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'IMPLICIT CREATION' NON-PROGRAMMER CONCEPTUAL MODELS FOR AUTHORING IN INTERACTIVE DIGITAL STORYTELLING

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'IMPLICIT CREATION' –
NON-PROGRAMMER CONCEPTUAL MODELS
FOR AUTHORING IN INTERACTIVE DIGITAL STORYTELLING

by

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ABSTRACT

'Implicit Creation' – Non-Programmer Conceptual Models for Authoring in Interactive Digital Storytelling

Ulrike Martina Spierling

Interactive Digital Storytelling (IDS) constitutes a research field that emerged from several areas of art, creation and computer science. It inquires technologies and possible artefacts that allow 'highly-interactive' experiences of digital worlds with compelling stories. However, the situation for story creators approaching 'highly-interactive' storytelling is complex. There is a gap between the available technology, which requires programming and prior knowledge in Artificial Intelligence, and established models of storytelling, which are too linear to have the potential to be highly interactive. This thesis reports on research that lays the ground for bridging this gap, leading to novel creation philosophies in future work.

A design research process has been pursued, which centred on the suggestion of conceptual models, explaining a) process structures of interdisciplinary development, b) interactive story structures including the user of the interactive story system, and c) the positioning of human authors within semi-automated creative processes. By means of 'implicit creation', storytelling and modelling of simulated worlds are reconciled.

The conceptual models are informed by exhaustive literature review in established neighbouring disciplines. These are a) creative principles in different storytelling domains, such as screenwriting, video game writing, role playing and improvisational theatre, b) narratological studies of story grammars and structures, and c) principles of designing interactive systems, in the areas of basic HCI design and models, discourse analysis in conversational systems, as well as game- and simulation design.

In a case study of artefact building, the initial models have been put into practice, evaluated and extended. These artefacts are a) a conceived authoring tool ('Scenejo') for the creation of digital conversational stories, and b) the development of a serious game ('The Killer Phrase Game') as an application development. The study demonstrates how starting out from linear storytelling, iterative steps of 'implicit creation' can lead to more variability and interactivity in the designed interactive story. In the concrete case, the steps included abstraction of dialogues into conditional actions, and creating a dynamic world model of the conversation. This process and artefact can be used as a model illustrating non-programmer approaches to 'implicit creation' in a learning process.

Research demonstrates that the field of Interactive Digital Storytelling still has to be further advanced until general creative principles can be fully established, which is a long-term endeavour, dependent upon environmental factors. It also requires further technological developments. The gap is not yet closed, but it can be better explained. The research results build groundwork for education of prospective authors. Concluding the thesis, IDS-specific creative principles have been proposed for evaluation in future work.

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LIST OF ABBREVIATIONS

1st person POV	First person point of view
3D	Three-dimensional
ABL	A Behaviour Language
AI	Artificial Intelligence
AIML	Artificial Intelligence Markup Language
AR	Augmented Reality
CAVE	Cave Automatic Virtual Environment
CG	Computer Graphics
DA	Dramatic Advisor
DG	Directed Graph
FPS	First Person Shooter
GM	Game Master
GPS	Global Positioning System
GUI	Graphical User Interface
HCI	Human-Computer Interaction
IDS	Interactive Digital Storytelling
IM	Initiating Move
Impro, improv	Improvisational Theatre
IS	Interactive Storytelling
KP	Killer Phrase
LARP	Live Action Role-Playing
NL	Natural Language
NLP	Natural Language Processing
NPC	Non-Player Character
P&P RPG	Pen and Paper Role-Playing Game
PDA	Personal Digital Assistant
PDDL	Planning Domain Definition Language
RM	Resolving Move
RPG	Role-Playing Game
RT	Real-Time
RTS	Real-Time Strategy
SCAIML	Scenejo-AIML

SRE	Stimulus-Response Element
STRIPS	Stanford Research Institute Problem Solver
SWAT	Storyworld Authoring Tool
TBS	Turn-Based Strategy
TTS	Text-To-Speech
XML	Extensible Markup Language

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Special thanks to all who have contributed to the *'Scenejo'* platform (see credits on scenejo.org) in a series of independent academic projects since 2004, especially to Sebastian and Wolfgang.

Finally, I would like to thank Dirk for his understanding, advice and humour, anytime and especially in the final phase of my writing of this thesis.

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.

Relevant scientific seminars and conferences were regularly attended at which work was often presented; external institutions were visited for consultation purposes and several papers prepared for publication. Some of the work reported has been previously published. Details of reviewed publications (as for conference publications, with oral presentations) carried out during the research programme can be found in Appendix A.

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Date: 30 September 2010

1 Introduction

Interactive Storytelling contains opportunities for massively enhancing the possibilities of interactive entertainment and computer games, by providing interactive access to social and human themes through compelling stories. Besides its use for entertainment purposes, applications include novel forms of edutainment and serious games, thus pointing to several important markets in the future. Interactive Storytelling also provides chances and challenges for redefining the experience of narratives through interactive simulations run in computer-generated story worlds. These are supposed to offer a different kind of entertainment value than stories in traditional media, by enabling active participation of individual members of the audience, making them agents in the storyworld. It has been recognised, however, that conservative ways of media production and digital storytelling, which are ignorant of procedural computing possibilities and relegate computers to being used as mere playback mechanisms, fail to produce a strong feeling of 'agency' – which broadly means 'having influence' – for human participants in these digital stories. The research field of Interactive Storytelling (IS, also: Interactive Drama, Interactive Narrative) has set the goal of finding solutions for *"highly-interactive"* virtual storyworlds (Kelso et al., 1993) by technical solutions in Artificial Intelligence (AI), such as the search of meaningful and dramatic responses to user actions from several possible events (Aylett, 1999; Bickmore and Cassell, 1999; Charles et al., 2001; Crawford, 1999; Dautenhahn, 1998; Szilas, 1999; Young, 2000)[1].

The result of ongoing research in combining AI with creative storytelling points to Interactive Digital Storytelling (IDS) as a new creative medium of the future. This medium is a virtual stage, consisting of software agents as a key technology. In contrast to predefined 'linear' content, autonomy of these virtual agents is essential to enable their intelligent adaptation to any user input. However, the goal of IDS is not to build independent virtual humans, but to provide semi-autonomous stages that can be used by storytellers to express messages for their target groups in an interactive way, by including into their design a range of potential influence aiming at interactive experiences for an audience. The new medium integrates aspects of storytelling, simulations and gaming to be combined in new artefacts that are not only suitable to entertain, but also to inform and to support constructive learning.

[1] Exemplary publications from the time of commencement in IDS research.

