) examined young and older adults' comprehension of health insurance plans using two types of multiple choice questions. The first type of question required participants to identify one piece of information from a table (factual questions). The second type of question required participants to identify and combine information from two places in the table (inferential questions). Analysis revealed that both younger and older adults had more difficulty in understanding the information as the problem became more complex. When participants were asked to identify only one piece of information relatively few errors occurred. In contrast, multiple options and inferential questions were more challenging and led to more errors for both younger and older adults, with older adults performing significantly worse in both conditions.

Work by Hanoch, Wood, Barnes, Liu and Rice (2011) provided further evidence that increased choice led to poorer decision making. Hanoch et al., (2011) asked older and younger adults to select a drug plan with the lowest cost from a choice set with either three or nine options. Results indicated that the rate of poor decisions increased as the number of plans was increased and, this trend was even more pronounced for older participants.

Finucane, Mertz, Slovic and Schmidt (2005) argued that personal characteristics and experience should also be taken into account when explaining differences in decision-making. Their experiment presented participants with questions that increased in complexity over three domains: health, finances and nutrition. Individual variables such as physical condition and cognitive abilities were also measured. The researchers found that participants performed significantly better on simple rather than complex tasks and made fewer errors on factual questions vs. inferential questions. They also report that older adults made more comprehension errors as complexity increased across the three domains.

Finucane et al., (2005) proposed that individual differences, such as cognitive ability and social attitudes, may have accounted for variances in older adults' performance. Taken together, these studies (Finucane, et al., 2005; Hanoch, et al., 2011; Hibbard, et al, 2002; Schaie & Willis, 1993) suggest that there are important differences between older and younger adults' capabilities in the comprehension of information in decision making and, that these differences may be affected by individual differences.

Another factor important for good decision-making is the ability to recognise and apply the best strategy for a given task. Adaptive strategy selection assumes that people select a strategy that is successful in a specific situation and can change their strategy use to changing environments (Mata, Schooler, & Rieskamp, 2007). Despite declines in cognitive ability and comprehension (e.g. Schaie, 1994), a growing body of evidence suggests that older adults do not always show deficits in decision-making abilities; instead, it is thought that they may use different strategies in their decision making. Mata, et al., (2007) investigated the impact of (cognitive) ageing on the ability to select decision strategies as a function of different environmental structures. Participants had to select which was the most expensive diamond from a set of 50 pair comparisons. Participants had access to a number of cues including size, overall proportions, colour and clarity of a diamond. Results indicated that older adults tended to look up less information and take longer to process it as well as preferring to use less cognitively demanding strategies. Despite this, Mata et al., (2007) observed that both young and older adults seemed to be equally adaptive at adjusting their information search and selecting a decision strategy.

Alternative explanations for age differences in strategy selection are based on the idea that individuals use simpler strategies in an attempt to avoid conflict when making complicated choices. The literature suggests that the context and complexity of a problem significantly influences decision strategy selection (Payne, 1976; Payne, Bettman & Johnson, 1988; Tversky & Simonson, 1993). With regard to older adults, Baltes et al., (1999) proposed that they use different strategies compared to young adults because deficits in fluid intelligence sets limits on the cognitive effort that can be utilised, therefore constraining the range of possible strategies that can be accessed in a particular situation. For example, information-intensive strategies are likely to be difficult for individuals with memory limitations. However, selecting simpler strategies also affects the decision process in that they tend to require less information (Rieskamp & Otto, 2006). In support of Baltes et al., (1999), Shugan (1980) suggested that the costs of decision making to an individual were associated with his/her processing capability, the complexity of the choice, time pressure and other factors. In line with this thinking, others have argued that older adults may rely more on strategies that require fewer cognitive resources (Gigerenzer, 2003; Hess, Germain, Swaim, & Osowski, 2009; Sanfey & Hastie, 1999).

Recently, Hanoch et al., (2011) provided further evidence in support of this hypothesis. In Hanoch et al's., (2011) study, participants completed a computer-based program that allowed the researchers to observe their information acquisition process while selecting a medical insurance drug plan. Participants were presented randomly with information about either three or nine drug plans. Their task was to select the least expensive drug plan for a hypothetical friend. Participants were required to move a computer mouse to view information hidden beneath labelled boxes. Once the cursor moved from one box to the next, the previous box closed and a new one opened. Results showed that older adults tended to select less beneficial drug prescription plans and that their information search was less effective. When making a choice, older adults were more likely to evaluate the attributes within a particular plan rather than compare multiple plans using a specific factor (e.g. total annual cost). Hanoch et al., (2011) suggest that differences in decision quality may be due to differences in search patterns rather than age.

The finding that older adults tend to seek less information before making a choice has been shown in a number of studies. Johnson (1990) assessed older and younger adult decision-making by presenting participants with a choice of six cars that they could purchase. Before choosing, each participant could acquire comparative information such as fuel economy, riding comfort, maintenance cost, safety record, handling, interior roominess, purchase price, styling and resale value. No one car represented a clear optimum choice. Participants were able to select which information they wanted to view, however they could only view one piece of information at a time. The results showed no differences between age groups for choice of car. However, older adults selected fewer pieces of information than younger adults and that they spent longer viewing the information.

In a further study by Johnson (1993), participants were asked to choose an apartment to rent. Older and younger adults were presented with information about each apartment (the brightness of rooms, closet space and kitchen facilities) and then asked to select the apartment that they felt presented the best choice. Older adults, compared with young ones, spent more time considering less information. These findings were supported by Mata and Nunes (2009) meta-analysis of the impact of pre-decisional information search on decision quality. They found that ageing was significantly associated with a decrease in information search with little affect on the decisions quality. However, the idea that older adults always seek less information is still subject to debate: a recent study by Wood, Hanoch, Barnes, Liu, Cummings and Rice (2011), found that older adults made worse decisions despite a tendency to search more information and spend less time viewing each piece of information.

Further research supporting the notion that older adults seek less information compared to young adults was presented by Rafaely, Dror, and Remington (2006). In their first experiment, they studied the extent to which younger and older adults based their decisions on a single variable: outcome payoff. The results showed that both younger and older participants responded to this information. In a second study, they investigated younger and older adults' use of information under increased task demands by providing information on outcome probability as well as payoff. Results from the second study showed that younger adults responded to both payoff and probability whereas older adults ignored payoff, basing their decisions on probability information alone. Both experiments showed no significant age difference in decision quality and demonstrated older adults to be selective in the information they process.

Other researchers propose that older adults are not always worse at decision-making because they lack the capacity to engage in cognitively demanding strategies. In fact, theories of successful ageing suggest that increases in experience may even lead to better adaptive capacity (Baltes, Staudinger, & Lindenberger, 1999). Blanchard-Fields, Chen and Norris (1997) found that age was a significant predictor of the problem solving strategy employed. Their experiment examined age differences in problem-solving strategies for situations in three domains: consumer, home management and conflict with friends. Results showed that older adults used more efficient, problem-focused strategies compared in each condition to younger adults. Blanchard-Fields et al., (1997) argued that middle-aged and older adults used better strategies when faced with these problems because of accumulated experience.

In summary, comprehension, strategy selection and information search have been established as key to making good decisions. However, research has provided mixed evidence in terms of the relationship between age and decision quality; some findings suggest the ageing has a distinct negative impact on decision making quality (e.g. Finucane et al., 2005; Schaie & Willis, 1993), where older adults were shown to be more susceptible to the effects of framing, be more inconsistent in their choices (Malloy, et al., 1992) and worse at comprehending both simple and complex information (Hibbard, et al., 2002). However, other studies have shown no age differences in decision-making. It is unclear whether older adults are using different search strategies due to increased experience or due to increased limitations in their executive capacity. Understanding how age-related changes in cognitive functions affect comprehension, strategy selection and information search is key to predicting decision-making performance in older adults.

Taken together, the literature presents mixed evidence in terms of a clear age-related decline in decision-making aptitude. It seems that older adults may compensate for increasing limitations in ability however, still tend to make comparatively poor choices. Based on the literature, one possibility for this pattern of data is that it is due to general declines in cognitive functions.

1.4 Ageing, Individual Differences and Decision-Making

Age-related changes in cognitive functions have been shown to have consequences for decision-making. In order to understand how cognitive ability may impact decision-making, the components of intellectual functioning must be considered. The lifespan theory of intellectual development proposed by Baltes (1987) characterised two distinct components central to intellectual functioning: the mechanics and pragmatics of cognition. Baltes (1999) defined the mechanics of cognition as being the biological and genetically predisposed characteristics of the brain while the pragmatics of cognition to be associated with knowledge acquired through culture and experience.

The notion of a two-component model of intellectual development is not a novel idea. Baltes (1987) model can be seen as drawing conceptually from Horn and Cattell's (1967) theory of fluid and crystallized intelligence (*Gf-Gc*). These theories are similar in that they not only propose a two-component aspect to intelligence, but also that age affects fluid (mechanic) and crystallized (pragmatic) abilities differently.

Evidence in support of the Two-Component model is most clearly illustrated by the difference between fluid and crystallised abilities (Schaie, 1994). In one study Horn and Cattell (1967) found age-related declines in fluid intelligence, whilst crystallised test scores remained stable. Cunningham, Clayton and Overton (1975) demonstrated that younger people had significantly higher scores on a test of fluid intelligence (Raven's Standard Progressive Matrices) than older people, while age differences on a crystallised test of vocabulary remained relatively insignificant. Similar results using a battery of fluid and crystallized tests were found by Hayslip and Sterns (1979).

Longitudinal and cross-sectional data from the Seattle Longitudinal Study (SLS) (Schaie, 1994) and the Berlin Ageing Study (BASE) (Lövdén, Ghisletta, & Lindenberger, 2004) provide further support for the Two-Component model. Cross-sectional findings from the SLS show virtually linear negative age differences from young adulthood to old age in fluid abilities such as inductive reasoning, spatial orientation, perceptual speed and verbal memory. In contrast, crystallised abilities continue to improve until middle age (40 years) and then show gradual or no decline until about the age of 70 (Schaie 1994, 1996). Longitudinal findings from the SLS show a similar pattern of results, however the data is more homogeneous and shows lower levels of age-related decline across all abilities. BASE (Lövdén, et al., 2004) provides more evidence of differing age-gradients associated with fluid and crystallised intelligence. Cross-sectional analysis illustrated a pattern of decline during adulthood in fluid capabilities such as perceptual speed and spatial orientation. On the other hand, crystallised skills such as verbal knowledge appeared to be maintained and, only showed weak declines in very old age.

In summary, a range of studies provide evidence in support of a Two-Component model of intelligence whereby ageing affects fluid and crystallised cognitive functions differently.

1.5 Ageing and Fluid Intelligence

It has been shown that ageing is associated with a decline in general fluid intelligence (e.g. Schaie, 1994), where fluid intelligence is viewed as the ability to solve novel problems (Horn & Cattell, 1967). Three essential constructs proposed by Baltes, et al., (1999) in determining the rate of age-related changes in cognitive and intellectual functioning are processing rate (Salthouse, 1996), working memory (Baddeley & Della Sala, 1996) and inhibition (Zacks & Hasher, 1997).

1.5.1 Speed of Processing

The first construct proposed by Baltes, et al., (1999) is processing rate. The most influential theory explaining age-related changes in processing rate is the speed of processing theory (Salthouse, 1996). This accounts for the common notion that as age increases, the speed of cognitive operations slows down. Salthouse's (1996) theory proposed two distinct mechanisms: the limited time mechanism and the simultaneity mechanism. The limited time mechanism assumes that with ageing, relative cognitive operations are executed too slowly to be completed successfully in the available time. In complex tasks where many operations (e.g. retrieval and rehearsal) need to be performed, ability may be influenced by the number of operations an individual can complete in the available time. Older adults therefore may be at a disadvantage because they process information more slowly.

The simultaneity mechanism assumes that slower processing reduces the amount of information simultaneously available for higher level processing (Salthouse, 1996). A number of studies have shown speed of processing to be a good predictor of age-associated variances in performance on memory and reasoning tasks. For example, Salthouse (1994d) demonstrated that increased age was associated with lower accuracy and, longer decision time. In addition, Salthouse demonstrated that the relationship between age and decision accuracy, as well as age and decision time, were affected by a slower rate of cognitive operations. A battery of tasks for measuring cognitive performance was presented to participants. This included standard measures of processing speed such as The Letter Comparison test. This task required that participants inspect pairs of three, six or nine letters and then write an S if the two pairs were the same and a D if they were different. Performance was measured by the number of correct responses produced within 30 seconds. The results of this study are consistent with the view that a slower speed of processing reduces the amount of information simultaneously available which, in turn affects the quality of cognitive performance (see Salthouse, 1996).

1.5.2 Working Memory

Working memory has also been shown to change with age, leading to significant differences in older and younger adult decision-making. Working memory refers to a system or mechanism for temporarily maintaining information needed during the execution of a cognitive task (Baddeley, 1986). Age-related declines in working memory have been found in a variety of tasks including measures of simple span, storage and processing (e.g. Babcock & Salthouse, 1990; Bopp & Verhaeghen, 2005; Kail & Salthouse, 1994).

Span is often used as a basic measure of mental capacity, in particular, immediate mental capacity. Measures of span can be simple or complex. Simple span measures require participants to merely passively store information, often verbal in form. Complex working memory measures impose simultaneous processing and storage demands. Trade-off between processing and storage functions was investigated by Daneman and Carpenter (1980). In their study, they used a working memory span measure whereby participants were required to read and comprehend a series of sentences while also trying to remember the final world of each sentence. Results revealed that the number of words recalled (span) was correlated with measures of comprehension. Research suggests that older adults appear to have smaller span whether assessed by simple or complex measures, and individual differences in span are important predictors of performance on other tasks, including language comprehension and reasoning tasks (Zacks, Hasher & Li 2000). For example, Multhaup, Balota and Cowan (1996) found that older adults articulated words slower than younger adults and that this contributed to reduced span measures. However, research on age differences in simple span measures and working memory span are not always consistent: studies which rely upon vocabulary may overestimate older adults' ability because older adults generally perform better than younger adults on this dimension (Daneman & Carpenter, 1980).

There is still some dispute as to whether age-related declines occur most for storage or for processing operations. Craik (1986) proposed that age-related differences in memory are a consequence of age deficits in essential processing resources, such as attentional working memory capacity. The presumed age-related declines in processing resources means older adults are less able to carry out resource-demanding encoding and retrieval operations as compared to young adults. However, reliable age differences have been reported between memory tasks that measure storage and those that focus on storage and processing operations. As this brief review indicates, the relationship between age and memory has been researched extensively, however as this is not the focus of the work presented in this thesis, only a few studies have been evaluated (see Bower, 1988).

1.5.3 Inhibitory Control

The third process identified by Baltes, et al., (1999) is inhibitory control. Lustig, Hasher and Zacks (2007) suggested three functions of inhibition: (i) controlling access to attention's focus, (ii) deleting irrelevant information from attention and working memory, and (iii) suppressing strong but inappropriate responses. These three components work together to help ensure that mental representations form a coherent story relative to the current goals of cognitive function.

Hasher and Zacks (1988) proposed that age differences in working memory were due to reductions in inhibitory efficiency among older adults. Their theory suggests that the functional capacity of working memory is reduced with ageing because less efficient inhibitory processes are unable to prevent irrelevant information from entering or being maintained in working memory. It is thought that the presence of irrelevant information in working memory may lead to poorer encoding, retrieval and comprehension by older adults (McDowd, 1997).

The second function of inhibition is to delete irrelevant information from the focus of attention. It is thought that older adults' ability to regulate information that is no longer relevant is reduced, and therefore this accounts for their increased production of irrelevant information relative to relevant information. The inhibition deficit hypothesis would then suggest that older adults' deficits in working memory tasks are not a function of reduced capacity, but instead due to an increased inability to 'delete' unnecessary information so that available resources can be used efficiently. Finally, the 'restraint' function prevents inappropriate responses from gaining control over thought and/or action so as to allow consideration of more relevant responses.

Research examining the inhibition deficit hypothesis was conducted by Carlson, Hasher, Zacks and Connelly (1995). They found that when older adults were asked to read aloud a piece of text with distractions inserted in unpredictable locations, their reading speed was significantly decreased. It was proposed that older adults were less able to ignore the distractions. Findings from studies on 'directed forgetting' (Zacks, Radvansky, & Hasher, 1996) showed that older adults were less able than younger adults to suppress the continued processing and retrieval of items which had already been studied and cued to be forgotten. These 'cued to be forgotten' items were shown to produce more interference with the retrieval of items still to be remembered in older adults. Age-related reductions in inhibitory control may account for increases in irrelevant information being processed in working memory. It is thought that a consequence of this could be interference at encoding and retrieval.

In summary, age-related cognitive declines in fluid intelligence have been reliably established. However, there is still debate surrounding the related nature of the constructs outlined above. Some researchers consider speed of processing, working memory and inhibitory function to be separate with different predictive worth (e.g. Salthouse, 1996); others consider them to be interdependent, even sharing basic neurological processes (Li, Lindenberger, & Sikström, 2001). Despite incongruity in opinions and findings regarding the relatedness of these constructs, it is clear that the role of each component should be considered in thinking about age-related declines in fluid intelligence. Furthermore, the empirical question regarding how well fluid intelligence predicts age differences in consumer decision making remains open.

1.6 Ageing and Crystallised Intelligence

Despite well documented age-related declines in fluid intelligence, crystallised intelligence is thought to remain comparatively stable from middle age into older adulthood (Horn & Cattell, 1967; Lövdén, et al., 2004). Crystallised abilities conceptualise the roles of culture and experience in the acquisition of knowledge-based intelligence. Crystallised knowledge may come from normative cultural exposures such as in formal schooling or from individual experiences such as work-related expertise. It is thought that crystallised intelligence measures the amount of knowledge a person has acquired during his or her lifetime. Crystallised capabilities are typically measured using psychometric tests to assess verbal ability and basic knowledge about the World. For example, it is often measured using simple direct questions, such as asking a person to define words, i.e. tell me what *audacious* means? These types of questions can only be answered correctly if an individual already has the necessary knowledge available to them (Horn & Cattell, 1967). Individual differences in these domains are closely linked to years of education and other aspects of social stratification (Baltes, Staudinger, & Lindenberger, 2002).

Another measure of crystallised intelligence is person-specific knowledge. Person-specific knowledge has been assessed by comparing the performance of younger and older experts both inside and outside their domain of experience (Bartlett, Halpern, & Dowling, 1995; Hambrick, Meinz, & Oswald, 2007). Research in this area has provided mixed results. Typically, findings suggest that expertise benefits both young and old adults; however, these benefits are usually limited to the domain in which the individual is expert. Furthermore, expertise does not provide complete immunity from cognitive declines.

Morrow, Menard and Stine-Morrow (1999) compared young and older adult pilots with young and older novices on their memory for narrative passages concerning aviation or non-aviation themes. For both ages, expertise was associated with increased memory for the aviation-related narrative however, older adults in both conditions performed worse in recalling aviation and non-aviation passages as compared to younger adults. Meinz (2000) provided further evidence suggesting that any benefit of experience is limited. Pianists from a wide range of experience and age range were tested on measures for musical memory and musical perceptual speed. Results indicated no significant interactions of age and experience on memory or perceptual speed, however there was evidence to suggest that experience in older adults partially mediated the negative effects of cognitive ageing. In another study, the effects of expertise were shown to have no attenuating effects as age increased. For example, Charness (1982) studied bridge players varying in age (21-71) and skill. Results indicated that skill declined with increasing age and ceased entirely by age 60. The following considers how age-related changes in fluid and crystallised abilities may impact decision-making in older and younger adults.

1.7 Ageing, Fluid and Crystallised Intelligence, and Decision-Making

As outlined above, research on age related changes in decision-making have provided mixed results. For example, older adults are more likely than young adults to use non-compensatory search strategies, which require fewer comparisons. While using non-compensatory search strategies reduces cognitive load, it also decreases the chances of identifying the best available option (Hanoch et al., 2011; Johnson, 1990). Older adults are more likely to choose suboptimal options as the number of alternatives increases (Besedes, Deck, Sarangi & Shor, 2009), and to make mistakes when applying decision rules (Bruine de Bruin et al., 2007). Other decision-making skills seem to improve with age. Older adults are more likely to discontinue investments that are no longer paying off (Strough et al., 2008), and are better at resisting the influence of irrelevant options on choices (Kim & Hasher, 2005). Sometimes age seems to be unrelated to decision-making skills, such as following the rules of probability theory when judging risks (Bruine de Bruin et al., 2007).

Recent reviews (Hanoch et al., 2007; Peters et al., 2007) proposed that these mixed findings may reflect age-related decreases in fluid cognitive ability and marginal changes (or increases) in crystallised intelligence. Fluid cognitive abilities show linear declines with age while crystallised abilities remain relatively stable (Salthouse, 1991). Cunningham, Clayton and Overton (1975) demonstrated that younger people had significantly higher scores on a common test of fluid intelligence (Raven's Progressive Matrices) than did older people, while age differences on a crystallized test of vocabulary were relatively insignificant. Hayslip and Sterns (1979) found similar results using a battery of fluid and crystallized tests, and Rabbit et al., (2004) report accelerated decline in fluid intelligence, but no significant decline in crystallised intellectual measures of vocabulary (see also Singer et al., 2003)

Consistent with the idea that age-related changes in fluid and crystallised abilities can explain mixed findings in the decision literature, Stanovich and West (2008) speculate that making good decisions requires having enough experience to recognise which decision rule applies and enough fluid ability to implement it. Furthermore, they note that experience and fluid cognitive ability are interdependent for two reasons. First, fluid ability may reduce the experience needed to master new decision-making rules. Second, fluid cognitive ability will facilitate the application of a rule only if individuals have sufficient experience to recognise that the rule applies. Based on this, Stanovich and West (2008) predict two patterns in the relationship between fluid and crystallised intelligence and decision-making.

The first pattern predicts that on decision tasks that require no experience to detect a normative rule, individuals with higher fluid cognitive ability should be better at applying the rule correctly. Because fluid cognitive ability declines with old age, older adults should perform worse on these tasks. The second pattern predicts that on decision tasks which require experience to detect a normative rule, increased experience and fluid ability will lead to better performance. Because experience increases with age, it is thought that older adults may rely on this to moderate or even overcome age-related declines in fluid intelligence. The few studies that have examined the relationship between decision-making performance, specific cognitive ability and age provide support for the two patterns proposed by Stanovich and West (2008).

Hansson, Rönnlund, Juslin and Nilsson (2008) presented data suggesting that in circumstances where individuals need no experience to understand a normative rule, fluid ability is an important factor in being able to apply it correctly. In their study Hansson et al., (2008) tested participants in three different age groups (35-40 years, 55-60 years and 70-75 years). Cognitive measures of fluid and crystallised intelligence were recorded. All participants were presented with a probability judgement task where they made the best guess about the population of a country and then asked to assess the probability that a pre-stated interval would include the true population figure. For example, participants were presented with the following problem, “The population of Burma lies between X and Y million. What is the probability that this statement is correct: 0%, 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80%, 90% or 100%?” The results showed a negative relationship between age and using more appropriate (e.g., wider) credible intervals, which was affected by fluid cognitive ability.

Strough, Mehta, McFall and Schuller (2008) provided support for Stanovich and West’s (2008) second proposed pattern of findings whereby older adults made better decisions than young adults on a task which required both fluid cognitive ability and experience (or crystallised intelligence). Stough et al., (2008) investigated the relationship between cognitive ability, age and the sunk-cost fallacy. The sunk-cost fallacy is a decision-making bias that reflects the tendency to invest more future resources in a situation in which a prior investment has been made (e.g., the tendency to spend more time watching a boring film one has paid to watch than to watch a boring, but free, film). In this study older and younger adults were presented with two pairs of vignettes. Each pair consisted of one vignette involving investments and one analogous vignette involving no investment. For example, one of the investment vignettes said, "You paid $10.95 to see a movie on pay TV. After five minutes you are bored and the movie seems pretty bad." In the no-investment analogue, the sentence about the $10.95 payment was removed. After reading each vignette, participants selected one of five options for future time investment (e.g. stop watching entirely, watch for 10, 20 or 30 more minutes or watch until the end). Participants reported education level and completed several tests of verbal and fluid intelligence. Results revealed that older adults were less likely than younger adults to commit to the sunk-cost fallacy and more likely to make normatively correct consistent decisions across investment and no-investment analogues. Furthermore, performance was shown to be only weakly correlated with scores on fluid and verbal intelligence.

Finally, Bruine de Bruin et al., (2011) investigated the relationship between age, cognitive ability and a measure of decision-making competence. Bruine de Bruin et al., (2011) asked participants to complete a validated measure of Adult Decision Making Competence (A-DMC), and a measure of fluid cognitive ability (Raven's Standard Progressive Matrices). Results revealed that after controlling for fluid cognitive ability, tasks on which performance decreased with age (resistance to framing and applying decision rules), the negative relationships were lessened by age-related declines in fluid ability. Tasks where performance did not decrease with age (consistency in risk perception, recognising age-group social norms, over/under confidence and resistance to sunk costs), were found to be positively and independently correlated with both fluid cognitive ability and age.

In summary, the literature clearly suggests that fluid intelligence declines with age, but, declines in crystallised intelligence are comparatively limited; some data even implies that crystallised intelligence increases with age (Schaie, 1994). Research has shown a relationship between changes in these intelligences and declines in decision-making ability. However, recent work proposes that fluid and crystallised ability are not the only individual differences that affect decision-making. Relevant knowledge is imperative to making good decisions within a given domain. In terms of consumer decision-making, one area of relevant knowledge is numeric ability. In the next section, the implications of good numeric ability on decision making is considered and research on ageing, numeracy and decision-making is discussed.

1.8 Ageing, Numeric Ability and Decision Making

Research on age, cognitive ability and decision-making has made progress over recent years, yet the relative importance of numeric ability has only lately received attention (e.g. Peters, et al., 2007). Currently there is no general agreement on the definition of numeracy, however many researchers have attempted to broadly classify the key processes associated with this construct. For example, Peters et al., (2006) define numeracy as "the ability to process basic probability and numerical concepts" (p. 407). Research has shown that having inadequate numeric skills is associated with increased biases in judgement and decision-making (e.g. Reyna, Nelson, Han & Dieckmann, 2009) and lower comprehension and use of numeric information (Peters et al., 2007). Consequently, lower levels of numeracy may place an important barrier to individual's understanding of financial, health and consumer domains. Furthermore, evidence suggests that poor numeracy skills may be associated with economic and social disadvantage, including poor health, living in deprived neighbourhoods and disadvantaged housing conditions (Jenkins, Ackerman, Frumkin, Salter & Vorhaus 2011).

To date, the literature provides a mixed picture in terms of how numeric ability is related to fluid and crystallised intelligences. For example, Kroesbergen, Luit, Ven Lieshout, Loosbroek and Van de Rijit (2009) found that numeric ability in 5-7 year olds was strongly correlated with both crystallised intelligence (measured by a Dutch verbal task; Taal Voor Kleuters, 1996) and fluid intelligence (measured by Raven's Coloured Progressive Matrices). However, other research has shown numeracy to be linked with either crystallised intelligence (Schaie and Willis, 1989; 1993) or fluid intelligence, (Kyttala & Lehto, 2008). Furthermore, recent literature has shown numeric ability to be independent of other measures of intelligence (see Banks & Oldfield, 2006; Weller, Diekmann, Tusler, Merty, Burns & Peter's, 2012; Wood et al., 2011).

In review of these findings, it seems that numeric ability might test relevant knowledge in terms of numeric rules as well as the application of this relevant knowledge for novel problem solving. Therefore it is argued that numeric ability reflects aspects related to both fluid intelligence and crystallised intelligence. In other words, numeric ability is a test of a specific capability within the particular domain of mathematical knowledge. On this basis, this thesis will regard numeric ability as a unique measure of intelligence.

Research suggests that individuals differ substantially in numeric ability (Lipkus, Samsa, & Rimer, 2001) and that many people do not possess even basic numerical skills. The Skills for Life Survey (SfL) commissioned by the Department for Education and Skills (2002/3), consisted of a population sample of adults aged between 16 and 65. Data from this study suggested that 15 million adults in England possessed very low levels of numeracy and that respondents in the oldest age group (55-65) were most likely to be classified at the lowest level. In 2002, the English Longitudinal Study of Ageing (ELSA) sought to provide data about literacy and numeracy proficiency of those beyond the age of 65. ELSA assessed numeracy through five questions, which required successively more complex numerical calculations. Respondents were divided into four groups based on their answers to the numeracy questions. The results showed an overall trend for numeracy to decrease with age: 51% of adults in their fifties were classified as being in one of the bottom two numeracy groups, 62% for people in their sixties, 72% among people in their seventies and 78% for those aged eighty and above. These findings support data from the Seattle Longitudinal Study (Schaie, 1994), which suggested that numeric ability tends to rise until approximately middle age before declining steadily until age 60 whereby another lower plateau is reached. Furthermore, current research investigating the relationship between numeracy and age suggests that as a group, older adults evidence lower levels of numeracy than young adults (Banks & Oldfield, 2007; Peters, et al., 2007).

Numeric ability has been shown to have important consequences in terms of health and wealth. To date, the health domain has seemingly been the primary focus of much research in regard to numeracy. Indeed, many health-related tasks, such as reading food labels, refilling prescriptions, measuring medications, interpreting blood sugars and understanding health risks require good numeracy abilities (Rothman, et al., 2008). For example, patients often have to make decisions based on information acquired from tables, charts or text. Information about many consumer products (i.e. financial services, nutritional values in food or utility expenses) is acquired in the same manner. Therefore, despite a focus towards reviews of research associated with decision-making and health, it is reasonable to assume that numeracy is as important in other domains (e.g. financial).

With regards to health, Fasolo, Reutskaja, Dixon and Boyce (2010) investigated how people understood information presented on the National Health Service (NHS) website. In their study, participants had to compare and select a hospital they would choose to attend based on a number of indicators such as waiting time, cleanliness and distance. Results indicated that younger and more highly numerate participants engaged in more cognitively demanding strategies and attempted to make tradeoffs. Older (and less numerate) participants found it harder to process different pieces information and tended to rely on summative measures to overcome these difficulties.

Williams, Parker, Baker, Parikh, Pitkin, Coates et al., (1995) found that many patients could not read and understand basic numeric medical information including instructions on medication bottles, standard appointment slips or financial information. In their study 19-33% of patients could not determine the number of pills of a prescription they should take. Apter, Cheng, Small, Bennett, Albert, et al., (2006) showed that asthma patients who had been prescribed inhaled steroids and had low levels of numeracy were more likely to have a history of hospitalizations and asthma-related emergency room visits.

In the financial domain, numeric ability has been shown to be associated with prosperity. For example Lusardi and Mitchell (2011) found that American citizens who were less numerate were less likely to accumulate wealth. And furthermore, individuals who could not perform a 2% interest rate calculation were much less likely to plan for retirement. Similar patterns of results have been found in other countries. For example, in the Netherlands, those who could perform a 2% interest calculation were found to be much more likely to plan for retirement, and in Italy, those able to do this calculation were more likely to participate in private pension plans (Van Rooij, Lusardi & Alessie, 2011).

In terms of ageing, numeric ability and wealth, surveys suggest that older adults with high numeric ability tend to be wealthier. For example, the Survey of Health, Ageing and Retirement in Europe (SHARE) assessed people aged 50 and above in 11 European countries. The survey included questions on demographics, physical and mental health, employment, income, assets, social activities, and expectations. Results indicated that numeracy was generally low amongst the older population however, older participants with higher numeric ability were found to be more likely to own stocks and general investments (Christelis, Jappelli, & Padula 2010). In addition, Banks (2006) found a positive correlation between numeracy and prosperity. Among 50-59 year old men, those with the highest numerical ability were also in the highest wealth quintile, while those with the lowest numeric ability were over six times more likely to be in the poorest wealth quintile. Similar results were established for women aged 50-59 and for both men and women aged 60-74.

Numeric ability is found to be linked with many important decisions associated with health and finances. Studies and surveys have shown that numeric ability among populations across in America and Europe tends to be low. In addition, lack of numeracy is not only widespread but is particularly severe among some demographic groups, specifically the elderly.

Many important decisions require the individual to be proficient with numbers. How age impacts decision-making in the real world has received surprisingly little attention given the significant consequences of making poor choices. Furthermore, research investigating the association between age, decision-making and numeric ability has provided mixed findings.

Numeracy has been found to be a significant predictor of comprehension and decision-making performance by Wood et al., (2011). Wood et al., (2011) examined the impact of increasing choice options for prescription drug plans in younger and older adults. Measures of executive functioning, speed of processing, working memory, crystallised intelligence and numeric ability were also taken. Their results revealed that numeracy was a robust independent predictor of decision-making ability, regardless of age.

Other research has not always found age-related declines in tasks requiring numeric comprehension. Tanius, Wood, Hanoch and Rice (2009) found no significant effects of age on performance when participants were asked to compare and select a prescription drug plan. Although, numeric ability and speed of processing were found to be significant predictors with participants who scored highly on these measures making better choices.

Further research suggests that older adults can be as adept as younger adults in decision-making involving numbers. Specifically, previous research reports that adults use at least two types of strategies (exhaustive and non-exhaustive) to solve numeric problems, and they adjust their strategy to the problem and situation characteristics. Exhaustive strategies require that cognitively demanding verification processes be implemented before making a choice (e.g. encoding numbers and calculating the correct solution). Non-exhaustive strategies do not require all verification processes to be completed before a decision is made; an individual may simply retrieve a solution directly from memory. Geary and Wiley (1991) demonstrated that both older and younger adults engaged in exhaustive and non-exhaustive verification strategies and were equally adaptive in their strategy selection. In their study, a simple addition task was presented to older and younger adults and verbal reports of their strategy selection were recorded. Both age groups reported using non-exhaustive strategies (i.e. solving 4 + 9 by directly retrieving 13 from memory) and exhaustive strategies (i.e. solving 4 + 9 by calculating 10 + 4 – 1). Young adults used exhaustive strategies on easier problems more often than older adults (7% vs. 2%) and non-exhaustive strategies less often than older adults (88% vs. 98%).

Further evidence in support of adept strategy selection in older adulthood was presented by Geary, Frensch and Wiley (1993). In their study, participants were presented with simple and complex subtraction problems. Results indicated that the subtraction skills of the older adults were better developed than those of younger adults. In explaining these findings, the authors proposed that older adults' early education in basic mathematics was superior to that of young adults, however the effect of practice throughout adulthood may also have contributed to the advantage of the older group. On this basis, it was thought that increased practice may have lead older adults to rely more upon non-exhaustive, retrieval based processes or be more adept at selecting an appropriate strategy for particular problems.

So far, the literature reviewed suggests that age-related changes in cognitive abilities cannot be characterized by mere declines, but are in fact complicated and potentially malleable. Arguably, even more interesting than the weaknesses are the relative strengths that older adults display. Findings demonstrate age-related gains in emotional functioning (e.g. Carstensen & Mickels, 2005). This pattern stands in contrast to the substantial body of literature documenting age-related declines in processes that are effortful, deliberative and resource intensive. Next, age-related changes in emotional functioning are outlined. Then emotion-regulation strategies used by older and younger adults are considered, followed by an evaluation of these strategies within a model of limited resources.

1.9 Ageing, Emotion and Decision-Making

Research provides convergent evidence that self-regulation, especially emotional functioning, is spared from age-related decline (Charles & Carstensen, 2004). Furthermore, some research suggests that emotional functioning improves with age (Carstensen & Mikels, 2005). The finding that gains in emotional functioning occur despite well-documented declines in effortful cognitive processing raises intriguing questions. How developmental changes affect decisions that draw on both emotional and cognitive processes may have different implications for young and old adults. It is proposed that identifying areas of preserved functioning along with areas of deterioration may help in determining methods to compensate for age-related losses.

Evidence suggests a positivity bias as people age where older adults appear to attend to and remember emotionally positive information more than they do negative and neutral information. Charles, Mather and Carstensen (2003) conducted a study in which older and younger adults were tested on recognition and recall memory subsequent to viewing a number of positive, negative and neutral images. Results from the first study revealed that the ratio of positive to negative material accurately recalled by participants increased with age. Further research by Mather and Carstensen (2003) provided additional evidence for the increased favouring of positive over negative material with age. In their study, pairs of faces (one neutral and one showing positive or negative emotion) were presented to participants on a computer screen simultaneously for 1000 ms, followed by a small grey dot that appeared in the location where one of the photographs had been. Results showed that younger adults responded to the dot probes for positive and negative trials equally fast. Older adults however, were significantly faster when the dot appeared behind a positive face indicating older adults attended to positive faces most.

John and Gross (2004) propose that this normative shift in emotion regulation in older adults is due to age-related cognitive limitations. It is assumed that negative emotions such as anger and frustration are energy and resource consuming (Mroczek & Kolarz, 1998), therefore older adult's declining cognitive resources may lead them to avoid sources of negative emotion and instead engage in less resource-demanding positive affect. Furthermore, it has been suggested that older adults have greater control over their emotions which permits them to selectively enhance positive emotions and selectively reduce their experience of negative emotions (Gross, Carstensen, Pasupathi, Tsai, & Skorpen, 1997).

Gross (1998) defined emotion regulation as “the process by which we influence which emotions we have, when we have them, and how we experience and express them” (p.224). Gross identified two distinct forms of emotion regulation: reappraisal and suppression and, proposed that emotions are regulated either by manipulating the input to the system (“antecedent-focussed” emotion regulation - reappraisal) or by manipulating its output (“response-focussed” emotion regulation - suppression). This process model of emotion sees reappraisal as occurring early on in the emotion-generative process, by engaging executive cognitive control processes to reformulate the meaning of a situation and therefore determining the sequence of emotions before emotion-led responses have been generated (Goldin, McRae, Ramel, & Gross, 2008). Suppression is thought to come later in the emotion-generative process, and relies on the individual to consciously manage and modify the behavioural aspects of their emotional responses.

It is thought that reappraisal and suppression may have different cognitive costs based on differing self-regulatory demands. For example, emotion regulation that requires sustained self-monitoring and on-going self-corrective action during an emotional event (i.e. suppressing emotional expression) may require the continual expenditure of cognitive resources which in turn could result in impaired executive processes. In contrast, using reappraisal as a form of emotion regulation may not require continual self-regulatory effort. Entering into a situation after having construed it in less emotional terms may pre-empt a strong emotional response and therefore the need to expend self-regulatory effort is diminished, leaving executive functions intact.

The suggestion that there may be cognitive implications as a result of emotion regulation has been studied by a number of researchers. Lazarus and

Alfert (1964) provided some of the first evidence that emotion regulation has measurable beneficial consequences. In their study, participants were shown a film depicting a circumcision ritual while the accompanying soundtrack was manipulated. In one condition, participants heard a soundtrack designed to minimise the negative emotional impact of the film (by denying the pain and potential physical harm involved in the surgery) while emphasising the positive aspects of the procedure (the joy derived by the boys from their participation in a significant tribal ceremony). In another condition, participants heard no soundtrack at all. Results from this study showed that participants in the sound-track condition evidenced slower heart rate, lower skin conductance levels and more pleasant mood ratings.

In order to test the hypothesis that suppression and reappraisal may affect memory differently Richards and Gross (2000) conducted the following study: All participants were told that they would see several slides of people who had all been severely injured and that they would hear each person's name, occupation and type of accident. Participants were randomly assigned to two conditions, the expressive suppression condition and the reappraisal condition. Participants in expressive suppression condition were told to keep facial muscles still and not make any facial expressions. Participants assigned to the reappraisal condition were instructed to think about what they were seeing in an objective and analytical manner so as to watch the film in such a way that they did not feel anything at all. The results from this experiment supported the hypothesis that different forms of emotion regulation have different cognitive consequences. Participants in the suppression condition showed poorer memory for information presented during the emotion-eliciting slides. However, participants in the reappraisal condition showed no evidence of diminished memory. A second finding was that despite changes to emotion experience and behaviour, suppression did not seem to lessen affective emotional experience.

In terms of age-related changes in emotion regulation, it is thought that older adults learn to make greater use of reappraisal and less use of suppression (John & Gross, 2004). This supports the notion that older adults are more adept at regulating affect in a less cognitively exhaustive manner. John and Gross (2004) provided data in support of this claim. Using a retrospective design, a sample of women in their early 60's were asked to complete the Emotion Regulation Questionnaire (ERQ) twice, one with respect to how they were in their early 20's and once with respect to how they were now. Results indicated that the use of reappraisal increased with age and the use of suppression decreased.

Consistent with the findings of John and Gross (2004), a correlational study conducted by Gross, et al., (1997) found that older adults reported greater control of their inner experience of emotion but were less able to control their external expression of emotion. Furthermore, recent work by Scheibe and Blanchard-Fields (2009) suggests that emotion regulation of inner emotional experience requires fewer cognitive resources for older adults than for young adults. Taken together, these findings support the notion that older adults are better able to regulate their emotions than young adults. It is proposed that preserved abilities (such as emotion regulation) could be employed to support other, weakened areas (such as cognitive ability).

Many models of decision-making propose that good decisions require a number of exhaustive cognitive processes. These cognitive processes can be seen as placing a significant burden on the individual's resources. Because ageing is associated with fewer cognitive resources, older adults may face an increased disadvantage when making complex decisions compared with young adults. How older adults adapt to regulatory exertion, has received little attention.

The limited resource model proposes that the self has limited reserve of resource resembling energy or strength (Schmeichel, Vohs and Baumeister, 2003). This stock is expended when it is used to regulate a response by either changing or overriding an intuitive reaction. Schmeichel (2007) defines self-regulation as any attempt to override or alter one's thoughts, feelings or behaviours. One of the central predictions of the limited resource model is that exertion of resources will be followed by a period of diminished capacity. In other words, regulating one response may result in poorer regulation of a concurrent response. Furthermore, self-regulation in one domain may lead to diminished ability to self-regulate in other domains because regulatory capacity is reduced (although regulatory strength should return to its previous level after sufficient rest; Muraven, Tice & Baumeister, 1998). The state of reduced regulatory powers stemming from prior exertion has been termed ego depletion (Baumeister, Sparks, Stillman, & Vohs, 2008). Research has shown that inducing a state of ego depletion can have both cognitive (Pocheptsove, Amir, Dhar & Baumeister, 2008) and physiological consequences (Gross 1998; Muraven, Tice & Baumeister, 1998).

Recent work suggests that the self's limited resource is not used only for self-regulation but also for other cognitive functions including choice and decision-making (Schmeichel, 2007; Vohs, Baumeister, Schmeichel, Twenge, Nelson & Tice, 2008). In addition, it has been proposed that self-regulation shares a high degree of conceptual overlap with executive control (Schmeichel, 2007). It is assumed that in order to persist at a task, several executive control processes are required, such as focussing attention, inhibiting the impulse to give up, and updating working memory. Pocheptsove et. al., (2008) provided support for a proposed link between self-regulation and executive function. They conducted a number of studies where findings suggested that both self-regulation and cognitively effortful processing involved in making choices draw on the same limited resource required for executive control. In one study, they found that resource depletion inhibited the executive processes required to make effortful trade-offs between difficult choices. Participants were asked to choose between two mobile phones on the basis of pictures and detailed descriptions; they also had the option to defer their decision and not select either phone. Results indicated that 42 per cent of participants in the depleted condition chose to defer their decision compared with only 27 per cent of control participants. The finding that self-regulation and cognition draw on the same resources used for executive functioning could have implications for consumer's decisions. As demonstrated by Pocheptsove et al., (2008) decisions made in a state of ego-depletion can affect choices with financial implications.

In summary, research suggests that ageing is associated with a greater focus on emotional content, which in later life may compensate for limited cognitive resources. Understanding how emotion regulation interacts in terms of facilitating or mediating cognitive costs could be important to recognising its role in decision-making. To date, researchers investigating ageing and decision-making have studied either emotional or cognitive processing but rarely both. This is surprising given that age-related changes in basic cognitive and emotional functions may have important consequences for the lives of older adults.

1.10 Summary

Nowadays, older adults are faced with an abundance of choice and more information than ever before. This comes at a point in their lives when their ability to deliberate carefully about important decisions may be declining. Therefore, it is essential to examine how older adults fare when faced with everyday consumer decisions.

To date, there has been little research on how ageing impacts older adults' decisions about consumer products, and the research which has been conducted provides mixed findings. In addition, the relationship between discrete cognitive processes, numeric ability and real consumer decisions has received little attention. Furthermore, the effects of emotional processing and self-regulation on decision-making in older adults has yet to be researched. The application of age-related gains in emotion-regulation in minimising the impact of resource depletion could provide insights for improving older adult's decision making. Indeed, the research outlined in this chapter on cognitive ageing has demonstrated that there are both patterns of decline and compensation associated with increased age. This thesis presents six experiments designed to clarify the relationship between age-related gains and losses in cognitive and emotional abilities, and consumer decision-making within realistic domains.

Specifically, the current body of work evaluates the extent to which measures of fluid intelligence, numeracy and crystallised ability independently contribute to consumer decision-making in younger and older adults. Furthermore, the degree to which older and younger adults are reliant upon less resource demanding decision strategies is examined. Finally, the different impact of emotion-regulation strategies on applied decision-making in younger and older adults is evaluated.

Chapter 2

2.1 Introduction

Every day, individuals are faced with decisions, which may incur small or significant consequences. There has been growing interest in the relationship between age differences in decision-making and cognitive ability (Bruin de Bruin, et al., 2011; Hanoch, et al., 2007; Mata et. al., 2007). How older adults cope when making everyday choices could have an important impact on their quality of life with implications for their physical and financial wellbeing (Jenkins et al., 2011). As outlined in Chapter 1, research presents mixed findings in terms of demonstrating differences between younger and older adults decision-making. While there is some evidence suggesting that older adults tend to use less information when making decisions (which may lead to poorer performance), other findings imply that older adults can compensate for deficiencies in cognitive ability by relying on crystallised abilities. How older adults make up for age-related cognitive decline may have important implications for the quality of older adults' choices; yet most research has typically only examined the impact of age on either cognitive ability or on decision performance.

This chapter examines younger and older adults' performance when making consumer decisions likely to be encountered by individuals in their everyday lives. Original tasks were developed which required participants to make decisions within the contexts of choosing a utility supplier and a mobile phone company. Two experiments are presented which investigate whether decision-making ability varies as a function of age.

A secondary aim of the current chapter was to evaluate the relationship between a range of abilities and performance on the consumer decision task. As outlined in Chapter 1, research on ageing has shown that a wide variety of cognitive abilities decline with age, including reasoning, processing speed and working memory (Salthouse, 2004; Schaie 1993). These capabilities are generally categorised as fluid intelligence, that is, they relate to the ability to generate, transform and manipulate information (Salthouse 2010). While fluid intelligence and executive functions reflect cognitive capabilities important for processing information in novel situations, crystallised intelligence reflects a stable reserve of knowledge acquired through experience, culture and education (Carroll, 1993; Cattell, 1987; Salthouse 2010).

Although research on fluid intelligence shows uniform declines with age, research on crystallised intelligence shows it to remain relatively stable until very old age (Horn & Cattell, 1967; Li et al., 2004; Salthouse 2004, 2006, 2010). This pattern of results may be what explains the varied data relating to decision-making and ageing. Recent reviews (Hanoch et al., 2007; Peters et al., 2007) speculate that these mixed results reflect age-related decreases in fluid ability and increases in experience, or crystallised intelligence. Much of the ageing literature sees that decision-making ability varies as a function of age-related changes in fluid and crystallised ability. For example, Salthouse (2010) points out that compensatory changes in fluid and crystallised ability are key in allowing most older adults to function effectively and independently. And Stanovich and West (2008) propose that making normatively appropriate decisions requires both the experience to recognise the correct decision rule to use and enough fluid ability to implement it.

To date, relatively few studies have examined the relationship between age-related changes in decision-making and cognitive abilities. Research examining the impact of ageing and the associated changes in cognitive processes on real world decision-making is even scarcer. Furthermore, given that many important decisions require the individual to be proficient with numbers, surprisingly little attention has been given to how older adults are faring in a world where beneficial choice is dependent upon numeric skill.

The relationship between age and numeric competence is still unclear. In longitudinal studies of ageing (e.g. Lövdén, et al., 2004; Schaie 1994b), evidence suggests age-related declines in numeric processing. This is unsurprising given that decisions involving numeric information require cognitive ability to process, and cognitive abilities tend to decline with age. For example, results from health plan choice studies suggest that elderly decision makers do not always comprehend even fairly simple numeric information (e.g. Park et al., 1999; Finucane et al., 2002; Hibbard et al., 2001), and others (Hanoch et. al., 2009) have found that older age was associated with more errors when choosing a health insurance plan.

However, other studies have provided data implying older adults make decisions based on numeric computations as adeptly as young adults (Chen &un, 2003; Duverne & Lemaire, 2004; Geary & Wiley, 1991). Furthermore, in another study modelled on a health insurance plan, older age was not a significant predictor of decision-making performance, but rather numeracy and speed of processing were found to affect performance (Tanius et. al., 2009).

With regards to everyday decision-making, consumer choices can be seen as often based on complicated numeric material. Research suggests that older adults may be at a disadvantage when making these sorts of decisions as they tend to have lower levels of numeracy (Banks & Oldfield, 2007; Wood et al, 2011). In light of the above, the current chapter has two key objectives: First, to evaluate the impact of ageing on applied consumer decision-making and second, to investigate the extent to which fluid and crystallised intelligence, numeracy, processing speed and experience independently contribute to decision-making in younger and older adults.

2.2 Experiment 1

The aim of this study was to examine differences in younger and older adult's decision-making for consumer problems. It was predicted that older adults would make comparatively worse decisions than young adults and, both younger and older adults would perform worse on complex consumer problems compared to simple ones. In addition, it was anticipated that differences in decision aptitude could be explained by differences in cognitive abilities or task specific knowledge (gained through experience).

2.3 Method

2.3.1 Participants

Sixty five participants took part in the study; 31 young adults (21 female), aged 18-25 (Mean Age = 19.8, SD =1.25), and 34 older adults (29 female) aged 63 to 85 (Mean Age = 71.57, SD = 5.27). Older adults were paid £6 per hour for their time, and were recruited from the South West of the UK. Young adults received course credits for their participation and were recruited from the university.

2.3.2 Materials

With the exception of the Energy Supplier Decision Task, all measures used in this experiment were selected because they had been utilised in previous studies investigating age and decision-making. Furthermore, each measure has been validated with diverse populations and was considered to represent a reliable method of investigating intelligence or ability.

Energy Supplier Decision Task: A decision task was designed to evaluate individuals' ability to select a utility supplier. This framework provided a good opportunity to investigate an existing problem faced by many UK households. Furthermore, the information needed to make a decision in this domain is numeric in nature, i.e. price and the amount of energy used (kWhs).

In maximising the ecological validity of the experiment, marketing information provided by existing utility companies was used as a model for the materials in the present research. Real information presented to customers regarding tariffs for both gas and electricity are illustrated in Appendix 1A, figures 1-3.

The depiction of a two-band price structure (Tier 1 and 2) and price per kWh (kilowatt-hour) in table format was used in the present experimental material. Furthermore, it was decided that all numbers be presented as whole so as to simplify calculation processes. In total, a matrix comprising 16 individual values per kWh was presented to participants. While the table presented to participants is a simplified version of tariff information normally distributed by energy suppliers in the UK, it was nonetheless designed to accurately mimic those faced by consumers. A matrix which included information about costs of four energy suppliers was presented to participants (see Table 2.1).

Table 2.1 Table of Energy Suppliers Depicting the Cost of Electricity and Gas for Four Energy Suppliers

Tariff	Central Utilities	Energy West	Light House	Powerfuel
Band One Electricity Price Per kWh This price applies to a block of 1000 kWh each year. When this has been used, all other kWh will be charged at Band Two rates	15p	16p	18p	15p
Band Two Electricity Price Per kWh	8p	6p	5p	8p
Band One Gas Price per kWh This price applies to a block of 6000 kWh each year. When this has been used, all other kWh will be charged at Band Two rates.	4p	5p	6p	4p
Gas Band Two Price Per kWh	3p	2p	1p	2p

Participants were given 8 different hypothetical scenarios that differed in the amount of gas and electricity used. In each scenario, information about energy suppliers' prices for two electricity and gas bands was provided (electricity in band one and band two/ gas in band one and band two). The table informed participants that the price of electricity in "band one" was applied to a block of 1000kWh each year. When this had been used all other kWh would be charged at "band two" rates. Participants were told that the price of gas in "band one" was applied to a block of 6000kWh each year. When this had been used, all other kWh would be charged at "band two" rates.

After reviewing the information, participants were asked to solve 8 problems. Problems 1-3 were factual questions and required the individual to identify one piece of information from the table. For example: *Looking at the table, please indicate which Energy Supplier you think charges the most for Electricity in Band One.* A complete list of the factual questions presented to participants can be found in Appendix 1B.

Each question was followed by four response options whereby the participant was forced to choose only one of these as correct. Problems 4-8 were inferential questions requiring participants to identify and combine information from two places in the table. For example: *Sue uses 10,000 kWh of Gas each year. Looking at the table, which Energy Supplier is best value for Sue?* All inferential questions required the participant to calculate the cheapest Energy Supplier. A complete list of the inferential questions presented to participants can be found in Appendix 1C. In order to correctly answer these questions, participants had to compare gas price information in "band one" and "band two" for each of the four energy suppliers.

Raven's Standard Progressive Matrices: This task was designed to measure two main components of general intelligence: the ability to think clearly and make sense of complexity, as well as the capacity to store and reproduce information. Raven's Standard Progressive Matrices (SPM) has been widely used to measure general fluid intelligence. For example, Cunningham, Clayton and Overton, (1975) used Raven's (SPM) alongside the Wais III vocabulary sub-task to test fluid and crystallised intelligence respectively in both older and younger adults. More recently, Bruine de Bruin et al., (2007) employed Raven's SPM to assess general fluid intelligence in a study of individual differences in adult decision-making competence. Missier, Mantayla and Bruine de Buin, (2012) utilised Raven's SPM and a numeracy scale (Lipkus, Samsa and Rimer, 2001) to study the relationship between executive functioning and general cognitive abilities. In general, research has shown that scores on this measure of cognitive fluid ability tend to decrease with age (Raven, Raven, & Court, 2003).

All participants completed sections B, C and D of Raven's SPM. Sections A and E were omitted from the task because standardised data suggested that variability in scores for each of the two age groups tested in these sections were minimal. See Appendix 1D for examples of problems presented to participants.

All participants solved the same problems in the same order (from easy to hard). All participants completed the task at their own speed, without interruption, from the beginning to the end of the test. Three sections consisting each of 12 test items were presented whereby participants had to identify the missing segment required to complete a larger pattern. Participants recorded their answers by writing down the number of the option selected as being correct on a specially devised answer sheet. A person's score on the test was the total number of problems solved correctly out of a total of 36.

Wechsler Adult Intelligence Scale-III Vocabulary Scale: This sub-test of the Wais-III assesses learning and memory. Crystallised intelligence measures the amount of knowledge a person has acquired during his or her lifetime (e.g. Alan, 2001; Alfredo, 2007; Walter, Cunningham, Clayton, & Overton, 1975). The vocabulary subscale of the Wais-III was used because (like Raven's SPM) it is considered a well-established and reliable measure of crystallised intelligence. Previous research where older and younger adults have been compared on cognitive variables including crystallised intelligence measured by this scale include Cunningham, Clayton and Overton, (1975), Isingrini and Advazou (1997) and Phillips, MacLeon and Allen (2002).

The vocabulary subscale of the Wais-III required that all individuals were presented with a series of words both orally and visually. Words were presented visually on a card to the participant and the examiner would simultaneously point and say: "Tell me what ______________ means." A total of 33 words were then orally defined by the participant. Responses to items 1-33 were scored 0, 1 or 2 points. A 2-point response was achieved if the participant showed good understanding of the word. A 1-point response was classified as not incorrect but showing poverty of content and a 0-point response was given for providing obviously wrong responses. See Appendix 1E for the complete set of words presented to participants.

Digit Comparison Task: The digit comparison task (Finucane et al, 2005) evaluates speed of processing. Previous research using the digit comparison task has found it to be a fast and robust measure of processing speed. Studies on age differences in cognitive processing that utilised the current digit comparison task include Finucane et al., (2005), Hedden, Park, Nisbbett, Ji, Jing & Jiao, (2002), Tanius et al., (2009) and Wood et al., (2011). As this test had been reliably established in the associated literature, it was decided that the digit comparison task would be used to measure speed of processing in the present study.

Participants were asked to quickly determine whether or not two numerical figures were the same. Three, 45-second conditions were administered. This task was scored by summing the total number of correct digit comparisons across all three sections. See Appendix 1F for examples of the digit comparison task presented to participants.

Numeracy Scale: An 11- item numeracy scale (Lipkus, et al., 2001) was used to evaluate numerical ability. This scale has been used recently by a number of researchers investigating age differences in decision-making, (see Galesic, Garcie-Retamero and Gigerenzer, 2009; Tanius et al., 2009 and Wood et al., 2011) and was therefore considered an appropriate and reliable measure for this experiment. Questions presented participants with hypothetical scenarios in which the individuals' aptitude to understand probability was examined, (e.g. "Imagine that we roll a fair, six-sided dice 1,000 times. Out of 1,000 rolls, how many times do you think the dice would come up even (2, 4 or 6)"? Answers were marked as either correct or incorrect. Participants received one point for each correct response, thus the maximum score for this scale was 11. See Appendix 1G for a copy of the numeracy questionnaire presented to participants.

Demographic Questionnaire: Participants' age, gender, education and income were recorded. Participants' experience with making decisions about energy suppliers was also assessed. This was done by asking three questions: whether they were responsible for the payment of energy bills, whether they had changed supplier in the last year, or whether they had ever complained about a billing error. See Appendix 1H for a copy of the demographic and experience questionnaire presented to participants.

2.3.3 Procedure

Participants were tested individually and without time limit. The experiment consisted of six tasks: Utility decision task, demographic questionnaire, standard progressive matrices, Wais-III vocabulary scale, digit comparison, and the numeracy scale.

Prior to testing, participants were given a short introduction to familiarise themselves with the various tasks. It was made clear that calculators were not allowed to be used however, scrap paper and pens were provided and the participants informed that they could use these should they wish to make notes in order to aid them with their answers.

2.4 Results

The impact of ageing on consumer decision-making was examined. Table 2.2 depicts performance on predictive measures of ability for both younger and older adults.

Table 2.2 Descriptive Statistics for Younger and Older Participants

	Young		Old	
	M	*SD*	*M*	*SD*
Age (years)	21.77	5.01	71.41	5.26
Numeracy	9.00	1.61	6.97	2.48
Digit Comparison	74.18	12.64	57.63	13.05
Vocabulary	38.63	5.93	44.41	10.72
RAVENS	32.21	1.82	28.89	4.2

The data in Table 2.2 is consistent with previous literature on cognitive ageing so far as age is associated with declines in processing speed, fluid intelligence and numeracy. Scores on the vocabulary task show that older adults outperformed their younger counterparts in this domain. An independent samples t test showed a significant difference in the scores for numeracy, t (71) = 4.11, p < .01, digit comparison, t (71) = 5.51, p < .01 and fluid intelligence, t (71) = 4.33, p < .01 whereby young participants did better than old participants. Older adults performed significantly better than young adults on the vocabulary task, t (71) = -2.76, p < 0.1.

Table 2.3 The Percentage of Factual and Inferential Questions Answered Correctly by Younger and Older Adults

	Young Adults		Older Adults	
	M	*SD*	*M*	*SD*
Factual	92.98	13.77	83.8	24.75
Inferential	65.26	25.33	59.43	35.14

Table 2.3 shows that younger and older adults performed better on factual compared to inferential questions and, that younger adults performed better on both question types than older adults. To see if these findings were significant, a 2 X 2 ANOVA (Age X Question Type) was conducted. Results showed that there was no significant main effect of age, F (1, 71) = 2.67, p >.05, η^2 = .04, although older adults showed a trend to perform worse than younger adults. However, a significant main effect of Question Type (Factual vs. Inferential) F (1, 71) = 44.97, p <.01, η^2 = .39 was found. As Table 2.2 shows, factual questions were answered at significantly higher rates than inferential problems. Finally, results indicated no significant interaction between Question Type and Age F (1, 71) = .19, p > .05, η^2 = 0. Please refer to Statistics Appendix 1 for all summary tables corresponding to Experiment 1.

To test the hypothesis that older adults are compensating for declines in fluid intelligences by relying on crystallised abilities, a univariate ANOVA (Age X Question Type) was performed with vocabulary as a covariate. Analysis revealed a main effect of age, F (1, 66) = 7.81, p < .01, η^2 = .11 and a marginal effect of question type (factual vs. inferential), F (1, 66) = 3.02, p = .09, η^2 =.04. No interaction between problem type and age was revealed, F (1, 66) = .16, p >.05, η^2 = 0. This shows that older adults seemed to rely on crystallised ability to moderate the effects of declines in other cognitive abilities.

When fluid intelligence was entered as a covariate alongside crystallised intelligence, the main effect of age disappeared F (1, 65) = .79, p > .05, η^2 = .01. A main effect of question type emerged F (1, 65) = 9.99, p <.01, η^2 =. 13. A main effect of vocabulary was revealed F (1, 65) = 7.88, p <.01, η^2 =.11 along with a main effect of fluid intelligence F (1, 65) = 7.6, p <.01, η^2 =. 11 No significant interaction was found between question type (factual vs. inferential) and age, F (1, 65) = .31, p >.05, η^2 = .01. A significant interaction was found between age and vocabulary F (1, 65) = 6.86, p <.01, η^2 =. 1. Finally, an interaction between question type, fluid intelligence and age was not significant, F (1, 65) = 3.27, p >.05, η^2 =.05. This means that when crystallised and fluid ability are accounted for, age no longer predicted decision-making performance. Decision-making ability on each type of question was independently affected by fluid ability.

When numeracy was added as a covariate alongside measures of crystallised and fluid intelligence, no significant main effect of age was found, F (1, 64) = .06, p > .05, η^2 = 0. A significant effect of question type was established, F (1, 64) = 9.84, p < .01, η^2 = 13. No significant interaction was found between age and numeracy, F (1, 64) = 1.89, p >.05, η^2 = .03. Although, a significant interaction between question type (factual vs. inferential) and age was revealed, F (1, 64) = 4.65, p <.05, η^2 = .07.

Next the relationships between performance on factual and inferential questions with fluid, crystallised abilities, speed of processing and numeracy were examined. Descriptive statistics can be found in Table 2.4.

Table 2.4 Pearson Correlation Matrix among Predictive Measures of Ability and Factual, Inferential Questions and Both Questions Combined for Young and Old Adults.

	Predictors				
	Group	Numeracy	Digit Comparison	Vocabulary	Ravens
Factual	Young	-.28º	-.08	.23	.21
	Old	.38*	.10	.43*	.10
Inferential	Young	.04	-.01	.03	.01
	Old	.59**	-.06	.45**	.69**
Combined	Young	-.05	-.03	.1	.07
	Old	.64**	-.02	.53**	.62**

*$p < 0.05$ ** $p < 0.01$ º$p < .1$

The correlation matrix in Table 2.4 shows that there were no relationships between the predictor variables and younger adults' performance on factual or inferential questions. Although a marginally significant negative correlation between numeracy and performance on factual questions was revealed. This finding is in the opposite direction to what might be predicted. Results indicated that older adults' performance on the energy supplier decision task was significantly correlated with numeracy, Ravens and vocabulary for inferential questions, while factual questions were only found to have a significant relationship with numeracy. When data on factual and inferential questions were combined, results indicated no significant relationships for young adults' performance and any predictive measures. For older adults, highly significant relationships between overall performance on the decision task and numeric ability, crystallised intelligence and fluid intelligence were found.

Having found significant correlations between performance on numeracy, vocabulary and fluid intelligence and older adults' performance on inferential questions, a number of regression analyses were performed to see if any of these variables could independently predict performance. Numeracy, fluid intelligence, crystallised intelligence and speed of processing were entered as predictive variables. In total, three independent stepwise analyses were run for each age group with factual, inferential and combined scores for both problem types entered as dependent variables.

Table 2.5 Multiple Regression Analysis for Younger Adults Decision Making Ability and Predictive Measures of Performance.

Question	Predictors	β	t	Sig	R^2	ΔR^2
Factual	Numeracy	-.31	-1.66	.11	.16	.05
	Fluid Intelligence	.2	1.15	.26		
	Vocabulary	.07	.34	.73		
	Speed of Processing	-.06	-.34	.74		
Inferential	Numeracy	.09	.47	.65	.01	-.12
	Fluid Intelligence	-.06	-.31	.76		
	Vocabulary	.09	.43	.67		
	Speed of Processing	.06	.29	.77		
Combined	Numeracy	-.01	-.06	.95	.01	-.12
	Fluid Intelligence	.01	.06	.96		
	Vocabulary	.1	.5	.62		
	Speed of Processing	.03	.17	.87		

Data from Table 2.5 shows that for young adults, no predictive measures of performance could significantly predict aptitude on factual questions, inferential questions or types of questions combined.

Table 2.6 Multiple Regression Analysis for Older Adults Decision Making Ability and Predictive Measures of Performance.

Question	Predictors	β	t	Sig	R^2	ΔR^2
Factual	Numeracy	.21	.99	.33	.25	.14
	Fluid Intelligence	-.12	-.61	.55		
	Vocabulary	.39	1.83	.08º		
	Speed of Processing	.15	.86	.4		
Inferential	Numeracy	.33	1.92	.07	.52	.46
	Fluid Intelligence	.49	3.2	0**		
	Vocabulary	.03	.2	.85		
	Speed of Processing	-.11	-.77	.45		
Combined	Numeracy	.35	2.06	.05*	.53	.47
	Fluid Intelligence	.36	2.4	.02*		
	Vocabulary	.17	1.01	.32		
	Speed of Processing	-.03	-.24	.81		

*p < 0.05, **p< 0.01, ° p< .1

The data in table 2.6 shows a different pattern of results for older adults. For factual questions, no predictive measures could significantly account for decision-making performance, although fluid ability was found to be marginally significant. For inferential questions, fluid intelligence was revealed as a highly significant predictor of decision-making ability. For inferential and factual questions combined, numeracy and fluid ability were both found to independently predict decision-making aptitude.

Due to the finding that older and younger adults showed no significant difference in decisions about selecting a utility company (except when a measure of crystallised intelligence was added as a covariate), it was proposed that task specific experience may account for older adults' apparent proficiency in decision making. The data from three questions aimed at assessing experience were analysed using Chi Squared. The three questions asked were (i) if the participant was responsible for paying their utility bills, (ii) if the participant had changed their utility supplier in the last year and (iii) whether the participant had ever contact their utility company regarding billing company regarding billing errors.

Results indicated that there was a significant association between age and responsibility for paying utility bills, χ^2 (1) = 17.97, p < .01, whereby older adults were more likely to be responsible for payment of utility bills than their younger counter parts. There was no significant association between age and whether an individual had changed utility supplier in the last year χ^2 (1) = 1.59, p > .05, nor was there a significant association between age and whether an individual had ever contacted their utility supplier regarding billing errors, χ^2 (1) = .48, p > .05.

Finally, a univariate ANOVA (Age X Responsibility for payment of bills X Total number of factual and inferential questions answered correctly) was conducted. Results revealed a significant effect of age on performance, F (1, 68) = 3.94, p<.05, η^2 = .06. However, there was no main effect of responsibility for payment of bills on performance, F (1, 68) = 1.75, p >.05, η^2 = .03. Finally, there was no significant interaction between age and responsibility for payment of bills, F (1, 68) = .49, p>.05, η^2 = 01. This analysis shows that there was no difference between those who had responsibility for payment of bills and those who didn't and their performance on the consumer decision task.

2.5 Discussion

How older adults fare when making consumer choices has received little attention. A unique task was developed to assess older and younger adult decision-making when selecting a utility supplier. In addition, measures of ability were included to assess the extent to which fluid and crystallised intelligence, numeracy, processing speed and experience could independently predict quality for both complex and simple consumer problems.

The data from Experiment 1 indicated that although younger adults scored better on both factual and inferential questions, their performance was not significantly better than that of older adults. This finding is contrary to previous findings which suggest that older adults' comprehension (and performance) should be somewhat worse than younger adults for both question types (Finucane, et al. 2002; Willis & Schaie, 1993). The present findings are surprising given that age was associated with declines in fluid intelligence, processing speed and numeracy.

In attempting to explain why older adults' performance on the energy supplier decision task was not significantly different to younger adults, it was proposed that older adults may rely more heavily on crystallised intelligence (Stanovich & West, 2008). Scores on the vocabulary task showed that older adults significantly outperformed their younger counterparts in this domain. These findings are consistent with the notion that vocabulary tasks are assumed to reflect crystallised intelligence and that crystallised abilities are maintained from early to late adulthood (Craik & Salthouse, 2000). It is proposed that older adults were utilising their greater crystallised knowledge to compensate for declines in fluid intelligence. Indeed, when a measure of crystallised intelligence was added as a covariate, a significant effect of age emerged. When fluid intelligence was added as a covariate alongside a measure of crystallised intelligence, the effect of age disappeared. This finding implies that age effects are the result of cognitive decline, however, Experiment 1 clearly suggests that crystallised intelligence can compensate for age-related declines. Therefore, these findings can be seen to provide strong support to predictions made by Stanovich and West (2008).

Further analysis revealed that fluid ability provided the best model for predicting older adults' decision-making performance on inferential questions and, that fluid and numeric abilities could independently predict factual and inferential questions combined. These findings support previous work by Tanius et al., (2009) and Wood et al., (2011) who also found numeric ability to be a robust predictor of decision aptitude in older adults. These results highlight the independent role of numeric ability in older adult decision-making. Furthermore, they provide some support for the compensatory function of crystallised intelligence as a mediator to age-related declines in fluid abilities, in other words, when making some consumer decisions, older adults seem to rely on crystallised intelligence to make up for losses in other cognitive abilities.

Analysis on predictive measures of performance and younger adults' decision-making revealed only a marginal negative relationship between numeric ability and aptitude on factual questions. This finding implies that increased numeric ability lead to poorer decision making performance. However further scrutiny showed no measures of cognitive ability to significantly predict young adults decision making performance on factual or inferential problems. The mechanisms young adults rely on when making decisions about utility companies are still unclear.

Both young and old adults were better at answering factual questions and worse at answering inferential questions. These findings are consistent with previous work, and replicate that of Schaie and Willis (1993) and Finucane, et al., (2002). In practical terms, this finding suggests, individuals may be at a disadvantage when making consumer decisions where information is complex. It should be noted that the consumer problems presented to participants in Experiment 1 were simplified versions of literature supplied to customers by utility companies. If participants were having difficulties in solving these problems, this may indicate a worrying trend in terms of people's ability to make good consumer choices outside of the lab.

This study also assessed the role of experience. As has been reviewed in the ageing literature, older adults may have an advantage in adaptive strategy selection because of their richer experience (Baltes et al., 1999). Results revealed that although older adults were significantly more likely to be responsible for payment of utilities, this experience did not affect the quality of their decision-making.

It was informally observed that older adults spent longer completing the energy supplier decision task. In addition, it was noted that older adults often took substantially longer to complete the Ravens standard progressive matrices. This could be because older adults took longer in processing information (as evidenced by slower speed of processing). It may be that older adults put more effort into completing the task than young adults. Alternatively, it may imply that older adults were more motivated when completing the energy supplier task, and that individual differences in motivation accounted for their apparent aptitude. To investigate this, it was decided that a scale measuring need for cognition should be included in the second study.

In conclusion, Experiment 1 showed no significant difference in performance between participants in each age group on the energy supplier decision task. However, analysis showed that an age difference did emerge when crystallised intelligence was taken into account. In addition, the key role of numeracy and fluid intelligence as independent predictors of ability on the consumer choice task were revealed.

2.6 Experiment 2

A second experiment was conducted to confirm and extend the findings from Experiment 1 but with a larger sample and on a wider range of problems. An additional decision task was developed (identical in structure to the energy supplier task), whereby questions were based upon selecting a mobile phone provider from a range of options. Given that mobile phones are a relatively new technology, associated mainly with younger generations, it was assumed that young adults would have more experience in making decisions in this domain compared to older adults. Therefore it was predicted that older adults would be unlikely to rely on experience to aid their performance when making decisions in this domain.

To prevent older adults from spending an excessive length of time completing the Ravens task, a time limit was imposed. Other researchers have also restricted available time for completion of the Ravens task, e.g. Carpenter, Just and Shell (1990).

Finally, a scale was introduced to investigate whether results from Experiment 1 could be partially explained by differences in need for cognition. Need for cognition was investigated using a scale which has been shown to correlate with performance on decision making and judgement tasks (Cacioppo, Petty, & Kao, 1984).

2.7 Method

2.7.1 Participants

One hundred and twenty eight participants took part in the study; 65 young, aged 18-25 (Mean Age = 21.14, SD =5.34), and 63 older adults aged 63 to 85 (Mean Age = 71.74, SD = 5.59). Older adults were paid £6 per hour for their time and were recruited from the South West of the UK. Young adults were university students and received course credits for their participation.

2.7.2 Materials

The materials and procedure were nearly identical to those used in the first study. The most important difference was the introduction of a new consumer decision task and a questionnaire measuring need for cognition. This meant that participants in Experiment 2 were presented with a total of four factual questions and four inferential questions for each of the two topic tasks (energy suppliers and mobile phone companies). In addition participants completed sub-sections B, C and D from Raven's Standard Progressive Matrices, the vocabulary scale from the Wechsler Adult Intelligence Scale III, the digit comparison task, the numeracy scale and a demographic questionnaire.

Mobile Phone Provider Decision Task:

This task examined young and older adults' ability to identify which of four mobile phone providers was the cheapest. A matrix comprising information about the costs of four mobile phone providers was presented to participants (see Table 2.5).

Table 2.7 Information about the Cost of Phone Calls and Text Messages for Four Mobile Phone Companies

Tariff	Speakn-Text	Connect-UK	Mobinet	Green-Phone
Band One: Price Per Minute This price applies up to the first 300 minutes, once this limit has been reached, Band Two prices apply.	10p	15p	16p	9p
Band Two: Price Per Minute	8p	11p	10p	9p
Band One: Price per Text Message This price applies up to the first 100 text messages, once this limit has been reached, Band Two prices apply.	10p	1p	10p	9p
Band Two: Price Per Text Message	5p	6p	2p	4p

Participants were given eight vignettes which described how many minutes and text messages a given individual might use. Participants then had to use the matrix to identify which of the four mobile phone companies provided the cheapest deal based upon the requirements given in each vignette. The matrix provided information about two tariffs for minutes and text messages for each of the mobile phone providers: price of minutes in “band one” and “band two”, and price of text messages in band one and band two. The matrix informed participants that the price of minutes in band one applies to the first 300 minutes and that once this limit had been reached, band two prices apply. Similarly, the matrix also notified participants that the price of text messages in band one applied to the first 100 text messages and that once this limit had been reached, band two prices would apply. In total, the matrix contained 16 individual values ranging between one pence and 16 pence. Like the energy supplier table, this matrix was designed to be representative of actual sales material presented to consumers by mobile phone providers, albeit in a simplified version.

After reviewing the information, participants were asked to answer 8 problems. Problems 1-4 were factual questions and required the individual to identify one piece of information from the matrix (see Appendix 2A). Each question was followed by four response options whereby the participant was forced to choose only one of these as correct. Problems 5-8 were inferential questions requiring participants to identify and combine information from two places in the table, (see Appendix 2B). To correctly answer these questions, participants had to locate and combine information from more than one place in the table.

Need for Cognition.

An 18 item need for cognition scale (Cacioppo, et al., 1984) was presented to participants. This scale was considered to be a robust measure of need for cognition with a Cronbach’s alpha coefficient of +.90 (Cacioppo, et al., 1984). A copy of the 18 item need for cognition scale presented to participant can be found in Appendix 2C.

Demographic and Experience Questionnaire: Participants' age, gender, education and income were recorded. Participants' experience with each consumer domain was also assessed. Participants were asked questions about their interaction with energy supplier companies and mobile phone providers. See Appendix 2D for a copy of the demographic and experience questionnaire presented to participants.

2.7.3 Procedure

All participants were tested individually. Apart from the Ravens Standard Progressive Matrices, no time limit was set for completing any other component of the experiment. However, the time it took each participant to complete both the energy supplier task and the mobile phone task were recorded. In total, Experiment 2 consisted of eight discrete tasks: Energy supplier decision task, Mobile phone company decision task, demographic questionnaire, Ravens standard progressive matrices, Wais-III vocabulary scale, digit comparison, numeracy questionnaire and need for cognition scale. All participants were presented with either the energy company or the mobile phone provider decision task first. The presentation of these tasks was counterbalanced across both age groups, as was the order of the questions within each decision task according to five different sequences.

Prior to testing, participants were given a short brief to familiarise themselves with the various tasks. The use of calculators was not permitted; however scrap paper and pens were provided and participants were informed that they could use these should they wish to aid them with their answers.

2.8 Results

The data in table 2.8 is consistent with data in Experiment 1 showing declines in processing speed, fluid intelligence and numeracy as a function of age. Furthermore, older adults performed better than younger adults in the vocabulary task (measuring crystallised abilities).

Table 2.8 Descriptive Statistics for Young and Old Participants

Predictive Measures	Young		Old	
	M	*SD*	*M*	*SD*
Age	21.14	5.34	71.74	5.59
Ravens	31.61	2.39	26.07	5.03
Digit Comparison	75.83	13.42	57.5	13.8
Numeracy	9.47	1.4	7.71	2.16
Need for Cognition	63.26	9.9	57.33	12.85
Vocabulary	58.12	9.76	64.28	15.66

An independent samples *t* test showed that young participants did significantly better than old participants on scores for numeracy, t (126) = 5.49, p < .01, digit comparison, t (126) = 7.62, p < .01 and RAVENS, t (125) =7.93, p < .01, and on need for cognition, t (126) =2.93, p < .01. Finally, older adults performed significantly better on the vocabulary task than younger adults t (120) = -2.63, p < .01.

Table 2.9 Descriptive Statistics for Young and Old Participants for Topic and Question Type.

Problem Type	Condition	Young		Old	
		M %	*SD*	*M %*	*SD*
Factual	Utility Task	95.90	11.04	84.66	27.16
	Phone Task	85.77	18.2	71.96	30.98
Inferential	Utility Task	51.66	24.39	44.97	29.73
	Phone Task	70.13	26.02	55.03	25.73
Average time taken to complete task (min)	Utility Task	9.4	4.57	13.37	6.58
	Phone Task	9.78	4.53	13.43	6.78

Table 2.9 shows the percentage means and standard deviations for the number of correct decisions older and younger adults made in both decision contexts. The data suggests that younger adults performed better than older adults on all questions; and that all participants scored better on factual questions compared to inferential questions. Younger adults completed both tasks an average of approximately 4 minutes more quickly than older adults. A t test confirmed that younger adults completed the utility task significantly faster than older adults, t (128) = 3.97, p < .01. Young adults also completed the mobile phone task significantly more quickly than older adults, t (128) =-3.59, p < .01.

A 2X2X2 (Age X Question type X Topic) repeated measures ANOVA was used to analyse the data. Results indicated a significant main effect of age (old vs. young), F (1,126) = 18.97, p<.01, η^2 = .13. Please refer to Statistics Appendix 2 for all summary tables corresponding to Experiment 2.

A significant main effect of question type (factual vs. inferential) was revealed, F (1,126) = 231.38, p <.01, η^2 = .65, but no significant interaction was found between age and question type, F (1,126) = .18 p >.05, η^2 = 0. This data replicates the results of Experiment 1 whereby it seems both younger and older adults had more difficulty in identifying the correct answer as the problems became more complex. In contrast with the findings from Experiment 1, the data from the current study suggests that older adults were not as successful as younger adults at making accurate judgements.

There was no significant main effect of topic (utility supplier vs. mobile phone company), F (1,126) = .48, p >.05, η^2 = 0 and no significant interaction was found between age and topic, F (1,126) = 1.78, p >.05, η^2 = .24. This data suggests that both young and old adults found each topic equally demanding. In addition, no significant interaction between question type (factual vs. inferential), topic (energy company vs. mobile phone supplier) and age (young vs. old) was established, F (1,126) = .51 p>.05, η^2 = 0.

Although many of these findings are consistent with those of Experiment 1, the data from the current study indicates a main effect of age. This suggests that age did impact performance on the decision making task. Further analysis revealed that when vocabulary was used as a covariate, the effect of age remained robust F (1,119) = 17.42 p <.01, η^2 =.13 and a main effect of question type (factual vs. inferential) was stable, F (1,119) = 10.1, p <.01, η^2 = .08. No significant interaction was revealed between question type and vocabulary, F (1,119) = .02 p >.05, η^2 = 0. Finally, no significant interaction was revealed between age and question type, F (1,119) = .06, p >.05, η^2 = 0.

When fluid intelligence was added alongside vocabulary as a covariate, the main effect of age disappeared F (1,117) = .39, p >.05, η^2 = 0, as did the main effect of problem type F (1,117) = .6, p >.05, η^2 = .01. No significant interaction was revealed between age and question type, F (1,117) = .58, p >.05, η^2 = .01, vocabulary and question type, F (1,117) = .18, p >.05, η^2 = 0, or fluid intelligence and question type, F (1,117) = 1.98, p >.05, η^2 = .02. This finding suggests that the age differences in decision-making ability can be explained by differences in fluid intelligence (as seen in Experiment 1).

When numeric ability was added as a covariate alongside vocabulary and fluid intelligence, the main effect of age remained absent F (1,116) = 1.63, p >.05, η^2 = .01 as did the main effect of problem type, F (1,116) = .1.41, p >.05, η^2 = .01. No significant interaction was found between age and question type, F (1,116) = .11, p >.05, η^2 = 0. No interaction was revealed between question type and vocabulary, F (1,116) = .06, p >.05, η^2 = 0. However significant interactions were found between question type and fluid intelligence, F (1,116) = 5.89, p <.05, η^2 = .05 and question type and numeracy, F (1,116) = 6.58, p <.01, η^2 = .05. This data suggests that participants with lower levels of fluid and numeric ability were more affected by question difficulty. In other words, individuals who scored poorly on measures of fluid intelligence and numeracy found inferential questions more difficult than participants who scored highly on these measures.

Because no significant difference in performance in either topic domain was established, the data from the utility and mobile phone company problems were combined. To examine whether there were any relationships between predictive measures of performance and aptitude on factual and inferential problems for younger and older adults, a series of Pearson correlations were carried out.

Table 2.10 Pearson Correlation Matrix among Predictive Measures of Ability, Questions Type and Combined Topics for Young Old Adults

		Predictors				
Question	Group	Numeracy	Digit Comparison	Ravens	Need for Cognition	Vocabulary
Factual	Young	.14	.28*	.25*	-.06	.01
	Old	.34**	.25*	.57*	.32*	.09
Inferential	Young	.4**	.16	.21	.03	-.04
	Old	.51**	.28*	.44**	.24	.18
Combined	Young	.38**	.37*	.3*	0	-.03
	Old	.5**	.31*	.6**	.33*	.16

*p < 0.05 **p<0.01

The pattern of data for older adults displayed in Table 2.10 shows a strong relationship between performance on factual and inferential questions and fluid intelligence and numeracy. The pattern of results was less clear for young adults, however once the data from both question types was combined, numeracy, digit comparison and Ravens were all found to be significantly related to performance on the decision making task.

A multiple regression analysis was performed next. Numeracy, fluid intelligence, crystallised intelligence, speed of processing and need for cognition were entered as predictive variables. In total, three independent analyses were run for each age group with factual, inferential and combined scores for both problem types entered as dependent variables. The data from the two topic domains were collapsed so that the total number of factual and inferential questions correctly answered by either age group could be analysed.

Table 2.11 Multiple Regression Analysis for Younger Adults Decision Making Ability and Predictive Measures of Performance

Question	Predictors	β	t	Sig	R^2	Adjusted R^2
Factual	Numeracy	0	-.01	.99	.15	.07
	Fluid Intelligence	.23	1.71	.09º		
	Vocabulary	-.08	-.57	.57		
	Speed of Processing	.31	2.4	.02*		
	Need for Cognition	.01	.09	.93		
Inferential	Numeracy	.36	2.74	.01*	.2	.12
	Fluid Intelligence	.11	.79	.43		
	Vocabulary	-.17	-1.31	.2		
	Speed of Processing	.1	.84	.41		
	Need for Cognition	.03	.22	.83		
Combined	Numeracy	.78	2.14	.04*	.24	.17
	Fluid Intelligence	.2	1.58	.12		
	Vocabulary	-.17	-1.35	.18		
	Speed of Processing	.24	2	.05*		
	Need for Cognition	.03	.22	.83		

*$p < 0.05$, **$p < 0.01$, ° $p < .1$

Table 2.11 shows that for young adults, performance on factual questions could be independently predicted by speed of processing. Furthermore, fluid intelligence was a marginally significant predictor of consumer decision-making on these types of problems. In terms of inferential decision-making, numeracy was revealed to be a highly significant independent predictor of performance. Numeracy and speed of processing were also found to be significant predictors of performance when both factual and inferential problems were combined.

Table 2.12 Multiple Regression Analysis for Older Adults Decision Making Ability and Predictive Measures of Performance

Question	Predictors	β	t	Sig	R^2	Adjusted R^2
Factual	Numeracy	.1	.84	.4	.44	.38
	Fluid Intelligence	.59	4.49	0**		
	Vocabulary	-.18	-1.49	.14		
	Speed of Processing	-.02	-.16	.87		
	Need for Cognition	.12	.89	.38		
Inferential	Numeracy	.46	3.52	0**	.36	.3
	Fluid Intelligence	.18	1.25	.22		
	Vocabulary	.08	.66	.51		
	Speed of Processing	.17	1.3	.2		
	Need for Cognition	-.16	-1.15	.26		
Combined	Numeracy	.33	2.78	.01*	.5	.46
	Fluid Intelligence	.47	3.75	0**		
	Vocabulary	-.06	-.57	.58		
	Speed of Processing	.08	.72	.48		
	Need for Cognition	-.02	-.14	.89		

*p < 0.05, **p< 0.01

Table 2.12 shows that fluid intelligence was a highly significant predictor of older adults' decision-making ability for factual questions. For inferential questions, numeracy was found to be a highly significant independent predictor of performance. When both factual and inferential problems were combined, both numeracy and fluid ability were found to independently predict decision-making performance.

Data from the six questions aimed at assessing experience were analysed using a Chi-squared. Results indicated that older adults were most likely to be responsible for payment of utility bills, χ^2 (1) = 36.52, P <.01, most likely to have changed their utility supplier in the last year, χ^2 (1) = 5.86, P <.05, and contacted their utility supplier in the last year, χ^2 (1) = 6.83, P <.05.