AI-based Interactive Digital Storytelling as an entire discipline is still in its infancy. Possible content creators and producers currently face huge obstacles for a number of reasons:

- There are no mainstream products that serve as archetypes; rather, there are many incomplete research prototypes as ‘proof-of-concepts’ and a variety of theoretically possible forms between storytelling, games and simulations;
- theoretical underpinnings of how to combine interactivity and storytelling have not yet matured; therefore, they show contradictions and are currently not easy to apply to concrete realisations;
- intuitive tools for creation are lacking; in fact, intuitive conceptual models that could build the basis for tools are also lacking.

1.1 Research Background and Challenges

The research presented herein has started out from the point of view of ‘creation’ in interactive media. The vision of having a seamless conversation with self-constructed virtual agents (Spierling, 2000) was initially frustrated by a huge technical challenge that this goal was facing. Subsequent research was based on practical experiments of artefact building and was led by the aim of closing an obvious gap perceived between the low accessibility (or simply the lack) of technical tools to create such interactive storytelling experiences, and the creative principles of traditional design and storytelling that turned out to be limited for conception.

By participating in the academic interdisciplinary research community of IDS, a variety of viewpoints and knowledge fields congregated as being relevant and influential in the endeavour of developing novel creative principles for IS authors, some of which are rooted in Linguistics, Narratology, Knowledge Representation, Psychology, Logic Formalisms, Planning, Agent Technology etc. Especially the attempt of finding ‘intuitive’ solutions for ‘non-programming authors’ has been constantly challenged by the demand of having to include AI principles of interactive story technology – at least to some extent.

Fig. 1.1 shows an overview of research fields and themes that are relevant to the challenges tackled in the context of this work. They are arranged in two opposite areas of themes, either falling into the realm of Computer Science and Engineering (the left side) or towards the Humanities and Design (the right side). The kinds of challenges and contributions of both sides can be theoretical as well as practical. The current state of the art reflected by existing IDS artefacts and successfully built prototypical examples is mainly driven by technological approaches and concepts developed in academic circles and computer research labs (the left side of Fig. 1.1). This situation will be described in more detail in the next chapter.

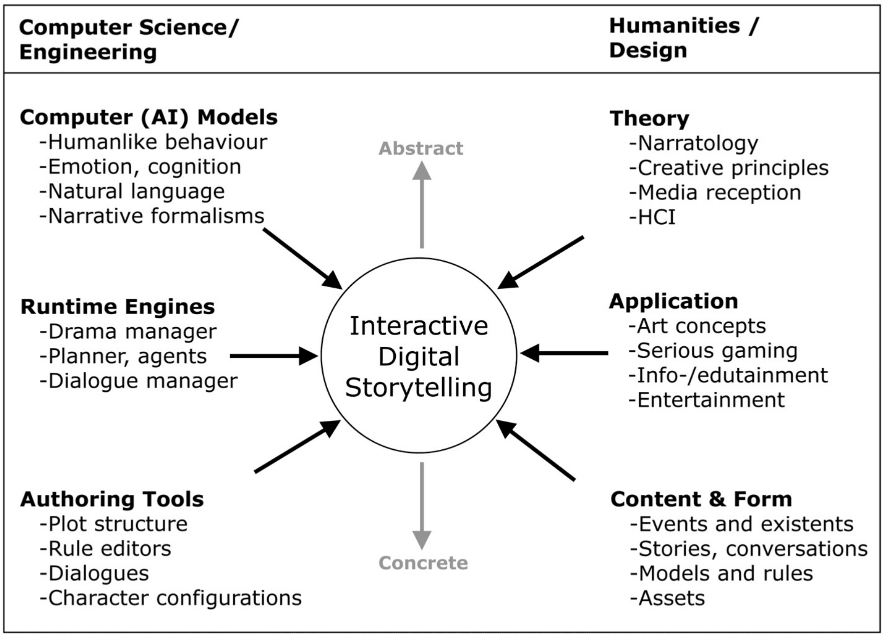

Fig. 1.1. Research and development fields concerned with Interactive Digital Storytelling.

1.1.1 Research Challenges

AI-based Interactive Storytelling relies on the application and implementation of cognitive models and rule systems that enable the dynamic management of dramatic flow and adaptation of story structures in response to users. In general terms, the stated goal is to let software ‘generate’ narrative courses of events in ‘real time’ (the time in which the interaction takes place) or ‘on the fly’. The development of systems capable of these tasks is a research challenge of its own, addressed by the computer science field. The intended results can be seen as an offer of computational models and tools to be used in interactive story creation.

However, these technically-motivated novel artefacts, methods and tools have been invented more quickly than they can be assimilated by traditionally oriented creators – which results in yet another challenge. By contrast to generative models, best practice and arts in storytelling and media design – also ‘interactive’ media design – so far have relied on different models that can be more easily visualised, such as for example a branching structure. Now, this kind of visual thinking often reaches limitations when complex interactive structures are to be accomplished. Further, defining ‘generative’ rules requires programming, which is a barrier for storytellers.

There are – of course – possibilities of dividing up the work of storyworld conception and implementation within an interdisciplinary team, assigning the different tasks to specialists in their field – a common modus operandi in film and game production. However, that does not avoid the necessity for authors to develop a conceptual image about the possibilities of experiences they can conceive, including the details at which they can influence and shape them. There is also a new complication involved in having to re-structure formerly more established design processes in storytelling media. In any case, creative workers are used to deal with rather ‘messy’ situations, especially in early phases of a design task (Buchanan, 1992). An idealised two-step approach, in which solutions are not commenced before complete analysis of all requirements, is often not operable. Making matters worse now, possible work cycles for IDS are yet unknown.

In summary, there is indeed a clash between technically motivated models structuring software architectures, which require analytical previous knowledge in AI computing and cognition (not even ‘programming’ knowledge is sufficient), and on the other side creative principles of conventional plot crafting in the narrative arts.

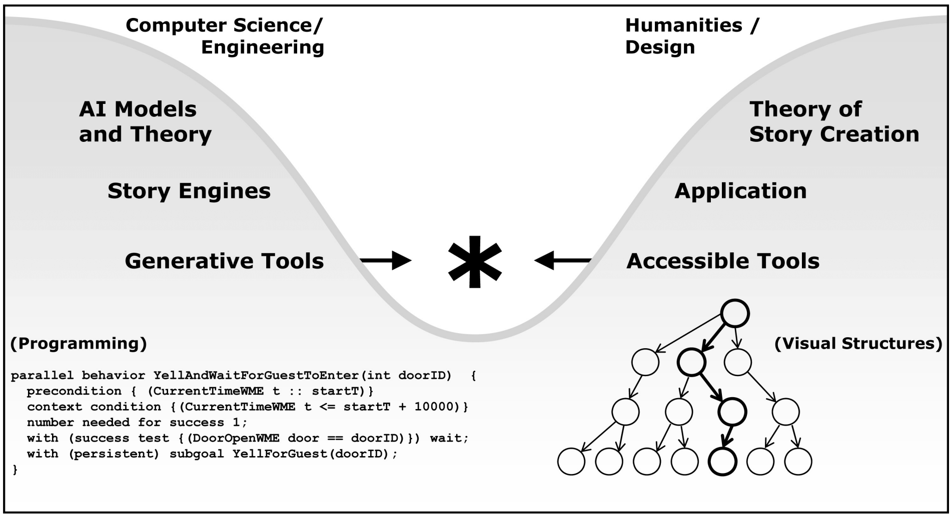

Fig. 1.2. A gap between disciplines. The left side shows an exemplary behaviour description (with ABL), the right side shows a typical branching structure.