With regard to participants' interaction with mobile phone companies, young adults were most likely to own a mobile phone, χ^2 (1) = 17.53, P <.01, be responsible for paying their mobile phone, χ^2 (1) = 8.17, P <.05, and have changed their mobile phone company in the last year, χ^2 (1) = 18.78, P <.01.

Over all, these findings indicate that younger adults have much greater interaction with mobile phone companies while older adults are much more engaged with utility suppliers. Finally, analysis exploring whether experience with utility suppliers and mobile phone companies affected decision making performance was conducted. A number of ANOVAs (age X experience X Total number of factual and inferential questions answered correctly) were performed. Results revealed a main effect of age on decision performance across all measures of experience. No main effects of experience on decision performance for either topic was found.

2.9 Discussion

Experiment 2 sought to extend and replicate the findings from Experiment 1 by adding a few changes to the method. A sample twice as large was used; an additional consumer task was introduced and a scale measuring individual need for cognition was added.

Data from Experiment 2 was consistent with both previous literature and the findings in Experiment 1: younger adults out-performed older adults on measures of fluid intelligence, speed of processing and numeric ability whilst, older adults did better on a measure of crystallised intelligence. Interestingly, Experiment 2 revealed a significant main effect of age, whereby younger adults made better consumer decisions than older adults and furthermore, that when fluid intelligence was added as covariate, the effects of age disappeared. This finding replicates that found by Experiment 1 and suggests that age differences in decision-making are affected by fluid intelligence.

Further data replicating findings from Experiment 1 showed both young and old participants found complex problems more difficult than simple problems. This finding supports previous research (e.g. Hanoch, et. al., 2011; Hibbard, et. al., 2002; Schaie & Willis, 1993) whereby comprehension is compromised as decision environments becomes more complex.

The results illustrated that adding fluid intelligence and numeracy created the best model for predicting performance on inferential consumer decisions for older adults. This finding supports our prediction regarding the key role of numeric ability in making consumer choices.

In addition, the data also suggests that domain specific knowledge cannot explain choice. It seems that even when presented with a consumer decision in a relatively unfamiliar domain (selecting a mobile phone company), older adults were able to perform to an equivalent level as when making decisions in a familiar domain (selecting an energy supplier). That is, experience had little effect.

Finally, the notion that older adults' performance was influenced by increased need for cognition was not supported for two reasons. First, older adults performed poorly compared to young adults on the need for cognition scale. Second, need for cognition was unrelated to performance on the consumer decision task. Therefore this data suggests that need for cognition cannot account for consumer decision-making ability in these domains.

2.10 General Discussion

In a country where millions of older adults are living in fuel poverty and are faced with increasing rises in the price of basic commodities, the need to make sound financial decisions is imperative. The current research aimed to investigate age differences in consumer decision-making. In attempting to explain the differences factors thought to predict performance including numeracy, fluid and crystallised intelligence, speed of processing, need for cognition and experience were investigated. It was proposed that age-related limitations in cognitive ability may affect older adult's ability to make good consumer decisions. Furthermore, the idea that older adults may compensate for declines in fluid intelligence by relying more on other abilities such as knowledge gained through experience, crystallised intelligence or numeracy was investigated.

Data from Experiment 1 indicated that young and old adults were equally adept at making factual and inferential decisions when selecting an energy supplier. These findings are interesting for two reasons; first, older adults performed significantly worse than young adults on most predictive measures of ability; and second, previous research suggests that older adults tend to perform poorly on decision making exercises compared to young adults. Analysis revealed that when a measure of crystallised intelligence was added as a covariate, a main effect of age emerged (perhaps because older adults in this experiment scored particularly highly in terms of crystallised ability and crystallised ability is associated with relevant knowledge). A main effect of age was already apparent from the data for Experiment 2 whereby younger adults were more adept at making consumer choices than older adults. Most interestingly, the main effect of age could be removed from both experiments when fluid intelligence was added as a covariate. In addition, numeric ability was found to independently predict performance on the decision-making task for both young and old adults. These findings add further support to the idea that fluid intelligence and numeric ability play important independent roles in consumer decision making. These findings are consistent with ideas proposed by Stanovich and West (2008) who thought that making good decisions required having enough experience to recognise which decision rule applies and enough fluid ability to implement it. With regards to Experiments 1 and 2, decisions were made in a consumer context where the decision rule was numeric in nature. Therefore, good numeric ability was crucial in recognising which rule to apply and fluid intelligence was important in terms of having the capacity to apply it.

The data from Experiments 1 and 2 is consistent with the idea that decision-making is affected by different processes for old and young adults. In Experiment 2, numeric ability was found to independently predict decision performance for younger adults on inferential questions. However, no other cognitive measures of ability were found to significantly predict decision-making aptitude in younger adults for either experiment. For older adults, numeric ability and fluid intelligence were consistently found to predict performance in decision making in Experiments 1 and 2. These results are consistent with previous research by Peters, et al., (2006), Tanius et al., (2009) and Wood et al., (2011) who found that numeracy was a strong independent predictor of performance in similar decision tasks. These findings imply that in the case of older adults' financial decision making, performance is highly dependent upon numeric ability. Taken together, previous research and data from Experiments 1 and 2 may have important financial consequences when considered in terms of making decisions outside of the laboratory. Individuals with poor numeric ability may be at increased risk of making bad consumer choices with serious financial implications. In support of this argument, Banks and Oldfield (2006) reported that individuals with good numeric ability were more than two and a half times more likely to be in the highest wealth quintile. Those with the worst numeric ability were over 6 times more likely to be found in the poorest wealth quintile. Overall, it seems that data from the current study and previous research support the idea that numeric ability is an independent skill, integral to making sound consumer decisions.

The data raises important practical implications. It is well established that little can be done to halt most age related cognitive declines. However, if numeric ability is malleable, it may have the potential to be improved, even in later life. This is an exciting possibility as it suggests that numeracy skills in older populations have the potential to be developed in order to support their consumer decision-making. Previous studies have demonstrated that educational interventions designed to target low-literacy individuals in making health choices can benefit these individuals (DeWalt et al., 2006). This finding has also been shown to be true of numeracy. For example, Nicol and Anderson (2001) showed that numeric ability could be improved in adults with mild learning disabilities by implementing a maths training programme, using either a computer or teacher lead course.

The current experiments have a number of limitations. First, the decision-making tasks had been simplified and therefore do not necessarily capture the complexity of these problems that people are faced with in everyday life. Second, the tasks were well structured and well defined with regards to the dimensions of relevant information (for example, prices are displayed as whole numbers and the amount of available information to compare is comparatively small), and therefore differ from making real-life decisions, which have more complicated features. Furthermore, participants were forced to make a choice, whereas when faced with choices in the real world, consumers have the option to abstain from making a decision. Third, the decisions that participants made did not involve significant consequences and thus may not necessarily reflect real-life decision-making. It is possible that participant performance could have been improved if incentives were included. Indeed, it is important to note that consumers making choices outside of the laboratory could be more liable to influence from other factors (e.g. emotions) which may place increased limitations on their decision-making ability.

It is becoming ever more important that individuals are able to use numeric information in making financial choices, medical decisions and many other vital evaluations. The need for a clear understanding of what influences decision-making abilities as we age is imperative. Identifying the types of tasks which are most challenging for older adults, and how age related potential and limits develop is key in order that judgement and decision aids can be tailored optimally.

Chapter 3 explores how older adults adapt to consumer environment structures given that age-related cognitive declines may place limitations on their decision-making ability. In an attempt to maximise the validity of the research, participants were provided with three decision options available to consumers in the real world: to stick with a predetermined choice, to switch to an alternative option or, to decide in the future. Furthermore, it is important to consider that the reality of decision-making in a consumer environment often requires individuals to engage in some form of self-regulation. The literature suggests that older adults have a positivity bias and are better at regulating their emotions. However, it has also been well documented that older adults have comparatively fewer cognitive resources on which to draw when making decisions. How older adults balance increases in affective control and declines in cognitive ability when making consumer choices may have important implications for their quality of life. Next, how older adults may optimise their restricted cognitive reserves by using emotion regulation to lessen the effects of age-related cognitive decline is considered in the context of Baumeister, et al's., (1998) strength model.

Chapter 3

3.1 Introduction

Chapter 2 identified and measured how cognitive and numeric abilities affect consumer decision-making performance in young and old adults. The results suggested that numeric and fluid ability were good predictors of decision-making capability for older adults. It is important to note that the problems presented to participants in Chapter 2 only required that one alternative be selected. However when making a decision in the real world, people often have the opportunity to stick with a pre-selected option, select an alternative option (switch), or to avoid making a decision by deferring (do not make a choice) or postponing the decision (decide to make a decision in the future). Consumers can exercise a number of defer-choice options; this may include deciding to seek more information on existing alternatives or searching for new alternatives. Given the evidence suggesting that older adults have limited cognitive resources, it seems reasonable to expect they may tend to select less demanding strategies when making decisions, this might involve attempting to avoid making a decision or choosing to stick with a pre-determined option. As will be outlined, much of the literature has concentrated on the circumstances where participants simply defer making a decision. Surprisingly little attention has been paid to the conditions where participants opt to decide in the future, despite this representing a valid response to many of the types of decisions faced by consumers. A primary aim of Experiment 3 was to measure age differences in the number of times older and younger adults chose to stick, switch or decide in the future when presented with a preselected option.

A secondary aim was to assess age differences in decision-making in a manner that reflected the real world. It is acknowledged that individuals are subject to many factors, which may impact their ability to make good consumer choices. These factors include affect, emotion and motivation. Experiment 3 examined the extent to which older and younger adults were influenced by tasks that required emotional regulation prior to decision-making.

3.2 Choosing to Defer or Decide in the Future

Dahr (1997) and Shafir and Tversky (1992) proposed that an individual will be more likely to defer choice when the decision environment becomes more complex. For example, research has shown choices involving conflict cause people to defer more often than when choices are easy (Shafir & Tversky, 1992). The literature proposes two dominant viewpoints in explaining why individuals defer choice (Karni & Schwartz, 1977; Tversky & Shafir, 1992). On the one hand, some researchers propose that the no-choice option should be chosen when none of the alternatives are seen as attractive, or when there are benefits to further search (Karni & Schwartz, 1977). Conversely, research into pre-decisional processes suggests that consumers may decide not to choose in order to avoid making difficult trade-offs (Tversky & Shafir, 1992). Decision avoidance can be defined as a tendency to avoid making a choice or by postponing it by seeking an easy way out that involves no action or change (Wesseler, Weikard & Weaver, 2003).

Tversky and Shafir (1992) conducted a number of studies to investigate why individuals chose to defer choice. In one study, participants were asked to imagine that they were making a choice between two student apartments. They were presented with information about the monthly rent and distance from the university campus. Each apartment had one bedroom and a kitchenette. Participants were then given the option to choose between two apartments or to continue to search for alternative apartments. Results indicated that the decision to defer choice was dependent upon the difficulty of choosing among the options under consideration. Tversky and Shafir (1992) concluded that when the choice involved conflict, people were more likely to seek a new option than when the choice was easy.

In another experiment, Tversky and Shafir (1992) illustrated that decision conflict increased the tendency to select both the default option and the tendency to defer choice. Two conditions existed. In the first condition, participants were asked to imagine that they were considering buying a CD player but had not yet decided which model to buy. They were asked to imagine that they pass a store that is having a one-day clearance sale that offers a popular SONY player for $99, well below the list price. Participants were then asked whether they wanted to buy the SONY CD player, or wait until they had learnt more about various other models. In the second condition, participants were asked to imagine the same scenario as in condition one, with the addition of a top of the line AIWA CD player priced at $159 (again, well below the list price) being available in the sale. Participants were then asked if they would like to buy the AIWA player, the SONY player or, wait until they had learnt more about various models. The results from this study suggested that the addition of a second CD player significantly increased the tendency to delay a purchase. When the SONY CD player was available alone, it could be seen as representing a “good buy,” and the same may also be true for the AIWA. However, when both models were available, Tversky and Shafir (1992) proposed that the decision-maker faced a conflict between the better priced SONY and the higher quality AIWA. It was proposed that the difficulty in resolving this conflict lead participants to defer their decision and put off the purchase.

The findings outlined by Tversky and Shafir (1992) supported previous work by Shapard (1964), who noted that although people experience little difficulty in evaluating alternatives when considering only one attribute, their ability to weigh or combine separate attributes is not as good. Although there is no precise definition of conflict, it is generally assumed to depend upon the degree to which the alternatives under consideration have different advantages and disadvantages (Dahr, 1997).

In a number of studies, Dahr (1997) demonstrated that the attractiveness difference between alternative options can influence the conflict between different options, and thus affect the probability that an individual will defer their choice. In one study all participants were presented with a choice set with two non-dominated alternatives for four different choice problems. The alternative options were described on five features: three good and two bad. For example, participants were shown information about two holiday destinations. Destination A was listed as having the following attributes: good theatres and clubs, good restaurants, attractive beach, bad weather possible and frequent traffic jams. Destination B had the following features: beautiful scenery, good museums, plenty of good party spots, has a pollution problem and unfriendly tourists. Participants had three options, to look for other holiday destinations, choose destination A or choose destination B. Participants were assigned to one of two conditions: those in the experimental group were asked to think about each feature for two alternatives and then rate the extent to which it made them more or less likely to choose each option. Participants in the control condition were simply instructed to read the information about the alternatives carefully before making their decisions. Results indicated that 40 per cent of participants in the control condition decided to look for other holiday destinations, this number increased to 54 per cent when participants were first asked to rate the importance of each feature. These findings provide evidence supporting the notion that the inability to clearly identify the best choice among alternatives results in increases in the decision to defer choice.

As outlined above, opting to defer choice can be seen as a way of avoiding making a decision. Wesseler et al., (2003) suggested that decision avoidance may take the form of postponing making a decision. It is proposed that deferring a choice (i.e. deciding not to make a choice) and opting to postpone making a decision (i.e. to decide in the future) may incur very different psychological interpretations and therefore, potentially different responses. In other words, providing participants with the option to decide in the future suggests that if participants choose not to make a decision now, they should expect to do so at some forthcoming point in time, whereas choosing to defer implies that a decision will not be revisited. Taken together, it is not unreasonable to propose that selecting to defer or to decide in the future may incur different costs in terms of psychological resources. To date, research on deciding to make a decision in the future is scarce. This is surprising given that opting to make a decision in the future represents a valid response to many consumer decisions.

3.3 Choosing to Stick

The choice to stick with a pre-selected option can be viewed as arising from similar decision conditions as the choice to defer. The role of effort in explaining why people tend to stick with a pre-selected option has been widely discussed (Samuelson & Zeckhauser, 1988; Sunstein & Thaler, 2003; Thaler & Sunstein, 2008).

Samuelson and Zeckhauser (1988) found that people showed a strong and robust tendency to stick with what they have (the status-quo) even when it had been randomly allocated. Samuelson and Zeckhauser (1988) developed two versions of a number of decision questions: neutral and status quo. In the neutral version, participants were presented with a novel decision whereby they were required to make a selection from several alternatives, all of which were comparatively equal. Participants were given information about financial investments and instructed to imagine that they had received a large sum of money and were considering investing it in either one of four portfolios: a moderate-risk company, a high-risk company, treasury bills or municipal bonds. In the status quo version, participants were presented with the same scenario whereby they were again required to make a selection from a number of alternatives however, this time, they were told that a significant portion of the money was already invested in a moderate-risk company. In this status-quo condition, one of the options presented was equal to selecting the status quo. Many different scenarios were investigated, all using the same experimental design. Results from this study show that an alternative became significantly more likely to be selected when it was designated as the status quo.

Hartman, Doane and Woo (1991) tested the status-quo bias in a field setting using a survey of California electric power consumers. Initially, consumers were divided into two groups: one with much more reliable service than the other. Each group was then asked to select a preference among six combinations of service reliabilities and rates, with one of the options designated as the status quo. The results demonstrated a clear status quo bias, 60.2 per cent of consumers in the high reliability group selected their status quo as their first choice. In addition, 58.3 per cent of consumers in the low reliability group also chose to stick with the status quo as their first option. In other words, people tended to stick with their electricity supplier regardless of service. The status quo bias has been observed both inside and outside of the laboratory.

Similarly to the literature on status-quo bias, most existing research on the effects of default options concludes that default options affect choice by taking advantage of consumers' processing limitations. Researchers have often seen status-quo bias and default preferences as representing a very similar idea, namely that individuals are highly prone to keeping with customary (status-quo) or default options even when other alternatives are available (Loewenstien, Brennan & Volpp, 2007). For example, Johnson, Bellman, and Lohse (2002) showed that consumers who were obliged to opt out of an e-mail list were as much as twice as likely to participate in the list than consumers who could explicitly choose between receiving and not receiving the e-mails. Similarly, Park, Jun, and MacInnis (2000) found that consumers presented with a fully loaded car and given the opportunity to remove optional features to save on cost ended up with a more expensive set of features than those presented with a basic model and given the opportunity to add features for more money.

In line with a cognitive limitations explanation of decision-making, Wesseler, Weikard and Weaver (2003) suggested that people might avoid making a decision (i.e. stick with a pre-selected option or postpone the decision) so that they can conserve energy (or resources). In other words, individuals perceive the cognitive effort required to compare competing alternatives to be too costly. Peoples' resources are subject to many demands. How young and old adults reconcile these demands and make good decisions when resources are limited is an important question. To date, no research has empirically investigated the relationship between ageing and the following decision options: to stick (with a pre-selected option), switch or choose to decide in the future. Given stark convergent evidence that ageing is associated with declines in many abilities key to good decision-making, it is predicted that older adults will attempt to conserve resources by selecting strategies which are least demanding of their cognitive reserves. In other words, older adults will choose to stick with a preselected option or choose to decide in the future more often than young adults.

3.4 Ageing, Limited Resources and Decision-Making

Findings provide strong evidence that self-regulation, in particular, emotional functioning, is spared from age-related decline, if not enhanced with age (Charles & Carstensen, 2004). This pattern is in stark contrast to the substantial body of literature documenting age-related declines in cognitive ability. How ageing affects decisions that draw on both emotional and cognitive processes may have different implications for young and old adults. Experiment 3 seeks to examine how areas of preserved functioning may help in determining methods to compensate for age-related declines in fluid ability and decision-making. When making choices outside of the laboratory, individuals are subject to many affective factors. These factors can be seen as competing for resources, yet regulating them can also be costly in terms of cognitive reserves. The consequences of these factors on decision-making can be considered in the context of the Strength Model (Muraven, Baumeister & Tice, 1998). The Strength Model proposes that acts of self-regulation (cognitive, emotional or behavioural) all draw upon one, limited supply. Furthermore, all acts involving self-control, volition or initiative rely on this resource (Baumeister, Muraven & Tice, 2000). It is thought that this resource is easily depleted (a process known as ego-depletion). Ego-depletion has been reported across a variety of tasks in physical, intellectual and emotional domains. The relationship between ego-depletion and decision-making may have important implications in terms the type of choice a consumer will make.

Dewitte, Pandelaere, Briers and Warlop, (2005) showed that participants were significantly more likely to select a product compliant with that presented on a poster after a period of ego-depletion. In their study, participants were assigned to one of three ego-depletion conditions: high, low and no ego-depletion. This was manipulated by means of an information search task on the Internet under time pressure. Following the manipulation procedure, participants were required to select one brand from a selection of brands for several product categories. One of these brands was made salient by means of a poster display. These results suggest that ego-depletion can increase the effect of salient situational cues, such as a supporting poster display on consumers' choice. An alternative explanation is that participants viewed the brand depicted in the poster as a default selection. Any attempt to process alternative options can be seen as requiring an increased expenditure of effort. Both these explanations are supported by Baumeister et al.,

(1998) strength model whereby ego-depleted individuals will seek to conserve resources by reducing the level of elaboration used when making a choice. Likewise Pocheptsova et al., (2007) found that depleted individuals were more likely to engage in flawed decision strategies in an attempt to conserve energy by taking short cuts instead of engaging in effortful processes.

Other research has revealed that seemingly unrelated functions such as emotion and executive function seem to draw from the same limited resource. Indeed, decision-making is often done in the context of competing distractions and affective responses. Schmeichel (2007) investigated whether attempts to control emotional responses deplete the capacity for executive control. Participants were shown two short film clips, which were intended to elicit negative emotions. One clip depicted disgusting eye surgery and the other clip showed sad children describing family hardships. Some participants were instructed to exaggerate the outward expression of their emotions as they watched, whereas other participants were instructed to simply express their emotions. Results showed that exaggerating the expression of negative emotional responses reduced subsequent working memory span. Other researchers have shown that emotion regulation effects memory both in laboratory settings (Richards & Gross, 2000) and outside the laboratory environment (Richards, 2000). The finding that emotion regulation and cognition draw on the same resource used for executive functioning could have implications for consumer decision-making.

Research provides compelling evidence in support of the strength model, however self-regulation may not always have a depleting effect on reserves. Specifically, it is thought that different forms of emotion regulation incur different consequences, which vary as a function of age.

Two forms of emotion regulation were defined by Gross: reappraisal and suppression. Reappraisal is thought to take place early on by engaging executive control processes to redefine the meaning of a situation and thus determine the subsequent sequence of emotions. Suppression takes place later and requires the individual to consciously manage and modify the behavioural aspects of their emotional responses. It is proposed that reappraisal entails less cognitive effort compared to suppression and therefore, when regulating emotions using this method, executive functions are more likely to remain intact. Suppression is considered to be relatively demanding of cognitive resources, which may lead to impaired executive processes. In general, research investigating the effects of emotion-regulation can be seen as supporting a model of limited resources (Gross, 1998; Richards 2000).

In terms of ageing, John and Gross (2004) proposed that older adults tend to make greater use of reappraisal and less use of suppression. This hypothesis was based upon two observations in the ageing literature. First, when compared to younger adults, older adults tend to report experiencing less negative emotion (Carstensen, Pasupathi, Mayr, & Nesselroade, 2000; Charles, Mather, & Carstensen, 2003). Second, older adults describe having greater emotional control than younger adults (Gross, et al., 1997).

Research investigating the interaction between age, emotion regulation and executive function has shown that reappraisal has a far greater impact on memory for young adults compared with older adults (Scheibe & Blanchard-Fields, 2009). In their study, Scheibe and Blanchard-Fields, (2009) allocated both young and old participants into one of three conditions: control, down-regulation and maintenance control. All participants were shown a film designed to induce feelings of disgust. The footage used depicted a woman eating horse rectum while describing her experience. Prior to viewing the film, participants completed a memory task and rated their emotions. Participants in the control condition were given no instructions regarding how to regulate their emotions. Participants in the down-regulation condition were told to change the negative emotions elicited by the film into positive ones as quickly as possible and, participants in the maintenance control condition were told to maintain any negative feelings experienced while viewing the film. After the film, participants again rated their emotions and completed another memory exercise. Results showed that instructions to down-regulate emotions differently affected working memory performance in young and older adults. Working memory performance was impaired after the mood induction for young adults, yet was unaffected in older adults. Furthermore, memory was unaffected in both young and old adults when they were given no explicit emotion regulation instruction, or when given instructions to maintain feelings of disgust. These findings are consistent with the literature insofar that regulating emotions is more costly for young adults compared to old (Baumeister at al., 2007; Richards, 2004).

In summary, research on both the physical and cognitive costs of emotion regulation illustrate that different emotion regulation strategies can have diverse consequences. The costs of emotion regulation may be different depending upon the strategy used. Understanding how emotion regulation interacts in terms of facilitating or mediating cognitive costs could be important to recognising its role in decision-making. Many models of judgement and decision-making propose that good decisions require a number of exhaustive cognitive processes. Because ageing is associated with fewer cognitive resources, older adults may face an increased disadvantage when making decisions following periods of emotion-regulation. However, literature on ageing and the positivity bias suggests that older adults simply have better strategies for dealing with emotionally demanding stimuli (Carstensen & Mikels, 2005). Alternatively, it may be that as with any practiced skill, the effectiveness of different emotion regulation strategies may change with age because cognitive resources required for practiced strategies are reduced.

3.5 Experiment 3

Many decisions are made while in a state of emotional arousal. For example, medical decision-making may entail significant consequences for an individual and therefore can be seen as carrying a considerable emotional burden. Making good decisions under these circumstances may be difficult for even the most able. However, even mundane, everyday decision-making can place a strain on the individual's emotional and cognitive reserves. For example, an unexpected bill may cause worry or anxiety about financial repercussions. Complex discussions may lead to feelings of fatigue or pressure. Often an individual will control their emotions by engaging in a form of self-regulation. The toll of self-regulation on subsequent decision-making may be significant. How older adults balance declines in cognitive ability with advances in emotional control could have implications in terms of identifying ways to compensate for losses.

It was observed that choosing to make a decision in the future has received very little attention in the decision literature. As outlined above, previous research has concentrated on the circumstances where participants defer making a decision. It was proposed that opting to defer a decision might be understood differently compared to deciding to make a decision in the future. If this is true, it may be that allowing participants an option where they can decide in the future will reveal different findings compared to studies investigating the circumstances in which participants merely decide to defer. It is thought that the current study is unique in presenting both older and younger adults with the option to decide in the future.

Experiment 3 tested a number of hypotheses. First, that participants who regulated emotions using a demanding strategy (suppression), while viewing a distressing film, would make decisions using strategies requiring comparatively few cognitive resources (e.g. to stick or decide in the future). The second hypothesis predicted that participants instructed to regulate their emotions using a less demanding strategy (reappraisal or none) would decide to switch more often and make more correct decisions as cognitive reserves remain intact.

In terms of age differences, the ageing literature provides strong evidence in support of a developmental decline in cognitive abilities (such as fluid intelligence) and improvements in emotional control. Experiment 3 explored whether age-related advantages in emotion-regulation protected older adults from a state of ego-depletion or, whether ego-depletion was more prevalent in older adults due to age-related declines in cognitive resources. If age-related improvements in emotional control did protect older adults from the effects of ego-depletion, it was hypothesised that older adults placed in emotion-regulation conditions would make better (or equal) decisions compared to older adults in the control group. However, it was also hypothesised that older adults may be more susceptible to the effects of ego-depletion due to declines in cognitive ability. If this was true, it was predicted that older adults in the emotion-regulation conditions would make poorer decisions compared to those in the control group, and poorer decisions across all conditions compared to young adults.

3.6 Method

3.6.1 Participants

A total of 120 participants took part in the study; 61 young adults (52 female) aged 18 - 45 (M = 23.71, SD =7.82) and 59 older adults (40 female) aged 63 – 93 (M = 73.61, SD = 8.21). Participants from each age group were divided into three conditions: reappraisal (20 young and 20 old), suppression (20 young and 20 old) and control (21 young and 19 old). Older adults volunteered their time to complete the experiment and were recruited from Plymouth and the surrounding area. Young participants were recruited from the University of Plymouth and received course credits for their participation.

3.6.2 Materials

Films

In line with previous research (Scheibe et al., 2009; Schmeichel, 2007), footage designed to elicit disgust was presented to participants. A one-minute film depicting close-up footage of a fish hook being removed from a patient's eyeball was used in the current study. To test the reliable effects of the film at eliciting disgust a pilot study was conducted. Thirteen participants were shown the film and asked to rate on a likert type scale the extent to which they felt each of 16 emotional states. A rating of zero indicated that the film did not induce this emotion at all and a rating of ten denoted that the film elicited it very strongly. Of the 16 emotional states presented to participants ‘disgust’ and ‘tension’ were rated as the most strongly perceived emotions (see Statistics Appendix 3.1). To restore participants’ resources at the end of the experiment, a short comedy clip of Charlie Chaplin was presented. Research suggests that positive affect can help improve self-regulation following a period of ego-depletion (Tice, Baumeister, Shmueli & Muraven, 2007).

Manipulation check questionnaire

A manipulation check in the form of a short questionnaire was presented to participants after having viewed the film. This was used to verify whether instructions given to the reappraisal and suppression condition (but not the control group) were effective. Participants were required to read through three statements and rate on a scale from 0-8 how much they agreed or disagreed with each (‘0’ denoted ‘strongly disagree’ and ‘8’ denoted ‘strongly agree’). This scale was used for the first three statements: “During the film, I did not feel anything at all”, “During the film, I felt emotions but tried to hide them” and, “During the film, I reacted completely spontaneously.” A fourth statement required participants to rate on a scale from 0-8 how difficult they found it to follow instructions given to them prior to watching the film. ‘0’ denoted ‘not at all difficult’ and ‘8’ denoted ‘very difficult’. The fourth statement was not presented to participants in the control group as they were not given any instructions before viewing the film. The questions used in this manipulation check were borrowed directly from published research investigating the cognitive, physiological and social effects of emotion regulation (see Gross, 1998 and Richards and Gross, 2000). A copy of the questions presented to participants complete with response scales can be found in Appendix 3B.

Decision Task

To increase ecological validity, a new decision task was designed comprising choice options available to real consumers. This included the option to stick with a current option, switch to an alternative option or decide in the future. The decision task presented participants with hypothetical scenarios in which they were asked to make four choices in each of three consumer domains. In total, participants were required to make twelve decisions. The three consumer domains asked participants to make a choice regarding: a travel company (hotel, flight cost and how many stars the hotel had), hiring a car (hire, insurance and fuel economy), and a diving school (diving lessons, equipment cost and customer satisfaction). Information about eight companies labelled A-H was presented in a unique table for each of the twelve questions (see Table 3.1 and Appendix 3A for further details). An example scenario presented to participants is also depicted below. Participants were asked to imagine that they were making choices as they would in real life.

*"Imagine that you are planning a holiday. You are thinking about using Travel Company **A** which costs **£200** for the **hotel** and **£100** for the **flight**. The hotel has a **four-star rating**. You are generally satisfied with this holiday package but you suspect another travel company may offer better value and so you wish to investigate further."*

Table 3.1 Table of Travel Companies Depicting the Price of Hotels and Flights and the Number of Stars Each Hotel was rated as Holding.

Travel Company	Price of Hotel	Hotel Stars	Price of Flight
A	£200	☆☆☆☆	£100
B	£173	☆☆☆☆	£127
C	£144	☆☆☆	£156
D	£122	☆☆☆☆	£183
E	£133	☆☆	£172
F	£172	☆	£138
G	£114	☆☆☆	£196
H	£107	☆☆☆☆	£203

In each table one company had been highlighted. Participants were told that this indicated the company they were thinking of selecting. Participants then had the option to 'stick' with the option already selected, 'switch' to an alternative company or 'decide in the future.' Prior to attempting each problem, participants were presented with a short vignette outlining what they were expected to do and highlighting the important information relevant to each decision. If the option to 'switch' was chosen, participants were asked to indicate which company they would switch to by circling a letter from A-H.

Each of the three sections contained four questions. The questions were individually designed to manipulate difficulty. Questions were considered 'difficult' if differences in attractiveness between options were small (see problem types I and II). Questions were considered 'easy' if differences in attractiveness between options were large (see problem types III and IV). Each of these four questions was constructed so that the decisions were counterbalanced: (I) All options (A-H) were very similar, however two equal optimum choices were presented, one of which had already been selected. The correct choice would be to 'stick.' (II) All options (A-H) were very similar, with two equal optimum choices were available. However, neither of these options had been selected. The correct choice would therefore be to 'switch'. (III) Six of the eight options were very similar, though one company was markedly better than the others and one company was much worse. The best option had already been selected therefore the correct response would be to 'stick'. (IV) Six of the eight options were very similar, however, one company was much better value than the rest and one was much worse. An inferior option had been selected for this question, therefore the participant should opt to 'switch' to get a superior alternative.

Performance on the consumer decision task was scored in a number of ways. Participants could achieve a total score of 12 (100%) if they opted to stick on problems where the correct option had already been selected (as was the case for 6 items) and switch on problems where an incorrect alternative had been selected. Because the present task included the option for participants to decide in the future, the total number of correct answers a participant could attain varied depending on the number of times they chose to decide in the future. Another score was therefore given for the total mean percentage of times the option to decide in the future was selected.

After the number of times each participant selected the option to decide in the future had been subtracted, three additional scores were calculated. First, the mean percentage of correct stick and switch actions. Second, the mean percentage of complete correct switch decisions. This was done to attain a clearer picture of decision accuracy. In order that a decision to switch be recorded as completely correct, two steps were required: 1) to choose to switch and, 2) to switch to the correct alternative. Finally, the mean percentage of times participants correctly chose to stick and make complete correct switch decisions.

Positive and Negative Affect Schedule (PANAS-X; Watson & Clark, 1994)

The PANAS-X was used as a control measure to check that the ego-depletion manipulation was not affecting subsequent decision making because it caused changes in affect. One possible interpretation of the results is that self-regulation by way of suppression or reappraisal might have affected subsequent decision-making performance insofar that trying to regulate emotion may have been sufficiently averse that it increased negative affect. It is important to investigate this interpretation because negative affect has been shown to facilitate careful cognitive elaboration (e.g., Bless, Mackie, & Schwarz, 1992). With regards to the current experiment, if emotion-regulation were to increase negativity it should follow that performance on the consumer decision task should be improved.

Furthermore, the strength model of ego-depletion proposes that exertion of resources will be followed by a period of diminished capacity, or fatigue which is evidenced by poorer performance on subsequent tasks (Muraven et al., 1998). Should emotion-regulation be affective in causing a state of ego-depletion, it would be evidenced by higher scores on the fatigue sub-scale of the PANAS-X.

The PANAS-X yields separate scores of positive affect, negative affect and fatigue, and has been used in a number of similar studies (see Schmeichel, Vohs and Baumeister, 2003, Schmeichel and Vohs, 2009). The positive, negative and fatigue sub-scales were administered to participants (see Appendix 3C). Participants were required to read through a total of 24 words describing positive, negative and fatigue and rate the extent to which they experienced that item at the present moment. Items were rated on a scale from 1-5 where: 1 = Very slightly or not at all, 2 = A little, 3 = Moderately, 4 = Quite a bit and 5 = Extremely. A mean score for each subscale was then calculated.

Demographic Questionnaire

Participant's age, gender, education and yearly household income was collected (See Appendix 3D).

3.6.3 Procedure

Participants were tested individually and without a time limit. Prior to testing, participants were given a short introduction to familiarize themselves with the experimental tasks and order that they would be presented. The experiment consisted of two film clips (eye-surgery and Charlie Chaplin excerpt) and four tasks: Manipulation check questionnaire, Consumer Decision Task, PANAS-X and the Demographic Questionnaire.

All instructions used were taken from previous work conducted by Gross (1998) and Richards and Gross (2000). Before being presented with the eye-surgery film, participants were told that the computer screen would be blank for one minute and that this time should be used to "*clear your mind of all thoughts, feelings and memories*". After this one-minute baseline, participants received the following instructions; "*we will now be showing you a short film clip. It is important to us that you watch the clip carefully, but if you find the clip too distressing, just say*

"stop". For the control participants (*n* = 40, 21 young and 19 old) no further instructions were given.

Reappraisal participants (*n* = 40, 20 young and 20 old) received the following instructions: "*Try to adopt a detached and unemotional attitude as you watch the film. In other words, as you watch the film clip, try to think about what you are seeing objectively, in terms of the technical aspects of the events you observe.*

Watch the film carefully, but please try to think about what you are seeing in such a way that you don't feel anything at all."

Participants in the suppression condition (n = 40, 20 young and 20 old) received the following instructions: "*If you have any feeling as you watch the clip, please try your best not to let those feelings show. In other words, as you watch the film clip, try to behave in such a way that a person watching you would not know you were feeling anything. Watch the film clip carefully, but please try to behave so that someone watching you would not know that you are feeling anything at all*."

All participants then watched the eye-surgery film. This was followed by the manipulation check questionnaire. Participants then continued onto the decision task and were asked to work until they had completed all questions and then inform the experimenter once they had finished. There was no time limit imposed to complete this task, however the length of time it took each participant to finish these questions was recorded.

Time was recorded using a stopwatch. All older participants were tested individually and younger participants were tested in small groups. Before beginning the decision-making task, participants were briefed in terms of how they should begin and end this part of the experiment. The question booklet containing the consumer problems was placed face-down in front of each participant. Participants were told that they could turn the booklet over and begin working when the experimenter said 'start'. The experimenter explained that the length of time each participant took to complete this task was being logged, and that they should answer the questions at their own pace. Furthermore, young participants were told to raise their arm once they had completed the consumer problems and older adults were asked to simply inform the experimenter verbally. When the experimenter said 'start', the timer was begun. When participants indicated that they had completed the task, a note of how long each individual had taken was recorded from the stopwatch.

Participants were then instructed to work their way through the PANAS-X and demographic questionnaire. Instructions outlining how to complete each task were printed at the top of the corresponding pages. After participants had completed all aspects of the experimental procedure, they watched a short comedy film clip by Charlie Chaplin to restore their emotional standing.

3.7 Results

Performance on the Consumer Decision Task

To assess whether instruction to regulate emotions differently affected older and younger adults' performance on the consumer decision task, a number of performance measures were taken. Means and standard deviations for older and younger adults in each of these measures of the consumer decision task for all three conditions are presented in Table 3.2.

Table 3.2 Younger and Older Adults Performance in each Condition on the Consumer Decision Task.

	Condition	Young		Old	
		M	*SD*	*M*	*SD*
Percentage of 'Decide in the Future' choices	Suppression	8.33	14.05	11.25	22.5
	Reappraisal	2.92	5.59	7.08	15.60
	Control	1.98	4.49	16.23	29.46
Percentage of correct stick and switch choices and actions minus decide in the future responses	Suppression	88.1	12.54	68.92	20.58
	Reappraisal	79.63	13.29	79.04	17.31
	Control	82.49	13.43	56.02	26.37
Percentage of correct stick decisions	Suppression	82.5	21.27	60	26.16
	Reappraisal	80.83	14.58	75.83	25.06
	Control	79.37	14.82	55.26	28.89
Percentage of correct switch decisions	Suppression	80.83	18.16	59.17	30.34
	Reappraisal	73.33	19.79	74.17	23.86
	Control	81.74	16.59	48.25	32.34

The means and standard deviations for the number of times old and young adults selected to decide in the future are presented in Table 3.2. A univariate analysis of variance (Age X Condition) was conducted to see if either of these factors were related to the number of times participants selected the option to decide in the future. Results showed that there was a significant main effect of age F (2, 114) = 4.99, p<.05, η^2 = .04 with older adults selecting this option more often than young adults. There was no significant main effect of condition (suppression vs. reappraisal vs. control) F (2, 114) = .88, p >.05, η^2 = .02. No significant interaction between age and condition was found, F (1, 114) = 1.27, p >.05, η^2 = .02. Post hoc analysis using the Fischer LSD test revealed no significant difference between the percentages of times the older or younger adults opted to decide in the future in any condition. Please refer to Statistics Appendix 3 for all summary tables corresponding to Experiment 3.

To see whether condition affected the number of correct stick or switch decisions participants made, a mixed 3X2X2 analysis of variance (Condition X Correct choice X Age) was conducted. The results revealed no significant main effect of age, F (1, 114) = 1.45, p >.05, η^2 = .1, and a marginally significant main effect of condition, F (1, 114) = 24.07, p =.09, η^2 = .04 A significant interaction between age and condition was found, F (2, 114) = 4.97, p < .01, η^2 = .08. However, no significant interactions were found between correct choice and age, F (1, 114) = .04, p >.05, η^2 = 0; correct choice and condition, F (2, 114) = .19, p >.05, η^2 = 0 or correct choice, age and condition, F (2, 114) = .98, p >.05, η^2 = .02.

Additional t-tests were conducted to investigate further the interaction between correct choice, age and condition. Results revealed that for participants in the suppression condition, younger adults (M = 82.5, SD = 21.27) made significantly more correct stick choices than older adults (M = 60, SD = 26.16), t (1, 38) 3, p < .01. Younger adults (M = 80.83, SD = 18.18) also made significantly more correct switch choices than older adults (M = 59.17, SD = 30.33), t (1, 38) 2.74, p < .01.

Interestingly, for participants in the reappraisal condition, analysis revealed no significant difference in the number of correct stick choices made by young adults (M = 80.83, SD = 14.58) and old adults (M = 75.83, SD = 25.06), t (1, 38) .77, p > .05. Furthermore, no significant difference was revealed in the number of correct switch choices made by young adults (M = 73.33, SD = 19.79) and old adults (M = 74.17, SD = 23.86), t (1, 38) .77, p > .05.

For participants in the control condition, results showed that, younger adults (M = 79.37, SD = 14.81) made significantly more correct stick choices than older adults (M = 55.26, SD = 28.9), t (1, 38) 3.37, $p < .01$. Younger adults (M = 81.75, SD = 16.59) also made significantly more correct switch choices than older adults (M = 48.24, SD = 32.34), t (1, 38) 4.18, $p < .01$.

Problem Difficulty and Choice

The percentage means and standard deviations for the number of times old and young adults chose to stick and decide in the future on difficult and easy problems are presented in Table 3.3.

Table 3.3 Descriptive Statistics for the Number of Times Young and Old Adults Opted to 'Stick' or 'Decide in the Future' on Difficult and Easy Problems in Each Condition

	Condition	Young		Old	
		M	*SD*	*M*	*SD*
Stick choices on difficult problems	Suppression	45	18.02	44.5	18.01
	Reappraisal	54.16	20.14	46.33	17.37
	Control	50.79	17.06	46.32	23.67
Stick choices easy problems	Suppression	48.33	18.92	43.67	18.92
	Reappraisal	49.16	15.2	47.17	15.2
	Control	46.03	22.73	43.51	22.73
Decide in the future difficult problems	Suppression	11.67	18.81	12.17	22.72
	Reappraisal	3.33	8.72	8.83	16.38
	Control	3.33	8.98	19.3	30.05
Decide in the future easy problems	Suppression	5.83	12.42	11.17	24.71
	Reappraisal	2.5	8.16	5.83	18.16
	Control	0	0	13.16	30.21

To examine whether the number of times participants chose to stick or decide in the future on difficult and easy problems varied as a function of condition, two multivariate 2X2X3 analyses of variance (Age X Problem difficulty X Condition) were conducted. In terms of the number of times young and old participants chose to stick in each condition, no significant main effect was found for age, F (2,114) = 2.11, p >.05, η^2 = .02 or condition, F (2,114) = .8, p >.05, η^2 = .01. This suggests that neither age nor the condition participants were assigned affected how often they opted to stick. No significant main effect was found for problem difficulty, F (2,114) = .54, p >.05, η^2 = .01. This means that problem difficulty did not affect the rate at which participants chose to stick. No significant interaction was found between age and condition F (2,114) = .07, p >.05, η^2 = 0. This suggests that old and young adults chose to stick at a similar rate as each other across conditions. No significant interaction was found between age and problem difficulty suggesting that both young and old adults chose to stick at an equivalent rate as one another for both types of problems, F (1,114) = .08, p >.05, η^2 = 0. No significant interaction was revealed between problem difficulty and condition, F (2,114) = .5, p >.05, η^2 = 0. This implies condition did not affect the number of times participants chose to stick. Furthermore, no significant interaction was found between problem difficulty, age and condition, F (2,114) = .49, p >.05, η^2 = 0. This suggests that older and younger adults did not differ in terms of the number of times they selected the option to stick across conditions or problem types.

In terms of the number of times participants selected the option to decide in the future, a significant main effect was found for age, F (2,114) = 4.92, p <.05, η^2 = .04, with older adults selecting the option more often than younger adults. No significant main effect was found for condition, F (2,114) = .91, p >.05, η^2 = .02. This suggests that the condition participants were assigned to did not affect how often they opted to decide in the future. However, a significant main effect of problem difficulty was revealed, F (2,114) = 10.8, p <.01, η^2 = .09 with participants choosing to decide in the future more often when faced with difficult problems. No significant interaction was found between age and condition F (2,114) = 1.2, p >.05, η^2 = .02. This finding shows that old and young adults chose to decide in the future at a similar rate as each other across conditions. No significant interaction was found between age and problem difficulty suggesting that both young and old adults chose to decide in the future at an equivalent rate to one another for both types of problems, F (1,114) = .01, p >.05, η^2 = 0. No significant interaction was revealed between problem difficulty and condition, F (2,114) = .74, p >.05, η^2 = .01. This implies condition did not affect the number of times participants chose to decide in the future. Furthermore, no significant interaction was found between problem difficulty, age and condition, F (2,114) = 1.23, p >.05, η^2 = .02. This suggests that older and younger adults did not differ in terms of the number of times they selected the option to decide in the future across conditions or problem types.

Post hoc analysis revealed that young adults in the suppression condition chose to decide in the future significantly more often than participants in the reappraisal condition (p < .05). A marginally significant finding was also found whereby young adults in the suppression condition also chose to decide in the future more often than participants in the control condition (p = .06). Post hoc analysis revealed no significant differences for the number of times older adults chose to decide in the future and the condition they were in.

It is interesting to note that young adults chose to decide in the future significantly more when placed in the suppression condition compared to the other two groups. Once the option to decide in the future had been removed from the analysis, young adults performed best in the suppression condition. This may suggest that some of the younger adults were affected differently by the suppression instructions.

Manipulation Checks

In order to ensure that participants understood the instructions they were presented, a number of manipulation checks were included in the design of the experiment. Participants were presented with four questions after having been assigned to a condition and watched the film (see Appendix 3B). Mean ratings for each of these questions are presented in Table 3.4. To analyse the manipulation checks a 2 X 3 univariate analysis of variance (Age X Condition) was conducted for each question.

Table 3.4 Descriptive Statistics for Young and Old Adults Ratings for Each of the Manipulation Check Questions.

Question	Condition	Young		Old	
		M	*SD*	*M*	*SD*
Feelings while viewing film	Suppression	3.3	2.59	5.1	2.57
	Reappraisal	4.8	2.14	5.45	2.46
	Control	2.38	2.48	5.4	2.79
Hide emotions while viewing film	Suppression	5.05	2.48	3.05	2.78
	Reappraisal	3.25	2.47	3.35	2.47
	Control	3.52	2.42	1.42	2.19
Spontaneous reaction while viewing film	Suppression	1.85	2.23	4.8	3.12
	Reappraisal	2.45	2.01	5.75	2.27
	Control	3.14	2.22	6.68	2.24
Difficulty in performing instructions while viewing film	Suppression	2.5	2.14	1.21	1.61
	Reappraisal	3.4	2.54	1.65	1.84

In summary, the manipulation checks suggest instructions presented to participants in each condition were understood and adhered to correctly. Results for the question asking if participants had any feelings while watching the film showed that there was a significant main effect of age, F (1, 114) = 16.2, p <.01, η^2 =

.12 whereby older adults reported having less feelings in each of the three conditions compared to young adults. However, no significant main effect was found for condition (suppression vs. reappraisal vs. control) F (2, 114) = 2.49, p >.05, η^2 = .04. Finally, results indicated no significant interaction between age and condition F (2, 114) = 2.36, p>.05, η^2 = .04. Post-hoc analysis using Fischer's LSD test showed that participants assigned to the reappraisal condition reported having less feelings than those in the control groups (p < .05). No significant differences were found in other conditions for ratings of feelings while watching the film and condition.

Results for the question asking participants if they hid their emotions while viewing the film showed that there was a significant main effect of age, F (1, 114) = 8.38, p <.05, η^2 = .07 whereby young adults hid their emotions more than older adults, and a significant main effect of condition (suppression vs. reappraisal vs. control) F (2, 114) = 3.91, p <.05, η^2 = .06. However, there was no significant interaction between age and condition F (2, 114) = 2.43 p>.05, η^2 = .04. Post hoc analysis using Fischer's LSD test showed participants were significantly more likely to hide their feelings if placed in the suppression condition than in the control group (p < .05). No significant differences were found between the other conditions and the amount participants reported hiding their feelings while watching the film.

Results for the question asking participants if they reacted spontaneously while watching the film showed that there was a highly significant main effect of age, F (1, 114) = 56.6, p <.01, η^2 = .33 whereby older adults rated themselves as reacting far more spontaneously than young adults across all conditions. Also a significant main effect of condition (suppression vs. reappraisal vs. control) F (2,

114) = 4.47 p <.05, η^2 = .07 was found. As expected, both younger and older adults reported reacting most spontaneously in the control condition and least spontaneously in the suppression group. No significant interaction was found between age and condition F (2, 114) = .16, p >.05, η^2 = 0. Post-hoc analysis using Fischer's LSD test showed that participants assigned to the control condition reported reacting significantly more spontaneously than participants in the suppression group (p <.01). No significant differences were found between the other conditions and the amount participants reported reacting spontaneously while watching the film.

Results for the question asking how difficult participants found it to perform the self-regulation instructions showed a significant main effect of age F (1, 76) = 11.31, p <.01, η^2 = .13 whereby older adults reported that they found it easier than young adults to regulate their emotions. No significant effect of condition (suppression vs. reappraisal) F (1, 76) = 2.31, p >.05, η^2 = .03 and no significant interaction was found between age and condition F (1, 76) = .19, p >.05, η^2 = 0. Taken together, these findings suggest that the manipulation instructions were successful.

Time taken to complete the Consumer Decision Task

The time spent completing the decision task was recorded for each participant. This was to ensure that any effects were not confounded by the length of time taken by individuals assigned to each condition. Means and standard deviations for the number of minutes taken by younger and older adults in each condition are presented in Table 3.5.

Table 3.5 Descriptive Statistics for the Number of Minutes taken by Young and Old Adults in Each Condition to Complete the Consumer Decision Task.

	Suppression		Reappraisal		Control	
	M	SD	M	SD	M	SD
Young Adults	9.15	4.96	10.5	4.08	9.57	1.66
Old Adults	15.6	6.1	15.5	4.83	17.8	13.46

A 2 X 3 univariate analysis of variance (Age X Condition) was conducted to investigate whether condition had a significant effect on the time it took participants to complete the consumer task. Results revealed a significant main effect of age with older adults taking significantly longer on the consumer decision task than young adults, F (1, 111) = .29.68, p <.01, η^2 = .21. No significant main effect of condition was found, F (2, 111) = .41, p >.05, η^2 = .01 nor was there an interaction between age and condition, F (2, 111) = .61, p >.05, η^2 = .01.

The effects of condition on affect

In order to test the hypothesis that there would be no differences in affect in each of the three conditions, a univariate analysis of variance (condition) was conducted for each of the three scales tested in the PANAS-X. The means and standard deviations for the number of times old and young adults rated themselves as positive, negative or fatigued in each condition are presented in Table 3.6.

Table 3.6 Descriptive Statistics for Young and Older Adults Ratings for the Positive, Negative and Fatigue Sub-Scales of the PANAS-X

Scale	Condition	Young		Old	
		M	*SD*	*M*	*SD*
Positive	Suppression	2.37	.82	2.88	.60
	Reappraisal	2.15	.84	3.35	.67
	Control	2.21	.66	3.3	.82
Negative	Suppression	1.27	.53	1.2	.43
	Reappraisal	1.36	.50	1.09	.18
	Control	1.34	.37	1.12	.19
Fatigue	Suppression	2.16	.91	1.74	.83
	Reappraisal	2.01	.99	1.53	.77
	Control	2.32	.99	1.53	.79

Results for the positive scale of the PANAS-X showed a significant main effect of age F (1, 113) = 47.16, p <.01, η^2 = .29 whereby young adults showed lower levels of positive affect across all conditions as compared to their older counterparts. These findings are consistent with previous literature suggesting that older adults tend to be more positive than young adults. No significant main effects of condition on affect were found, F (2, 113) = .39, p>.05, η^2 = .01. No significant interaction between age and condition was found, F (2, 118) = 2.39, p >.05 η^2 = .04.

Results for the negative scale of the PANAS-X showed a significant main effect of age F (1, 113) = 6.59, p<.05, η^2 = .06 whereby younger adults reported more negative affect than older adults. There was no significant main effect found for condition (suppression vs. reappraisal vs. control) F (2, 113) = 0, p >.05, η^2 = 0. No significant interaction between age and condition was found, F (2, 118) = .62, p >.05, η^2 = .01.

Interestingly, the fatigue scale showed younger adults as being significantly more tired than older participants F (1, 113) = 18.04, p <.01, η^2 = .1 and that participants in the suppression condition to be more tired than those in the reappraisal condition for both young and old adults however, these results were not significant, F (2, 113) = .45, p >.05, η^2 = .01. No significant interaction between age and condition was established, F (2, 113) = .5, p >.05, η^2 = .01.

3.8 Discussion

When making consumer decisions, individuals have a number of options available to them: to stick with a pre-selected option, switch to an alternative, or to postpone making a decision and decide in the future. Furthermore, consumer decisions are often made in the context of competing demands on resources. The current study investigated the types of decisions younger and adults made (given different age-related limitations in resources) when faced with problems varying in difficulty. In addition how emotion regulation (suppression and reappraisal) differently affected the resources available to older and younger adults was measured by examining the number of times participants selected to stick, switch or decide in the future.

Results from Experiment 3 showed that older adults in the reappraisal condition performed significantly better across all measures on the consumer decision task than older adults in the control group. It is proposed that older adults performed best in this condition because regulating emotions using reappraisal matched strategies less demanding of cognitive effort (which older adults would normally adopt). Interestingly, suppressing emotions also seemed to preserve older adults decision-making performance but not to the same extent as reappraisal. These findings support Gross and Richards (2000) who suggested that (for older adults at least) regulating emotions using reappraisal preserves resources necessary for decision-making. In other words, older adults in this condition had enough resources to engage in effortful processing and avoid simply sticking with an unfavourable option when a better alternative was available or opting to decide in the future. This data is also consistent with John and Gross' (2004) hypothesis that as people reach older adulthood, they are better able to regulate their emotions and learn to make greater use of reappraisal and less use of suppression. Based on these findings, it seems that age-related advantages in emotion-regulation may have protected older adults from a state of ego-depletion.

Young adults' performance was counter to expectations. Once data relating to the number of times participants opted to decide in the future had been removed from the analysis, the results suggested that young participants in the suppression condition made significantly better consumer decisions than participants in the reappraisal and control conditions. These findings are in the opposite direction to those reported by Richards and Gross (2000) who proposed that suppressing emotions should be more costly than reappraising them and therefore lead to a decrease in performance on subsequent tasks. In an attempt to explain the current findings, it is suggested that different forms of emotion regulation incur different cognitive costs which vary as a function of age. It is proposed that younger adults find reappraisal more demanding in terms of resources than suppression and this pattern is reversed for older adults. Data from the current experiment supports research by Scheibe and Blanchard-Fields (2009), who found that older adults were more adept at emotion regulation and that the cognitive consequences associated with reappraisal and suppression was less for older adults than young adults.

The number of times older and younger adults chose to stick, switch or decide in the future in each condition was used as a measure of ego-depletion incurred by different emotion-regulation strategies. Interestingly, no significant differences were found for the number of times older and younger adults chose to decide in the future and the condition they were in. However, young adults assigned to the suppression condition chose to decide in the future significantly more often compared to young participants in the reappraisal condition and (although not significant) more than those in the control condition. These findings can be interpreted in the context of Baumeister's strength model. It is proposed that suppression may have been particularly draining for younger adults; this resulted in a reduction in cognitive resources available which, in turn, lead them to select an option which required fewer resources (decide in the future). Taken together, it seems that older adults do not find suppressing emotions as cognitively demanding as young adults, and adds further evidence to the hypothesis that reappraisal and suppression are two different processes which, depending upon age, require different amount of effort to perform.

It is noted that the data revealed by young adults is complex and may be due to additional factors other than age. It seems that young participants in the suppression condition chose to decide in the future most often. However, once data relating to the number of times participants chose to decide in the future had been removed, participants in the suppression condition made better decisions than those in the reappraisal and control groups. The current pattern of results suggests that young participants may be affected differently by instructions to self-regulate by way of suppression. Future research would seek to identify the individual factors responsible for these differences.

The second aim of Experiment 3 was to test the hypothesis that both young and old adults would choose strategies least demanding of resources (e.g. to stick or decide in the future) more often when problems were difficult. The data was consistent with this hypothesis: significantly more participants (in both age groups) chose to decide in the future when problems were difficult. This finding supports that of Dahr (1997a; 1998b) and Tversky and Shafir (1992) who proposed that consumers would choose to defer a decision when the choice environment becomes more complex. In other words, when given the option, participants avoided making a decision by postponing it or choosing to stick with a pre-selected option rather than switch, as this requires fewer resources. Furthermore, a significant main effect of age was found whereby older adults chose to decide in the future more often than young adults. This may reflect attempts to conserve resources due to age-related declines in cognitive abilities.

It is thought that the current experiment represents one of the first of its kind to provide older and younger adults with the option to decide in the future rather than simply to defer (as has been observed in previous studies, see Dahr 1997a; 1998b and Tversky & Shafir 1992). It was proposed that deciding in the future might be interpreted differently compared to choosing to defer which in turn have may incurred different cognitive costs. Differences in cognitive resources would have been observed by the number of times the option to decide in the future was selected compared to the stick or switch responses. The findings from Experiment 3 suggest that older and younger adults treat the option to decide in the future in the same manner observed in other studies where the option to defer has been utilised. This provides support to Wessler et al., (2003) who proposed that individuals will attempt to conserve energy by avoiding making a decision, either by choosing to postpone it or deferring altogether.

In order to check that the self-regulation instructions presented to participants did not cause differences in positive and negative affect or fatigue (which could explain subsequent performance differences between conditions), a manipulation check was carried out. The data revealed no significant differences in feelings of positivity, negativity or fatigue across the three conditions. However, a significant age difference was revealed whereby young adults reported feeling less positive, more negative and more fatigued than older adults. These findings are consistent with the literature which suggests that older adults tend to be more positive than young adults (Carstensen, et al., 2000; Charles, et al., 2003).

Further evidence showing age differences in emotional experience were revealed in the manipulation check questionnaire whereby older adults reported experiencing fewer emotions while watching the film and, found it easier to regulate their emotions using each strategy compared with young adults. Interestingly, no differences were found for the amount of feeling experienced and condition. These findings are consistent with Gross (2003) who found that subjective feelings were not affected by emotion regulation but were affected by age.

The reason why suppression did not appear to cause the same ego-depleting effects reported in other research (Richard & Gross, 2000) is unclear. It is proposed that (despite comparing the same regulatory processes), a key difference in paradigms may be responsible for the unexpected results in Experiment 3. Richards and Gross's study used a dual task paradigm during which participants were required to reappraise or suppress their emotions while watching a film clip. Their findings suggested that people in the suppression condition had worse memory for the clip than people in the reappraisal condition and thus concluded that suppression required more effort than reappraisal. However, Senesac (2010) proposed that these results may simply be a function of the way people paid attention to the film clip during the instruction conditions. For example, participants who were asked to suppress their expression of emotion may have paid more attention to controlling expressions in their face and body, therefore leaving fewer resources to process the film clip. Participants in the reappraisal condition may not have had to draw attention away from the film clip in order to successfully regulate their emotions in this manner. Consequently, the two groups would have different levels of memory for the content of the clip despite having spent the same amount of effort following instructions. In the present study, the demands of emotion-regulation on cognitive resources were measured according to responses in the consumer decision-making task. Because performance on the decision task was unrelated to memory of the film, participants' decision-making ability should not have been affected by the aspects of the film they had attended to, but rather, how much effort they put into the consumer decision task. Based on this premise, it could be argued that the methodology used in Experiment 3 could overcome the limitations of that employed by Richards and Gross (2000).

Data from the present study is also at odds with Baumeister et al., (2007) who found that suppression was associated with cognitive costs. The results from Experiment 3 may be explained by the idea that different emotions have different cognitive costs and that the costliness of reappraising or suppressing particular emotions may vary by age. It should be noted that Experiment 3 required participants to regulate the feelings of disgust. Baumeister's work mostly utilised films and other emotional stimuli that elicited sadness, anger or feelings of injustice (Baumeister, Bratslavsky, Muraven, & Tice, 2008; Schmeichel, Vohs & Baumeister, 2003). In the current study, young and older adults may not have displayed the typical suppression effect found by Baumeister et al., (2008) because disgust might have been less difficult for them to suppress compared to emotions typically used in other research such as sadness and anger. In support of this argument, it was informally noted (through conversation with participants during the debrief), that many of the older adults expressed great interest as opposed to disgust while viewing the film clip, often remarking that either someone they knew (or even themselves) had had cataract surgery. As such, it may be that the film did not provoke the same emotional response in older adults compared with young adults, therefore older adults may not have expended as much energy regulating their emotions while watching the film. The present study piloted the footage on young adults only, future studies would need to test emotional potency of material on both young and old adults.

Another explanation for the findings is based on research conducted by Hagger, Wood, Stiff and Chatzisarantis (2010). Hagger et al., (2010) performed a meta-analysis of 83 studies investigating self-regulation. Their results show that although the effect of ego-depletion was generally consistent across different tasks and subsequent measures of performance, the effect was significantly smaller for studies adopting dependent tasks involving cognition, choice and volition. They suggest that making choices may not place as many demands on depleted individuals' self-control resources as other tasks used to measure ego-depletion.

Furthermore, Hagger et al., (2010) found that studies which relied upon depletion tasks requiring participants to control impulses and dependant tasks using cognition exhibited smaller ego-depletion effect sizes than other methodologies used in this field. Experiment 3 also relied upon a depletion task, which required participants to control impulses (i.e. in the suppression condition, participants had to behave in such a way that someone watching them would not know that they were feeling anything at all). Taken together, this may explain why the current data is inconsistent with that of other researchers who used different methodologies.

In conclusion, the current research extends our knowledge in two important ways. First, findings are consistent with the literature in that both younger and older adults selected the option to decide in the future most often for difficult problems. Furthermore, older adults chose to decide in the future significantly more often than young adults. It is proposed that older adults selected the option associated with the fewest cognitive demands to conserve limited resources. Second, Experiment 3 shows that young and old adults appear to require different amounts of resources to regulate their emotions in accordance with different strategies. The underlying mechanisms as to why this might be are as yet unclear. It is proposed that older adults may be less susceptible to any ego-depleting effects of emotion regulation due to age-related increases in emotional control. Further research is needed to assess the reliability of material at inducing states of ego-depletion. The next chapter aims to test alternative methods of causing ego-depletion and the subsequent effect on consumer decision-making.

Chapter 4

4.1 Introduction

Many decisions are made in the context of emotional arousal. The consequences of controlling emotions prior, or while, making a choice may be significant. How the complex demands on peoples' resources impact their ability to make good decisions is an important question. The data from Experiment 3 suggested that regulating emotions using reappraisal and suppression differently affected decision making in younger and older adults. Specifically, older adults performed best under conditions of reappraisal. The finding that older adults were able to successfully regulate their emotions and, in turn, maintain performance on a subsequent decision making exercise was consistent with previous research (Schiebe & Blanchard Fields, 2009). However, younger adults revealed a different pattern of results whereby suppressing emotions seemed to maintain decision-making performance and reappraisal diminished it. This finding was surprising given that Richards and Gross (2000) proposed that suppressing emotions should be more costly than reappraising them and therefore lead to a decrease in performance. The notion that ageing may provide some form of immunity to the depleting effects of emotion-regulation may provide an opportunity to harness this ability in order to minimise the effects of age-related declines in other cognitive abilities.

Some data from Experiment 3 was consistent with previous research (e.g. Dahr, 1997; Tversky & Shafir, 1992) insofar that both younger and older adults chose to avoid making a decision and decide in the future more often when problems were difficult compared to when they were easy. Furthermore, older adults chose to decide in the future more often than younger adults. These findings were in line with what may reasonably be expected given older adults' declining cognitive abilities and the assumption that to decide in the future is the least demanding strategy in terms of cognitive effort. It was proposed that older adults may have tended to utilise this option more regularly in an attempt to conserve limited resources.

4.2 Experiment 4

In view of these findings, two possible explanations were proposed: (i) emotion-regulation instructions were effective, however the consumer decision task was unusual and thus was affected in an unexpected way. Or (ii) the emotion-regulation was not effective in the same way that typical tasks of this kind are. Based on these proposals, Chapter 4 presents two exploratory experiments using young participants only.

The first experiment utilised the same manipulation procedure and decision task used in Experiment 3, but included an additional dependent measure. The aim of this experiment was to test whether instructions to regulate emotions using reappraisal and suppression affected participants in the same way that has been observed in the literature (Gross, 2000). The second experiment introduced a new manipulation task, shown to be reliable in causing a state of ego-depletion. Both experiments sought to determine a method of ego-depletion that impacted upon the consumer decision task in a predictable way.

The consumer decision task used in Experiment 3 presented participants with three choice options: to switch, the stick or to decide in the future. Results indicated that on difficult problems, participants tended to choose to decide in the future and older adults tended to decide in the future more than younger adults. In other words, participants displayed a tendency to decide in the future when cognitive demands were high rather than simply stick (the other least cognitively demanding option). It is proposed that including an option to decide in the future may have compromised the accuracy of analysis whereby the number of times participants chose to stick was influenced by the number of times participants chose to decide in the future. In an attempt to address this problem, the consumer decision task used in Experiment 4 presented participants with only two options: to stick or switch. It was assumed that removing the option to decide in the future would create conditions for a clearer evaluation of correct performance. It was anticipated that participants would tend to stick more often under conditions of self-regulatory load and when problems were more difficult.

To address the disparity between the findings of Experiment 3, and those of other researchers (e.g. Richards & Gross 2000), it was proposed that differences in methodology could account for the apparent contradiction in findings. It was noted that in Richards and Gross (2000) study, memory for a film clip was the main subject of investigation, where participants had to regulate their emotions while viewing the footage. It was suggested that the amount of attention participants paid to the film clip may have varied as a function of the self-regulation group they were assigned to. In Chapter 3, it was argued that the decision-making exercise should not have been affected by aspects of the first task that participants were attending to because they were not directly linked. Rather, performance on the decision-making exercise can be seen as measuring how much cognitive effort a participant made subsequent to regulating their emotions, not how much effort they made subsequent to regulating their attention. To test this argument, it was decided that the methodology employed in Experiment 3 should be assessed further.

To examine whether differences on the consumer decision task could reliably be attributed to the differential ego-depleting effects of emotion-regulation styles, an additional intellectual task was used to measure subsequent performance. Schmeichel, Vohs and Baumeister (2003) conducted an experiment to test the idea that ego-depletion due to prior self-control would impair performance on intellectual tasks, requiring cognitive processes. Participants were required to watch a video of a woman being interviewed while at the bottom of the screen a series of words, irrelevant to the interview, were flashed. In the ego-depletion condition, participants were instructed to direct their attention away from the words and focus exclusively on the woman. In the control condition, participants were given no instructions. Intellectual functioning was measured by performance on a section of the Graduate Record Examination (GRE), a standard test given to university students in the United States. The results from this study indicated that engaging in self-regulation impaired subsequent cognitive performance (as measured by the GRE). Participants in the ego-depletion condition provided significantly less correct answers. They also attempted fewer problems, which suggested that their speed of information processing was reduced. Finally, ego-depleted participants scored a lower proportion of correct answers among the problems they did attempt, indicating that their reasoning abilities were less effective. Taken together ego depleted individuals were not only slower, but scored significantly worse.

Based on the findings reported by Schmeichel, et al., (2003), it was decided that the GRE represented a reliable method of testing for the effects of ego-depletion. To test whether performance on the decision-making exercise was due to the ego-depleting effects of different forms of emotion regulation, Experiment 4 required participants to complete a subsection of problems taken from the GRE immediately after the task manipulation. If the instructions to reappraise or suppress emotions while viewing a disgust-eliciting film required differing amounts of cognitive effort to maintain, participants may have been subject to varying amounts of ego-depletion, which should be apparent by way of differences in aptitude on the GRE. For example, assuming that instructions to suppress emotions cause participants to regulate their emotions in this manner, and that this form of emotion regulation is indeed costly in terms of cognitive effort. It should follow that subsequent performance on the GRE is impaired together with that on the decision-making exercise (see Schmeichel, Vohs & Baumeister, 2003). In terms of performance on the consumer decision-making exercise, should suppression be more demanding in terms of resources, it is predicted that participants will attempt to conserve energy by opting to make more stick decisions compared to participants in the reappraisal condition.

A secondary aim of Experiment 4 was to replicate some of the findings revealed in Experiment 3. Specifically, it was predicted that participants would choose to stick with a pre-selected option more often on difficult problems compared with easy problems.

It was predicted that participants would evidence which form of emotion-regulation they found to be the most costly by how much time they spent completing the consumer decision task. It was anticipated that the emotion-regulation strategy requiring most effort would result in participants spending less time completing the decision making task. This expectation is based on the work of Hagger, Wood, Stiff and Chatzisarantis, (2010) who found that ego-depleted individuals were more fatigued and tended to expend less effort.

4.3 Method

4.3.1 Participants

It was decided that only young adult participants would be used in Experiments 4 and 5. This decision was based on two main factors. First, the two experiments outlined in the current chapter are exploratory in nature. The aim was to establish a reliable method of causing and measuring self-regulation in a way typical to that reported in the literature. It was anticipated that once a robust methodology had been established, it could then be utilised in a comparative study with older and younger adults. Second, using older adults as participants is reasonably resource-intensive in terms of recruitment, time and money. It was therefore thought prudent to establish a reliable methodology for testing self-regulation by using only young adults as participants (who are comparatively inexpensive and simple to recruit).

A total of 61 participants took part in the study aged 18 – 45yrs (M = 20.92, SD = 4.67). Participants were divided in to three conditions: reappraisal

(20), suppression (21) and control (20). Participants were recruited from the University of Plymouth and received course credits for their participation.

4.3.2 Materials

Film

The film was designed to induce a state of ego-depletion and depicted close-up footage of a fish hook being removed from a patient's eyeball. This film ran for 1 min.

Manipulation check questionnaire

The same manipulation check presented to participants in Experiment 3 was given to participants after having viewed the film. A copy of the manipulation check questionnaire can be found in Appendix 3B.

Graduate Record Examination Order Test (GRE)

Cognitive functioning was assessed using items from the Order subset of the Graduate Record Exam (GRE). Thirteen problems were selected (see Appendix 4A). It was assumed that presenting participants with the GRE soon after the ego-depletion task would mean that any findings were indicative of the residual after effects of self-regulation incurred by emotional control. This hypothesis was tested on three different performance measures (as established by Schmeichel, Baumeister & Vohs, 2003): the number of items answered correctly, the number of items attempted (i.e. the number of items for which a participant recorded an answer), and the proportion of items answered correctly. Number correct represented a global measure of performance, number of items attempted measured working speed and effort, and the proportion of correct answers assessed overall accuracy. Participants were asked to work on the GRE for 10 minutes (timed by the experimenter) or until they had completed all the problems.

Decision Task

Participants were presented with the same consumer decision task developed for Experiment 3 (see Appendix 3A). In summary, participants faced a hypothetical consumer scenario in which they were asked to make a decision. Three scenarios were devised, each comprising four decision tasks. The three scenarios asked participants to make a choice regarding (a) a travel company, based on the price of the hotel, how much the flight cost and how many stars the hotel received, (b) a hire car with information about the price of hire, the price of insurance and fuel economy, and (c) a diving school, with details of the price of diving lessons, the cost to rent equipment and customer satisfaction.

4.3.3 Procedure

The procedure followed a similar pattern to that used in Experiment 3. Prior to watching the film participants were shown a blank screen for one minute. This time was used to allow participants a baseline period to clear their mind of all thoughts feelings and memories. After this one-minute baseline, participants were informed of their right to stop the study should they find the film clip too distressing. For the control participants (N = 20) no further instructions were given. Participants in the reappraisal (N = 20) and suppression (N = 21) condition received the same instructions outlined in Experiment 3. Those in the reappraisal condition were asked to think about what they were viewing in an objective manner and in such a way that they do not feel anything at all. Participants in the suppression condition were asked to hide their feelings so that someone watching them would not know that they were feeling anything at all. All participants then watched the eye-surgery film. This was followed by the manipulation check questionnaire.

Participants then continued to complete the GRE. Next, participants were instructed to work on the stick or switch decision task and to inform the experimenter once they had finished. There was no time limit imposed to complete this task, however the length of time it took each participant to finish these questions was recorded. Time was recorded using a stopwatch in the same manner employed in Experiment 3. The question booklet containing the consumer problems was placed face-down in front of each participant. Participants were told that they could turn the booklet over and begin working when the experimenter said ‘start’. Because participants were tested in groups of between two and six, they were told to raise their arm once they had completed the consumer problems. When participants indicated that they had finished the task, a note of how long each individual had taken was recorded from the stopwatch.

Participants were then instructed to work their way through the demographic questionnaire. Instructions outlining how to complete each task were printed at the top of the corresponding pages.

4.4 Results

First, performance on the consumer decision task was assessed. Measures of ability were evaluated using five measures of performance (as in Experiment 3). These included the percentage total of correct stick and switch actions achieved when those who opted to switch selected the correct alternative, the percentage total of times participants chose to stick correctly, the percentage total of times participants chose to switch correctly and the percentage of times participants simply carried out the action to stick or switch. Means and standard deviations for performance on the decision task for participants in each condition are presented in Table 4.1.

Table 4.1 Descriptive Statistics for Participant's Performance in each Condition in the Consumer Decision Task.

	Suppression		Reappraisal		Control	
	M	*SD*	*M*	*SD*	*M*	*SD*
% correct stick and switch	92.86	6.61	77.91	17.76	84.17	11.75
% correct stick	95.24	7.71	80	19.19	85.83	14.58
% correct switch	90.48	11.27	75.83	20.17	82.5	14.78
% stick choices	52.38	7.04	52.31	8.92	51.67	8.8
% switch choices	47.62	7.04	47.69	8.92	48.33	8.8

The data in Table 4.1 suggests that participants in the suppression condition performed best. Furthermore, this data suggests that participants tended to be more accurate when deciding to stick than switch.

To see whether condition affected the number of correct stick or switch decisions participants made, a mixed 3X2 ANOVA (Condition X Correct choice) was conducted. The results revealed no significant main effect of correct choice, F (1, 58) = 3.72, p >.05 η^2 = .06, and a significant main effect of condition, F (2, 58) = 7.06, p < .05, η^2 = .2. No significant interaction between condition and correct choice was found, F (2, 58) = .04, p > .05, η^2 = 0. Post-hoc analysis using Fischer's LSD test revealed participants in the suppression condition made significantly more correct choices than participants in the reappraisal condition (p <.01) and the control condition (p <.05). No significant difference in performance was found between participants in the reappraisal and control conditions. Please refer to Statistics Appendix 4 for all summary tables corresponding to Experiment 4.

To see if condition affected the number of times participants chose to stick or switch a mixed 3X2 ANOVA (Condition X Choice) was conducted. The results revealed a partially significant main effect of choice (stick or switch), F (2, 58) = 4.9, p = .05, η^2 = .06. Participants tended to choose to stick more often than switch. No significant main effect of condition was found, F (2, 58) = 0, p >.05, η^2 = 0, and no significant interaction between condition and choice, F (2, 58) = .05, p >.05, η^2 = 0. Post-hoc analysis using Fischer's LSD test revealed no significant differences in the number of times participants chose to stick or switch between any of the three conditions.

To investigate the prediction that participants would opt to stick more on difficult problems compared to easy problems, a repeated measures three-way ANOVA (Condition X Problem difficulty) was conducted. Percentage means and standard deviations for the number of times stick was chosen for each problem type are presented in Table 4.2.

Table 4.2 Descriptive Statistics for the Number of Times Participants Chose to Stick on Difficult and Easy Problems.

	Suppression		Reappraisal		Control	
	M	*SD*	*M*	*SD*	*M*	*SD*
Difficult Problems	55.56	13.26	57.5	15.74	52.5	15.56
Easy Problems	49.21	6.4	46.67	11.6	50.83	10.48

The data in Table 4.2 shows that participants opted to stick most on difficult problems. Analysis confirmed this finding as problem difficulty was revealed to be a main effect, F (1, 58) = 6.18, p <.05, η^2 = .1. These findings provide further support to the status quo bias occurring as a function of problem complexity as found in Experiments 3. No main effect of condition was revealed, F (2, 58) = .04, p >.05, η^2 = 0, suggesting that emotion-regulation strategy did not cause participants to stick more often when problems were difficult. Furthermore, no interaction between condition and problem type was found, F (2, 58) = 1.08, p >.05, η^2 = .04.

To assess the reliability of the emotion regulation procedure used in Experiment 3, performance on the GRE and consumer decision-making task were examined in young adults only. In analysing the data for the GRE, three different performance measures were tested: the number of items answered correctly, the number of items attempted and the proportion or items answered correctly. Means and standard deviations for each of these measures of the GRE across the three conditions are presented in Table 4.3

Table 4.3 Descriptive Statistics in Percentages for Performance on the GRE for Participants in Each Condition.

GRE	Suppression		Reappraisal		Control	
	M	*SD*	*M*	*SD*	*M*	*SD*
Number of correct items	29.3	13.24	35.77	13.96	36.92	15.51
Number of items attempted	51.28	18.89	57.69	21.97	52.69	20.01
Proportion of items answered correctly	65.83	37.78	66.29	23.3	71.53	19.43

For each measure, a univariate ANOVA (Condition) was used to compare performance in the suppression condition versus the reappraisal and control conditions. No significant difference for the total number of correct answers in each group was found F (2, 58) = 1.72, p > .05, η^2 = .06. No significant difference in the number of questions participants attempted in either condition was found F (2, 58) = .56, P > .05, η^2 = .02. No significant difference was found between the three conditions for the proportion of items answered correctly, F (2, 58) = .26, $P > .05$, $\eta^2 = .01$. The data suggests that instructions to self-regulate emotion did not affect overall performance, working speed, effort or overall accuracy on the GRE. This data implies that instructions to regulate emotion did not cause participants differential states of ego-depletion and is inconsistent with findings in the literature, (e.g. Schmeichel, et al., 2003).

In order to ensure that participants understood the instructions they were presented with the same manipulation checks used in Experiment 3 were included in the design of the experiment (see Appendix 3B). Mean ratings for each of these questions are presented in Table 4.4.

Table 4.4 Mean Ratings for the Manipulation Check Questions.

Question	Suppression		Reappraisal		Control	
	M	*SD*	*M*	*SD*	*M*	*SD*
Feelings while viewing film	1.43	1.86	3.33	2.58	2.5	1.93
Hide emotions while viewing film	6.33	1.24	4.6	2.41	4.3	2.2
Spontaneous reaction while viewing	2.61	2.11	3.55	2.61	4.1	1.86
Difficulty in performing instructions	4.9	2.36	3.75	2.61	3.2	2.82

To analyse the manipulation checks, a number of univariate 3-way ANOVAs (condition) were conducted. Overall, the manipulation checks suggest instructions presented to participants in each condition were understood and conducted accordingly. Question 1 asked if participants had any feeling while viewing the film. Results indicated a highly significant difference between the three conditions, F (2, 58) = 3.94, $p < .05$, $\eta^2 = .12$. Post hoc comparisons using a Fischer LSD test indicated that participants in the suppression condition reported having significantly more feelings than those in the reappraisal condition ($p < .01$). However, there was no significant difference between scores for participants in the reappraisal and control condition or, the control and suppression condition.

Question 2 investigated whether participants reported hiding their emotions while watching the film. Results indicated a highly significant effect between the three conditions F (2, 58) = 6.17, p < .01, η^2 = .18. Post hoc analysis using a Fischer LSD test confirmed that as would be expected, participants in the suppression condition reported hiding their feelings significantly more than in the reappraisal condition (p < .01), and control condition (p < .01). There was no significant difference in scores for the reappraisal and control conditions.

Question 3 asked participants how spontaneously they reacted during the film. Results showed no significant difference between conditions. Although the data showed that participants in the suppression condition did report behaving less spontaneously than participants in the reappraisal and control conditions, the difference was not significant F (2, 58) = 2.36, p > .05, η^2 = .08. Post hoc comparisons using a Fischer LSD test indicated that participants in the suppression condition reported behaving significantly less spontaneously than participants in the control condition (p < .05).

Question 4 asked participants how difficult they found it to perform the instructions given to them before the film started. Again, no significant difference was found between conditions. F (1, 58) = 2.3, p > .05, η^2 = .07. This suggests that participants in both conditions were able to perform their instructions while viewing the film equally well. However, post hoc comparisons using a Fischer LSD test indicated that participants in the suppression condition reported finding it significantly more difficult to perform the instructions than participants in the control condition (p < .05).

The length of time participants in each condition spent completing the consumer decision task was recorded. Descriptive statistics are presented in Table 4.5.

Table 4.5 Descriptive Statistics for the Time (minutes) Participants in Each Condition Took to Complete the Consumer Decision Task.

	Suppression		Reappraisal		Control	
	M	*SD*	*M*	*SD*	*M*	*SD*
Time (Minutes)	12.14	4.45	11.05	4.43	11.1	4.46

A univariate three-way ANOVA (condition) was conducted to see if differences in time taken could be reliably established to vary as a function of condition. The data revealed no significant difference in time taken to complete the task and condition, F (2, 58) = .39, p > .05, η^2 = .01.

4.5 Discussion

Experiment 4 tested the ego-depleting effects of the emotion-regulation instructions by introducing a reliable measure of cognitive performance, which has been shown to be sensitive to ego-depletion manipulations (GRE). In addition, the status quo-bias revealed in Experiment 3 was tested further to see if the number of times participants chose to stick varied as a function of the emotion-regulation strategy used.

Results for performance on the consumer decision-making task replicated those revealed for younger adults in Experiment 3, where young adults in the suppression condition made significantly better, and more accurate choices than participants in the control and reappraisal groups. However, (although not significant), participants in the reappraisal condition performed worse than those in the control group. Participants in this condition opted to stick more often and this difference was significant for difficult problems. These findings again present a challenge Gross's (2004) hypothesis that suppression is a more costly form of emotion-regulation in terms of resources. And, when considered in the context of Baumeister's (1998) strength model, this data suggests that reappraisal is more demanding of cognitive reserves than suppression. Furthermore, no significant difference was found for the time taken by participants in each condition to complete the consumer decision task. Had participants been subject to a state of ego-depletion, this should have been evident in the time they took to complete the task (Hagger, Wood, Stiff & Chatzisarantis, 2010).

In an attempt to explain the findings reported in Experiment 3 and their replication in Experiment 4, the current study tested the hypothesis that the emotion-regulation procedure was not effective in the same way that typical tasks of this kind are. To test these hypotheses, the GRE was used as an additional reliable measure of subsequent cognitive performance.

Data from the GRE task showed no significant difference between conditions in measures for global performance, working speed, effort or overall accuracy. This suggests that instructing participants to regulate their emotions did not cause differential states of ego-depletion. Had the emotion-regulation instructions succeeded in depleting cognitive reserves, it was expected that this would be evidenced in subsequent differences in performance. For example, Schmeichel, et al., (2003) showed that controlling attention while viewing a film led to impaired subsequent performance on the GRE. Taken together, these findings suggest that differences in performance may not have been due to ego-depletion, but some other mechanism affected by the instruction to regulate emotion.

In terms of finding a status-quo bias, the results from the current study are consistent with previous findings insofar that participants chose to stick significantly more often on difficult compared to easy problems. Interestingly, Experiment 4 revealed that when the option to decide in the future was removed, participants chose to stick more often (in place of where they may have originally selected to decide in the future). These findings provide further evidence in support of Tversky and Shafir (1992) who proposed that consumers would opt to defer a decision when the choice environment became more complex.

It was expected that participants assigned to the suppression condition would opt to stick most when compared to participants in the other two conditions. This is based on the finding that suppression of emotional expression is particularly costly for young adults (Gross, 1998: Richards & Gross, 2000; Schmeichel, 2007). However, condition did not significantly affect the likelihood that participants would select to stick more often. This finding suggests that participants did not find suppressing emotions to be more costly in terms of cognitive resources than the control or reappraisal conditions. When considered along with the finding that condition did not significantly affect performance on the GRE, the data from Experiment 4 implies that attempts to obtain a state of ego-depletion in young participants were unsuccessful.

In summary, Experiment 4 suggests that the emotion-regulation instructions did not show typical effects in line with what would be expected had ego-depletion been evident (as demonstrated in the literature). Results from the manipulation questionnaire confirmed that participants understood the instructions presented to them and behaved accordingly. Indeed, the data implies that instructing participants to regulate emotion using suppression and reappraisal had differential effects on overall performance on the consumer decision task. However, data from the GRE and analysis of the number of times participants in each condition chose to stick suggests that these effects cannot confidently be attributed to states of ego-depletion caused by emotion-regulation.

Questions regarding the consequences of operating in a state of ego-depletion remain unanswered. In conclusion, the data from Experiments 3 and 4 suggest that emotion-regulation cannot reliably be used to generate ego-depletion. Consequently, Experiment 5 utilised a methodology shown to be reliable in causing ego-depletion and tested its subsequent effects on consumer decision-making.

4.6 Experiment 5

Experiments 3 and 4 showed using emotion-regulation to induce states of ego-depletion had unexpected effects. The question of how people make consumer decisions following a period of exertion is still unanswered. Because the data from the previous studies suggested that controlling emotion did not have clear ego-depleting effects, another self-regulation strategy was examined.

Hagger, Wood, Stiff and Chatzisarantis (2010) conducted a meta-analysis of 83 studies looking at the impact of ego-depletion on task performance. They found that ego-depletion tasks which involved crossing out letters had the largest effect size in comparison to other frequently used depleting tasks (e.g. video-watching affect regulation, video watching attention control and the modified

Stroop task). In view of Hagger et al's., (2010) findings, it was decided that a letter-crossing task would be used to encourage an ego-depletion state.

Fischer, Greitemeyer, and Frey (2007) investigated the hypothesis that ego-depleted (compared to non-depleted) individuals would be less optimistic about their future expectations. In their study, participants were presented with a typewritten sheet of paper with meaningless text (a page from a statistics book). Two conditions were used. In the high ego-depletion condition, participants were presented with a difficult task, which required them to consider and follow multiple rules and control their decisions. They were told that they must follow the rule to only cross out an 'e' if it did not occur next to another vowel or one letter away from another vowel (for example, they could not cross out the 'e' in Peter). In addition, the photocopy of the stimulus page had been lightened, making it difficult to read and therefore requiring additional attention. Participants in the non-depletion condition were given a high quality photocopy with good contrast and were told to cross out every 'e' with no further rules or restrictions. The depletion manipulation lasted about 10-15 minutes. Results indicated that participants in the high ego-depletion condition were less optimistic about their future than non-depleted participants. The researchers proposed that optimistic illusions require large amounts of regulatory resources to preserve. Because ego-depleted participants had fewer resources available to them in order to control thoughts, emotions and behaviours, they were less able to maintain positive future expectations.

Tice, Baumeister, Shmueli, and Muraven (2007) induced ego-depletion in participants by first giving them a page of text and instructing them to cross out the letter "e" each time it appeared. They noted that most participants quickly learned to scan the page and mark every "e" so that the habit became established.

Participants were then given a second page and told to cross out every "e" except if it was adjacent to another vowel or one letter removed from another vowel. Therefore the second page required participants to override a learned habitual response of marking every "e". Participants in the control group did not perform any crossing-out task. Results indicated that participants in the ego-depletion condition spent significantly less time than those in the control condition, persisting at a game designed to induce frustration.