A gap exists (see Fig. 1.2) between conventional forms of storytelling and visions of ‘highly-interactive’ storytelling. On both side of the gap, tools exist (details see Chapter 2). On the right side, accessible tools follow traditional conceptual models of authors incorporating established design principles. On the left side, tools reflect technological constraints and structures, not taking into account creation philosophies and principles, because these are not yet established. As a prerequisite for a resolution to this issue, such novel creation philosophies have to be explored, evaluated by experiments, and enunciated. This refers to another challenge of reconciling traditional theoretical narrative frameworks laying the ground for story creation with technological models and theory.

Finally, a further challenge is a methodological one. The situation is complicated by the fact that there are only few ‘IS authors’ as a target group who have created currently known interactive storyworld examples. The field possibly has to ‘lend’ authors from neighbouring storytelling disciplines, bringing in their traditional conceptual models – which involves ‘unlearning’. At the current state of development, it is therefore impossible to ultimately verify concrete and general user requirements based on summative evaluations of a big user group. Representing a classic ‘wicked problem’ (see Chapter 3), it is a case for ‘design research’, having to build playable prototypes to draw conclusions, with limited possibilities to repeat the same experiment.

1.1.2 Hypotheses for Research

The points of view of the disciplines mentioned in Fig. 1.1 are so diverse that the tools implied on the ‘left side’ (Fig. 1.2 and Fig. 1.3) are likely to not be understandable by authors. On the other hand, it is also unlikely that current authors can articulate their requirements for systems they have never thought about using. Hence, the aim of this work is to lay the groundwork for a more user-centred development of creation tools by structuring the previously messy situation for creators in interactive story design. The gap between engineers and designers as users shall be bridged through one shared conceptual image. The first focus is on developing comprehensive metaphors that grasp the idea of building software agents demonstrating semi-autonomous behaviour, while telling a story that is reactive to (and includes) an audience. Then, further detailed conceptual models on lower abstraction levels can serve as blueprints for tools to build. Since current methods include programming, there shall be a critical investigation as to what extent authoring tools can support creation without presupposed programming skills. Finally, the conceptual models shall also help novices to get into the field more easily, as they allow for teaching fundamentals in a comprehensible way.

The work starts out from the hypothesis that both sides of the described gap have to move. On the one hand, accessible tools must be built, but on the other hand, it is risky to assume that without learning new concepts, or unlearning old concepts, novel principles can be found. The goal is to find conceptual models for the authoring process that can be shared by both sides, and on which future work can build on to derive creative principles and develop new tools. In order to fit both sides, these models have to meet the following criteria:

- Accessibility: The models shall be understandable. However, it has to be assumed that a learning curve must be accepted.
- Effectiveness: Building effectively running examples of 'highly-interactive' (AI-based) storytelling shall be possible without breaking the models.

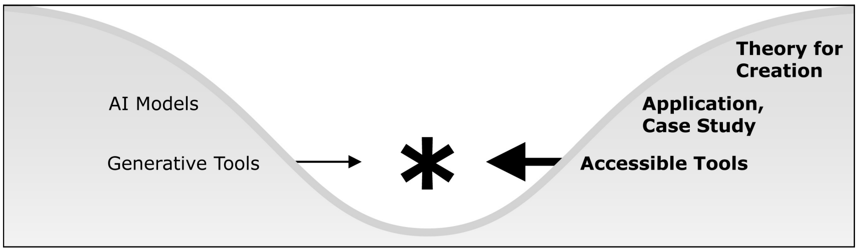

Fig. 1.3. Research approach, targeting the gap in steps from the side of accessible tools, by theory review and by case-based research.

Fig. 1.3 illustrates the approach of this research. It starts out from the ('right') side of accessible tools, by building a running application that shall come close to 'highly-interactive' storytelling. The goal is to find ways to increase interactivity by adding concepts of 'the left side'. The investigation shall be informed by theory about creative principles and structures in storytelling, and be inspired by the study of selected AI models and generative tools.

1.2 Objectives and Contributions of the Research

At its most general level, this research contributes answers to the question: "What general abstract design models need to be adopted by 'non-programming' story creators to reach higher levels of content variability than with the branching of linear paths, e.g. by using dynamic story engines based on AI concepts?" In the following, the main contributions are summarised and their novelty is pointed out.

1.2.1 Theoretical Contribution Towards Conceptual Models

The main objective of this research is the proposal and evaluation of conceptual models for content structuring and content creation in future Interactive Storytelling development processes. These models shall support the employment of so-called ‘highly-interactive’ methods, involving AI software that functions as equivalents to digital ‘drama managers’ or as ‘story engines’ controlling the outcome.

As a main result of this work, ‘implicit creation’ is proposed as a mental image and guiding principle that is opposed to traditional ‘explicit’ creation of a story representation in a concrete medium. While borrowing from existing concepts of several technical backgrounds (such as modelling techniques in simulation design, planning, cognition, language), the novelty of the result lies in the formulation of the conceptual model as a communication tool between disciplines. Reconciling model thinking and storytelling, implicit creation is here especially targeted at the domain of story creation. Further, more detailed conceptual models describe structures and borderlines in interactive story content, in creation processes and in sharing control.

The enunciated conceptual models have the potential of advancing the field in the following aspects:

- They provide umbrella concepts and terms that allow for discussing and categorising different solitary approaches, facilitating creative education and communication.
- They bridge a perceived gap between contemporary storytelling principles and the affordances of AI-oriented tools of IDS, by reconciling narrative thinking in sequences with logical thinking in models.
- They are the base for the formulation of general creative principles in IDS.
- They can be used to inform the development of future authoring tools, making the next generation of IS technology more accessible to authors.

The results have been achieved by the combination and cross-fertilisation of parallel activities, following a design research strategy. Models – from an authoring perspective – have been formulated during the creation of artefacts (see below) and their formative evaluation, as well as by analysis of literature and research prototypes.

1.2.2 Artefact Development

Further, the research consisted in artefact development as one solution to a given problem in Interactive Storytelling creation. This work comprised the design and production of several case studies in Interactive Storytelling content creation, the most complete being the ‘Killer Phrase Game’, a serious game based on conversational storytelling with the storytelling platform ‘Scenejo’. It allows a user to play the moderator of a debate between two virtual characters, influencing the result by verbal communication. During this design process, the work also covered the design of the authoring concept and the co-design of two versions of authoring tools for the 'Scenejo' platform. It was also complemented by smaller design exercises with other tools, allowing for comparisons of approaches and inspirations.

The developed artefacts are novel and unique for their low access barrier in terms of programming requirements, in their approach to model inter-character dialogues with possible user interactions and finally, as a showcase of a serious game. The results of this development serve the research topic in the following ways:

- The 'Killer Phrase Game' example is a playable prototype that can be evaluated for successes and flaws in its experience and design structure.
- The experiences from the design process directly feed into the proposal and validation of conceptual models (see above), and can illustrate potential pitfalls.
- The experiences also serve as requirement analysis for future authoring tools.

Artefact development was part of a design research strategy (see Chapter 3) following the hypothesis that creation knowledge can only be achieved by experiments in creation.

1.3 Thesis Structure

This document presents the performed research including the results and discussions of the findings. It is further structured as follows:

Chapter 2: Interactive Digital Storytelling: Overview and State of the Art

This chapter analyses in detail the scope and background of the research field targeted in this thesis. It locates forms and genres of Interactive Storytelling that are subject of this research, presents application areas and illustrates possible artefacts by selected examples. The state of the art of existing technology, existing tools and approaches for authoring and creation is reviewed, leading to a restatement of research challenges.

Chapter 3: Research Method

This chapter explains the chosen research method. It gives a short overview on qualitative research, arguing that the intended research goal is a case for 'design research'. At the end of the chapter, the used method is related to the reported results and interdependencies in the following chapters are explained.

Chapter 4: Contributions from Theory

In the context of the main objectives of this work (proposing conceptual models for IDS content structure and creation, and the creation of IDS artefacts), this chapter provides a selection of relevant models and solutions, directly or indirectly applicable from existing theory. It focuses on creative principles for storytelling, structural models from narrative theory and theoretical background of human-computer interactivity. In our selection, we are not searching for 'truth', but for 'utility'. We look at theory in the context of a suggested reconciliation of logic modelling and narrative sequencing for interactive story invention and creation.

Chapter 5: Conceptual Models: Structure of IDS Content Creation

This chapter presents the result of the research towards conceptual models. The models are presented as a suggestion, by design, and are justified by reference to existing problems in the understanding of IDS structure, its creation and its elements. The suggestion is informed by literature review (partly described in Chapters 2 and 4), and by practical experiences in constructive projects (see Chapter 6). In two sections, the models explain the structure of IDS content incorporating roles of authors and end-user interactivity, and the demands for 'implicit creation' that reconcile traditional narrative skills with abstract modelling.

Chapter 6: Case Study: Scenejo Authoring Tool Design and 'The Killer Phrase Game'

This chapter describes the development of working examples (artefacts), consisting of the conception of a tool set for authoring conversational interactive storytelling and an example authoring process. The study serves as illustration and evaluation of conceptual models. The main result of the example conceptualisation and implementation is a serious conversational game – the 'Killer Phrase Game'. User feedbacks and qualitative evaluations are summarised. In a redesign process, the step-by-step application of 'implicit creation' has led to increased variability in the game. The conclusion discusses the influences of these developments on the resulting models and the derived creation principles.

Chapter 7: Conclusions

This chapter summarises the presented research results, points out the objectives fulfilled and the novelty of the results. Limitations of the research are explained further. We conclude with the presentation of future work, which contains a suggestion of creation principles that can be derived from the experiences described herein.

2 Interactive Digital Storytelling: Overview and State of the Art

This chapter analyses in detail the scope and background of the research field targeted in this thesis. It locates forms and genres of Interactive Storytelling that are subject of this research, presents application areas and illustrates possible artefacts by selected examples. The state of the art of existing technology, existing tools and approaches for authoring and creation is reviewed, leading to a restatement of research challenges.

2.1 Visions and Applications of the Research Field

Interactive Digital Storytelling (IDS) constitutes a research field that emerged from several areas of art, creation and computer science. It inquires methods, technologies and possible artefacts that allow the experience of digital worlds with compelling stories.

2.1.1 Definitions of Interactive Storytelling

For the research presented here, our working definition of a 'story' refers at first to a type of information structure. It is independent of its representation in any digital medium – it could either be rendered with graphics and/or sound or narrated with a text-based interface using language (or both). The minimum ingredients of a story are more than one event happening to a character, typically structured in sequences following a logic grammar of implied causes and effects. A character acts as protagonist within a potential relationship network of further characters. Events can be deliberate actions of an agent (one of the characters) or passive happenings. Further, we are especially interested in the effects of these events on the inner human attributes or the relationships of the characters, as well as in the motivation for their actions. This may draw a line separating IDS from other forms of interactive entertainment, in which mere physical actions and events (also with causal logic) are predominant.

For our working definition of 'interactive' storytelling, we assume that during the interactive experience of a story, members of the audience become participants in a storyworld that enables the resulting story. They take a more or less active role right within that storyworld that grants them some degree of influence on the plot as one possible outcome. The degree of influence may be variable, depending on the designs of specific storyworlds. Although flexible, this working definition draws lines to distinguish possible other interpretations of what could constitute that interactivity: First, 'active role within a story' means that a designed storyworld needs to exist a-priori, in which we then involve end-users. Therefore, this storyworld needs to be configured beforehand, as a result of an 'authoring' process. Second, we do not consider this mere authoring to be the intended 'interaction' (of creation). Instead, we aim at a two-step approach, in which 'storyworld authors' create an 'interactive experience for end-users.'

In her ground-breaking book *"Hamlet on the Holodeck"* (Murray, 1997), Murray described this intended experience as a combination of *"immersion"*, *"agency"* and *"transformation"*. 'Immersion' is the possibility of being captured by a story and/or by involvement in a digital environment that constructs the imagination or even technical representation of a lifelike virtual world by using graphical, audio and tangible features. 'Agency' is the power of a computer user to take meaningful action in this virtual world, and 'transformation' refers to the possibilities offered by this involvement for 'playing' or 'being' somebody else, or at a shifted (fictional) place, acquiring changing or multiple perspectives. While the first two qualities can be achieved by many task-solving activities with computers, it requires 'storiness' to add the sense of 'transformation' to the experience. On the other hand, stories require the addition of 'agency' for the audience to finally fulfil the quality of 'Interactive' Storytelling.

The vision of the Holodeck has for long dominated developments in Virtual Storytelling with an emphasis on the representational (mainly computer-graphical) features of intelligently behaving virtual worlds and their lifelike inhabitants. For the research presented herein, another branch of investigations – which is nonetheless important in order to achieve the Holodeck – is more relevant, which is that of systems enabling 'highly interactive' storytelling.