In a similar task, Baumeister, (2002) showed that self-regulation and making choices rely upon the same resource. In his study, participants were also made to regulate their behaviour by having to form and then break a similar habit as that used by Tice, et al., (2007). This procedure made people more likely to take the passive option in a decision task. These findings suggest that the energy resource is not limited to self-control, but is also linked to the self's executive function generally.

In light of the letter crossing tasks used by Tice, et al., (2007), Baumeister (2002) and Peter et al., (2007) it was decided that a combination of these methodologies would be employed in the present study. Three discrete conditions were devised. In Condition 1 (control) participants simply had to cross out all instances of the letter "e" on pages of clearly printed text. In Condition 2, participants were instructed to cross out all instances of the letter "e" in accordance with set rules presented to them on pages of poorly printed text. Participants in Condition 3 had to complete the procedures outlined in Condition 1 and 2, in other words, participants formed a habit (crossing out all instances of the letter "e") and then had to break it (crossing out selected instances of the letter "e"). To check whether the letter crossing manipulation worked in causing participants to feel depleted, the GRE was used again.

Although participants in Condition 3 spent twice as long to complete the manipulation procedure compared with participants in the other two groups, it was not expected to affect performance on the decision making task. The meta-analysis conducted by Hagger, Wood, Stiff and Chatzisarantis (2010) revealed only a marginally significant relationship between the duration of the depleting task and ego-depletion in the hypothesised direction. They suggest task duration accounted for relatively little variance in the ego-depletion effect and, as such, task duration should only be a minor consideration when designing and evaluating ego-depletion experiments.

It was predicted that performance on the consumer decision task would differ as a function of condition. Specifically, participants in Condition 1 should perform best because they were subject to a task, which required moderately little in terms of resources. Participants in Conditions 2 and 3 would be more likely to select the option to "stick" and their overall performance on this task should be poorer than that of participants in Condition 1.

In addition, we aimed to replicate the status-quo effect found in Experiments 3 and 4. Specifically, that participants would choose to stick more often when problems were difficult compared to when problems were easy. Finally, it was expected that participants assigned to condition 2 and 3 would take longer to complete the decision task.

4.7 Method

4.7.1 Participants

A total of 88 participants took part in the study aged 18-36 (M = 30.39, SD = 3.22). Participants were recruited from the University of Plymouth and received course credits for their time.

4.7.2 Materials

Letter Crossing Task

Participants in Condition 1 were presented with eight pages of text describing how Vikings lived and worked (The Viking Achievement, P.G. Foote & D.M Wilson, 1974, p. 90-97). Following Fischer, Tobias, Greitemeyer and Frey (2007), participants in Condition 1 were given a high quality photocopy with good contrast participants and were instructed to read a text for ten minutes and cross out all instances of the letter 'e'.

Participants in Condition 2 were presented with the same eight pages of text however, the photocopy of the stimulus material had been deliberately lightened making it comparatively difficult to read. These participants were instructed to read a text for ten minutes and only cross out instances of the letter 'e' in accordance with set rules.

Participants in Condition 3 were presented with identical sets of stimulus material outlined in Condition 1 and 2 (see Appendix 4C) and instructed to read a text for ten minutes and cross out all instances of the letter 'e'. This was then followed by another task whereby participants had to read a text for ten minutes and only cross out the letter 'e' in accordance with set rules.

Decision Task

The decision task was exactly the same as that used in Experiment 4 (see Appendix 3A).

Graduate Record Examination Order Test, (GRE)

As in Experiment 4 cognitive functioning subsequent to the ego-depletion task was assessed using the same 13 items from the Order subset of the Graduate Record Exam (GRE) (see Appendix 4A). Three measures of performance were recorded: the number of items answered correctly, the number of items attempted and the proportion of items answered correctly.

4.7.3 Procedure

Participants were tested in small groups of between three and six individuals. Prior to testing participants were given a short introduction to familiarize themselves with the experimental tasks and order that they would be presented.

Participants in Condition 1 (cross out all 'e's) were presented with the high quality stimulus material and instructed to "*Cross off all instances of the letter "e"*". The experimenter allowed participants to continue working on this task for precisely ten minutes. Participants in Condition 2 (cross out with rules) were presented with the poor quality stimulus material and told to "*Cross off all instances of the letter "e" according to the following: An "e" should only be crossed off* *if it is **not** adjacent to another vowel or is only **one** letter away from another vowel.*" Again, participants were allowed to work on this task for precisely ten minutes. Participants in Condition 3 (override learned response) were made to regulate their behaviour by having to form and then break a habit. This was done by presenting participants with the letter crossing task as outlined in Condition 1 (crossing out all instances of the letter "e") followed by the completion of the letter crossing task outline in Condition 2 (crossing out instances of the letter "e" in accordance with set rules).

Half the participants then continued onto the GRE, whereby they worked until they had completed all the problems or until they reached the predetermined limit of ten minutes. The remaining participants were instructed to work on the stick or switch decision task and then inform the experimenter once they had finished. There was no time limit imposed to complete this task, however the length of time it took each participant to finish these questions was recorded in the same manner used in Experiments 3 and 4. Participants who completed the GRE first then went on to work on the stick or switch decision task. Participants who completed the stick or switch decision task first were then directed to the GRE. All participants were then instructed to work their way through demographic questionnaire. Instructions outlining how to complete each task were printed at the top of the corresponding pages.

4.8 Results

Next, performance on the consumer decision task was assessed. Measures of performance were evaluated using five indices (identical to those used in

Experiment 4). Complete means and standard deviations for performance for participants in each condition are presented in Table 4.6.

Table 4.6 Descriptive Statistics in Percentages on Five Measures of Performance Recorded by the Consumer Decision Task for All Participants.

Total scores *(N* = 88)	Condition 1 Cross out all e's		Condition 2 Cross out with rules		Condition 3 Override learned response	
	M	*SD*	*M*	*SD*	*M*	*SD*
% total of all correct decisions	80.17	12.87	84.44	9.47	87.64	11.05
% total of stick choices	53.74	11.48	48.33	10.46	49.14	8.44
% total of switch choices	49.14	9.8	51.67	10.36	50.86	8.44
% total of *correct* stick choices	75.86	15.8	82.78	13.48	86.78	12.89
% total of *correct* switch choices	84.48	17.21	86.11	14.57	88.51	14.84

The data in Table 4.6 suggests that participants in condition 3 performed better than participants in either of the other two conditions. To see if these findings were significant, a univariate three-way ANOVA (condition) was conducted to compare the effect of each condition on subsequent performance on the consumer decision task. A significant difference was found between the conditions for the total percentage of correct stick or switch responses, F (2, 85) = 3.25, P < .05, η^2 =.07. Post hoc analysis using Fischer's LSD test revealed that participants in condition 3 made significantly more correct stick and switch choices than participants in condition 1 (p < .01). No significant differences were found between overall number of correct decisions and participants in conditions 1 and 2 and conditions 2 and 3. Please refer to Statistics Appendix 5 for all summary tables corresponding to Experiment 5.

To see whether condition affected the number of correct stick or switch decisions that participants made, a mixed 3X2 ANOVA (Condition X Correct choice) was conducted. The results revealed a significant main effect of correct choice, F (1, 85) = 4.79, p < .05, η^2 = .05, with participants performing best when they chose to switch. No significant interaction between condition and correct choice was found, F (2, 85) = .99, p > .05, η^2 = .02.

To see if condition affected the number of times participants chose to stick or switch a mixed 3X2 ANOVA (Condition X Choice) was conducted. The results revealed no significant main effect of choice (stick or switch), F (1, 85) = .01, p > .05, η^2 = 0. No significant main effect of condition was found, F (2, 85) = 2.21, p >.05, η^2 = .05, and no significant interaction between condition and choice, F (2, 85) = 1.46, p >.05, η^2 = .03.

To investigate the prediction that participants would opt to stick more on difficult problems compared to easy problems a repeated-measures three-way ANOVA (Condition X Problem difficulty) was conducted. Percentage means and standard deviations for each problem type are presented in Table 4.7.

Table 4.7 Means and Standard Deviations in Percentages for Participants in Each Condition for Stick Choices on Difficult and Easy Problems.

	Condition 1 Cross out all e's		Condition 2 Cross out with rules		Condition 3 Override learned response	
	M	*SD*	*M*	*SD*	*M*	*SD*
Difficult Problems	51.72	15.65	53.89	16.77	51.72	14.33
Easy Problems	50	8.91	42.78	11.32	46.55	12.1

Analysis revealed a significant main effect of problem difficulty whereby participants opted to stick more often on difficult problems, F (1, 85) = 8.85, p <.01, η^2 = .09. These findings provide further support to the status quo bias occurring as a function of problem complexity as found in Experiments 3 and 4. No main effect of condition was revealed, F (2, 85) = .54, p >.05, η^2 = .01 suggesting that the ego-depletion task did not cause participants to stick more often when problems were difficult. Furthermore, no interaction between condition and problem type (easy/hard) was found, F (2, 85) = 1.86, p >.05, η^2 = .04.

The primary function of the GRE was to measure cognitive functioning after the experimental manipulation. As in Experiment 4, three measures of performance were recorded. Means and standard deviations for each of these measures of the GRE across the three conditions are presented in Table 4.8.

Table 4.8 Descriptive Statistics in Percentages for the Three Measures of Performance Recorded by the GRE for Participants in Each of the Three Conditions.

GRE	Condition 1 Cross out all e's		Condition 2 Cross out with rules		Condition 3 Override learned response	
	M	*SD*	*M*	*SD*	*M*	*SD*
Number of correct items	44.56	15.97	46.15	17.84	42.97	15.59
Number of items attempted	25.2	12.14	35.64	17.2	28.38	13.81
Proportion of items answered correctly	60.97	27.87	74.81	18.77	67.31	15.06

A three-way univariate ANOVA (Condition) was conducted on the number of correct items, the number of items attempted and, the proportion of items answered correctly. Results revealed a significant main effect of condition in terms of the percentage of correct answers attained by participants, F (2, 85) = 3.99, p < .05, η^2 = .09. A Fischer LSD test revealed that participants in condition 2 (cross out with rules) performed significantly better than participants in condition 1 (cross out all "e"s) (p < .01) and a marginally significantly better than participants in condition 3 (override learned response) (p = .06). Post-hoc analysis revealed no significant difference between the percentage of correct items obtained by participants in conditions 1 and 3.

In terms of the number of questions attempted, a three-way univariate ANOVA (Condition) revealed no significant effect of condition, F (2, 85) = .37, p > .05 η^2 = .01.

No significant effect of condition was found for the proportion of correct answers from those attempted, F (2, 85) = 2.4, p >.05, η^2 = .05. Post hoc analysis using a Fischer LSD test revealed a marginally significant difference between participants in condition 1 and condition 2 (p > .05) whereby participants in condition 2 attempted more problems. No significant difference was found for the proportion of correct answers from those attempted between participants in conditions 1 and 3 and conditions 2 and 3.

The length of time participants in each condition spent completing the consumer decision task was recorded. Descriptive statistics are presented in Table 4.9.

Table 4.9 Descriptive Statistics for the Time (minutes) Participants in Each Condition Took to Complete the Consumer Decision Task.

	Condition 1 Cross out all e's		Condition 2 Cross out with rules		Condition 3 Override learned response	
	M	*SD*	*M*	*SD*	*M*	*SD*
Time (Minutes)	11.13	2.12	13.1	7.2	11.46	3.6

A univariate three-way ANOVA (Condition) was conducted to see if differences in time taken could be reliably established to vary as a function of condition. The data revealed no significant difference in time taken to complete the task and condition, F (2, 85) = 1.42, p > .05, η^2 = .03.

4.9 Discussion

Given that the emotion-regulation procedure used in Experiments 3 and 4 were not effective in the same way that typical tasks of this kind are, Experiment 5 aimed to test a methodology shown to be reliable in depleting cognitive resources. A review of the literature suggested that tasks involving letter crossing were most effective in causing participants to display signs consistent with being ego-depleted. It was decided that a letter crossing task would be used whereby two conditions were designed to encourage ego-depletion in our participants.

Results for performance on the consumer decision-making task revealed that participants in condition 3 (who had to override a learned response) made significantly more correct choices overall than participants in condition 1 (who simply had to cross out all cases of the letter 'e' on a good quality photocopy). Although these findings are contrary to those found by previous researchers, they replicate with those reported in Experiments 3 and 4 whereby young participants placed in conditions designed to maximise effort (and therefore drain resources) consistently performed best. In addition, participants in Condition 1 were more likely to stick than participants in Condition 2 (who were presented with a poor quality photocopy and instructed to cross out instances of the letter 'e' in accordance with set rules) and Condition 3. Again, this is contrary to what may be expected as participants in this condition should have been the least depleted in terms of cognitive resources. Pocheptsove et al., (2008) proposed that given the option, resource-depleted individuals often chose to defer their choice or stick with a pre-selected option because they lack the cognitive reserves necessary to engage in effortful trade-offs. The data from Experiment 5 did not show this.

Interestingly, participants in Condition 3 were most accurate in their choices to stick, which again differs to what would be predicted had the ego-depletion manipulation been effective.

To test whether the letter-crossing task caused participants to behave in a way typical when in a state of ego-depletion, the GRE was again used as an additional reliable measure of subsequent cognitive performance. It seems the procedure used in Experiment 5 was unsuccessful in causing a state of ego-depletion. Participants in Condition 2 (cross out with rules) actually performed better on the GRE in terms of the percentage of correct answers than participants in Condition 1 (cross out all "e"s). Participants in Condition 2 also performed best on a measure of overall accuracy whereby they scored more highly in the proportion of correct answers attained (however this effect was only marginally significant). In light of these findings, it seems that rather than leading to reduced performance, the ego-depletion manipulation resulted in equal or even better performance. In light of previous findings (e.g. Schmeichel, et al., 2003), the data from Experiment 5 is surprising. Had Conditions 2 (cross out with rules) and 3 (override learned response) worked in causing participants to exhibit signs of ego-depletion, this would be evidenced in reduced overall performance, accuracy and working speed.

Half the participants received the GRE task prior to the consumer decision task, and half received the GRE after the consumer decision task. Only the combined analysis is presented in the main body of the thesis as the effects of order were minimal. The data shows that when data for participants who completed the GRE before and after the consumer decision task are taken together, participants in Condition 2 scored significantly better in terms of the percentage total of correct answers than participants in Conditions 1 and 3.

Based on the findings from Experiments 3 and 4, it was anticipated that participants would opt to stick with the status quo more often when problems were difficult compared to when they were easy. The data from the current experiment was consistent with this prediction and previous research in this area (e.g. Tversky & Shafir, 1992). Furthermore, it was expected that participants assigned to conditions designed to cause a state of ego-depletion would opt to stick more often than participants in the control group. However, no significant differences were revealed between conditions in terms of the number of times participants opted to stick on either type of problem. This adds further evidence to the argument that the letter crossing manipulation was unsuccessful in causing participants to behave in a manner consistent with being ego-depleted.

Taken together, data from the GRE and consumer decision task suggests that the manipulation used to induce ego-depletion was unsuccessful and if anything, worked to facilitate decision-making. Despite the wealth of evidence providing support for the strength model of self-regulation, attempts to replicate these findings are not always successful. Murtagh and Todd (2004) conducted two experiments to try and reproduce studies that support the strength model. In their first study, participants completed a Stroop task, and then squeezed a handgrip for as long as they could. In their second experiment, participants were instructed not to think about a white bear while they wrote down their thoughts; depletion was then measured by time working on difficult anagrams. Neither of these studies provided evidence of ego-depletion.

In explaining their findings, Murtagh and Todd (2004) suggest the self-regulatory failure may be due to difficulties in switching from a task in one domain to another. This may be particularly true for typical studies investigating ego-depletion, which tend to cross domains (e.g. presenting a physical task and then an emotion control task). It is argued that behaviours associated with ego-depletion are presented because participants find it difficult to organise their responses, rather than a lack of resources due the costs associated with an initial task.

An alternative explanation proposes that the manipulation used in each condition cued different processing mechanisms. Research has shown that instructing participants to reason intuitively or logically can have an effect on their reasoning performance, (e.g. Klaczynski, 2001). For example, Thompson and Hamilton (2004) showed that different modes of information processing were able to either enhance or undermine the effectiveness of advertising, depending upon the match between the format of the advert and the processing mode consumers used to encode the advert information. In their study, participants were divided into four groups and asked to rate messages in car advertisements on the basis of persuasiveness, strength of argument and importance of information. The advert given to participants was either comparative or non-comparative. Participants were presented with instructions regarding how they should process the advert information. In the analytical condition, participants were asked to focus on the attributes and benefits of the car and think about how these attributes would meet their needs. In the imagery condition, participants were asked to try and picture the car in their mind and imagine as vividly as possible this experience. Results indicated that in the analytical condition, the message on the comparative advert was more persuasive than the message on the non-comparative ad but the reverse was true in the imagery condition. It was concluded that matching advert format with processing instructions appeared to increase the message persuasiveness by improving the processability of information.

In review of Experiments 3, 4 and 5 it is proposed that participants exposed to the ego-depletion manipulations may have been inadvertently cued to process information in a manner that matched that needed to make adaptive choices on subsequent cognitive tasks. It could be seen that the self-regulation tasks presented to participants in Experiments 3, 4 and 5 primed young participants to handle successive information in the decision-making tasks in a more adaptive manner, i.e. these participants were cued to match their mode of processing with the operations needed to make good choices on the GRE and consumer decision task. In other words, participants instructed to increase their attention to detail by consistently monitoring and controlling their actions (as required by the suppression condition in Experiments 3 and 4, and Conditions 2 and 3 in Experiment 5), may have continued to process information in subsequent decision tasks in an analytic manner therefore matching the process needed to perform well on these types of problems.

In conclusion, the data from Experiments 3, 4 and 5 consistently suggests that manipulations designed to be demanding in terms of resources, has in fact caused younger adults to perform better on subsequent cognitive tasks. It is proposed that the instructions presented to young participants in the ego-depletion conditions may have primed them to work harder to overcome the effort expended in adhering to the manipulation instructions. The effects of this priming led to better subsequent cognitive performance on successive tasks. The following chapter presents research designed to examine the effect of instructions on consumer decision-making in both young and old adults. These effects will be measured by way of overall performance and the number of times participants opt to stick with the status quo or switch to an alternative option. Age differences in status-quo bias are examined. Furthermore, predictive measures of cognitive performance are recorded in an attempt to replicate the findings presented in Chapter 2, which suggested that numeric and fluid abilities are intrinsic in the explanation of age-related differences in consumer decision-making.

Chapter 5

5.1 Introduction

It is generally thought that good decision-making relies upon conscious, effortful and deliberative processes; however, the impact of age-related cognitive declines suggests negative consequences for older adults' deliberative abilities and reductions in decision-making aptitude. Contexts that require exhaustive verifications might place older adults at a disadvantage given their limited cognitive resources.

Previous research has shown that priming participants to process information in a specific manner can affect subsequent processing on unrelated tasks. For example, Ferreira, Garcia-Marques, Sherman, and Sherman (2006) primed participants with inferential problems designed to facilitate heuristic processing. The inferential problems preceded the tasks presented to participants and shared the same basic structure. Results suggested that heuristic priming significantly increased heuristic processing. A further experiment conducted by the same research team tested whether the same effect could be attained in cueing individuals to engage in reason based processing. Participants were presented with formal problems as primes for subsequent target problems. Results indicated that rule-governed thinking involved in solving the priming problems led to an increase in reason based processing.

Klaczynski (2001) investigated age-related differences in normatively correct responses and biased responses on a several judgement and decision-making tasks. Depending upon the condition participants were assigned to, they were presented with 'framing' instructions which required them to respond to subsequent problems using either their "usual" mode of processing or, an "analytic" mode of processing. Results indicated that when given the instruction to process information in a more analytic manner, the use of automatically activated heuristics was reduced (Klazynski, 2001).

In terms of the methodologies used to prime participants, both Ferreira et al., (2006) and Klaczynski (2001) employed the use of simple instructions. For example, in one experiment testing how people made choices on the basis of incomplete information, Ferreira et al., (2006) told participants that they were taking part in a study of human intuition. Participants in this condition were encouraged to base their answers on personal intuition and sensitivity. In the second condition, participants were told that they were taking part in an experiment on human rationality and that the study's goal was to evaluate scientific reasoning ability. Participants in this condition were encouraged to behave like scientists and base their answers on rational and reflective thinking. Klaczynski (2001) induced analytic processing by asking participants to think about a given situation from the perspective of a perfectly logical person. In both these experiments, participants' choices varied as a function of the instructions they were presented with.

In light of the research outlined above, it is proposed that instructions presented to participants in Experiments 3, 4 and 5 may have primed participants to engage in discrete processing styles while completing the subsequent decision tasks. In Experiments 3 and 4 young adults in the suppression condition performed better than those in the reappraisal and control conditions. In both experiments, participants in the suppression condition were given the same instructions. These instructions required that should participants experience any feelings while viewing a distressing video clip, they must do their best not to let these feelings show, and behave in a way that someone watching them would not know that they were feeling anything at all. It is possible that these instructions led participants to pay attention to both their emotional and physical responses (such as facial expressions) in order that they could be controlled. To maintain this level of self-control, it is thought that participants engaged in a deliberative process whereby their reactions were constantly monitored and corrected if necessary. To make optimal choices, participants were required to calculate all alternative options and then compare these against a preselected target. To do this, it is argued that a process of self-control must be employed so that the individual can engage in a resource-intense analysis of each option before making a choice. It is proposed that the deliberative mode of processing was induced by the suppression instructions, and continued to be employed while completing the stick or switch decision task.

In Experiment 5, participants placed in Condition 3 were made to form a habit (cross off all instances of the letter 'e') and then break it (only cross off instances of the letter 'e' when in accordance with certain rules). It is possible that this procedure primed participants to override an established intuitive response (crossing out all "e"s) in order that a more analytic, reasoned processing mechanism be employed (cross out only certain "e"s). Again, this analytic, deliberative processing style may have been utilised in the subsequent consumer decision task. The decision task can be seen as requiring that rule-based calculation procedures are employed in order that optimum choices are made. Taken together, it is argued that the manipulation used in Condition 3 cued participants to process information in a manner that matched the necessary operations needed for the subsequent consumer decision task.

In view of the findings outlined by previous researchers (Ferreira et al., 2006; Klaczynski, 2001) and those obtained in Experiments 3, 4 and 5, Experiment 6 tested the effects of instruction manipulation (rational vs. intuitive) on a subsequent stick or switch decision task. The instructions were based on those used by Ferreira et al., (2006) and Klaczynski (2001). It was proposed that priming older adults to make choices in an intuitive manner may reduce the cognitive burden associated with decision-making. It is also hypothesised that priming young adults to utilise more deliberative processes will improve their decision-making. Performance on the decision-making task was measured by examining overall accuracy and the number of times participants opted to stick with the status quo or switch to an alternative option. Experiment 3 revealed that older adults tended to stick more often than younger adults. It was proposed that this was a strategy employed by older adults to conserve limited resources. It is anticipated that older adults would again reveal a general tendency to stick more than young adults. Furthermore, because processing information in a rational manner places additional demands on resources, it is thought that older adults in this condition may attempt to reduce the cost to their (limited) reserved by opting to stick even more often.

In addition to examining the effects of processing style on decision-making, predictive measures of performance were used to examine individual differences. Data from Experiments 1 and 2 showed that numeric and fluid ability were important determinants of older adults' performance on a consumer decision task. By including measures of fluid and crystallised intelligence, speed of processing and numeric ability, it was anticipated that results from Experiments 1 and 2 could be extended and replicated in a further consumer choice task.

Finally, the data from Experiment 2 also suggested that domain specific knowledge could not fully explain older adults' apparent aptitude at the consumer decision-making task. The data showed that even in a comparatively unfamiliar domain (e.g. mobile phone provider), older adults demonstrated maintained decision-making ability. Although it may be reasonable to assume that individuals make better choices in contexts in which they have experience, our findings showing no difference between domains are not unique. Kim and Hasher (2005) tested two possible hypotheses regarding the effects of age and experience on decision-making. The first hypothesis postulated a general expertise view that older adults are generally more skilled at making decisions than younger adults. The second tested whether older adults were simply more skilled in making decisions in domains where they have greater knowledge.

Kim and Hasher (2005) presented older and younger participants with two choice tasks. Each task displayed information about price and quality for three brands. Brands A and B were competitive to each other because Brand A was weaker on the quality dimension and stronger on the price dimension, while the reverse was true for Brand B. A third option, Brand C was also presented, however this option was always irrelevant. The two choice tasks were presented within the context of grocery shopping or earning extra credit for a course. It was assumed that older adults would be more familiar with grocery shopping and younger adults would be more familiar with attaining course credits. Results indicated that older adults were consistent in their choices in both domains. Younger adults made inconsistent decisions when making choices in the grocery shopping problem. However, they did not show this effect in the extra credit domain. These findings suggest that general expertise may explain performance in later years. In addition to this, and consistent with the predictions made in the current chapter, Kim and Hasher (2005) argue that the better performance shown by older adults may lie in their increased propensity to rely on heuristic or intuitive information processing while younger adults tend to rely on analytic, systematic information processing. Experiment 6 investigated this issue in four consumer domains: one familiar to both young and old adults, one unfamiliar to both young and old adults, one familiar to older adults only and one familiar to young adults only.

5.2 Experiment 6

Experiment 6 aimed to examine the effect of age and instruction manipulation on task performance. Firstly, it was predicted that young and old adults would perform best in the rational condition. Second, it was predicted that participants will select the option to stick with the status quo more often on difficult problems than easy problems and older adults would stick more often overall compared to younger adults. Third, that numeric and fluid abilities would independently predict performance on the consumer decision task for old adults. Finally, it was anticipated that domain specific experience would not affect decision aptitude across domains for old or young adults.

5.3 Method

5.3.1 Participants

123 participants took part in Experiment 6: sixty three young adults aged 18-52 (M = 22.1, SD = 5.78), and sixty old adults aged 63-93 (M = 73.18, SD = 6.62). Participants in each age group were randomly divided into two separate conditions: intuitive and rational. A total of 31 younger adults participated in the intuitive condition (M = 22.29, SD = 5.34) and 32 participated in the rational condition (M = 21.91, SD = 6.31). Thirty older adults participated in the intuitive (M = 71.66, SD = 5.03) and rational (M = 74.81, SD = 7.75) conditions respectively.

Old adults were paid £8 per hour for their time and young adults received course credits for their participation. Young participants were university students and old adults were recruited from the South West of the UK.

5.3.2 Materials

Manipulation Instructions

Two sets of instructions were used. The instructions were adapted from those used by Ferreira et al., (2006) and Klaczynski (2001) and were designed to cue participants to either use an intuitive or rational mode of processing. All participants received the following instructions:

"*The present study's goal is to evaluate how individuals make choices on the basis of some information. The following pages consist of scenarios where a choice has already been made. It is your job to decide whether you want to stick with this choice or switch to an alternative option*."

Participants in the Intuitive condition were then told: "*Please answer on the basis of your **intuition** and **personal sensitivity**. Try to respond to the questions based upon **gut instinct** using your **intuition** as the guide for responding*"

Participants in the Rational condition were then told: "*Please answer on the basis of your **rational** and **reflective thinking**. Try to think about the questions objectively in terms of the technical aspects of each problem. When answering these questions, try to **take the perspective of a perfectly logical person***"

Stick or Switch Decision Making Task

The decision task replicated the format of that used in Experiments 3, 4 and 5 whereby participants were presented with a number of hypothetical scenarios and asked to make a choice regarding whether they would like to stick with an option already selected for them, or switch to an alternative option. In total, participants were required to make sixteen decisions in four domains. The selection of the four domains was based upon their familiarity to both young and old adults. The findings from Experiment 2 suggested that young adults were very familiar with making choices about selecting mobile phone companies, and that older adults were very familiar with making choices about utility suppliers. Based on these findings, it was decided that four questions would be framed within the context of selecting a mobile phone company (familiar to young adults). Four questions would be framed within the context of selecting an energy supplier (familiar to older adults). In addition, two further contexts were introduced, one which would be familiar to both older and younger adults, i.e. choosing a supermarket, and one which would be relatively unfamiliar to both age groups such as selecting a pharmacological supplier. Details of all problems presented to participants can be found in Appendix 6A.

Decisions about mobile phone companies were based upon the price of 100 minutes call time, the price of 100 text messages, and how well rated the company was in terms of reception coverage (1-5, where 1 is bad and 5 is good). Decisions about energy companies were based upon the price of 100 kWhrs of gas, the price of 100 kWhrs of electricity and how well rated the company was in terms of customer service (1-5, where 1 is bad and 5 is good). Decisions about supermarkets were based upon the price of a loaf of bread and the price of a pint of milk as well as how well rated the supermarket was on scores of customer satisfaction (1-5, where 1 is bad and 5 is good). Finally, decisions about pharmacological suppliers were based upon purchasing an equal amount of two drugs: Polymyxin B and Dexamthasone as well as a score for delivery speed (1-5, where 1 is fast and 5 is slow).

The presentation of the problems matched that used in Experiments 3, 4 and 5. Information about eight companies labelled A-H was presented in a unique table for each of the sixteen problems. As with the previous experiments using this task, in each table one company had been highlighted. Participants were told that this was the company they were thinking of selecting. Participants then had the option to 'stick' with the option already selected, or 'switch' to an alternative company. Prior to each problem, participants were presented with a short vignette outlining what they were expected to do and highlighting the important information relevant to each decision. If the option to 'switch' was chosen, participants were asked to indicate which company they would switch to by circling a letter from A-H. All participants were asked to make these decisions as though they were making them for themselves in real life.

Furthermore, the questions were designed in a specific manner, meaning that some problems were harder to solve than others. As with problems presented in Experiments 3, 4 and 5, the questions were individually designed to manipulate difficulty, (see Appendix 6A). Questions were considered 'difficult' if differences in attractiveness between options were small (see problem types I and II). Questions were considered 'easy' if differences in attractiveness between options was large (see problem types III and IV). Each set of questions contained four problems. Each of these four problems was constructed carefully so that the decisions were counterbalanced: (I) All options (A-H) were very similar, however two equal optimum choices were presented, one of which had already been selected. The correct choice would be to 'stick'. (II) All options (A-H) were very similar, with two equal optimum choices available however, neither of these options had been selected. The correct choice would therefore be to 'switch'. (III) Six of the eight options were very similar, though one company was markedly better than the others and one company was much worse. The best option had already been selected; therefore the correct response would be for the participant to 'stick'. (IV) Again, six of the eight options were very similar, however, one company was much better value than the rest and one was much worse. An inferior option had been selected for this question; therefore the participant should opt to 'switch' in order to correctly solve this problem.

Standard Progressive Matrices

All participants completed sections B, C and D of Raven's Standard Progressive Matrices (Raven, Raven & Court, 2003). This task was designed to measure two main components of general intelligence: the ability to think clearly and make sense of complexity, as well as the capacity to store and reproduce information.

Wechsler Adult Intelligence Scale-III Vocabulary Scale

This sub-test of the Wais-III assesses learning and memory (Alan, 2001; Alfredo 2007; Walter et al., 1975). All individuals were presented with a series of words both orally and visually. Participants were tasked with verbally defining each word as it was presented to them.

Speed of Processing:

The digit comparison task (Finucane et al, 2005) was employed to evaluate speed of processing. Participants were asked to quickly determine whether or not two numerical figures were the same. Three, 45-second conditions were administered.

Numeracy Scale

An 11-item numeracy scale (Lipkus, Samsa, & Rimer, 2001) was used to evaluate numerical ability.

Demographic Questionnaire

This asked for information about age, gender, and education. To measure domain specific experience, participants were also asked questions about their interaction with energy suppliers, mobile phone companies, shopping habits and whether they had ever worked for a pharmacological supplier (see Appendix 6B).

5.3.3 Procedure

Older adult participants were tested individually and younger adults were tested in pairs. The experiment consisted of six tasks: The stick or switch decision task, demographic questionnaire, standard progressive matrices, Wais-III vocabulary scale, digit comparison, and the numeracy scale. Prior to testing, participants were given a short introduction to familiarise themselves with the various tasks. It was made clear that calculators were not allowed to be used for the duration of the experiment, however scrap paper and pens were provided and the participants were informed that they could use these should they wish to make notes in order to aid them with their answers.

All participants completed the stick or switch decision task first. Depending upon which condition they were allocated to they received either the intuitive or rational instructions. The instructions were read aloud to all participants and a printed copy was also provided for participants to refer to for the duration of the decision making task. All participants were informed that there was no time limit in which they had to complete the decision task, however the length of time it took them to accomplish the task would be noted. Participants' timings were recorded using a stopwatch in exactly the same manner used in Experiments 3,4 and 5. To prevent order effects, the sequence that the questions in the decision task were presented was counterbalanced across age groups and conditions.

Once the decision task had been completed, participants were then asked to answer the questions on the demographic questionnaire. All other procedures regarding the Ravens, Wais – III, speed of processing task and numeracy scale replicate those used in Experiments 1 and 2.

5.4 Results

The impact of instructions to process information in an intuitive or rational manner was examined in older and younger adults. In order to ensure that participants assigned to each condition were equivalent, a multivariate analysis of variance (Age X Condition) for each predictive measure of performance was conducted. Means, standard deviations, F values and Eta squared are presented in Table 5.1.

Table 5.1 Descriptive Statistics, F values and Eta Squared for Predictive Measures of Performance by Age and Condition.

Predictive Measures	Age Group	Intuitive		Rational		*F*	η^2
		M	*SD*	*M*	*SD*		
RAVENS	Young	85.57	7.22	86.37	9.13	.15	0
	Old	74.54	11	69.72	14.25	2.15	.04
Digit Comparison	Young	77.23	10.44	74.97	13.87	.53	.01
	Old	60.9	11.96	53.4	10.69	6.56*	.1
Numeracy	Young	83.28	9.99	82.67	15.38	.04	0
	Old	72.12	15.1	69.7	20.16	.28	.01
Vocabulary	Young	58.06	8.12	54.31	12.54	2	.03
	Old	65.25	14.42	65.25	11.81	0	0
Time (Minutes)	Young	10.81	3.57	12.94	2.96	6.66*	.1
	Old	16.9	11.11	22	7.24	4.38*	.07

*$p < 0.05$

The data presented in Table 5.1 shows that older adults assigned to either condition showed no significant difference in terms of fluid intelligence, numeric ability or crystallised intelligence. However, older adult participants in the intuition condition evidenced significantly faster processing speed and completed the consumer decision task significantly more quickly than older adults in the rational condition.

Table 5.1 shows that younger adults assigned to each condition did not differ significantly in terms of fluid intelligence, numeric ability, crystallised intelligence or speed of processing. And, as with the older adults, young participants in the rational condition took significantly longer to complete the decision-making exercise than those in the intuition condition.

Next, an independent measures t-test was conducted to test for differences in performance in predictive measures of ability between participants in each age group. Descriptive statistics, *t* values and significance are presented in Table 5.2.

Table 5.2 Descriptive Statistics in Percentages on Predictive Measures of Performance for all Younger and Older adults

Predictive Measures	Young		Old		*t*
	M	*SD*	*M*	*SD*	
Ravens	85.98	8.2	72.13	12.84	7.09**
Digit Comparison	76.08	12.26	57.15	11.87	-8.7**
Numeracy	82.97	12.91	70.91	17.7	4.33**
Vocabulary	56.16	10.68	65.25	13.07	4.24**

**p < 0.01

Table 5.2 shows that younger adults performed significantly better than older adults on measures of fluid intelligence, numeric ability and speed of processing. Older adults scored significantly higher on a measure of crystallised intelligence (vocabulary) than younger adults. These findings are consistent with the literature on cognitive ageing (and data from Experiments 1 and 2), suggesting our sample is representative.

Next, the effects of age and condition on decision-making ability on the consumer decision task were investigated. Means and standard deviations for old and young adult's performance on the consumer decision task for both conditions are presented in Table 5.3.

Table 5.3 Descriptive Statistics in Percentages for Performance of Younger and Older Adults by Condition on the Consumer Decision Task.

		Intuitive		Rational	
		M	*SD*	*M*	*SD*
Total Stick and Switch Correct	Young	77.41	10.91	81.84	10.76
	Old	70	16.85	75	10.76
Total Correct Stick Choices	Young	94.47	7.97	94.64	9.43
	Old	85.71	21	92.7	8.34
Total Correct Switch Choices	Young	64.87	15.48	70.14	14.23
	Old	58.44	20.32	61.56	16.55
Total Times Stick was Chosen	Young	50.81	7.7	47.23	6.53
	Old	46.46	15.8	50.21	9.21
Total Times Switch was Chosen	Young	49.2	7.69	52.73	6.53
	Old	53.54	15.8	49.17	8.95

To see whether condition affected the number of correct stick or switch decisions participants made, a mixed 2X2X2 analysis of variance (Condition X Correct choice X Age) was conducted. The results revealed a significant main effect of correct choice, F (1, 119) = 268.91, $p < .01$, $\eta^2 = .69$, a significant main effect of age, F (1, 119) = 9.64, $p < .05$, $\eta^2 = .08$, and a marginally significant main effect of condition, F (1, 119) = 3.52, $p = .06$, $\eta^2 = .03$. These results indicate that young adults performed better than old adults in both conditions. Choices were correct most often when participants opted to stick and when participants were placed in the rational condition. No significant interaction between age and condition was found, F (1,119) = .32, $p > .05$, $\eta^2 = 0$. No significant interaction was found between correct choice and age, F (1, 119) = .4, $p > .05$, $\eta^2 = 0$. No significant interaction was found between correct choice and condition, F (1, 119) = .03, $p > .05$, $\eta^2 = 0$. Furthermore, no significant interaction was found between correct choice, age and condition, F (1, 119) = 1.71, $p > .05$, $\eta^2 = .01$. Please refer to Statistics Appendix 6 for all summary tables corresponding to Experiment 6.

Next the prediction that participants would opt to stick more on difficult problems compared to easy problems was tested. Means and standard deviations for old and young adults in the intuition and rational conditions are presented in Table 5.4

Table 5.4 Means and Standard Deviations for Old and Young Adults in the Intuition and Rational Conditions on Difficult and Easy Problems.

	Young				Old			
Stick	Intuition		Rational		Intuition		Rational	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Difficult Problems	69.75	10.59	65.23	9.91	61.25	22.11	69.17	14.21
Easy Problems	37.1	13.88	31.25	10.04	35.83	16.33	36.67	14.28

A 2X2X2 analysis of variance (Age X Condition X Problem difficulty) was conducted. Results indicated no significant main effect of age, F (1, 119) = .01, $p > .05$, $\eta^2 = 0$, and no significant main effect of condition, F (1, 119) = .04, $p > .05$, $\eta^2 = 0$. However, a significant main effect of problem type was found, F (1, 119) = 477.8, $p < .01$, $\eta^2 = .8$ where all participants chose to stick more often on difficult problems. Furthermore, a significant interaction between age and condition was revealed F (1, 119) = 4.9, $p < .05$, $\eta^2 = .04$ where both young and old adults chose to stick more when placed in the rational condition. No significant interactions were found between age and problem type F (1, 119) = 2.35, $p > .05$, $\eta^2 = .08$, problem type and condition, F (1, 119) = 2.18, $p > .05$, $\eta^2 = .02$, or problem type, age and condition, F (1, 119) = 1.02 $p > .05$, $\eta^2 = .01$. These findings suggest that both younger and older adults tended to stick more often on problems that were difficult compared to problems which were easy. Furthermore, the data indicates that the number of times younger and older adults chose to stick was equivocal across conditions. Finally, younger and older adults did not differ significantly from one another in terms of the number of stick choices made for difficult and easy problems.

Next, a series of Pearson correlations were conducted to investigate any relationships between predicative measures of ability and performance on the consumer decision task. Pearson correlation values and significance for participants in each condition and combined condition are presented in Table 5.5.

Table 5.5 Pearson Correlation Matrix Among Predictive Measures of Ability for Overall Decision Performance for Young and Old Adults in the Intuitive and Rational and Conditions Combined.

		Predictors				
Age	Group	Numeracy	Digit Comparison	Ravens	Vocabulary	Time
Young	Intuitive	-.56**	-.21	.0	-.04	.44**
	Rational	-.12	.16	.21	-.13	-.03
	Combined	-.29*	-.03	.12	-.12	.29*
Old	Intuitive	.34°	.05	.56**	.12	-.1
	Rational	.35°	.33	.31	.17	-.03
	Combined	.31*	.08	.37**	.13	-.03

*p < 0.05, **p< 0.01, ° p< .1

Table 5.5 reveals that numeracy and time were related to decision-making ability for young adults in the intuitive condition. Interestingly, the correlation for numeracy and ability at the stick or switch task was negative, suggesting that good numeric ability led to poorer overall performance. Surprisingly, no correlations were found between ability to select adaptively and predictive measures in the rational condition. In terms of older adults, the data presented in Table 5.5 shows that a significant relationship occurred between numeric ability and fluid intelligence in the intuitive and combined group analysis. Numeric ability was also marginally significant in both the intuitive and rational conditions. When data from participants in the rational and intuitive group were combined, numeric ability and fluid intelligence were significantly correlated with performance.

The next analysis examined the extent to which numeracy, fluid and crystallised intelligence and speed of processing predicted performance. A number of multiple regression analyses were performed with numeracy, fluid intelligence, crystallised intelligence and digit comparison entered as predictive variables. A total of three independent analyses were run for each age group. Performance on the consumer decision task was the dependent variable for participants in both the rational and intuitive conditions and, data for participants in both conditions combined.

Table 5.6 Multiple Regression Analysis for Younger Adults Decision Making Ability and Predictive Measures of Performance

Question	Predictors	β	t	Sig	R^2	Adjusted R^2
Rational	Numeracy	-.28	-1.25	.22	.16	.04
	Fluid Intelligence	.37	1.76	.09º		
	Vocabulary	-.17	-.84	.41		
	Speed of Processing	.19	.97	.34		
Intuitive	Numeracy	-.55	-3.4	0**	.35	.25
	Fluid Intelligence	-.02	-.08	.93		
	Vocabulary	-.03	-.2	.85		
	Speed of Processing	-.23	-1.2	.24		
Combined	Numeracy	-.39	-2.74	.01*	.16	.1
	Fluid Intelligence	.29	2.17	.03*		
	Vocabulary	-.08	-.62	.54		
	Speed of Processing	.07	.59	.56		

*$p < 0.05$, **$p< 0.01$, ° $p< .1$

Table 5.6 shows that none of the measures of intelligence could predict young adults' decision-making performance when placed in the rational condition, although fluid ability was marginally significant. Numeric ability was found to be a highly significant predictor of performance for young participants in the intuitive condition. Furthermore, numeric and fluid ability were found to be significant predictors of performance when the scores for participants in the rational and intuitive conditions were combined.

Table 5.7 Multiple Regression Analysis for Older Adults Decision Making Ability and Predictive Measures of Performance

Question	Predictors	β	t	Sig	R^2	Adjusted R^2
	Numeracy	.29	1.41	.17		
Rational	Fluid Intelligence	.03	.11	.91	.22	.09
	Vocabulary	.09	.51	.62		
	Speed of Processing	.28	1.39	.18		
	Numeracy	.06	.28	.78		
Intuitive	Fluid Intelligence	.54	2.67	.01*	.32	.21
	Vocabulary	-.01	-.08	.94		
	Speed of Processing	-.06	-.33	.75		
	Numeracy	.16	1.08	.29		
Combined	Fluid Intelligence	.3	1.94	.06º	.16	.1
	Vocabulary	.04	.31	.76		
	Speed of Processing	-.04	-.32	.75		

*p < 0.05, **p< 0.01, ° p< .1

Table 5.7 shows that decision-making performance for older adults in the rational condition could not be predicted by any of the variables measured. However, fluid intelligence was found to be a significant predictor of consumer decision making for participants in the intuition condition. When the data from older participants in both the rational and intuition conditions were combined, fluid intelligence was found to be a marginally significant predictor of decision performance.