2.1.2 'Highly-Interactive' Storytelling

The attribute of 'highly-interactive' with regard to storytelling has been introduced by Kelso at al. (1993) describing design goals for the *"Oz"*-System, which can be regarded as an important predecessor of today's research in Interactive Drama. *"'Highly interactive' is an important phrase of our description. The word 'interactive' distinguishes our work from conventional media, while 'highly interactive' indicates the interactor is choosing what to do, say, and think at all times, in contrast to other interactive media such as hypertext, where the interactor is given only a small number* *of fixed choices. If our example had been a conventional story, the author alone would decide exactly what happens to the protagonist. In interactive drama, the interactor is the protagonist and determines the action.* (Kelso at al., 1993)

This notion of interactivity explicitly excludes forms of branching stories in the sense of fixed hyperlinks, in which the audience decides between forking paths to follow that were explicitly prepared by authors. Such a branching story of plot alternatives is technically easy to produce with basic design tools for interactive media. However, providing more choices for users than only a few branches would lead to a 'combinatorial explosion' of ramifications, a reason for game designer Crawford (1993) to dismiss such an approach right away and claim the necessity of 'story engines' to solve the problem. Within following developments of prototypical solutions, Stern – co-designer of the Façade System – claimed that for interactive storytelling, *"authors must program"* (Stern, 2001). Today, available prototypical solutions of 'running' IDS systems with story content are rare for exactly that reason (authors lacking these skills), which forms one motivation for the research reported herein.

Within recent developments of the research field, the claims for 'highly-interactive' storytelling as defined by Kelso et al. are pursued by investigations into several dimensions of increased interactivity for digital stories, which we describe as follows (examples see Table 2.1 below):

- 'Bandwidth': Increasing the 'emotional bandwidth' of human-like communication within a digital storyworld, by supporting multimodal input and output channels, e.g., including expressivity through gestures and speech.
- 'Frequency': Increasing the possible frequency of user interaction to enable a mutually symmetric and coequal 'conversation' with the IDS artefact (whether or not these interactions are turn-based or real-time interactions).
- 'Meaning': Increasing the meaningfulness of user interactions for the story at a deeper semantic level than short-term reactions at the surface.

Each dimension presents a series of technical challenges to be solved, especially in processing user input as a part of a-priori unknown 'content' of a story. Besides the challenge of recognition of free multi-channel user actions, it is especially expensive to let authors a-priori hand-craft every possible flow of events following these actions, especially when they occur frequently. Therefore, AI researchers propose and claim that an interactive story system must 'generate' meaningful responses to users' actions, while 'automatically' maintaining a kind of logic and dramatic discourse. Several solutions have been presented how dedicated software – e.g., story engines, drama managers, or director agents – address this problem of creating a logical flow of causally dependent events. Examples of such generative solutions are described in Section 2.2. In the following, examples of applications and projects influential for this work are given.

2.1.3 Selected Examples of Interactive Storytelling Projects

With regard to the demands for 'highly-interactive' storytelling mentioned above, this section gives a brief illustrative and non-exhaustive overview of relevant prototypical systems that have recently been presented in the research field. *"Façade", "FearNot!", "Storytron", "Emo-Emma", "IDtension"* and *"Thespian"* (see Section 2.1.3.1) have inspired reflection of interactive story creation, which is in the focus of this work further on. Besides showing exemplarily a range of different interfaces and applications of highly-interactive storytelling, other selection criteria have been that these projects pertain to the same two-step approach that we follow in our case study (see Chapter 6, the 'Scenejo' system). This means, in a first step, authors create interactive artefacts to be delivered to end-users, whose experiences then build a second step of interaction. *"Geist"* and *"art-E-fact"* have been added as predecessors of this case study research.

To complement the picture, in Section 2.1.3.2, further prototypical IDS system examples (*"The Virtual Storyteller", "Teatrix", "Say Anything"*) are mentioned that follow different goals.

2.1.3.1 Exemplary Systems and Applications

The following examples are a selection of complete and 'playable' artefacts that may best illustrate IDS applications envisioned in this work. More often than providing fully playable systems, research prototypes of story engines only tackle and demonstrate technical achievements on partial research goals. The criteria for being selected as 'highly-interactive' artefacts ('Bandwidth', 'Frequency' or/and 'Meaning') are mentioned in Table 2.1, by referring to the above descriptions (Section 2.1.2). Also, the circumstances of their development and their available end results are outlined. In all projects, the development time and invested effort varies according to funding and other project realities. Further, distinctions can be made whether a system is finalised including a finite story structure in one bundle with a runtime engine, or an open story engine system offering the possibility to use the engine with different content instantiations.

IDS project	*'Highly-Interactive'* elements or aspects	Artefact type(s)	Project type
Façade[2]	Bandwidth, Frequency, Meaning. / NL interaction, effects on behaviour model	Playable interactive drama, one bundle with engine and finite story content	Long-term academic arts/research project. Independent game application.
VICTEC/ eCIRCUS, FearNot![3]	Bandwidth, Meaning. / NL interaction, effects on emotion model	Playable interactive drama, one bundle with engine and content	European consortial research project on agent technology. Educational application.
Storytron[4]	Frequency, Meaning. / Relationship models.	Toolset of authoring and playback systems, div. content loadable	Long-term personal research project. Application intended for interactive story creators.
IDtension[5]	Frequency, Meaning.	Runtime engine and story model, several contents loadable.	Long-term personal and academic research project. Multiple application types.
Emo-Emma[6]	Bandwidth, Meaning. Effects on plan details.	Playable interactive drama, one bundle with engine and content.	Technical demonstrator reg. emotional speech input and story planning.
Thespian[7] / TLTS	Bandwidth, Frequency, Meaning.	Complete system and toolset, playable training application	Long-term US Military-funded / academic research project.
GEIST[8]	Bandwidth, Meaning. / Effects on plot model.	Playable interactive drama, one bundle with engine and content.	Technical demonstrator in German research project on mobile Augmented Reality. Educational application.
art-E-fact[9]	Bandwidth, Frequency.	Toolset of authoring and playback systems, div. content loadable.	European research project on multimodal interaction and the Arts. Educational application.
Scenejo[10]	Bandwidth, Frequency, Meaning.	Toolset of authoring and playback systems, div. content loadable.	Independent educational research project. Mostly educational application.

Table 2.1. IDS project examples (selection criteria: their 'highly-interactive' aspects).

Façade

Many research community members agree in mentioning *"Façade"* as the most important representative artefact illustrating 'highly-interactive' storytelling. Beyond academic circles, it has received recognition within practical game developer communities in the area of 'independent games' in the year of its official release, 2005. The system has been technically developed inheriting parts of the research platform of the *"Oz"* project mentioned above (Mateas, 1997). The development time amounted to around 5 years by a small academic team. In *Façade*, two virtual characters act out a conversation along a rough plot outline, in the situation of a couple having a terrible argument (reminiscent of Albee's play *"Who's Afraid of Virginia Woolf"*). The

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[2] Project information online: http://www.interactivestory.net/#facade (Mateas and Stern, 2002).
[3] Project information online: http://www.e-circus.org/ (Aylett et al., 2005)
[4] Project information online: http://www.storytron.com/
[5] Project information online: http://www.idtension.com/ (Szilas, 2007)
[6] Project information online: http://www-scm.tees.ac.uk/f.charles/ (Cavazza et al., 2009).
[7] Project information online: http://www.isi.edu/isd/carte/proj_tactlang/index.html (Si et al., 2006)
[8] (Kretschmer et al., 2001), (Spierling et al., 2002)
[9] (Spierling and Iurgel, 2003), (Iurgel, 2006)
[10] Project information online: http://www.scenejo.org/ (details see case study in Chapter 6)

resulting role-play assigns the role of a friend to the player stopping by their apartment and getting involved in the quarrel – either to calm things down or to witness their break-up, by typing contributions to their conversation on a keyboard. It contributes to several aspects of 'highly-interactive' storytelling:

- Representational and multimodal bandwidth: The representation is a 3D CG[11] world (with a flat/cartoon rendering style), emotional facial expressions and recorded human, emotional voices. The user has a 1st-person point of view, can move freely in the 3D world and type text in natural language (English).
- Interactivity: One player can interact 'anytime' like in a conversation. The interactor's role is being a friend of the characters. Typed sentences can have meaning as discourse acts changing emotional states of the characters, which as a consequence influence the further plot.
- Plot: The married couple has invited the player on the evening of their wedding anniversary. The conversation turns into a fight, at the end of which the two potentially break up. The player can influence the order and some details of the small *"social games"* played by the two characters, including the outcome of their breakup.

Fig. 2.1. *"Façade"* screenshot (Mateas and Stern, 2002), showing representations of the storyworld (cartoon-rendering) and the user (typed text and hand cursor).

FearNot!

"FearNot!" is an educational game on the topic of bullying in schools, targeted at school children. It has been developed by a multi-disciplinary team within the European project *"VICTEC"*. Technically, it implements an emotional agent platform called

[11] 3D CG = Three-dimensional Computer Graphics

"FAtiMA", developed in parallel with the content during the project. It was released 2005 and tested with school children, being a pedagogical and technical challenge.

Fig. 2.2. *"FearNot!"* screenshot (Aylett, 2010) , showing a menu-based verbal interaction of the user (*"invisible friend"*) between animated episodes.

- Representational and multimodal bandwidth: The representation is a 3D CG world (with a 3D cartoon rendering style), emotional expressions and synthetic and recorded voices. Animations within episodes are generated in real time by a simulator, taking into account complex emotional models of the characters. The user does not move in the 3D world.
- Interactivity: One player can interact at defined spots between animated episodes. The interaction phase is mainly a dialogue between player and bully victim, which is partly menu-based and partly accomplished by typed text in limited situations. The interactor's role is an *"invisible friend"*, asked for help by the victim. The user's input influences the emotional model of the characters by selecting coping strategies from a menu, which is taken into account for the next simulated episode. In summary, the interaction is particularly infrequent, but has influence on the 'deep' model.
- Plot: In several possible situations chosen by gender and age of children, a main character is being bullied at school and asks the user (the 'invisible friend') for help. Depending on the player's advice, the next episodes show the outcome of coping strategies, for example hitting back, laughing away, telling parents etc. This plot structure has been inspired by Boal's forum theatre approach (Boal, 2002).

Storytron

"Storytron" is a multi-component system for the creation and playing of interactive stories. It has been developed by Crawford as a follow-up of his *"Erasmatron"* system, which can be considered one of the pioneer endeavours in Interactive Storytelling, started in year 1991. Interactive content to be run with the system is sparsely available, such as *"Balance of Power 2K"*, created by the developer himself. Crawford looks for creators who want to build stories based on the system, and indeed there exists an online forum for discussion of creation techniques. However, compelling examples beyond *Balance of Power* have yet to be published. For the creation of stories, no limitations are given, beyond the circumstance that the system dictates the style of interaction, which is based on language constructs with the *"toy language Deikto"* (Crawford, 2010a).

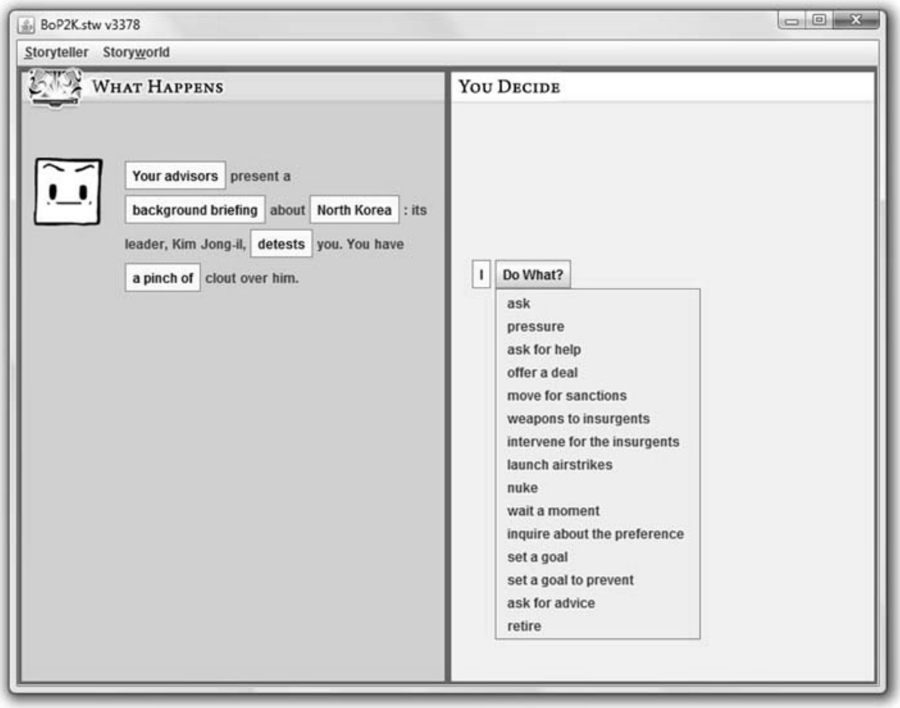


Fig. 2.3. ***"Storytron"*: screenshot of the interaction with *"Balance of Power 2K"* by means of the menu-style *"toy language Deikto"* (Crawford, 2010a).**

- Representational and multimodal bandwidth: The representation is text- and menu-based only, with potential icons presenting facial expressions with each sentence. The strict layout (Fig. 2.3) divides into system turns (left) and player turns (right). After interaction with a story, the result can be printed as a continuous 'literary' text for review. The communicational 'bandwidth' is symmetrically distributed between system and user.