To examine whether experience can account for performance, a number of Pearson Chi-Square analyses were performed. Experience with the four topic areas was assessed by asking participants about their interactions specific to each domain. Data from one question corresponding to each topic was used in the analysis. Questions can be found in Appendix 6B. In summary, results revealed no significant associations between experience and decision making in each domain for either age group.

5.5 Discussion

The work presented in this chapter explores age differences in consumer decision-making. Experiment 6 tested the idea that older and younger adults would vary in performance on the decision-making task depending upon the processing instructions they received. It was thought that asking participants to manage information in a rational manner would encourage them to process information in a deliberative way. In contrast, asking participants to manage information in an intuitive manner would encourage them to process information in an instinctive, less resource demanding way.

The first prediction assumed that young and old adults would perform best in the rational condition. Results from Experiment 6 revealed that both young and old in the rational condition performed better than participants in the intuitive group. These findings supported the predictions. The current data implies that both older and younger adults must engage in deliberative and effortful processing to attain good decisions. In terms of Experiment 3, the mechanisms underlying the performance of older adults in the reappraisal condition remain unclear. In light of this, it seems that reappraisal may not simply have been less cognitively demanding than other strategies, but that some other process incurred by the reappraisal instructions caused older adults to handle information in a more beneficial way.

Further analysis revealed that young and old adults were significantly more likely to stick when placed in the intuition condition and switch more when assigned to the rational condition. This finding implies that participants expended less energy when placed in the intuition condition as deciding to stick requires fewer cognitive resources than choosing to switch (Dahr, 1997). In view of the manipulation instructions, this data suggests that directions to process information in an intuitive or rational manner were successful.

Finally, young adults were significantly more accurate in their choices than older adults. This finding was consistent with the literature on ageing whereby older adults tend to make worse consumer decisions than young adults (e.g. Peters et al., 2007; Reyna et al., 2009).

An additional prediction was that all participants would opt to stick with the status quo more often on difficult problems. The data from the current study is consistent with this prediction and previous research (including data from Experiments 3, 4 & 5). Taken together, the findings from the research presented in this thesis provide robust support for Dahr (1997) and Tversky and Shafir (1992) who proposed that consumers would choose to defer a decision when the choice environment becomes more complex. Furthermore, the present findings demonstrate differential effects of instructions for older and younger adults in terms of the decisions they make in complex and simple choice environments.

Despite the mixed pattern of results for younger and older adults' performance on the decision-making exercise, it was assumed that the instruction manipulations were effective. This belief is based on older and younger adults' performance on other measures of ability. For example, both older and younger adults in the rational condition spent significantly more time completing the stick or switch decision task. This implies that those in the rational condition were indeed engaging in a more effortful form of processing. Furthermore, on the digit comparison task, both older and younger participants in the rational condition were found to compare fewer digits than those in the intuitive condition. This suggests that participants in the rational condition were responding in a deliberative and more effortful manner, the consequence of which was a reduction in processing speed.

An additional explanation for these findings is that old and young adults may have had different definitions regarding which alternative they considered to be the best. In Experiment 6, the best alternative was deemed to have the most positive (and fewest negative) attributes; this definition is consistent with that used by Dijksterhuis (2006). However, Calvillo and Panaloza (2009) propose the following example to illustrate a problem with this definition: “suppose one is deciding between two cars, each with three known attributes. Car A has cup-holders and a sunroof, but gets poor gas mileage, while Car B has no cup-holders or sunroof, but gets good gas mileage. Car A has two positive and one negative attribute while Car B has one positive and two negative attributes” (Calvillo & Panaloza, 2009, p. 510). According to the definition used in the present study, one should choose car A. However, a person who weighs gas mileage more than the sum of weights for cup-holders and sunroofs should select Car B. Because the weighting of attributes is subjective, when positive and negative attributes vary between alternatives, it can be seen as difficult to know which alternative to select. Older adults may have weighted attributes in each problem differently to young adults, for example problems presented to participants in the context of selecting a holiday provided information on the price of the hotel, the price of the flight and the number of stars assigned to each hotel. Older adults may have been prepared to pay additional money to stay at a hotel with extra stars because they weighted this attribute more highly than the costs of the hotel and flight.

It was proposed that numeric and fluid abilities would predict performance on the consumer decision task for both young and old adults. To test this hypothesis, cognitive predictors of performance (i.e. numeracy, speed of processing, crystallised intelligence and fluid intelligence) were examined. Results suggested that numeracy was the strongest predictor of performance for younger adults when instructed to work on problems in an intuitive manner, although this relationship was negative. This implies that the higher the numeric aptitude of the individual, the poorer their performance when asked to answer problems on the stick or switch decision task in an intuitive manner. Despite the unexpected nature of these findings, they are consistent with those found in Experiment 1 whereby a negative relationship between numeracy and performance on factual questions was found to be close to significant.

It is proposed that more numerate participants engaged in a more complex calculation procedure, which conversely led to poorer performance. It can be seen that the problems presented in the stick or switch task are relatively simple. The most efficient strategy in solving these items involves two stages. The first step would be to eliminate all options that scored below the pre-selected choice based on the visual depiction of ratings for customer satisfaction, speed of delivery, customer service or mobile phone reception. The second step requires that participants then complete a simple calculation process to achieve an overall cost relating the remaining alternative options. In light of this, making good choices on the stick or switch decision task can be viewed as being dependent upon information search, and relatively less reliant on numeric ability.

One possibility is that more numerate individuals may attempt to compare options by combining all of the information presented in the tables. This may have included assigning a value to each of the visual depictions for ratings of customer satisfaction. By engaging in this form of ratio-based processing participants would not achieve a correct response. In support of this explanation, research conducted by Reber, Brun, and Mitterndorfer (2008) suggested that when people do not have enough time to analyse a problem, they may engage in heuristic cues in order to assess the correctness of a proposed solution. They argue that it is this mechanism that underlies intuitive judgements in simple mathematical tasks. It is proposed that participants with better numeric skills may have developed more accurate heuristic cues able to efficiently process complex numeric problems. If this were so, participants with better numeric skills may have indeed tried to combine all the information presented in the tables by assigning a value to the visual depictions of product attributes. These forms of calculation may lead to an incorrect response.

It is interesting to note that a similar negative relationship was established for young participants in the factual condition in Experiment 1. Again, it could be argued that highly numerate individuals tried to engage complex calculation processes unnecessary for the task. By attempting to evaluate information in a complex manner, these participants performed worse than those who were less numerate. Interestingly, no measures of cognitive performance were found to significantly predict aptitude on the consumer decision task for young adults in the rational conditions. However, when data for young participants in both conditions was combined, numeracy and fluid intelligence presented the best model for predicting performance on the consumer decision task.

With regards to older adults, fluid intelligence and numeric ability were found to be significantly correlated with performance on the consumer decision task; Fluid intelligence also presented the best model for predicting performance when data for older participants in both conditions were combined. These findings are consistent with the literature whereby it is thought that, compared to young adults, older adults may rely on a more effortful processing mechanism (as measured by fluid intelligence) to manage exhaustive verification strategies used to calculate the most beneficial option on the decision task. No measures of cognitive performance predicted aptitude on the consumer decision task for old adults in the rational condition.

Results revealed that experience in each of the four domains could not significantly account for performance on the consumer decision-making task. Experiment 6 adds further support to the notion that domain specific knowledge cannot fully explain performance on the decision making task.

In summary, this experiment provides some interesting findings. Namely that priming young and old adults to process information in a rational manner leads to better decision-making compared with cueing intuitive processing. Furthermore, additional evidence for age-related differences in processing mechanisms when making consumer choices was provided. It seems that older adults rely most on fluid intelligence, whereas numeric ability seems key to predicting young adult's competence at making good decisions. Interestingly, the converse relationship between numeric ability and decision competence found in Experiment 1 is replicated, whereby better numeric ability lead to worse decision-making. Additional support is also afforded to Dahr (1998, 1997), Tversky and Shafir (1992) who proposed that consumers would choose to stick more often when the choice environment becomes more complex. However, age-differences in the status-quo effect were not revealed suggesting that older adults do not rely on this strategy more often than young adults as a way of conserving resources.

Finally, the current study found that experience did not impact performance on the decision task; this finding is in line with that of previous experiments in this thesis and other researchers (e.g. Dijksterhuis et al., 2006).

In conclusion, Experiment 6 provides further evidence regarding the impact of instruction on subsequent decision-making and, in addition the key role of numeracy and fluid intelligence as independent predictors of ability for young and old adults when making consumer choices.

Chapter 6

6.1 Experimental Review

Experiments 1, 2 and 6 examined differences in younger and older adults' consumer decision-making. It was predicted that older adults would make comparatively worse decisions than young adults and both younger and older adults would perform worse on complex consumer problems compared to simple ones. In addition, it was anticipated that differences in decision-making ability could be explained by differences in cognitive abilities. See Table 6.1 (p181) for a summary of significant findings across all studies.

Data from Experiment 1 showed no difference in decision performance on simple or complex problems for older and younger adults. This finding was interesting given that age was associated with lower scores on fluid intelligence tasks, processing speed and numeracy. It was suggested that older adults might have relied on improved crystallised intelligence to compensate for declines in fluid abilities. This explanation is consistent with ideas proposed by Stanovich and West (2008) insofar that age-related increases in crystallised intelligence can provide some protection against deficits in other cognitive abilities. Additional support for this argument was revealed when crystallised intelligence was added as a covariate and a significant main effect of age emerged. Furthermore, when fluid intelligence was added as a covariate alongside crystallised intelligence, the effect of age disappeared. Taken together, Experiment 1 suggests that age differences in decision performance are the result of cognitive decline, and provides evidence consistent with the idea that crystallised intelligence can protect against some age-related deficits in cognitive ability.

Contrary to Experiment 1, Experiments 2 and 6 revealed a significant main effect of age where young adults made better decisions than old adults. These results are consistent with previous research given age-related differences in independent measures of cognitive ability. Interestingly, when fluid intelligence was added as a covariate, the main effect of age disappeared. This finding was reliably shown across Experiments 1, 2 and 6 and suggests that age differences in decision-making are partially influenced by fluid intelligence.

With regard to numeric ability, Experiments 1 and 2 revealed this to be a significant independent predictor of older adults' decision aptitude. Furthermore, numeracy was significantly correlated with older adults' performance in Experiment 6. This finding is consistent with previous research conducted by Peters et al., (2006), Tanius et al., (2009) and Wood et al., (2011) and highlights the important independent role of numeric ability in decision-making. These findings imply that for older adults, consumer decision-making performance is highly dependent upon both numeric and fluid ability. One possible interpretation of these findings is that older adults might rely on more effortful processing mechanisms to manage the verification strategies used to calculate the best option.

In terms of younger adults, numeric ability was found to predict performance on the consumer decision task in Experiment 2 and for participants in the intuition condition in Experiment 6. The results however, revealed that younger adults high in numeric ability seemed to perform worse on the consumer task. One possible explanation is that more numerate participants engaged in a complex form of ratio based calculation process, which lead to incorrect responses.

Reber et al., (2008) showed that when people do not have enough time to fully analyse a problem, they engage in heuristic cues to assess whether a proposed solution is correct. Because participants in the intuition condition were told to make decisions based upon their 'gut instinct,' it was proposed that participants with better numeric ability (and more accurate numeric heuristic cues) may have attempted to combine all the information presented in the tables by assigning a value to the visual depictions of product attributes. This form of calculation may have led to an incorrect response. As will be discussed later, the wider implications presented by these results suggest that individuals with poor numeric ability may be at increased risk of making bad consumer choices with potentially serious consequences.

In summary, the findings from Experiments 1, 2 and 6 consistently show that older adults' consumer decision making can be independently predicted by fluid and numeric abilities. However, the mechanisms young adults rely on when making consumer decisions remain unclear. In attempting to explain young adults' performance a number of alternatives are considered. First, it is possible that younger adults simply had sufficient cognitive capacity to engage in the types of calculations needed to process the information effectively without predominantly relying on any one predictive measure. Second, it may be some other mechanism not included in this study can predict performance. A growing body of literature suggests that decision-making may be affected by many factors aside from cognitive ability. Klaczynski (2001; 2009) demonstrated that social, motivational, affect and prior beliefs can impact the way people make choices. Furthermore, Cacioppo and Petty (1982) found that participants with a higher need for cognition were more likely to think harder about problems. Finally, Blais, Thompson and

Baranski (2005) demonstrated that need for cognition was related to decision accuracy on comparative judgement tasks.

The idea that an alternative variable, not included in the current research, can predict young adult performance is substantiated by Stanovich and West (1997). As will be discussed later, Stanovich and West (1997) showed that decision-making can be independently predicted by both cognitive ability and by thinking dispositions. Taken together, it seems that decision-making can be affected by both cognitive and dispositional factors. Experiments 1, 2 and 6 concentrated on measuring cognitive abilities. As such, future research could extend the scope of the present work by adding additional measures of disposition. It is predicted that a clearer picture of the factors responsible for young adults' consumer performance would be established.

Table 6.1. Summary of significant findings across all studies

Study	Young Adults	Old Adults
One	Performed best on factual questions compared to inferential questions.	Performed best on factual questions compared to inferential questions. A significant main effect of age emerged when crystallised intelligence was added as a covariate. When fluid intelligence was added alongside crystallised intelligence, the main effect of age disappeared. Numeric ability and fluid intelligence were found to independently predict decision making performance on the consumer task.
Two	Performed best on factual questions compared to inferential questions. Young adults performed significantly better than old adults on the consumer decision task. Numeric ability independently predicted decision performance on the consumer task.	Performed best on factual questions compared to inferential questions. When fluid intelligence was added as a covariate, the main effect of age disappeared. Numeric ability and fluid intelligence were found to independently predict decision making performance on the consumer task.
Three	Participants chose to make a decision in the future significantly more often on difficult problems. Participants in the control and suppression conditions made more correct choices than older adults. Participants performed best in the suppression condition.	Participants chose to 'make a decision in the future' most significantly more often on difficult problems. Older adults found it easier to regulate their emotions compared to young adults. Older adults reported feeing more positive and less negative than young adults. Participants performed best in the reappraisal condition
Four	Participants in the suppression condition made more correct decisions than those in the reappraisal condition. Participants in all conditions decided to stick more often than switch. Participants decided to stick most often on difficult problems.	
Five	Participants in Condition 3 (high ego-depletion) made more correct decisions than participants in Condition 1 (low ego-depletion). Participants in Condition 2 (moderate ego-depletion) attempted most questions on the GRE. Participants decided to stick most often on difficult problems.	
Six	Young adults performed better than older adults on the consumer decision task in both the rational and intuitive condition. Young adults decided to stick most often in the rational condition. Numeric ability was negatively correlated with decision performance on the consumer task. Numeric ability and fluid intelligence predicted decision performance on the consumer task.	Older adults decided to stick most in the intuitive condition. When fluid intelligence was added as a covariate, the main effect of age disappeared. Numeric ability and fluid intelligence were correlated with overall performance on the consumer decision task. Fluid intelligence independently predicted performance on the consumer decision task.

6.2 Choosing to Stick, Switch or Decide in the Future

When making a decision, consumers have a number of decision strategies available to them including: to stick with a current option, select an alternative option or decide in the future. As discussed in Chapters 1 and 2, making a consumer choice often demands that the individual considers a large number of alternative options (companies, tariffs and payment preferences) and engage in an extensive and/or complicated calculation processes to attain the best option. The associated cost to individual resources such as memory is high. It is important to identify decision environments where people may be vulnerable in terms of choosing to stick with a company that does not offer them the most beneficial option. Ascertaining how age and decision environment impact choice is an important step to developing methods to help people in making better consumer decisions.

Dahr (1997) proposed that the choice to stick, switch or defer vary in terms of the cognitive resources needed to implement them. Furthermore, Wesseler et al., (2003) suggested that people may avoid making a choice when they perceive the cognitive effort required to compare competing alternatives as too costly. In other words, individuals may choose to stick or defer in an attempt to conserve effort or resources.

To date, research has provided data consistent with the theories presented by Dahr (1997) and Wesseler et al., (2003). For example, Shafir and Tversky (1992) showed that difficult choices lead people to defer more often than when choices were easy. The choice to stick or decide in the future can be viewed as arising from similar decision conditions as the choice to defer. Furthermore, the likelihood of the status quo effect occurring has been shown to significantly increase if an option has been predetermined (Hartman et al., 1991; Samuelson & Zeckhauser, 1988).

Based on previous studies outlined in the decision literature (e.g. Dahr, 1997; Tversky et al., 1992) and preceding experiments described in this thesis, two predictions were made: First, older adults would choose to stick and decide in the future more often than young adults. This was based on the findings of previous studies: Experiments 1 and 2 revealed fluid intelligence to be a key predictor of consumer decision-making performance for older adults. Furthermore, older adults were found to score significantly lower on a measure of fluid intelligence than young adults. These findings are consistent with a wealth of evidence documenting age-related declines in many processes key to good decision-making. Older adults and younger adults seem to rely heavily on cognitive capacity to solve consumer problems. Because older adults' ability to engage in complex processing is more limited than younger adults, it was proposed that they may be more likely to attempt to conserve cognitive resources by choosing options less demanding of their cognitive reserves.

The second prediction stated that both older and younger adults would choose to stick more often on difficult problems compared to easy problems. Consumer problems in the current research were defined as difficult when attractiveness between options was small. In order to make the best decision, participants had to engage in an exhaustive verification process, adding together costs for multiple companies before making a selection. For easy problems, differences in attractiveness were large. The best and worst options were clearly identifiable from the alternatives. To test the two predictions, an original decision task was designed to mimic real consumer decision by comprising authentic choice options available to consumers. Experiment 3 measured age differences in the number of times individuals opted to stick, switch or decide in the future and Experiment 6 measured age differences in the number of times older and younger adults chose to stick or switch.

The data from Experiments 3 and 6 provided some interesting findings on both accounts. Both Experiments 3 and 6 revealed no significant difference in the number of times older and younger adults chose to stick. This is surprising given age-related cognitive declines in processing ability and resources. Furthermore, participants chose to stick most when young and old participants were faced with difficult problems (this was also shown in Experiments 4 and 5 with young adult participants). Interestingly, when the option to decide in the future was removed (as in Experiments 4, 5 and 6), participants chose to stick significantly more often, in place of where they may have originally selected to decide in the future. These findings are consistent with the work of Dahr (1997), Tversky et al., (1992) and Wesseler et al., (2003) in providing further evidence for the idea that consumers tend try and avoid making decisions when the choice environment becomes complex. In terms of the current research, it is suggested that participants simply found the cognitive costs of engaging in a comprehensive calculation process (as required by difficult problems) comparatively costly and therefore selected an option less demanding of resources.

Another explanation sympathetic to proposals made by Dahr (1997), Tversky et al., (1992) and Wesseler et al., (2003) sees the decision to stick or decide in the future as a 'passive-option' (Brockner, Shaw & Rubin, 1979). Brockner et al., (1979) measured persistence in a futile endeavour under two constraining situations. In one, the person had to make a positive move to continue, but the procedure would stop automatically if he or she did nothing (i.e. continuing was active and quitting was passive). The other situation was the reverse, in which a positive move was required to terminate whereas continuing was automatic unless the person signalled to quit. Data revealed a 'passive-option effect' whereby participants showed greater persistence when persistence was passive than when it was active. It is argued that the passive option effect reflects a similar process to the status quo bias. Both can be defined by the fact that in any choice situation, the likelihood of any option being chosen is increased if choosing involves a passive rather than an active response. In terms of limited resources, both the passive-option effect and status quo bias are possible consequence of the individual preserving energy, where active responding requires the self to expend some of its resources and passive responses do not.

These findings also replicate studies conducted in field environments. For example, Hartman, Doane and Woo (1991) demonstrated a significant tendency for electricity customers to stick with a pre-selected option regardless of whether a service was rated as reliable or unreliable. Samuelson and Zeckhauser (1988) demonstrated that over extended periods of time, individuals tend to retain unchanging financial amounts of insurance cover (for cars, buildings and life) from the same provider. And today, charities can be seen to utilise status quo effects in their efforts to maximise donations as individuals are signed up to make standard monthly contributions.

The findings presented in Experiments 3 to 6 confirm expectations and accurately reflect real consumer decisions made in the real world: In 2011, the Office of the Gas and Electricity Markets (Ofgem) found that four out of five customers fail to shop around for gas and electricity. The present findings suggest both young and old adults are susceptible to avoiding decisions by sticking or opting to decide in the future when decisions are difficult. It is important to note that the decision tasks used in the current research were simplified versions of the marketing information presented to customers. Therefore, the tendency to stick or decide in the future may be even more pronounced when making real consumer decisions. The implications of these results are discussed later in the current chapter.

6.3 Ageing, Decision Making and Emotion Regulation

People frequently find themselves making everyday decisions in a state of emotional arousal. Often an individual will control their emotions by engaging in a form of self-regulation. As discussed in Chapter 1, it has been noted that emotions play an important role in decision-making and in particular, amongst older adults. Research provides convergent evidence that self-regulation of emotional functioning is spared from age-related decline (Charles & Carstensen, 2004), and can even improve with age (Carstensen & Mikels, 2005). The ageing research provides strong evidence in support of preserved emotional functioning despite declines in effortful cognitive processing. Experiment 3 investigated how age-related developmental changes affect decisions that draw on both emotional and cognitive processes. By identifying areas of preserved functioning along with areas of decline researchers could help develop methods to compensate for age-related losses.

Two strategies of emotion regulation were investigated, suppression and reappraisal, and evaluated in the context of Baumeister et al., (1998) strength model. Gross, (1998) proposed that suppression requires the individual to consciously manage and modify the behavioural aspects of their emotional responses and is therefore seen as costly in terms of resources. Reappraisal is thought to entail comparatively less cognitive effort than suppression as this process requires the individual to redefine the meaning of a situation before emotions are determined.

Based on the literature, it was proposed that differential changes in emotion regulation would have different implications for younger and older adults' decision making. The consequences of regulating emotion using either strategy would be apparent in the choice (to stick, switch or decide in the future) most favoured by participants in each condition.

As previously outlined, decisions to stick, switch or decide in the future are thought to differ in terms of cognitive costs. One way that individuals may try to reduce the cognitive burden of making a decision is to select an option that requires fewer resources. A central assumption of Baumeister et al., (1998) strength model is that that exertion of resources will be followed by a period of diminished capacity (a process called ego-depletion). Research suggests that regulating emotions and cognitively effortful processing involved in making choices draw from the same limited resource required for executive control. For example, Pochepstove et al., (2008) found that resource depletion inhibited the executive processes required to make effortful trade-offs between difficult choices.

It was predicted that ego-depleted participants would tend to select to stick or decide in the future more often than non ego-depleted participants. The results from Experiment 3 revealed that young and old adults did require different amounts of resources to regulate their emotions. Specifically, older adults in the reappraisal condition made better decisions compared to older adults in the control and suppression condition. Two explanations were proposed. First, older adults may be less susceptible to any ego-depleting effects of emotion regulation due to age-related increases in emotional control. Second, regulating emotion using reappraisal matched the type of strategy older adults would normally adopt because it is less demanding of cognitive effort. Taken together, these findings provide support for Richards and Gross (2000) theory insofar that using reappraisal to regulate emotion is less costly in terms of cognitive resources and thus reserves are preserved and can be used for decision-making.

Interestingly, younger adults presented a different pattern of results whereby once the option to decide in the future had been removed, those in the suppression condition performed best compared to those in the control and reappraisal condition. On this basis, it was proposed that younger adults found reappraisal more demanding in terms of resources than suppression. These findings are consistent with data presented by Scheibe and Blanchard-Fields (2009) who found that older adults were more adept at emotion-regulation and that emotion-regulation of negative emotions to be less costly in older age.

Taken together, this research suggested that young and old adults appeared to require different amounts of resources to regulate their emotions in accordance with different strategies. It could be argued that long-term practice, or experience in regulating emotions can decrease the amount of resources necessary to maintain or regain emotional wellbeing while performing well at other tasks. On this basis one may speculate that growing older has the adaptive potential to reduce the cognitive costs of emotion regulation.

Although the data from Experiment 3 confirmed and extended our knowledge in interesting ways, not all findings were consistent with those presented by previous researchers. Notably, suppression did not appear to cause the same ego-depleting effects reported in the literature (e.g. Richard & Gross, 2000). It was proposed that a difference in research methodology may explain the disparity in results. Richard and Gross (2000) required participants to reappraise or suppress emotions while watching a film clip. They concluded that using suppression to regulate emotions required more effort because participants in the suppression condition had worse memory for the film clip than those in the reappraisal group. However, it is argued that participants in the suppression condition may simply not have paid as much attention to the film because they were preoccupied with controlling the behavioural aspects of their emotions (e.g. facial expressions). Because performance on the decision task presented to participants in Experiment 3 was unrelated to memory of a previous task, performance should not have been affected by aspects of the previous task they attended to, but rather, how much effort they put into the consumer decision task.

The methodology used in Experiment 3 may provide an alternative explanation for the findings. Hagger et al., (2010) conducted a meta-analysis of studies investigating self-regulation. Results showed smaller effect sizes for studies that required participants to control impulses (or emotions) to deplete ego and measured the effects using cognitive tasks. Based on the work of Hagger et al., (2010), it is possible that the results of Experiment 3 were influenced by two methodological factors: (i) the emotion-regulation instructions were effective, but the consumer decision task was not sensitive enough to pick up these effects. And, (ii) the emotion regulation procedure did not produce the predicted effect. These two explanations were tested in two additional studies (Experiments 4 and 5) on young adults only.

Experiments 4 tested the ego-depleting effects of emotion-regulation instructions by introducing a measure of subsequent cognitive performance, which has been utilised often in this area of research (the GRE). Consistent with Experiment 3, participants' decision performance did not match earlier studies. Young adults in the suppression condition made significantly better and more accurate choices than participants in the reappraisal and control groups. Furthermore, data from the GRE revealed no difference in performance between participants assigned to each condition. Taken together, these findings suggest that differences in decision-making may not have been due to ego-depletion, but some other mechanism.

Experiment 5 tested a methodology shown to be reliable in depleting cognitive reserves: a letter crossing task. Again, findings showed that participants assigned to the high ego-depletion condition made better consumer decisions than participants assigned to control or low ego-depletion condition. Furthermore, measures of the GRE revealed that the ego-depletion manipulation resulted in equal or better performance.

In summary, attempts to verify a reliable method of ego-depletion were unsuccessful. However, consistent results emerged whereby participants assigned to conditions assumed to cause ego-depletion performed better compared to those assigned to other groups. Based on these findings, an alternative explanation was proposed. It was suggested that instructions used in Experiments 3, 4 and 5 might have primed participants to engage in discrete processing styles while completing the subsequent decision task. Specifically, it was hypothesised that instructions to self-regulate encouraged participants to process information in a deliberative manner that matched the necessary operations needed for the consumer decision task.

Experiment 6 tested the effects of deliberate instruction on age and decision-making. Previous research has shown that priming participants to process information in a specific manner can affect subsequent performance on unrelated tasks (Ferreira et al., 2006; Klaczynski, 2001). It was predicted that older and younger adults would vary in performance on the decision-making task depending upon the processing instructions they received. Two manipulations were used where participants were instructed to make decisions in either a rational or intuitive manner. It was hypothesised that asking participants to manage information in a rational manner would encourage them to process information in a deliberative way, and asking participants to manage information in an intuitive manner, would encourage them to process information in an instinctive, less resource demanding way.

Results revealed that both young and old participants in the rational condition made better decisions than participants assigned to the intuitive condition. An interesting pattern of data emerged whereby young adults opted to stick most often in the intuition condition and older adults chose to stick most often in the rational condition. It was proposed that the decision behaviour displayed by young adults showed that directions to process information in an intuitive or rational manner were successful. In other words, choosing to stick reflected a trend to expend fewer cognitive resources when evaluating information (Brockner et al., 1979; Dahr, 1997).

In terms of older adults, it is important to note that processing information in a rational manner is generally considered to be comparatively demanding of cognitive resources. It was argued that when rational processing was combined with age-related declines in cognitive ability, older adults would seek to preserve limited resources by selecting an option with fewer cognitive costs (e.g. stick).

Again, this data demonstrates how differential limitations in cognitive reserves may affect consumer decision-making in older and younger adults. However, despite differences in resources, it seems that both older and younger adults must engage in deliberative and effortful processing to make good decisions.

6.4 Practical Implications

The findings presented in this thesis have important practical implications. Two applications have been identified as possible ways to improve the likelihood that younger and older adults make good consumer decisions: numeric malleability and managing status quo bias.

6.4.1 Financial Education

Aside from selecting utility companies, older adults must deal with many other complex financial decisions, for example, investment of retirement savings and accumulated wealth and intergenerational transfers of wealth, all while living off accumulated savings (James, Boyle, Bennett & Bennett, 2012). A commonality shared by most consumer decisions of this type is that they require the individual to process numeric information. The data from Experiments 1, 2 and 6 consistently showed that older adults' consumer decision making performance was independently predicted by numeric ability. These results are consistent with research by Peters et al., (2006), Tanus et al., (2009) and Wood et al., (2011). However, as outlined in the literature and in Experiments 2 and 6, older adults tend to make poorer choices compared to young adults (e.g. Hibbard et al., 2002; Schaie &Willis, 1993). This is particularly worrying when the Financial Services Authority (2009) presented findings stating that 35 per cent of people in the UK targeted by fraud were over the age of 65. It is expected that research into the modifiable determinants of poor decision-making in older adults may provide avenues for development and better decision-making. If numeric ability is malleable, the potential exists for older adults to improve their numeracy skills and thus, their consumer decisions.

Research presented by James et al., (2012) suggested that health and financial literacy may be modifiable determinants of decision-making in older adults. Furthermore, their research showed that particular groups of older adults may benefit most from better health literacy, namely those with lower levels of cognitive function who were poorer and older. James at al., (2012) proposed that targeted improvements in these high risk groups may have particularly beneficial effects.

In 2009, Help the Aged commissioned a report by the National Research and Development Centre for Adult Literacy and Numeracy (NRDC) to assess older adults' money management. Recommendations from this report included the need for financial education to be a priority along with adult literacy and numeracy. Furthermore, the need for increased provision and awareness of formal financial education opportunities were highlighted. These findings support previous research conducted by the National Institute of Adult Continuing Education (2007) who found that 58% of people aged 65-plus in the UK think that adult education should cover the topic of financial advice.

Despite these recommendations, today formal financial and numeric education for older adults in the UK is limited. Age UK (the UK's largest charity for older people) currently provides a service where free factsheets and information guides can be obtained which supply advice on a wide range of financial and consumer issues faced by the elderly, i.e. tax, benefits, pensions, managing money, insurance and fuel bills (www.ageuk.org.uk). However, there is no national programme of education for older adults where basic skills (such as numeracy and literacy) are taught.

In light of the findings presented in the current thesis and those offered by the literature in this area, it is proposed that a programme of formal education of numeracy skills for people post-65 should be made available. It is anticipated that this would improve consumer decision-making in older adults and potentially their quality of life as better financial and health choices are made. Furthermore, it should be acknowledged that the positive effects of education reach beyond the practical skills learned in the classroom; older adult learners self-report significant benefits for life enjoyment, self-confidence, and ability to cope (Dench & Regan, 2000).

6.4.2 Managing status quo bias

Another method of facilitating consumers' decision-making may be to ensure that pre-selected options are consistent with the individual's needs or financial constraints. As has been outlined, data from the current research and previous studies clearly indicate a status quo bias. Rather than attempting to fight this phenomenon, it is suggested that it be used to an advantage. Examples currently exist where this methodology has already been implemented. A recent debate in the UK considered whether organ donation should be assumed permitted unless the individual has formally stated otherwise. In many countries, (i.e. Denmark, Finland, France, Italy and Singapore) people are presumed to consent to allow organ donation; however, they are allowed to opt out of this. Currently, the UK operates on an explicit consent system and requires that individuals authorise organ removal after death by carrying a donor card or joining a national registry.

A number of studies both inside and outside of the lab have found marked increases in the number of organ donation rates following the introduction of presumed consent legislation. For example, Johnson and Goldstein (2003) asked participants whether they would be donors on the basis of one of three questions with varying defaults. In the opt-in condition, participants were told to assume that they had just moved to a new state where the default was not to be an organ donor, and they were given a choice to confirm or change that status. The opt-out condition was identical, except the default was to be a donor. The third, neutral condition, simply required participants to choose with no prior default. Results revealed that participants were nearly two times more likely to donate when opting-out compared with opting-in. The neutral condition did not differ significantly from the opt-out condition. These findings have also been replicated in a number of real-world contexts: In Australia the 4.6 donors per million population per year before legislation increased to 10.1 per million in the four years after the introduction of presumed consent, and 27 per million in the five years after. In Belgium, kidney donation increased from 18.9 to 41.3 per million population per year over a three year period (Rithalia, McDaid, Suekarran, Myers &Sowden, 2008).

In terms of utilising the status-quo bias to help people make better consumer decisions, it is proposed that older adults are routinely placed onto the cheapest options available from any given company. For example, a utility supplier would automatically place older adults onto tariffs that incurred the lowest possible costs for gas and electricity. Indeed, this idea has recently gained credence as a serious method of addressing fuel poverty in the UK elderly population. In June 2012, the opposition party (Labour) proposed that energy firms could cut bills for 4 million pensioners by automatically putting all people over the age of 75 on the lowest tariff. It was predicted that this could save pensioner households £200 per year (www.ageuk.org.uk).

Furthermore, the effect of status-quo bias may be observed in a realistic setting as recent government reforms to pensions begin. Starting from October 2012, millions of workers will be automatically enrolled into a work-place pension. Workers will be able to opt out of this pension scheme at any time, however if they chose to do so, they will lose out on the employer contribution and tax relief from government (Department for Work and Pensions, 2011). Utilising the finding that people tend to stick with a pre-determined choice is already significantly shaping policy reforms. Extending this to other areas of obligatory financial commitments such as household or car insurance and essential commodities such as water supply and sewerage costs, or a bank account with the highest interest payment may help in insuring that the individual manages their money in the most beneficial way.

6.5 Limitations and Future Directions

The studies presented in this thesis investigated how ageing affects applied decision-making. Original tasks were developed to examine decision-making in the context of everyday choices, and existing choice architecture was utilised. Taken together, the current research can be seen as a novel and valid contribution to the decision literature. Despite this, it is important to note that the experiments presented are still subject to limitations, which may limit their robustness and generalisability. While methodological issues have been considered within each chapter, a number of additional issues are discussed here, along with suggestions for future directions.

6.5.1 Further research on Emotion Regulation and Deciding in the Future

Experiment 3 revealed a number of interesting findings. First, that suppression and reappraisal seem to require different amounts of cognitive resources, which vary as a function of age. An additional study to reaffirm these findings using a larger cohort would have provided important information regarding the reliability of this data. Furthermore, if using reappraisal to regulate emotions had again been shown to benefit older adults' consumer decision-making, it could be recommended that older adults engage in this form of emotion-regulation before making important consumer decisions.

Second, this study is unique in that it presented participants with the option to decide in the future alongside the options to stick or switch to a different alternative.

The literature states that people are most likely to defer making a decision when the decision environment is complex, i.e. when the difference between two variables is as small (Tversky & Shafir, 1992). The decision to defer or 'decide in the future' can be seen as similar and the findings in Experiment 3 seem to support the hypothesis presented by Tversky and Shafir (1992). Future research would seek to examine the cognitive mechanisms and individual differences that affect opting to decide in the future and how this decision might differ from simply deciding to defer. Finding out circumstances where individuals are most likely to choose these options might inform the development of decision aids and the design of decision environment structures. Opting to defer or decide in the future might (in some circumstances) have negative consequences for the individual. For example, in terms of consumer decision-making, opting to defer or decide in the future might mean missing out on a good financial opportunity when products are on offer for a limited time.

6.5.2 Alternative Areas and Measures of Consumer Decision Making

The experiments presented in the current thesis focussed on a limited number of every-decisions ranging from selecting a utility supplier, choosing a mobile phone provider, to deciding where to shop for groceries. Extending research into other areas of applied decision-making, relevant to the types of choices faced by elderly consumers would add to the literature in two important ways. First, it would shed light onto how older adults fare when making these important decisions and second, it would extend the present findings concerning specific cognitive abilities and decision aptitude.

Future studies could present older adults with decision tasks specific to the types of choices made by individuals over the age of 65. This might include making decisions about a savings plan, bank account or retirement home. The decision architecture of these types of choices is similar insofar that the individual is required to make complex calculations based on many alternatives. In addition, discrete measures of cognition and ability could be assessed. As with the current studies, fluid and crystallised intelligence and numeric ability would be examined. An additional measure of financial literacy (e.g. Lusardi & Mitchell, 2006) could be introduced to investigate any relationship between numeric aptitude, financial literacy and decision competency. Lusardi and Mitchell (2006) showed that financial knowledge and planning were interrelated: those who displayed financial knowledge were more likely to plan and succeed in their planning. By influencing planning patterns, financial literacy may influence household saving outcomes.

Many studies suggest a positive association between financial knowledge and household financial decision-making. For instance, Stango and Zinman (2008) showed that those unable to correctly calculate interest rates given a stream of payments ended up borrowing more and accumulating less wealth. Others show that the less financially literate were unlikely to invest in stocks (van Rooij, Lusardi, and Alessie, 2007; Christelis, Jappelli, and Padula, 2008) and tended to select mutual funds with higher fees (Hastings and Tejeda-Ashton, 2008). Lusardi and Tufano (2008) found that those who severely underestimate the power of interest compounding were more likely to experience difficulty with debt. Taken together, these studies show that financial literacy is an important mediator of consumer decision-making. If numeric ability and financial aptitude are found to be independent predictors of decision ability, the potential may exist for targeted educational interventions to be tailored for older adults.

6.5.3 Age Differences in Neurology and Decision-Making

This thesis considers age-related differences in decision making from a predominantly cognitive perspective. It is proposed that the explanations presented in this body of work can be significantly refined using neuroscientific methodologies. Advances in brain imaging methods have allowed unprecedented insights into the neural correlates of healthy ageing. It is proposed that these techniques be utilised in expanding our knowledge of ageing, individual differences and consumer decision-making. The following section will outline two avenues for future studies in this area. It is acknowledged that extensive research exists investigating neuroscientific explanations of ageing, however, as this is not the focus of the work presented in this thesis, only a few accounts are considered.

There is growing evidence linking the integrity of the prefrontal cortex to frequently studied consumer behaviours, such as comprehension, information search, and decision-making (e.g. Fellows, 2006). One of the most widely accepted theories of neuroscientific ageing is the frontal lobe hypothesis (West, 1996). The frontal lobe hypothesis of cognitive ageing broadly states that some older adults have disproportionate age-related change of prefrontal brain structures and consequently, of associated cognitive functions. This hypothesis is supported by multiple sources of evidence which are steadily mounting, involving neuropsychological (West, Murphy, Armilio et al., 2002), neuroanatomic, (Raz, Gunning-Dixon & Acker, 1998; Resnick et al., 2003), and functional neuroimaging (Gur et al., 1987) studies. This hypothesis is not without its critics (e.g. Greenwood, 2000) but it can be seen to provide a plausible and testable account of at least some age-related neurocognitive phenomena.

Denburg, Cole, Hernandez, Yamada, Tranel, Bechara et al., (2007) used a cross-sectional sample of community dwelling participants to show that a sizeable subset of older adults (approximately 35-40%) performed poorly on a decision-making task designed to mimic everyday choices. Participants who performed poorly on this task were found to display defective autonomic responses equivalent to those displayed by patients with acquired prefrontal lesions. Furthermore, participants shown to have defective autonomic responses were significantly less likely to comprehend information presented to them in an advertisement, and were more likely to make poor consumer choices based on information from advertisements. Taken together, this research adds weight to the frontal lobe hypothesis of cognitive ageing, and highlights the need for future research into the behavioural and neuroscientific correlates of defective consumer decision-making among healthy older adults. It may be that little can be done to halt age-related degeneration of the frontal lobe, however identifying otherwise healthy older adults and making them aware that they might be particularly susceptible to misleading advertising and poor consumer choices could be a first step in preventing detrimental decisions.

The second area of future neuroscientific research addresses numeric ability. At the neuronal level, studies have shown that difficulties or expertise with numbers are associated with functional and anatomical anomalies of the right parietal lobe (Aydin, Ucar, Oguz, Okur, Agayev, Unal et al., 2007). Recent research has provided some interesting findings suggesting that non-invasive brain stimulation to the right parietal lobe can enhance numerical abilities with remarkable longevity. Kadosh, Soskic, Iuculano, Kanai and Walsh (2010) combined transcranial direct current stimulation (TDCS), a non-invasive brain stimulation technique, with a learning paradigm involving artificial digits. TDCS involves applying a weak current constantly over time to enhance, or reduce the excitation of neural populations, with maximal effect on the stimulated area beneath the electrodes. Results revealed that participants who received TDCS to the right parietal lobe showed enhanced and consistent performance on subsequent numeracy tasks. Furthermore, the improvements were still present six months after the training.

Kadosh et al., (2010) findings are important because they establish TDCS as a tool for intervention in cases of poor numerical development or loss of numeric abilities due to other factors such as degenerative illness or age. Future research would investigate the potential for utilising TDCS in improving numeracy skills in older adults, which in turn may lead to better consumer decision-making.

In summary, an important area for future neurobiological and consumer research is to identify the extent to which bad decision-makers can recruit or be trained to use compensatory processing to improve accuracy of judgements. Adopting a neuroscientific perspective may lead to a better understanding of age differences in consumer decision-making at a more fundamental (neural) level, and reveal potential interventions tailored to improve decision making in older adults.

6.5.4 Dispositional Explanations

Experiment 1, 2 and 6 successfully identified cognitive predictors of consumer decision performance. A clear pattern of results was established for older adults however, the factors accounting for younger adults' ability were not as evident. Based on research by Stanovich and West (2008), it was proposed that cognitive abilities alone were not enough in explaining the processes young adults utilise when making consumer choices. In their study, participants thinking dispositions were measured using a number of scales. From these scales, a composite Actively Open-minded Thinking (AOT) score was achieved by summing up scores on measures of flexible thinking, openness–ideas and openness–values and subtracting the sum of the absolution, dogmatism and categorical thinking. Results revealed that the ability to evaluate objective argument quality was linked to individual differences in both cognitive ability and actively open-minded thinking dispositions. Furthermore, individual dispositions were found to directly predict decision performance independently of cognitive ability. These findings corroborate previous research demonstrating the important role of thinking dispositions in decision making (e.g. Kardash & Scholes, 1996; Schommer, 1990).

It is suggested that preferred dispositions (such as open-minded thinking) may account for their decision performance. Future research would consider age differences in thinking dispositions in an attempt to establish a more thorough understanding of the factors that predict decision performance across the life-span.