- Interactivity: One player takes turns with the system, by frequent interaction. The number of selectable action options in a menu can be higher than explicitly authored sentences, because the user constructs sentences (with menu choices) according to an underlying grammar made of available *"word sockets"* varying by situation (the *"Deikto"* toy language). The digital characters choose actions in turn with the player by evaluating authored reaction rules to the verb base.
- Plot: In *"Balance of Power 2K"*, the player has the role of the USA reacting to incidents of international conflict, influencing its own standing in the public opinion.

IDtension

"IDtension" is a system created by Szilas as a proof of concept for a grammar model of minimal structures for interactive storytelling. The model implies that basic narrative actions of characters are generated by the system according to goals, tasks and ethical values of the characters, and in reaction to obstacles. One completed story of the system is *"The Mutiny"*, an adventure story on a 17th century galleon.

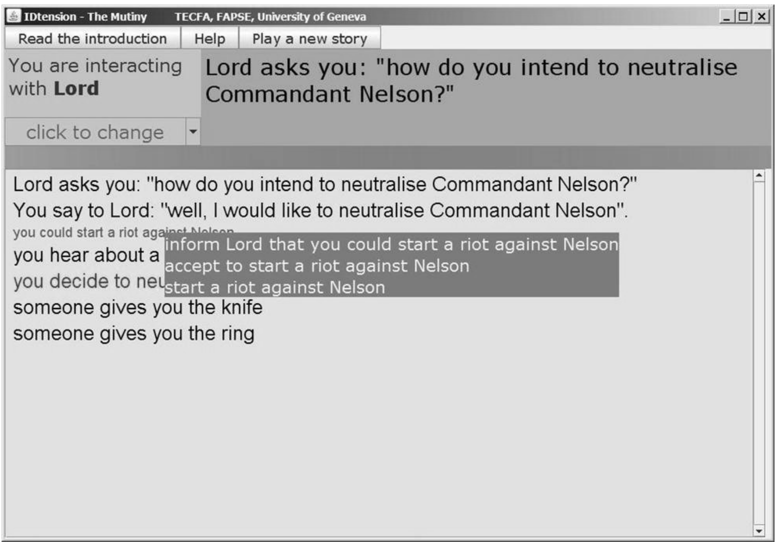


Fig. 2.4. *"IDtension"*: *"The Mutiny"* screenshot (Szilas et al., 2003) showing text-based interaction with choices offered by the system.

- Representational and multimodal bandwidth: As in *Storytron*, the representation is text- and menu-based, where menus are actually links within the represented story text. Such, they can be more complex in that they may allow the reselection of former actions and goals of characters.

Individual interaction with only one character can be chosen case-by-case. The displayed sentences are automatically built from authored templates.

- Interactivity: One player takes turns with the system, by frequent interaction. As in *“Storytron”*, the number of selectable action options can be higher than explicitly authored sentences, because *“IDtension”* generates basic action possibilities (of informing about facts, asking, etc.).
- Plot: In *“The Mutiny”*, the player has to plan a riot against the commander of the galleon, with the help of the non-player characters and by resource management (making friends, using objects as ‘agents’ to achieve goals, etc.).

Emo-Emma (Madame Bovary Prototype)

“Emo-Emma” is a technical demonstrator proving algorithms for emotional voice recognition and emotional planning. By mapping the user’s voice to narrative situations and virtual character’s feelings, users can influence the planning of the character’s following behaviour.

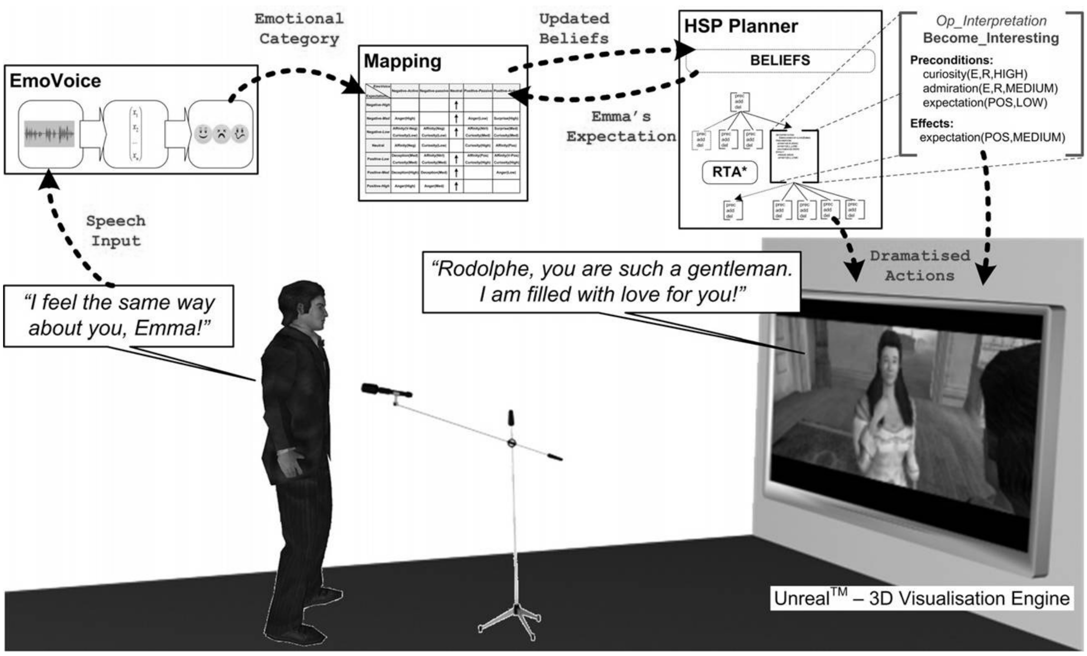


Fig. 2.5. *“Emo-Emma”*: Emotional speech interaction with Madame Bovary in a CAVE installation (Cavazza et al., 2009).

- Representational and multimodal bandwidth: The representation is a 3D CG world (with a realistically textured rendering style), possibly increasing sensorial immersion by surround stereo optics in a CAVE, with pre-animated sequences and synthetic voices. User input is performed in natural language including a speech-based emotion-detection system, trying to influence the emotional model of the character.

- Interactivity: One player speaks to ‘Madame Bovary’, trying to influence her attitudes in one directions or another by the sound of voice. Virtual Emma Bovary reacts with animated sequences, the choice of which results from a complex plan development towards decision points.
- Plot: Inspired by Flaubert’s novel *“Madame Bovary”*, the player obtains the role of *“Rodolphe”* trying to seduce *“Emma”* into an extra-marital love affair. Emma Bovary is torn between two conflicting goals (duty and pleasure) and reasons on her feelings based on the signals from the player, finally either sending him away or flirting with him.