Another individual difference that might account for differences in consumer decision-making is motivation. The data from Experiments 3, 4 and 5 suggested that young participants made better decisions when placed in conditions designed to be resource demanding. In explaining these findings, it was proposed that the instructions used to encourage participants to self-regulate may have inadvertently primed them to work harder and therefore make better decisions. In other words, these participants were more motivated. Should this hypothesis be true, it raises interesting questions in terms of the role of motivation in explaining differences in decision-making. Experiment 6 provided some evidence in support of this argument. Younger and older adults performed best when asked to make decisions on the basis of ‘rational and reflective thinking’. Making decisions in a rational, logical manner is assumed to require a lot of cognitive effort (Fishburn, 1991). Therefore it may be argued that these participants were more motivated to try hard when making decisions than participants in the intuitive condition.

Previous research has shown that priming can influence many variables, for example: problem-solving techniques (Higgins & Chaires 1980), judgment about a product (Herr 1989) and product choice (Bettman & Sujan 1987; Mandel & Johnson 2002). Therefore, it is reasonable to propose that participant motivation may have been affected by instructions presented to them prior to completing the consumer decision task. Decision performance was improved in younger adults in conditions that primed them to work harder (i.e. using suppression to control emotions in Experiments 3 and 4, completing a difficult letter crossing task in Experiment 5, and thinking about decisions in a rational manner in Experiment 6). Decision-making was also best for older adult participants in the rational condition in Experiment 6. It may simply be that asking participants to work harder improves decision-making ability. Future research would seek to investigate further the effects of priming on motivation and subsequent decision-making performance in younger and older adults.

6.5.5 Participants and Experience

It should be acknowledged that because age was not a variable that could be manipulated, random assignment of participants to the different age groups was impossible. Therefore, Experiments 1, 2 and 6 are cross-sectional in design and it could be argued that the findings revealed in these studies were (in part) due to cohort effects.

All the older adults recruited for the present research lived in or around Plymouth; it was informally observed that many had grown up and worked in the local area their whole lives. In terms of cohort effects, it should be noted that Plymouth was subject to very specific circumstances during the lifetime of many of the older adults who took part in this research. Namely, that many of these participants had their education disrupted during the Second World War. This may have affected the older adults used in the current body of work differently from other generations in terms of education and opportunities.

Data from the present studies show that younger adults have completed significantly more years of formal education than older adults. This is perhaps unsurprising given the social circumstances faced by many the older participants while they were growing up. Furthermore, the sample of young participants used in the current research was drawn from university students, the nature of whom required the attainment of set academic achievements usually accomplished in at least 13 years of schooling. Despite this, the data in terms of education is representative of most research on age differences. For example, Rentz and Reynolds (1981) point out that at any point in time, older adults report having completed fewer years of formal education, on average, than young people.

Taken together, it should be acknowledged that the findings revealed in Experiments 1, 2 and 6 may have been affected by the cohort membership of the groups studied together with the developmental changes associated with the ageing process. Ideally developmental changes in cognitive and emotional ability, and their relationship with decision aptitude across the lifespan would be measured. It is proposed that a programme of research utilising a longitudinal approach and combining a broad set of cognitive capability measures, including multiple measures of fluid and crystallised intelligence, with an even broader set of decision-making tasks (across different domains) would both address many of the methodological implications encountered in this thesis and shed further light on how cognitive, emotional, dispositional and motivational factors affect decision making across the lifespan. However, it is recognised that this type of methodology is often limited due to expense and time.

6.5.6 Challenges with Ego-Depletion

The aim of Experiments 3, 4 and 5 was to extend the work of ego-depletion into older adults. The materials used in these experiments were designed to replicate those observed in previous studies in this area (e.g. Baumeister et al., 1998; Schmeichel et al., 2003). Experiment 3 assessed the ego-depleting effects of emotion-regulation on subsequent decision-making. As the data differed from the predictions, two additional exploratory studies were conducted. Experiments 4 and 5 tested the methodology used in Experiment 3 and sought to establish a reliable manipulation and measure of ego-depletion. However, despite utilising well-established manipulations in producing ego-depleted states, the studies presented did not replicate previous findings. In evaluating why this might be, a number of explanations were considered.

First, it was proposed that different emotions carry different cognitive costs and that the costliness of regulating a particular emotion varies by age. Experiment 3 required participants to regulate feelings of disgust. It may be that young and old adults did not display behaviour typical of being ego-depleted following the film because disgust might have been less difficult for them to suppress compared to other emotions such as sadness or anger (Baumeister et al., 2008; Schmeichel et al., 2003). Future research might utilise different footage eliciting emotions shown to produce ego-depletion across age-groups.

As outlined earlier, the consumer decision task may not have been sensitive to the effects of ego-depletion and therefore was affected in an unpredictable way. Experiments 4 and 5 were designed to address this issue by including an additional measure of performance (the GRE); however data was not reliable in indicating ego-depletion in participants. Hagger et al., (2010) observed that the effects of ego-depletion are often significantly smaller for studies adopting dependent tasks involving cognition, choice and volition compared to dependent tasks measuring physical effects (e.g. squeezing a handgrip) or modified Stroop tasks. As the consumer decision task involved measuring performance by way of decision competence, it may be less surprising to find that the results obtained did not match those most often reported in the literature.

Finally, attempts to replicate findings in support of the strength model are not always successful. Many of the manipulations and measures used throughout Experiments 3, 4 and 5 were taken directly from previous research (Baumeister, 2002; Gross, 2000; Schmeichel et al., 2003; Tice et al., 2007). Yet, other researchers have also failed to produce an ego-depleted state and the negative consequences associated with it (Murtagh & Todd, 2004). It may be reasonable to assume that failure to reproduce findings consistent with much of the published literature on the strength model occur more frequently than has been reported. The implications of this suggestion may be that behaviours associated with ego-depletion are the result of some other cause. A meta-analysis of both published and unpublished studies in this area (including attempts to replicate ego-depletion which have been unsuccessful) may establish a more realistic rate of success.

6.6 Conclusions

This thesis offers an expanded view of the cognitive and affective abilities older and younger consumers rely on when making decisions. I present a unique theoretical contribution and highlight many practical implications in terms of how older adults might be supported in making better consumer decisions. A key factor that distinguished the current body of work from other research in this area is that original tasks representative of real consumer decisions were developed. This means that the data obtained is likely to more accurately reflect how consumers make decisions in the real world. It is believed that this work represents some of the first of its kind to begin to identify, from an individual-differences perspective, the factors that affect applied decision-making in older and younger adults.

One of the primary findings highlighted the notion that ageing is associated with many positive gains in terms of self-regulation and emotional control alongside declines in other cognitive abilities. It is well established that weaknesses and vulnerabilities do exist, however it is clear that several strengths do as well. Overall, the research presented suggests that older adults process information differently from young adults. Declines in deliberative capacity imply that older adults will make worse decisions than young adults in some situations. However, the current work provides compelling evidence to counter the notion that age-differences in consumer decision-making are simply due to deliberative decline. First, it seems that crystallised intelligence can compensate in part for age-related losses. Second, the independent role of numeric ability and fluid intelligence are highlighted as important factors in older adults' decision making and third, decision-making ability seems to be preserved if older adults regulate emotions using reappraisal.

Today older adults are faced with an increasing number of decisions about vital financial, health and other personal issues. At the same time, their proportion of the population is growing. Understanding the underlying processes involved with older adults' decision-making may help in developing methods to increase their likelihood of making the best consumer choice for them. The research presented in this thesis has enriched and uniquely contributed to this area of psychology; furthermore it provides a strong foundation for future work in an area rapidly increasing in political and social importance.

MATERIALS APPENDICES

All appendices are numbered in line with the experiment to which their contents refer.

Experiment 1

APPENDIX 1A: REAL INFORMATION PRESENTED TO CUSTOMERS REGARDING TARIFFS FOR BOTH GAS AND ELECTRICITY.

Figure 1.1 Gas tariffs presented by British Gas – August 2011

Rates are in pence per KWh and include VAT

PaymentType	Tier1	Tier2
Cash/Card	7.338	3.362
Direct Debit	7.338	3.362

Figure 1.2 Electricity tariffs presented by British Gas – August 2011

Rates are in pence per KWh and include VAT

PaymentType	Tier1	Tier2
Direct Debit	24.476	10.945
Cash/Card	24.476	10.945

Figure 1.3 Explanation or Tier 1 and Tier 2 Tariffs presented by British Gas – August 2011

Gas:

Tier 1 applies to the first 2680 kWh per year, pro rated across your billing period. All subsequent consumption is charged at Tier 2.

Electricity:

Single rate tariff customers: Tier 1 rates apply to the first 720 kWh per year, pro rated across your billing period. All subsequent consumption is charged at Tier 2.
Two rate tariff customers: Tier 1 rates apply to the first 720 kWh per year of day consumption, pro rated across your billing period. All subsequent day consumption is charged at Tier 2, with remaining consumption charged at night rates. Night means a period totalling 7 hours (which may be varied between 10pm and 8am).

APPENDIX 1B: FACTUAL QUESTIONS PRESENTED TO PARTICIPANTS IN THE ENERGY SUPPLIER DECISION TASK

1) Looking at the table, please indicate which Energy Supplier you think charges the most for Electricity in Band One.

2) Looking at the table, please indicate how much Energy Supplier B charges for Gas in band Two.

3) Looking at the table, please indicate which Energy Supplier you think charges the most for both Gas and Electricity in Band Two.

APPENDIX 1C: INFERENTIAL QUESTIONS PRESENTED TO PARTICIPANTS IN THE ENERGY SUPPLIER DECISION TASK

4) Sue uses 10,000 kWh of Gas each year. Looking at the table, which Energy Supplier is best value for Sue?

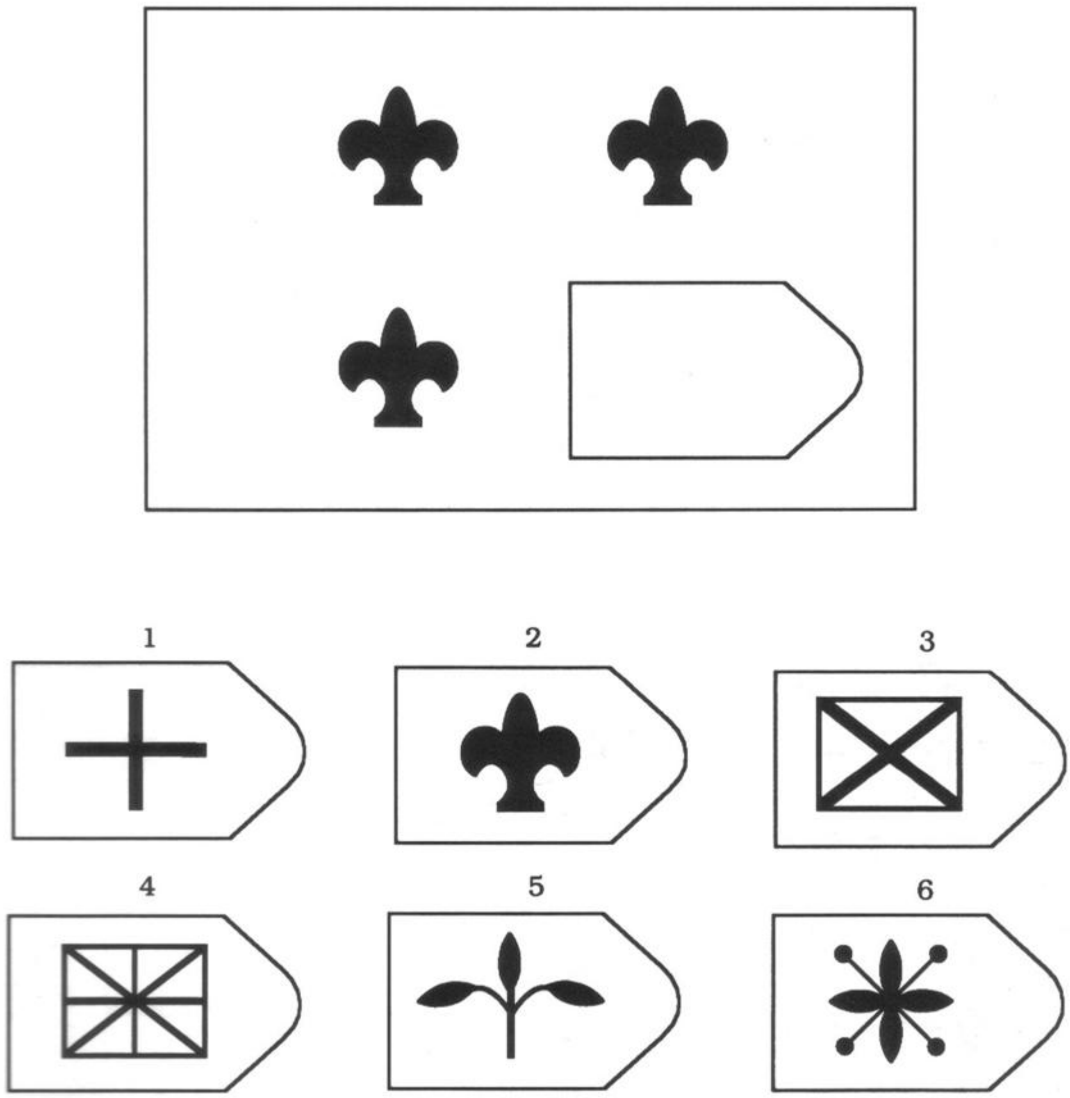
5) Robin and Louise live together. Between them, they use 21,000 kWh of Gas each year. Looking at the table, which Energy Supplier do you think is best value for Robin and Louise?

6) Richard uses 4,000 kWh of electricity each year. Looking at the table, which Energy supplier do you think is best value for Richard?

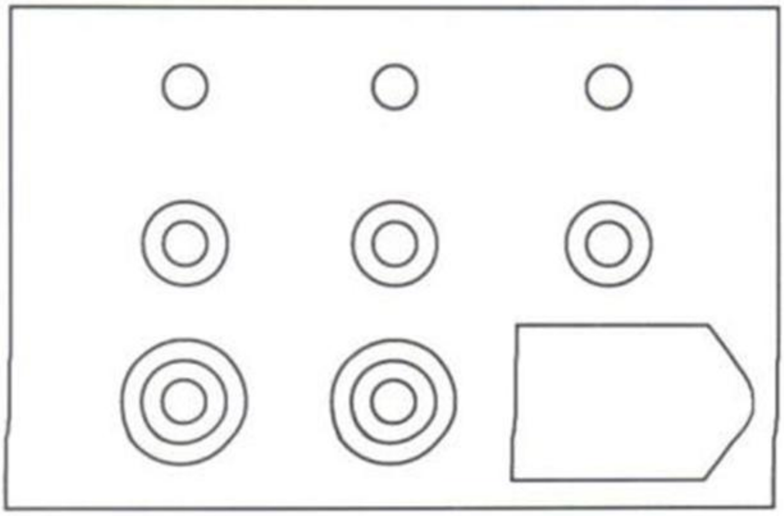
7) Tom is very environmentally aware. He only uses 2000 kWh of Electricity each year. Looking at the table, which Energy Supplier do you think is best value for Tom?

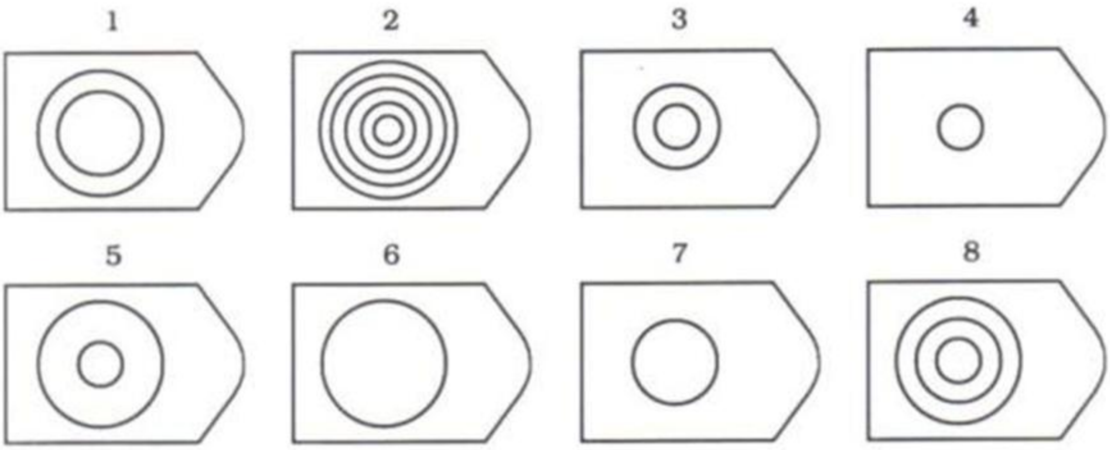
APPENDIX 1D: SAMPLE OF PROBLEMS PRESENTED TO PARTICIPANTS FROM RAVENS STANDARD PROGRESSIVE MATRICES (SUB SECTIONS B, C AND D).

B1

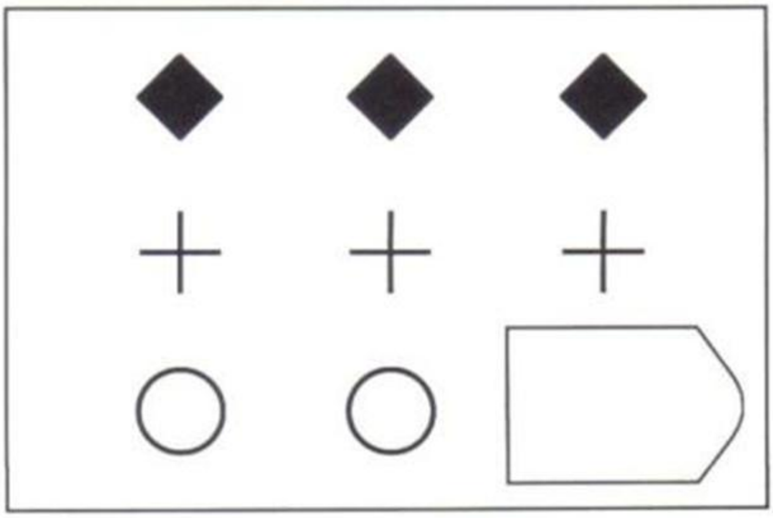


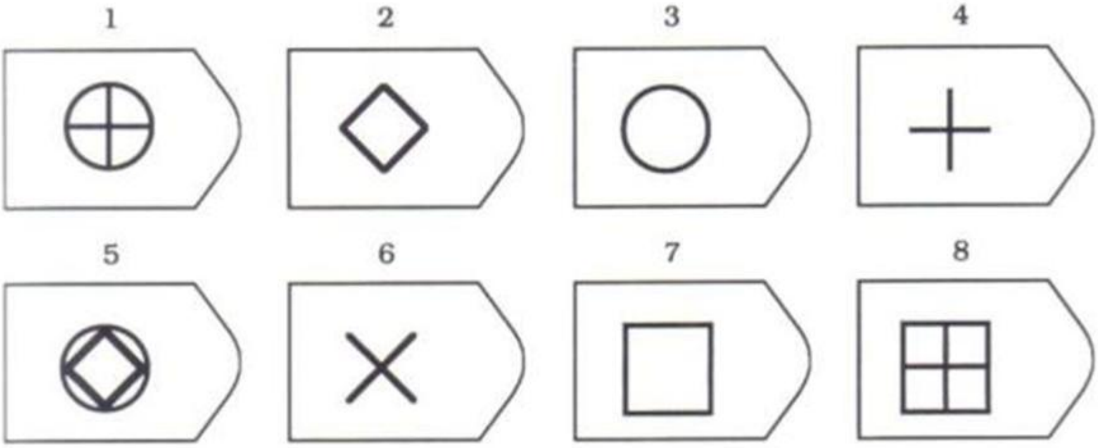
C1





D1





APPENDIX 1E: WECHSLER ADULT INTELLIGENCE SCALE-III – VOCABULARY SUBSET

Bed	Designate
Ship	Reluctant
Penny	Colony
Winter	Generate
Breakfast	Ballad
Repair	Pout
Assemble	Plagiarize
Yesterday	Diverse
Terminate	Evolve
Consume	Tangible
Sentence	Fortitude
Confide	Epic
Remorse	Audacious
Ponder	Ominous
Compassion	Encumber
Tranquil	Tirade
Sanctuary	

APPENDIX 1F: SAMPLE FROM EACH SUBSECTION OF THE DIGIT COMPARISON TASK

Three Digit Comparisons

	SAME	DIFF			SAME	DIFF	
265	( )	( )	265	251	( )	( )	231
632	( )	( )	632	712	( )	( )	712
735	( )	( )	735	694	( )	( )	894
183	( )	( )	184	786	( )	( )	286
325	( )	( )	325	096	( )	( )	096
308	( )	( )	308	395	( )	( )	395
923	( )	( )	973	436	( )	( )	436
536	( )	( )	506	846	( )	( )	846
612	( )	( )	612	573	( )	( )	973
524	( )	( )	924	645	( )	( )	845
206	( )	( )	205	492	( )	( )	496
238	( )	( )	238	730	( )	( )	738
867	( )	( )	863	542	( )	( )	542
734	( )	( )	732	879	( )	( )	879
793	( )	( )	794	961	( )	( )	261
176	( )	( )	176	439	( )	( )	439
	SAME	**DIFF**			**SAME**	**DIFF**	

Six Digit Comparisons

	SAME	DIFF			SAME	DIFF	
374957	( )	( )	374957	018382	( )	( )	918382
157034	( )	( )	147034	327498	( )	( )	327498
832765	( )	( )	832765	267635	( )	( )	267635
264540	( )	( )	264640	838650	( )	( )	838650
608079	( )	( )	628079	306837	( )	( )	806837
747821	( )	( )	797821	835456	( )	( )	835756
010642	( )	( )	010642	038072	( )	( )	028072
715283	( )	( )	715283	894309	( )	( )	894308
239613	( )	( )	239614	648206	( )	( )	648206
839240	( )	( )	839240	702408	( )	( )	702408
039860	( )	( )	039860	231541	( )	( )	931541
013209	( )	( )	613209	307065	( )	( )	302065
289651	( )	( )	281651	702925	( )	( )	702925
703454	( )	( )	703434	738942	( )	( )	738942
527803	( )	( )	527803	456152	( )	( )	456152
434965	( )	( )	434965	047134	( )	( )	040134
	SAME	**DIFF**			**SAME**	**DIFF**	

Nine Digit Comparisons

	SAME	DIFF			SAME	DIFF	
910317407	( )	( )	910217407	915783147	( )	( )	915783147
017459304	( )	( )	017459304	350725614	( )	( )	350725614
687219109	( )	( )	687219709	526287694	( )	( )	523287694
638461049	( )	( )	638461049	723956590	( )	( )	723956590
783436760	( )	( )	783416760	321524187	( )	( )	321524787
581302359	( )	( )	586302359	132048604	( )	( )	132047604
792404397	( )	( )	592404397	724094315	( )	( )	724094315
241263608	( )	( )	241263678	980242174	( )	( )	980242174
832125307	( )	( )	832125307	789619302	( )	( )	789619302
189573912	( )	( )	149573912	340747521	( )	( )	340747521
652910257	( )	( )	652910257	837532021	( )	( )	837532021
818306702	( )	( )	818308702	390206594	( )	( )	390206594
573681916	( )	( )	573681216	621693104	( )	( )	621693194
710809629	( )	( )	710809629	979352158	( )	( )	978352158
389274184	( )	( )	389274186	316450527	( )	( )	316450527
571836123	( )	( )	571836423	986905671	( )	( )	986905671
	SAME	**DIFF**			**SAME**	**DIFF**	

APPENDIX 1G: NUMERACY SCALE (LIPKUS, SAMSA & RIMER, 2001)

1. Imagine that we roll a fair, six-sided die 1,000 times. Out of 1,000 rolls, how many times do you think the die would come up even (2, 4, or 6)?

   Number of times: ____________________

2. In the BIG BUCKS LOTTERY, the chances of winning a $10 prize are 1%. What is your best guess about how many people would win a $10 prize if 1,000 people each buy a single ticket from BIG BUCKS.

   Number of people: ____________________

3. In the ACME PUBLISHING SWEEPSTAKES, the chance of winning a car is 1 in 1,000. What per cent of tickets of ACME PUBLISHING SWEEPSTAKES win a car?

   Per cent of tickets: ____________________

4. Which of the following numbers represents the biggest risk of getting a disease?

   ___ (1) 1 in 100   ___ (2) 1 in 1,000   ___ (3) 1 in 10

5. Which of the following represents the biggest risk of getting a disease?

   ___ (1) 1%   ___ (2) 10%   ___ (3) 5%

6. If Person A's risk of getting a disease is 1% in ten years, and Person B's risk is double that of A's, what is B's risk?

   Person B's risk: ____________________

7. If Person A's chance of getting a disease is 1 in 100 in ten years, and Person B's risk is double that of A, what is B's risk?

   Person B's risk: ____________________

8. If the chance of getting a disease is 10%, how many people would be expected to get the disease out of 100?

   Number of people: ____________________

9. If the chance of getting a disease is 10%, how many people would be expected to get the disease out of 1000?

   Number of people: ____________________

10. If the chance of getting a disease is 20 out of 100, this would be the same as having a _______% chance of getting the disease.

11. The chance of getting a viral infection is .0005. Out of 10,000 people, about how many of them are expected to get infected?

    Number of people: ____________________

APPENDIX 1H: DEMOGRAPHIC AND EXPERIENCE QUESTIONNAIR

1. Please indicate your sex Male Female

2. Please state how old you are...

3. What is your yearly household income?

- ☐ Less than £10,000
- ☐ Between £10,000 - £20,000
- ☐ Between £20,000 - £30,000
- ☐ Between £30,000 - £40,000
- ☐ Higher than £40,000

4. Please indicate what your highest level of education is

- ☐ GCSE or O Level
- ☐ A Level
- ☐ Diploma/Certificate
- ☐ University or College Degree
- ☐ Professional Qualification
- ☐ Post Graduate Qualification
- ☐ Other (Please Specify)

5. Are you responsible for paying the Energy Bills in your household?

- ☐ Yes
- ☐ No

6. Have you changed Energy Supplier in the last year?

- ☐ Yes
- ☐ No

7. Have you ever contacted your current Energy Supplier regarding billing errors?

- ☐ Yes
- ☐ No

Experiment 2

APPENDIX 2A: FACTUAL QUESTIONS PRESENTED TO PARTICIPANTS IN THE MOBILE PHONE COMPANY DECISION TASK.

1) Looking at the table, please indicate which Mobile Phone Company you think charges the Least for Text Messages in Band One.
2) Looking at the table, please indicate which Mobile Phone Company you think charges the Most Per Minute in Band One.
3) Looking at the table, please indicate which Mobile Phone Company you think charges the Most for Text Messages in Band One and Band Two, assuming that usage is equal in each band.
4) Looking at the table, please indicate which Mobile Phone Company you think charges the Most Per Minute and for Text Messages in Band One, assuming equal usage of minutes and texts.

APPENDIX 2B: INFERENTIAL QUESTIONS PRESENTED TO PARTICIPANTS IN THE MOBILE PHONE COMPANY DECISION TASK.

5) Grace uses 320 Minutes on the phone each month and sends 50 Text Messages. Which Mobile Phone Company do you think is best value for Grace?
6) Peter uses 200 Minutes and sends 400 Text Messages. Which Mobile Phone Company do you think is the best value for Peter?
7) Polly uses 60 Minutes of call time each month and sends 20 Text Messages. Which mobile phone provider do you think is best value for Polly?
8) Graham uses 90 Minutes of calls and sends 100 Text Messages. Which Mobile Phone Company do you think is best value for Graham?

APPENDIX 2C: NEED FOR COGNITION SCALE

1. I would prefer complex to simple problems.

1	2	3	4	5
(Not at all like me)	(Not very much like me)	(Don't know)	(A bit like me)	(Very much like me)

2. I like to have the responsibility of handling a situation that requires a lot of thinking.

1	2	3	4	5
(Not at all like me)	(Not very much like me)	(Don't know)	(A bit like me)	(Very much like me)

3. Thinking is not my idea of fun.

1	2	3	4	5
(Not at all like me)	(Not very much like me)	(Don't know)	(A bit like me)	(Very much like me)

4**. I would rather do something that requires little thought than something that is sure to challenge my thinking abilities.**

1	2	3	4	5
(Not at all like me)	(Not very much like me)	(Don't know)	(A bit like me)	(Very much like me)

5. I try to anticipate and avoid situations where there is likely chance that I will have to think in depth about something.

1	2	3	4	5
(Not at all like me)	(Not very much like me)	(Don't know)	(A bit like me)	(Very much like me)

6**. I find satisfaction in deliberating hard and for long hours.**

1	2	3	4	5
(Not at all like me)	(Not very much like me)	(Don't know)	(A bit like me)	(Very much like me)

7. I only think as hard as I have to.

1	2	3	4	5
(Not at all like me)	(Not very much like me)	(Don't know)	(A bit like me)	(Very much like me)

8. I prefer to think about small, daily projects to long-term ones.

1	2	3	4	5
(Not at all like me)	(Not very much like me)	(Don't know)	(A bit like me)	(Very much like me)

9. I like tasks that require little thought once I've learned them.

1	2	3	4	5
(Not at all like me)	(Not very much like me)	(Don't know)	(A bit like me)	(Very much like me)

10. The idea of relying on thought to make my way to the top appeals to me.

1	2	3	4	5
(Not at all like me)	(Not very much like me)	(Don't know)	(A bit like me)	(Very much like me)

11. I really enjoy a task that involves coming up with new solutions to problems.

1	2	3	4	5
(Not at all like me)	(Not very much like me)	(Don't know)	(A bit like me)	(Very much like me)

12. Learning new ways to think doesn't excite me very much.

1	2	3	4	5
(Not at all like me)	(Not very much like me)	(Don't know)	(A bit like me)	(Very much like me)

13. I prefer my life to be filled with puzzles that I must solve.

1	2	3	4	5
(Not at all like me)	(Not very much like me)	(Don't know)	(A bit like me)	(Very much like me)

14. The notion of thinking abstractly is appealing to me.

1	2	3	4	5
(Not at all like me)	(Not very much like me)	(Don't know)	(A bit like me)	(Very much like me)

15. I would prefer a task that is intellectual, difficult, and important to one that is somewhat important but does not require much thought.

1	2	3	4	5
(Not at all like me)	(Not very much like me)	(Don't know)	(A bit like me)	(Very much like me)

16. I feel relief rather than satisfaction after completing a task that required a lot of mental effort.

1	2	3	4	5
(Not at all like me)	(Not very much like me)	(Don't know)	(A bit like me)	(Very much like me)

17. It's enough for me that something gets the job done; I don't care how or why it works.

1	2	3	4	5
(Not at all like me)	(Not very much like me)	(Don't know)	(A bit like me)	(Very much like me)

18. I usually end up deliberating about issues even when they do not affect me personally.

1	2	3	4	5
(Not at all like me)	(Not very much like me)	(Don't know)	(A bit like me)	(Very much like me)

APPENDIX 2D: DEMOGRAPHIC AND EXPERIENCE QUESTIONNAIRE

1. Please indicate your sex Male Female

2. Please state how old you are...

3. What is your yearly household income?

☐ Less than £10,000
☐ Between £10,000 - £20,000
☐ Between £20,000 - £30,000
☐ Between £30,000 - £40,000
☐ Higher than £40,000

4. Please indicate what your highest level of education is

☐ GCSE or O Level
☐ A Level
☐ Diploma/Certificate
☐ University or College Degree
☐ Professional Qualification
☐ Post Graduate Qualification
☐ Other (Please Specify)

5. Do you own a mobile phone? ☐ Yes ☐ No

6. Are you responsible for paying your mobile phone bill?

☐ Yes ☐ No

7. Have you changed you mobile phone contract in the last year?

☐ Yes ☐ No

8. Are you responsible for paying the Energy Bills in your household?

☐ Yes ☐ No

9. Have you changed Energy Supplier in the last year?

☐ Yes ☐ No

10. Have you ever contacted your current Energy Supplier regarding billing errors?

☐ Yes ☐ No

Experiment 3

APPENDIX 3A: CONSUMER PROBLEMS PRESENTED TO PARTICIPANTS

Imagine that you are planning a holiday. You are thinking about using Travel Company **A** which costs **£200** for the **hotel** and **£100** for the **flight**. The hotel has a **Four star rating**. You are generally satisfied with this holiday package but you suspect another travel company may offer better value and so you wish to investigate further.

A) Look at the table below carefully. You have the option to **Stick** with your choice of Travel Company, **Switch** to an alternative option, or seek out other packages to the ones available here and **Decide in the future.**

Travel Company	Price of Hotel	Hotel Stars	Price of Flight
A	£200	☆☆☆☆	£100
B	£173	☆☆☆☆	£127
C	£144	☆☆☆	£156
D	£122	☆☆☆☆	£183
E	£133	☆☆	£172
F	£172	☆	£138
G	£114	☆☆☆	£196
H	£107	☆☆☆☆	£203

Please mark your decision in the appropriate box below.

Stick	**Switch**	**Decide in the future**
☐	☐	☐

B) If you decided to switch, please circle the letter of the Travel Agent you chose.

A B C D E F G H

Imagine that you are planning a holiday. You are thinking about using Travel Company **G** which costs **£248** for the **hotel** and **£162** for the **flight**. The hotel has a **Three star rating**. You are generally satisfied with this holiday package but you suspect another travel company may offer better value and so you wish to investigate further.

A) Look at the table below carefully. You have the option to **Stick** with your choice of Travel Company, **Switch** to an alternative option, or seek out other packages to the ones available here and **Decide in the future.**

Travel Company	Price of Hotel	Hotel Stars	Price of Flight
A	£189	☆☆☆	£211
B	£243	☆	£157
C	£310	☆☆☆	£90
D	£276	☆☆☆	£129
E	£304	☆☆☆	£101
F	£172	☆	£233
G	£248	☆☆☆	£162
H	£129	☆☆☆☆	£281

Please mark your decision in the appropriate box below.

Stick ☐ **Switch** ☐ **Decide in the future** ☐

B) If you decided to switch, please circle the letter of the Travel Agent you chose.

A B C D E F G H

Imagine that you are planning a holiday. You are thinking about using Travel Company **H** which costs **£123** for the **hotel** and **£177**for the **flight**. The hotel has a **Five star rating**. You are generally satisfied with this holiday package but you suspect another travel company may offer better value and so you wish to investigate further.

A) Look at the table below carefully. You have the option to **Stick** with your choice of Travel Company, **Switch** to an alternative option, or seek out other packages to the ones available here and **Decide in the future.**

Travel Company	Price of Hotel	Hotel Stars	Price of Flight
A	£267	☆☆	£233
B	£195	☆☆☆☆	£235
C	£258	☆☆	£172
D	£199	☆☆☆☆☆	£221
E	£249	☆	£171
F	£283	☆☆☆☆☆	£127
G	£176	☆☆☆	£234
H	£123	☆☆☆☆☆	£177

Please mark your decision in the appropriate box below.

Stick	Switch	Decide in the future
☐	☐	☐

B) If you decided to switch, please circle the letter of the Travel Agent you chose.

A B C D E F G H

Imagine that you are planning a holiday. You are thinking about using Travel Company **F** which costs **£198** for the **hotel** and **£112** for the **flight**. The hotel has a **Five star rating**. You are generally satisfied with this holiday package but you suspect another travel company may offer better value and so you wish to investigate further.

A) Look at the table below carefully. You have the option to **Stick** with your choice of Travel Company, **Switch** to an alternative option, or seek out other packages to the ones available here and **Decide in the future.**

Travel Company	Price of Hotel	Hotel Stars	Price of Flight
A	£160	☆☆	£240
B	£162	☆☆☆	£138
C	£189	☆☆☆☆	£111
D	£203	☆	£107
E	£167	☆☆	£143
F	£198	☆☆☆☆☆	£112
G	£135	☆☆☆	£185
H	£96	☆☆☆☆☆	£104

Please mark your decision in the appropriate box below.

Stick	**Switch**	**Decide in the future**
☐	☐	☐

B) If you decided to switch, please circle the letter of the Travel Agent you chose.

A B C D E F G H

Imagine that you want to hire a car. You are thinking about using Car Company **G** which costs **£203** for the **car hire** and **£142** for the **insurance**. The car scores **Five** for **fuel economy**. You are generally satisfied with this car hire package but you suspect another car company may offer better value and so you wish to investigate further.

A) Look at the table below carefully. You have the option to **Stick** with your choice of Car Company, **Switch** to an alternative option, or seek out other packages to the ones available here and **Decide in the future.**

Car	Price of Hire	Fuel Economy	Insurance
A	£174	👍	£176
B	£216	👍👍👍	£134
C	£139	👍👍	£211
D	£91	👍👍👍👍	£264
E	£166	👍👍👍	£189
F	£200	👍👍👍👍	£155
G	£203	👍👍👍👍👍	£142
H	£99	👍👍👍👍👍	£246

Please mark your decision in the appropriate box below.

Stick	**Switch**	**Decide in the future**
☐	☐	☐

B) If you decided to switch, please circle the letter of the Travel Agent you chose.

A B C D E F G H

Imagine that you want to hire a car. You are thinking about using Car Company **E** which costs **£155** for the **car hire** and **£125** for the **insurance**. The car scores **Four** for **fuel economy**. You are generally satisfied with this car hire package but you suspect another car company may offer better value and so you wish to investigate further.

A) Look at the table below carefully. You have the option to **Stick** with your choice of Car Company, **Switch** to an alternative option, or seek out other packages to the ones available here and **Decide in the future.**

Car	Price of Hire	Fuel Economy	Insurance
A	£162	👍👍👍👍	£113
B	£130	👍👍👍	£145
C	£97	👍👍👍👍	£178
D	£141	👍	£139
E	£155	👍👍👍👍	£125
F	£123	👍👍	£162
G	£162	👍👍👍	£123
H	£113	👍	£172

Please mark your decision in the appropriate box below.

Stick ☐ **Switch** ☐ **Decide in the future** ☐

B) If you decided to switch, please circle the letter of the Travel Agent you chose.

A B C D E F G H

Imagine that you want to hire a car. You are thinking about using Car Company **H** which costs **£33** for the **car hire** and **£67** for the **insurance**. The car scores **Five** for **fuel economy**. You are generally satisfied with this car hire package but you suspect another car company may offer better value and so you wish to investigate further.

A) Look at the table below carefully. You have the option to **Stick** with your choice of Car Company, **Switch** to an alternative option, or seek out other packages to the ones available here and **Decide in the future.**

Car	Price of Hire	Fuel Economy	Insurance
A	£173	👍👍	£127
B	£102	👍👍👍👍	£98
C	£75	👍👍👍	£125
D	£98	👍👍👍👍👍	£97
E	£116	👍	£79
F	£82	👍👍👍👍👍	£123
G	£106	👍👍👍👍	£99
H	£33	👍👍👍👍👍	£67

Please mark your decision in the appropriate box below.

Stick ☐ **Switch** ☐ **Decide in the future** ☐

B) If you decided to switch, please circle the letter of the Travel Agent you chose.

A B C D E F G H

Imagine that you want to hire a car. You are thinking about using Car Company **B** which costs **£130** for the **car hire** and **£270** for the **insurance**. The car scores **Four** for **fuel economy**. You are generally satisfied with this car hire package but you suspect another car company may offer better value and so you wish to investigate further.

A) Look at the table below carefully. You have the option to **Stick** with your choice of Car Company, **Switch** to an alternative option, or seek out other packages to the ones available here and **Decide in the future.**

Car	Price of Hire	Fuel Economy	Insurance
A	£211	👍	£189
B	£130	👍👍👍👍	£270
C	£153	👍👍👍👍	£147
D	£202	👍👍	£203
E	£206	👍	£199
F	£208	👍👍👍	£187
G	£230	👍👍👍	£165
H	£211	👍👍👍👍👍	£289

Please mark your decision in the appropriate box below.

Stick ☐ **Switch** ☐ **Decide in the future** ☐

B) If you decided to switch, please circle the letter of the Travel Agent you chose.

A B C D E F G H

Imagine that you want learn how to dive. You are thinking about using Diving School **F** which charges **£117** for the **lessons** and **£128** for **renting the equipment**. The diving school scores **Five** for **customer satisfaction**. You are generally satisfied with this diving school but you suspect another diving school may offer better value and so you wish to investigate further.

A) Look at the table below carefully. You have the option to **Stick** with your choice of Diving Company, **Switch** to an alternative option, or seek out other packages to the ones available here and **Decide in the future.**

Diving School	Price of Lessons	Customer Satisfaction	Equipment Rent
A	£73	☺	£177
B	£90	☺☺☺☺☺	£160
C	£94	☺☺	£156
D	£111	☺☺☺☺☺	£144
E	£72	☺☺☺	£183
F	£117	☺☺☺☺☺	£128
G	£108	☺☺☺☺☺	£137
H	£118	☺☺☺☺	£127

Please mark your decision in the appropriate box below.

Stick ☐ **Switch** ☐ **Decide in the future** ☐

B) If you decided to switch, please circle the letter of the Travel Agent you chose.

A B C D E F G H

Imagine that you want learn how to dive. You are thinking about using Diving School **D** which charges **£94** for the **lessons** and **£221** for **renting the equipment**. The diving school scores **Four** for **customer satisfaction**. You are generally satisfied with this diving school but you suspect another diving school may offer better value and so you wish to investigate further.

A) Look at the table below carefully. You have the option to **Stick** with your choice of Diving Company, **Switch** to an alternative option, or seek out other packages to the ones available here and **Decide in the future.**

Diving School	Price of Lessons	Customer Satisfaction	Equipment Rent
A	£164	☺☺	£156
B	£172	☺☺☺	£148
C	£128	☺☺☺☺	£192
D	£94	☺☺☺☺	£221
E	£80	☺	£235
F	£145	☺☺☺	£170
G	£134	☺☺☺☺	£176
H	£101	☺☺☺☺	£209

Please mark your decision in the appropriate box below.

Stick ☐ **Switch** ☐ **Decide in the future** ☐

B) If you decided to switch, please circle the letter of the Travel Agent you chose.

A B C D E F G H

Imagine that you want learn how to dive. You are thinking about using Diving School **H** which charges **£203** for the **lessons** and **£187** for **renting the equipment**. The diving school scores **Five** for **customer satisfaction**. You are generally satisfied with this diving school but you suspect another diving school may offer better value and so you wish to investigate further.

A) Look at the table below carefully. You have the option to **Stick** with your choice of Diving Company, **Switch** to an alternative option, or seek out other packages to the ones available here and **Decide in the future.**

Diving School	Price of Lessons	Customer Satisfaction	Equipment Rent
A	£252	☺	£238
B	£145	☺☺☺☺	£145
C	£201	☺☺☺☺	£189
D	£188	☺☺	£207
E	£219	☺☺☺☺☺	£176
F	£190	☺☺	£210
G	£205	☺☺☺	£195
H	£203	☺☺☺☺☺	£187

Please mark your decision in the appropriate box below.

Stick ☐ **Switch** ☐ **Decide in the future** ☐

B) If you decided to switch, please circle the letter of the Travel Agent you chose.

A B C D E F G H

Imagine that you want learn how to dive. You are thinking about using Diving School **A** which charges **£240** for the **lessons** and **£210** for **renting the equipment**. The diving school scores **Five** for **customer satisfaction**. You are generally satisfied with this diving school but you suspect another diving school may offer better value and so you wish to investigate further.

A) Look at the table below carefully. You have the option to **Stick** with your choice of Diving Company, **Switch** to an alternative option, or seek out other packages to the ones available here and **Decide in the future.**

Diving School	Price of Lessons	Customer Satisfaction	Equipment Rent
A	£240	☺☺☺☺☺	£210
B	£226	☺☺☺	£224
C	£192	☺☺☺☺☺	£108
D	£203	☺	£297
E	£239	☺☺	£206
F	£232	☺☺☺	£213
G	£167	☺☺☺☺	£278
H	£208	☺☺☺☺☺	£242

Please mark your decision in the appropriate box below.

Stick ☐ **Switch** ☐ **Decide in the future** ☐

B) If you decided to switch, please circle the letter of the Travel Agent you chose.

A B C D E F G H

APPENDIX 3B: MANIPULATION CHECK QUESTIONNAIRE

Please read through the statements below and circle the number which most closely matches how you feel.

1. During the film, I did not feel anything at all.

0	1	2	3	4	5	6	7	8

Strongly Disagree Strongly Agree

2. During the film, I felt emotions but tried to hide them.

0	1	2	3	4	5	6	7	8

Strongly Disagree Strongly Agree

3. During the film, I reacted completely spontaneously.

0	1	2	3	4	5	6	7	8

Strongly Disagree Strongly Agree

4. During the film, how difficult did you find it to perform the instructions given to you before it started?

0	1	2	3	4	5	6	7	8

Not at all Difficult Very Difficult

APPENDIX 3C: PANAS-X

This scale consists of a number of words and phrases that describe different feelings and emotions. Read each item and then mark the appropriate answer in the space next to that word. Indicate to what extent you have felt this way right now, that is, at the present moment.

Use the following scale to record your answers:

1	2	3	4	5
Very slightly or not at all	**A little**	**Moderately**	**Quite a bit**	**Extremely**

_______ active	_______ guilty	_______ enthusiastic
_______ attentive	_______ afraid	_______ tired
_______ nervous	_______ sluggish	_______ distressed
_______ sleepy	_______ excited	_______ determined
_______ strong	_______ hostile	_______ proud
_______ alert	_______ jittery	_______ interested
_______ irritable	_______ upset	_______ ashamed
_______ inspired	_______ scared	_______ drowsy

APPENDIX 3D: DEMOGRAPHIC QUESTIONNIARE

Age...

Gender: Male ☐ Female ☐

Years of education..

Highest Qualification…………………………………………………………………

What is your yearly household income?

Less than £10,000 ☐ Between £30,000-40,000 ☐

Between £10,000-£20,000 ☐ Higher than £40,000 ☐

Between £20,000-£30,000 ☐

Experiment 4

APPENDIX 4A: ORDER PROBLEMS

Directions: Each set of questions is based on a passage and set of conditions. In answering some of the questions, it may be useful to draw a rough diagram. For each question, select the best answer choice given.

Set 1

A veterinarian is doing an informal study of the growth of exactly seven poodles – Fido, Monet, Pal, Quixote, Rover, Spot and Tache – all six-month-old puppies from the same litter. The veterinarian's assistant collected the following comparative data concerning the poodles' heights:

- Rover is taller than Tache.
- Quixote is taller than Spot.
- Fido is taller than Tache.
- Pal is taller than Monet, but Tache is taller than Pal.
- None of the seven poodles is exactly the same height as any other poodle from the litter.

1. Which of the following could be the correct ordering of the poodles from tallest to shortest?
   (A) Fido, Rover, Tache, Monet, Quixote, Pal, Spot
   (B) Quixote, Spot, Fido, Tache, Pal, Rover, Monet
   (C) Rover, Fido, Tache, Pal, Quixote, Monet, Spot
   (D) Rover, Tache, Quixote, Pal, Spot, Fido, Monet
   (E) Spot, Rover, Fido, Tache, Pal, Quixote, Monet

2. Which of the following must be true?
   (A) Fido is taller than Pal.
   (B) Fido is taller than Rover.
   (C) Quixote is taller than Pal.
   (D) Spot is taller than Monet.
   (E) Tache is taller than Spot.

3. If Spot is taller than Tache, which of the following must be true?
   (A) Quixote is taller than Fido.
   (B) Quixote is taller than Pal.
   (C) Quixote is taller than Rover.
   (D) Rover is taller than Fido.
   (E) Tache is taller than Quixote.

4. If Tache is taller than Quixote, any of the following can be true EXCEPT:
   (A) Monet is taller than Quixote.
   (B) Quixote is taller than Pal.
   (C) Quixote is taller than Rover.
   (D) Spot is taller than Monet.
   (E) Spot is taller than Pal.

Set 2

1. A particular auto race involved eight cars – S, T, U, V, W, X, Y, and Z. At the end of every lap, an accurate record was made of the position of the cars from first (position 1) to last (position 8). For each of the records the following statements are true:

- No two cars occupy the same position.
- S is in some position ahead of Z.
- There is exactly one car between T and X, regardless of whether T or X is ahead of the other.
- U is in the position immediately ahead of Y.
- Both V and Y are in position ahead of S.
- W is in first position.

1. Which of the following could be noted on one of the records as the positions of the cars from position 1 through position 8?
   (A) W, U, S, Y, V, T, Z, X
   (B) W, U, Y, S, T, V, Z, X
   (C) W, U, Y, V, S, T, Z, X,
   (D) W, U, Y, Z, V, T, S, X
   (E) W, V, S, U, Y, T, Z, X

2. If on one of the records Y and X are in positions 4 and 5, respectively, which of the following must be true of that record?
   (A) S is in position 2.
   (B) S is in position 7.
   (C) T is in position 3.
   (D) V is in position 3.
   (E) Z is in position 8.

3. If on one of the records V is in some position behind T, which car must be in position 7 on that record?

(A) S
(B) T
(C) V
(D) X
(E) Z

Set 3

In a game, exactly six inverted cups stand side by side in a straight line, and each has exactly one ball hidden under it. The cups are numbered consecutively 1 through 6. Each of the balls is painted in a single solid colour. The colours of the balls are green, magenta, orange, purple, red and yellow. The balls have been hidden under the cups in a manner that conforms to the following conditions:

- The purple ball must be hidden under a lower-numbered cup than the orange ball.
- The red ball must be hidden under a cup immediately adjacent to the cup under which the magenta ball is hidden.
- The green ball must
- .be hidden under cup 5.

1. Which of the following could be the colours of the balls under the cups, in order from 1 through 6?

(A) Green, yellow, magenta, red, purple, orange
(B) Magenta, green, purple, red, orange, yellow
(C) Magenta, red, purple, yellow, green, orange
(D) Orange, yellow, red, magenta, green, purple
(E) Red, purple, magenta, yellow, green, orange

2. If the magenta ball is under cup 4, the red ball must be under cup

(A) 1
(B) 2
(C) 3
(D) 5
(E) 6

3. A ball of which of the following colours could be under cup 6?

(A) Green
(B) Magenta
(C) Purple
(D) Red
(E) Yellow

4. If the purple ball is under cup 4, the orange ball must be under cup

(A) 1
(B) 2
(C) 3
(D) 5
(E) 6

5. Which of the following must be true?

(A) The green ball is under a lower-numbered cup than the yellow ball.
(B) The orange ball is under a lower-numbered cup than the green ball.
(C) The purple ball is under a lower-numbered cup than the green ball.
(D) The purple ball is under a lower-numbered cup than the red ball.
(E) The red ball is under a lower-numbered cup than the yellow ball.

6. If the orange ball is under cup 2, balls of which of the following colours could be under the cups immediately adjacent to each other?

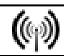
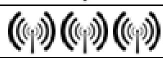
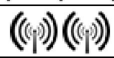
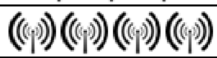
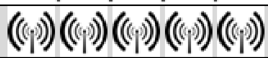
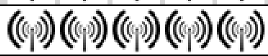
(A) Green and magenta
(B) Green and purple
(C) Orange and yellow
(D) Purple and red
(E) Red and yellow

Experiment 6

APPENDIX 6A: CONSUMER PROBLEMS PRESENTED TO PARTICIPANTS

Imagine that you are buying a mobile phone contract. You will use 100 minutes and 100 text messages per month. You are thinking about using Mobile Phone Company **G** which costs **£3.50** per 100 minutes and **£9.50** per 100 Text Messages. The Mobile Phone Company has a reception coverage score of **5**. You are generally satisfied with this mobile phone contract but you suspect another mobile phone company may offer better value and so you wish to investigate further.

A) Look at the table below carefully. You have the option to **Stick** with your choice of Mobile Phone Company or **Switch** to an alternative option.
Please mark your decision in the appropriate box below.

Mobile Phone Company	Price per 100 Minutes	Reception	Price per 100 Text Messages
A	£5.00		£10.00
B	£6.50		£8.50
C	£7.50		£7.50
D	£12.50		£5.00
E	£6.00		£11.50
F	£5.50		£12.00
G	£3.50		£9.50
H	£6.00		£8.00

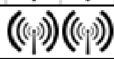
☐ **Stick** ☐ **Switch**

B) If you decided to switch, please circle the letter of the Travel Agent you chose.

A B C D E F G H

Imagine that you are buying a mobile phone contract. You will use 100 minutes and 100 text messages per month. You are thinking about using Mobile Phone Company **E** which costs **£15.50** per 100 minutes and **£12.50** per 100 Text Messages. The Mobile Phone Company has a reception coverage score of **4**. You are generally satisfied with this mobile phone contract but you suspect another mobile phone company may offer better value and so you wish to investigate further.

A) Look at the table below carefully. You have the option to **Stick** with your choice of Mobile Phone Company or **Switch** to an alternative option.

Mobile Phone Company	Price per 100 Minutes	Reception	Price per 100 Text Messages
A	£16.00		£11.50
B	£13.00		£14.50
C	£11.00		£17.50
D	£14.50		£13.50
E	£15.50		£12.50
F	£12.50		£16.00
G	£16.00		£12.50
H	£11.00		£17.50

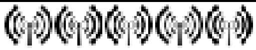
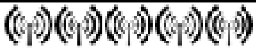
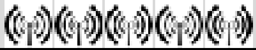
☐ **Stick** ☐ **Switch**

B) If you decided to switch, please circle the letter of the Travel Agent you chose.

A B C D E F G H

Imagine that you are buying a mobile phone contract. You will use 100 minutes and 100 text messages per month. You are thinking about using Mobile Phone Company **H** which costs **£3.50** per 100 minutes and **£6.50** per 100 Text Messages. The Mobile Phone Company has a reception coverage score of **5**. You are generally satisfied with this mobile phone contract but you suspect another mobile phone company may offer better value and so you wish to investigate further.

A) Look at the table below carefully. You have the option to **Stick** with your choice of Mobile Phone Company or **Switch** to an alternative option.

Mobile Phone Company	Price per 100 Minutes	Reception	Price per 100 Text Messages
A	£17.50		£12.50
B	£10.50		£9.50
C	£7.50		£12.50
D	£10.00		£9.50
E	£11.50		£8.00
F	£8.50		£12.00
G	£11.00		£9.50
H	£3.50		£6.50

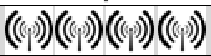
Stick **Switch**

B) If you decided to switch, please circle the letter of the Travel Agent you chose.

A B C D E F G H

Imagine that you are buying a mobile phone contract. You will use 100 minutes and 100 text messages per month. You are thinking about using Mobile Phone Company **B** which costs **£13.00** per 100 minutes and **£27.00** per 100 Text Messages. The Mobile Phone Company has a reception coverage score of **4**. You are generally satisfied with this mobile phone contract but you suspect another mobile phone company may offer better value and so you wish to investigate further.

A) Look at the table below carefully. You have the option to **Stick** with your choice of Mobile Phone Company or **Switch** to an alternative option.

Mobile Phone Company	Price per 100 Minutes	Reception	Price per 100 Text Messages
A	£22.00		£18.00
B	£13.00		£27.00
C	£15.50		£14.50
D	£20.50		£20.00
E	£21.00		£19.50
F	£21.00		£18.50
G	£23.00		£16.50
H	£21.50		£28.50

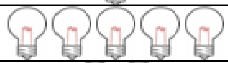
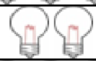
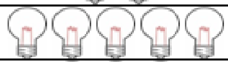
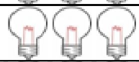
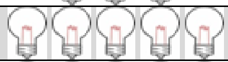
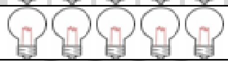
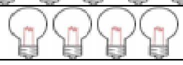
☐ **Stick** ☐ **Switch**

B) If you decided to switch, please circle the letter of the Travel Agent you chose.

A B C D E F G H

Imagine that you are changing Energy Company. You will use an equal amount of gas and electricity each month. You are thinking about using Energy Company **F** which costs **£12.50** per 100 kWhs for Gas and **£11.00** per 100 kWhs for Electricity. The Energy Company has a Customer Service score of **5**. You are generally satisfied with this Energy Company but you suspect another Energy Company may offer better value and so you wish to investigate further.

A) Look at the table below carefully. You have the option to **Stick** with your choice of Energy Company or **Switch** to an alternative option.

Energy Company	Price per 100 kWhs of Gas	Customer Service	Price per 100 kWhs of electricity
A	£8.00		£17.00
B	£9.00		£16.00
C	£9.50		£15.50
D	£13.00		£14.00
E	£9.00		£18.00
F	£11.50		£12.00
G	£11.00		£13.50
H	£12.50		£12.00

☐ **Stick**

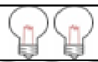
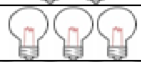
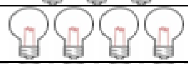
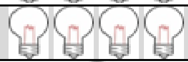
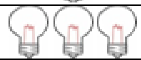
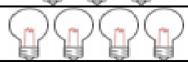
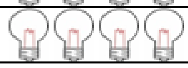
☐ **Switch**

B) If you decided to switch, please circle the letter of the Travel Agent you chose.

A B C D E F G H

Imagine that you are changing Energy Company. You will use an equal amount of gas and electricity each month. You are thinking about using Energy Company **D** which costs **£10.50** per 100 kWhs for Gas and **£21.00** per 100 kWhs for Electricity. The Energy Company has a Customer Service score of 4. You are generally satisfied with this Energy Company but you suspect another Energy Company may offer better value and so you wish to investigate further.

A) Look at the table below carefully. You have the option to **Stick** with your choice of Energy Company or **Switch** to an alternative option.

Energy Company	Price per 100 kWhs of Gas	Customer Service	Price per 100 kWhs of electricity
A	£16.50		£15.50
B	£17.50		£14.50
C	£12.50		£19.50
D	£10.50		£21.00
E	£8.00		£23.50
F	£14.50		£17.00
G	£13.50		£17.50
H	£11.00		£21.50

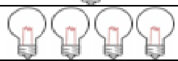
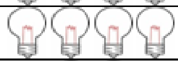
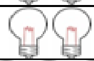
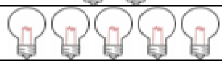
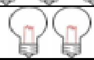
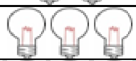
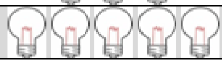
☐ **Stick** ☐ **Switch**

B) If you decided to switch, please circle the letter of the Travel Agent you chose.

A B C D E F G H

Imagine that you are changing Energy Company. You will use an equal amount of gas and electricity each month. You are thinking about using Energy Company **H** which costs **£20.50** per 100 kWhs for Gas and **£18.50** per 100 kWhs for Electricity. The Energy Company has a Customer Service score of **5**. You are generally satisfied with this Energy Company but you suspect another Energy Company may offer better value and so you wish to investigate further.

A) Look at the table below carefully. You have the option to **Stick** with your choice of Energy Company or **Switch** to an alternative option.

Energy Company	Price per 100 kWhs of Gas	Customer Service	Price per 100 kWhs of electricity
A	£26.00		£23.00
B	£14.50		£24.50
C	£20.50		£18.50
D	£19.50		£20.50
E	£22.00		£17.50
F	£19.00		£21.00
G	£20.50		£19.50
H	£20.50		£18.50

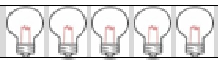
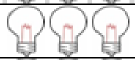
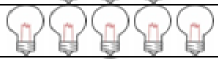
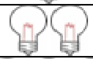
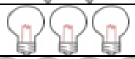
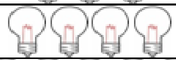
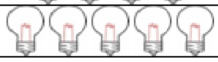
Stick **Switch**

B) If you decided to switch, please circle the letter of the Travel Agent you chose.

A B C D E F G H

Imagine that you are changing Energy Company. You will use an equal amount of gas and electricity each month. You are thinking about using Energy Company **A** which costs **£24.00** per 100 kWhs for Gas and **£21.00** per 100 kWhs for Electricity. The Energy Company has a Customer Service score of **5**. You are generally satisfied with this Energy Company but you suspect another Energy Company may offer better value and so you wish to investigate further.

A) Look at the table below carefully. You have the option to **Stick** with your choice of Energy Company or **Switch** to an alternative option.

Energy Company	Price per 100 kWhs of Gas	Customer Service	Price per 100 kWhs of electricity
A	£24.00		£21.00
B	£22.50		£22.50
C	£19.50		£10.50
D	£21.00		£29.00
E	£24.50		£20.50
F	£24.00		£21.00
G	£18.00		£27.00
H	£20.50		£24.50

☐ **Stick** ☐ **Switch**

B) If you decided to switch, please circle the letter of the Travel Agent you chose.

A B C D E F G H

Imagine that you are very price conscious and want to go shopping. You need to buy one loaf of bread and one pint of milk. You are thinking about using Super Market **A** which charges **£1.20** for a loaf of bread and **£1.00** for a pint of milk. The Super Market has a Customer Satisfaction Score of **4**. You are generally satisfied with this Super Market but you suspect another Super Market may offer better value and so you wish to investigate further.

A) Look at the table below carefully. You have the option to **Stick** with your choice of Super Market or **Switch** to an alternative option.

Super Market	Price of a loaf of bread	Customer satisfaction	Price of a pint of milk
A	£1.20	☺☺☺☺	£1.00
B	£1.20	☺☺☺☺	£1.05
C	£1.15	☺☺☺	£1.10
D	£1.15	☺☺☺☺	£1.20
E	£1.10	☺☺	£1.25
F	£1.40	☺	£1.00
G	£1.25	☺☺☺	£1.15
H	£1.10	☺☺☺☺	£1.30

☐ **Stick** ☐ **Switch**

B) If you decided to switch, please circle the letter of the Travel Agent you chose.

A B C D E F G H

Imagine that you are very price conscious and want to go shopping. You need to buy one loaf of bread and one pint of milk. You are thinking about using Super Market **G** which charges **£2.25** for a loaf of bread and **£1.40** for a pint of milk. The Super Market has a Customer Satisfaction Score of **3**. You are generally satisfied with this Super Market but you suspect another Super Market may offer better value and so you wish to investigate further.

A) Look at the table below carefully. You have the option to **Stick** with your choice of Super Market or **Switch** to an alternative option.

Super Market	Price of a loaf of bread	Customer satisfaction	Price of a pint of milk
A	£2.15	☺☺☺	£1.50
B	£1.55	☺	£1.45
C	£1.25	☺☺☺	£1.75
D	£2.25	☺☺☺	£1.25
E	£2.20	☺☺☺	£1.30
F	£2.15	☺	£1.35
G	£2.25	☺☺☺	£1.40
H	£2.00	☺☺☺☺	£1.65

☐ **Stick** ☐ **Switch**

B) If you decided to switch, please circle the letter of the Travel Agent you chose.

A B C D E F G H

Imagine that you are very price conscious and want to go shopping. You need to buy one loaf of bread and one pint of milk. You are thinking about using Super Market **A** which charges **£2.50** for a loaf of bread and **£1.50** for a pint of milk. The Super Market has a Customer Satisfaction Score of **2**. You are generally satisfied with this Super Market but you suspect another Super Market may offer better value and so you wish to investigate further.

A) Look at the table below carefully. You have the option to **Stick** with your choice of Super Market or **Switch** to an alternative option.

Super Market	Price of a loaf of bread	Customer satisfaction	Price of a pint of milk
A	£2.50	☺☺	£1.50
B	£1.75	☺☺☺☺	£1.75
C	£1.65	☺☺	£1.85
D	£2.20	☺☺☺	£2.00
E	£2.10	☺	£2.10
F	£2.20	☺☺☺☺☺	£1.90
G	£2.15	☺☺☺	£1.95
H	£1.45	☺☺☺☺☺	£1.55

☐ **Stick**

☐ **Switch**

B) If you decided to switch, please circle the letter of the Travel Agent you chose.

A B C D E F G H

Imagine that you are very price conscious and want to go shopping. You need to buy one loaf of bread and one pint of milk. You are thinking about using Super Market **F** which charges **£1.20** for a loaf of bread and **£1.90** for a pint of milk. The Super Market has a Customer Satisfaction Score of **5**. You are generally satisfied with this Super Market but you suspect another Super Market may offer better value and so you wish to investigate further.

A) Look at the table below carefully. You have the option to **Stick** with your choice of Super Market or **Switch** to an alternative option.

Super Market	Price of a loaf of bread	Customer satisfaction	Price of a pint of milk
A	£2.40	☺☺	£1.60
B	£1.35	☺☺☺	£1.65
C	£1.20	☺☺☺☺	£1.80
D	£1.80	☺	£1.30
E	£1.45	☺☺	£1.65
F	£1.20	☺☺☺☺☺	£1.90
G	£1.85	☺☺☺	£1.35
H	£1.50	☺☺☺☺☺	£1.00

☐ **Stick** ☐ **Switch**

B) If you decided to switch, please circle the letter of the Travel Agent you chose.

A B C D E F G H

Imagine that you work for a drug company. It is your job to buy the stock needed for the production of a new antibiotic. The antibiotic requires that you buy an equal amount of Dexamthasone and Polymixin B. You are thinking about using Pharmacological Supplier **D** which charges **£27.00** for 100g of Dexamthasone and **£40.50** for 100g of Polymyxin B. The Pharmacological Supplier has a delivery speed score of **5**. You are generally satisfied with this Pharmacological Supplier but you suspect another Pharmacological may offer better value and so you wish to investigate further.

A) Look at the table below carefully. You have the option to **Stick** with your choice of Pharmacological Supplier or **Switch** to an alternative option.

Pharmacological Supplier	Price of 100g of Dexamthasone	Speed of delivery	Price of 100g of Polymyxin B
A	£15.00		£55.00
B	£25.00		£45.00
C	£33.50		£35.00
D	£27.00		£40.50
E	£23.50		£45.00
F	£34.00		£39.00
G	£25.00		£48.00
H	£37.50		£35.50

☐ **Stick** ☐ **Switch**

B) If you decided to switch, please circle the letter of the Travel Agent you chose.

A B C D E F G H

Imagine that you work for a drug company. It is your job to buy the stock needed for the production of a new antibiotic. The antibiotic requires that you buy an equal amount of Dexamthasone and Polymixin B. You are thinking about using Pharmacological Supplier **D** which charges **£30.00** for 100g of Dexamthasone and **£65.00** for 100g of Polymyxin B. The Pharmacological Supplier has a delivery speed score of **4**. You are generally satisfied with this Pharmacological Supplier but you suspect another Pharmacological may offer better value and so you wish to investigate further.

A) Look at the table below carefully. You have the option to **Stick** with your choice of Pharmacological Supplier or **Switch** to an alternative option.

Pharmacological Supplier	Price of 100g of Dexamthasone	Speed of delivery	Price of 100g of Polymyxin B
A	£45.00		£45.00
B	£24.50		£65.50
C	£40.00		£50.00
D	£30.00		£65.00
E	£39.50		£55.50
F	£49.50		£45.50
G	£40.00		£40.00
H	£50.00		£35.00

☐ **Stick** ☐ **Switch**

B) If you decided to switch, please circle the letter of the Travel Agent you chose.

A B C D E F G H

Imagine that you work for a drug company. It is your job to buy the stock needed for the production of a new antibiotic. The antibiotic requires that you buy an equal amount of Dexamthasone and Polymixin B. You are thinking about using Pharmacological Supplier **H** which charges **£38.00** for 100g of Dexamthasone and **£37.00** for 100g of Polymyxin B. The Pharmacological Supplier has a delivery speed score of **5**. You are generally satisfied with this Pharmacological Supplier but you suspect another Pharmacological may offer better value and so you wish to investigate further.

A) Look at the table below carefully. You have the option to **Stick** with your choice of Pharmacological Supplier or **Switch** to an alternative option.

Pharmacological Supplier	Price of 100g of Dexamthasone	Speed of delivery	Price of 100g of Polymyxin B
A	£51.50		£47.50
B	£34.00		£55.00
C	£26.50		£62.50
D	£51.50		£33.50
E	£44.00		£41.00
F	£40.50		£39.50
G	£26.50		£53.50
H	£38.00		£37.00

Stick **Switch**

B) If you decided to switch, please circle the letter of the Travel Agent you chose.

A B C D E F G H

Imagine that you work for a drug company. It is your job to buy the stock needed for the production of a new antibiotic. The antibiotic requires that you buy an equal amount of Dexamthasone and Polymixin B. You are thinking about using Pharmacological Supplier **D** which charges **£25.50** for 100g of Dexamthasone and **£17.50** for 100g of Polymyxin B. The Pharmacological Supplier has a delivery speed score of **5**. You are generally satisfied with this Pharmacological Supplier but you suspect another Pharmacological may offer better value and so you wish to investigate further.

A) Look at the table below carefully. You have the option to **Stick** with your choice of Pharmacological Supplier or **Switch** to an alternative option.

Pharmacological Supplier	Price of 100g of Dexamthasone	Speed of delivery	Price of 100g of Polymyxin B
A	£28.50		£18.50
B	£9.50		£35.50
C	£30.50		£14.50
D	£25.50		£17.50
E	£21.00		£22.00
F	£16.50		£26.50
G	£24.00		£18.00
H	£18.50		£21.50

☐ **Stick**

☐ **Switch**

B) If you decided to switch, please circle the letter of the Travel Agent you chose.

A B C D E F G H

APPENDIX 6B: DEMOGRAPHIC QUESTIONNAIRE

Please indicate your sex ☐ Male ☐ Female

Please state how old you are...

What is your yearly household income? (Home)

☐ Less than £10,000 ☐ Between £30,000-£40,000

☐ Between £10,001 - £20,000 ☐ Higher than £40,001

☐ Between £20,001- £30,000

Please indicate what your highest level of education is

☐ GCSE or O Level ☐ Professional Qualification

☐ A Level ☐ Post Graduate Qualification

☐ Diploma/Certificate ☐ Other (Please Specify)

☐ University or College Degree

Do you own a mobile phone? ☐ Yes ☐ No

If so, for how many years have you owned a mobile phone? ....

How regularly would you say you use your mobile phone?

☐ Every day ☐ couple times a week ☐ Rarely ☐ Never

Are you responsible for paying your mobile phone bill?

☐ Yes ☐ No

Have you changed you mobile phone contract in the last year?

☐ Yes ☐ No

How often do you usually consider changing your mobile phone contract?

☐ Every 6 Months ☐ Every year ☐ Every 18 Months ☐ Every 2yrs

Are you responsible for paying the Energy Bills in your household?

☐ Yes ☐ No

Have you changed Energy Supplier in the last year? Yes ☐ No ☐

How often do you go to the supermarket to buy food?

☐ Never ☐ Once a week ☐ Twice a week ☐ 3 times a week or more

How important is PRICE to you when selecting which supermarket to shop at?

1 2 3 4 5

Very Important Not important at all

How important to you is customer satisfaction when selecting a supermarket to shop at?

1 2 3 4 5

Very Important Not important at all

Have you ever been responsible for sourcing the chemicals used in pharmacological drugs?

☐ Yes ☐ No

STATISTICS APPENDICES

All appendices are numbered in line with the experiment to which their contents refer.

Experiment 1

TABLE 1.1S: 2X2 ANOVA (AGE X QUESTION TYPE)

	F	Sig	Partial Eta Squared
Question Type	44.97	.00	.39
Age	2.67	.12	.04
Age*Question Type	.19	.67	.00

TABLE 1.2S: 2X2 ANOVA (AGE X QUESTION TYPE) WITH VOCABULARY AS A COVARIATE

	F	Sig	Partial Eta Squared
Question Type	3.02	.09	.04
Age	7.81	.01	.11
Vocabulary	.23	.63	.00
Age*Question Type	.16	.69	.00
Age*Vocabulary	16.15	.00	.19

TABLE1.3S: 2X2 ANOVA (AGE X QUESTION TYPE) WITH VOCABULARY AND FLUID INTELLIGENCE AS COVARIATES

	F	Sig	Partial Eta Squared
Question Type	9.99	.00	.13
Age	.79	.38	.01
Vocabulary	7.88	.01	.11
Fluid Intelligence	7.6	.01	.11
Age*Question Type	.31	.58	.01
Age*Vocabulary	6.86	.01	.1
Age*Fluid Intelligence	3.27	.08	.05

TABLE 1.4S: 2X2 ANOVA (AGE X QUESTION TYPE) WITH VOCABULARY, FLUID INTELLIGENCE AND NUMERACY AS COVARIATES

	F	Sig	Partial Eta Squared
Question Type	9.84	.00	.13
Age	.06	.8	.00
Vocabulary	5.77	.02	.08
Fluid Intelligence	4.53	.04	.67
Numeracy	3.92	.05	.06
Age*Question Type	4.65	.04	.07
Age*Vocabulary	.69	.41	.01
Age*Fluid Intelligence	4.53	.04	.07
Age*Numeracy	1.89	.17	.03

TABLE 1.5S: ANOVA (AGE X RESPONSIBILITY FOR PAYMENT OF BILLS X TOTAL NUMBER OF CORRECT FACTUAL AND INFERENTIAL PROBLEMS)

	F	Sig	Partial Eta Squared
Age	3.94	.05	.06
Responsibility for bills	1.78	.19	.03
Age*Responsibility	.49	.49	.01

Experiment 2

TABLE 2.1S: 2X2X2 ANOVA (AGE X QUESTION TYPE X TOPIC)

	F	Sig	Partial Eta Squared
Age	18.97	.00	.96
Question Type	231.38	.00	.65
Topic	.48	.49	.00
Age*Question Type	.18	.67	.00
Age*Topic	1.78	.18	.01
Question Type*Topic	39.31	.00	.24
Age*Question Type*Topic	.51	.48	.00

TABLE 2.2S: 2X2X2 ANOVA (AGE X QUESTION TYPE X TOPIC) WITH VOCABULARY ADDED AS A COVARIATE

	F	Sig	Partial Eta Squared
Age	17.42	.00	.13
Question Type	10.1	.00	.08
Topic	.54	.47	.00
Vocabulary	1.92	.17	.02
Age*Question Type	.06	.8	.00
Age*Topic	1.39	.24	.01
Question Type*Topic	3.21	.08	.03
Topic*Vocabulary	.44	.51	.00
Question Type*Vocabulary	.02	.89	.00
Age*Question Type*Topic	.22	.64	.00
Question Type*Vocabulary*Topic	.32	.57	.00

TABLE 2.3S: 2X2X2 ANOVA (AGE X QUESTION TYPE X TOPIC) WITH VOCABULARY AND FLUID INTELLIGENCE ADDED AS COVARIATES

	F	Sig	Partial Eta Squared
Age	.39	.54	.00
Question Type	.6	.44	.01
Topic	.53	.47	.00
Vocabulary	.41	.52	.00
Fluid Intelligence	52.3	00	.31
Age*Question Type	.58	.45	.01
Age*Topic	.00	.99	.00
Question Type*Topic	6.5	.01	.05
Topic*Vocabulary	.86	.36	.01
Question Type*Vocabulary	.18	.68	.00
Question Type*Fluid Intelligence	1.98	.16	.02
Topic*Fluid Intelligence	1.91	.17	.02
Age*Question Type*Topic	2.29	.13	.02
Question Type*Vocabulary*Topic	.01	.91	.00
Question Type Fluid Int*Topic	3.64	.06	.03

TABLE 2.4S: 2X2X2 ANOVA (AGE X QUESTION TYPE X TOPIC) WITH VOCABULARY, FLUID INTELLIGENCE AND NUMERACY ADDED AS COVARIATES

	F	Sig	Partial Eta Squared
Age	1.63	.2	.01
Question Type	1.41	.24	.01
Topic	.41	.53	.00
Vocabulary	.86	.6	.01
Fluid Intelligence	26.99	.00	.19
Numeracy	13.64	.00	.11
Age*Question Type	.11	.75	.00
Age*Topic	.01	.94	.00
Question Type*Topic	6.81	.01	.06
Topic*Vocabulary	.79	.38	.01
Topic*Numeracy	.22	.4	.00
Question Type*Vocabulary	.06	.8	.00
Question Type*Numeracy	6.58	.01	.05
Topic*Fluid Intelligence	2.09	.15	.02
Question Type*Fluid Intelligence	5.89	.02	.05
Age*Question Type*Topic	2.55	.11	.02
Question Type*Vocabulary*Topic	.02	.88	.00
Question Type Fluid Int*Topic	2.04	.16	.02
Question Type*Numeracy*Topic	.4	.53	.00

TABLE 2.5S: ANOVA DATA FOR THE MAIN EFFECTS OF AGE AND EXPERIENCE ON DECISION MAKING PERFORMANCE FOR PROBLEMS IN TWO CONSUMER DOMAINS (SELECTING AN ENERGY COMPANY AND, MOBILE PHONE SUPPLIER).

		Main Effects			
		age		performance	
Topic	Question	*F*	η^2	*F*	η^2
Energy	Responsibility for paying utility bills	6.02**	.05	.11	0
	Changed utility supplier in the last year	7.5**	.06	.23	.05
	Contacted utility supplier in the last year	6.61**	.05	.06	0
Mobile	Own a Mobile	16.24**	.12	.37	0
	Number of years of mobile owned	16.39**	.13	.04	0
	Responsibility for paying mobile phone bills	14.53**	.12	.07	0
	Changed mobile provider in the last year	10.48**	.09	1.3	.01

Experiment 3

3.1S: PILOT DATA

Figure 3.1. Mean rating for each of the 16 emotional states rated by participants after viewing footage of a fishhook being removed from a patients eyeball.

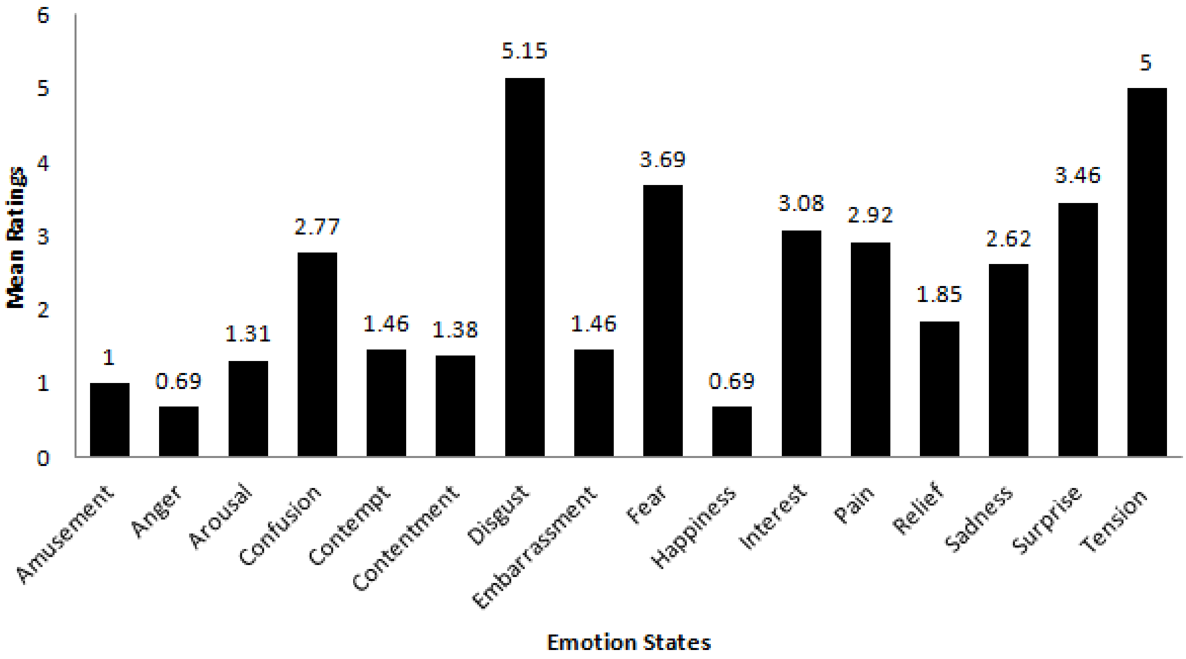


TABLE 3.2S ANOVA – DECISIONS TO DECIDE IN THE FUTURE

	F	Sig	Partial Eta Squared
Age	4.99	.02	.04
Condition	.88	.42	.02
Age*Condition	1.27	.29	.02

TABLE 3.3S ANOVA – CORRECT STICK AND SWITCH DECISIONS

	F	Sig	Partial Eta Squared
Age	1.45	.23	.01
Condition	24.07	.09	.04
Age*Condition	4.97	.01	.08
Correct Choice*Age	.04	.84	.00
Correct Choice*Condition	.19	.83	.00
Correct Choice*Age*Condition	.99	.38	.02

TABLE 3.4S ANOVA SHOWING THE NUMBER OF TIMES PARTICIPANTS CHOSE TO STICK ON EASY AND DIFFICULT PROBLEMS

	F	Sig	Partial Eta Squared
Age	2.11	.15	.02
Condition	.8	.45	.01
Problem Difficulty	.54	.46	.01
Age*Condition	.07	.93	.00
Problem Difficulty *Age	.08	.77	.00
Problem Difficulty *Condition	.5	.61	.01
Problem Difficulty *Age*Condition	.49	.62	.01

TABLE 3.5S ANOVA SHOWING THE NUMBER OF TIMES PARTICIPANTS CHOSE TO DECIDE IN THE FUTURE ON EASY AND DIFFICULT PROBLEMS

	F	Sig	Partial Eta Squared
Age	4.92	.03	.04
Condition	.91	.41	.02
Problem Difficulty	10.8	.00	.09
Age*Condition	1.2	.31	.02
Problem Difficulty *Age	.01	.94	.00
Problem Difficulty *Condition	.74	.48	.01
Problem Difficulty *Age*Condition	1.23	.3	.02

TABLE 3.6S: ANOVA (AGE X CONDITION) FEELINGS WHILE VIEWING FILM

	F	Sig	Partial Eta Squared
Age	16.2	.00	.12
Condition	2.49	.09	.04
Age*Condition	2.36	.1	.04

TABLE 3.7S: ANOVA (AGE X CONDITION) HIDE EMOTIONS

	F	Sig	Partial Eta Squared
Age	8.38	.01	.07
Condition	3.9	.02	.06
Age*Condition	2.43	.09	.04

TABLE 3.8S: ANOVA (AGE X CONDITION) SPONTANEOUS REACTION

	F	Sig	Partial Eta Squared
Age	56.6	.00	.13
Condition	4.47	.01	.07
Age*Condition	.16	.86	.03

TABLE 3.9S ANOVA (AGE X CONDITION) DIFFICULTY PERFORMING INSTRUCTIONS

	F	Sig	Partial Eta Squared
Age	11.31	.00	.13
Condition	2.31	.13	.03
Age*Condition	.19	.67	.00

TABLE 3.10S ANOVA (AGE X CONDITION) TIME TAKEN TO COMPLETE TASK

	F	Sig	Partial Eta Squared
Age	29.68	.00	.21
Condition	.41	.67	.01
Age*Condition	.61	.54	.01

TABLE 3.11S: ANOVA (AGE X CONDITION) POSITIVE AFFECT

	F	Sig	Partial Eta Squared
Age	47.16	.00	.29
Condition	.39	.68	.01
Age*Condition	2.39	.1	.04

TABLE 3.12S: ANOVA (AGE X CONDITION) NEGATIVE AFFECT

	F	Sig	Partial Eta Squared
Age	6.59	.01	.06
Condition	.39	.1	.01
Age*Condition	.62	.54	.01

TABLE 3.13S: ANOVA (AGE X CONDITION) FATIGUE

	F	Sig	Partial Eta Squared
Age	18.04	.00	.1
Condition	.45	.64	.01
Age*Condition	.5	.61	.01

Experiment 4

TABLE 4.1S: ANOVA (CONDITION X CORRECT CHOICE)

	F	Sig	Partial Eta Squared
Correct Choice	3.72	.06	.06
Condition	7.06	.00	.2
Correct Choice*Condition	.04	.96	.00

TABLE 4.2S: ANOVA (CONDITION X CHOICE)

	F	Sig	Partial Eta Squared
Choice	4.9	.05	.06
Condition	.00	1	.00
Choice*Condition	.05	1	.00

TABLE 4.3S: ANOVA (NUMBER OF STICK CHOICES X CONDITION)

	F	Sig	Partial Eta Squared
Number of Stick Choices	6.18	.02	.1
Condition	.04	.96	.00
Stick Choices*Condition	1.08	.35	.04

TABLE 4.4S: ANOVA (GRE RESPONSES X CONDITION)

	F	Sig	Partial Eta Squared
Number of Correct Items	1.72	.19	.06
No of Items Attempted	.56	.56	.02
Proportion of Items Attempted	.26	.78	.01

TABLE 4.5S: ANOVA (MANIPULATION CHECKS X CONDITION)

	F	Sig	Partial Eta Squared
Question 1	3.94	.03	.12
Question 2	6.17	.00	.18
Question 3	2.36	.1	.08
Question 4	2.3	.11	.07

TABLE 4.6S: ANOVA (TIME X CONDITION)

	F	Sig	Partial Eta Squared
Number of Stick Choices	.39	.68	.01

Experiment 5

TABLE 5.1S: ANOVA (CONDITION X CORRECT CHOICE)

	F	Sig	Partial Eta Squared
Correct Choice	4.79	.03	.05
Condition	3.25	.04	.07
Correct Choice*Condition	.99	.38	.02

TABLE 5.2S: ANOVA (CONDITION X CHOICE)

	F	Sig	Partial Eta Squared
Choice	.01	.94	.00
Condition	2.21	.12	.05
Choice*Condition	1.46	.24	.03

TABLE 5.3S: ANOVA (NUMBER OF STICK CHOICES X CONDITION)

	F	Sig	Partial Eta Squared
Number of Stick Choices	8.85	.00	.09
Condition	.54	.59	.01
Stick Choices*Condition	1.86	.16	.04

TABLE 5.4S: ANOVA (GRE RESPONSES X CONDITION)

	F	Sig	Partial Eta Squared
Number of Correct Items	3.99	.02	.09
No of Items Attempted	.37	.7	.01
Proportion of Items Attempted	2.4	.1	.05

TABLE 5.5S: ANOVA (TIME X CONDITION)

	F	Sig	Partial Eta Squared
Number of Stick Choices	1.42	.25	.03

Experiment 6

TABLE 6.1S: ANOVA (CORRECT CHOICE X AGE X CONDITION)

	F	Sig	Partial Eta Squared
Correct Choice	268.91	.00	.69
Age	9.64	.00	.08
Condition	3.52	.06	.03
Age*Condition	.32	.58	.03
Correct Choice *Age	.4	.53	.00
Correct Choice *Condition	.03	.86	.00
Correct Choice *Age*Condition	1.71	.19	.01

TABLE 6.2S: ANOVA (PROBLEM DIFFICULTY X AGE X CONDITION)

	F	Sig	Partial Eta Squared
Problem Difficulty	477.8	.00	.8
Age	.00	.96	.00
Condition	.04	.85	.00
Age*Condition	4.9	.03	.04
Problem Difficulty *Age	2.35	.13	.08
Problem Difficulty *Condition	2.18	.14	.02
Problem Difficulty *Age*Condition	1.02	.31	.01

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