Thespian / TLTS

“Thespian” (Si et al., 2006) as a system is based on many years’ research results, having started out from building *“Virtual Humans”* to perform mission rehearsals (Rickel et al., 2002) based on an intelligent agents architecture including dialogue management, story authoring and immersive real-time graphics (such as in a CAVE environment). *“TLTS” (“Tactical Language Training System”)* is one of its applications.

Fig. 2.6. *“Tactical Language Training System”* screenshot with GUI and 3D world interaction possibilities (Si et al., 2006).

- Representational and multimodal bandwidth: The representation is a fully immersive virtual environment, potentially in a CAVE with natural language interaction based on speech and gestures. Characters are rendered with behavioural animation.

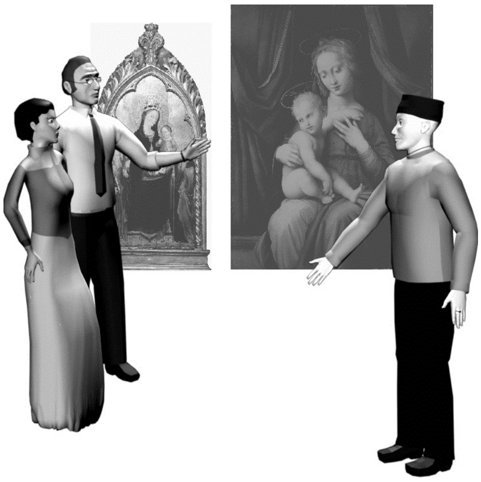
- Interactivity: Players may use GUIs to move their avatar around in the world. Potentially they can interact by speech input and gesture recognition.
- Plot: In an educational environment (with several realised stories), the player is typically a soldier on a mission in the Arabic world. The 'story' is typically a setting to solve particular tasks in a foreign country, such as introducing oneself, obtaining directions, and meeting with local officials. Aide characters offer suggestions to the player. In Fig. 2.6, the mission is to find the right words and strategy to gain trust of the inhabitants of a village.

GEIST and art-E-fact

"GEIST" (Kretschmer et al., 2001; Spierling et al., 2002) and *"art-E-fact"* (Spierling and Iurgel, 2003) have been projects of previous research preceding the investigations presented herein. They combined the development of interactive storytelling concepts, story engines and innovative interaction modes, making use of special interfaces that suit the interactive story content. *GEIST* introduced cutting-edge mobile AR technology as *"magic equipment"* to interact with ghosts walking over the Heidelberg castle. *art-E-fact* integrated tangible interfaces and dialogues to communicate with virtual characters in a museum, and had a focus on authoring tools. Both projects contain only little 'dynamic' content, but are early examples of increasing interactivity by interfaces.

- Representational and multimodal bandwidth: *GEIST:* The representation is a 3D CG animation of a virtual character as a floating overlay to 'reality' observed through a see-through device. *art-E-fact:* 3D CG animations of two characters who can present objects and talk to each other and the user.
- Interactivity: *GEIST:* User 'input' is done by walking in the outdoors (GPS plus other sensors) and using a PDA. *art-E-fact:* 3D CG animations are triggered by interacting with tangibles and text input by a keyboard.
- Plot: Both applications follow the instrumental goal of delivering historical information in an edutainment-based arrangement. *GEIST:* The user meets a ghost who asks for help, telling stories of the past and leading the user to meet other ghosts in the castle. *art-E-fact:* The user meets two or three characters who have a debate over art-related themes, asking the user for opinions, or asking him to interact with tangible devices to find out more details about a painting.

Fig. 2.7. Applying choices through special interfaces. Left: *"GEIST"* – in the Mobile-AR scenario, interaction occurs through finding ghosts by walking in real locations. Right: *"art-E-fact"* – video-tracked pointing gestures select parts of a painting, while special props define the meaning of the interaction (Spierling, 2005a).



Example of interactive script:

MARIA:	Oh Fritz, you know, my father worries about art forgery.
FRITZ:	What the heck - I only want to create more of these, for people who love meditation.
MARIA:	But the pigments they used had a symbolic value -- therefore, only the original facsimiles can praise the Lord appropriately!
FRITZ:	Hey, guess why I want to use original pigments?!! I want to do it the best way possible!
MARIA:	I don't know. <towards visitor>

Fig. 2.8. *"art-E-fact"* conversational interaction: example dialogue of the interactive drama (Spierling and Iurgel, 2003).

2.1.3.2 Further Systems

Above systems are meant to be examples showing a variety of different approaches of applications (for architectures see Section 2.2), but they are not the only ones. A more exhaustive listing of state-of-the-art systems including their authoring approaches is provided in Appendix B. In order to illustrate boundaries of this research, also three other IDS systems are briefly mentioned (exemplarily) that fall outside our previously given definition for selection. They follow different philosophies of how to interpret 'Interactive Storytelling' – which is, not in the sense that authors create interactive end-user experiences for someone else. Thus, they are less related to the questions targeted by this research and the case study described in Chapter 6.

The Virtual Storyteller

"The Virtual Storyteller" (Swartjes and Theune, 2008) is a generative narrative simulation system that technically uses plan operators. End-users can perform iterative authoring tasks with the simulator, but apart from that, there is no interactive story authoring result that can be delivered to a third party. Users can specify abstract stories by operators, similar to a story grammar. The *"Fabula"* system component is then capable of 'telling' the result as a linear narrative. Users can then iterate and try different grammar constellations to achieve different narratives.

Teatrix

"Teatrix" (Machado et al., 2000) is a collaborative virtual environment for children, with the goal to bring dramatic actions onto a stage. It follows educational goals, putting children into the role of authors of their own imagined dramatic actions in the sense of *"make-believe"*. In fact, the system contains authoring tools for children that constrain possible roles to a pedagogical frame, for example certain fairy tales. In the end, children author little stories or 'artefacts' that they can present linearly to others on a *"virtual stage"*.

Say Anything

"Say Anything" (Swanson and Gordon, 2009) is a collaborative storytelling application using crowdsourcing to fill a database of sentences that can be used similar to a chatbot pattern database. The database can at first be filled by sentences from online blogs, and further by end-user selection processes. In many iterations, the system presents users possible answers to typed sentences and lets them choose a best reply. That way the system is trained to recognise suitable answers in certain contexts. While users are interacting with the system, the experience of entertainment and contributing to the authoring is supposed to take place at the same time.

2.1.4 Conclusion for Reviewing the State of the Art

The vision that drives this research is related to the before-mentioned projects and achievements. However, we pursue to carve out the creative fundamentals to be accepted by future authors without a background in computer science or AI. Looking for 'conceptual models' supporting effective creative conception, we are interested in all related themes that would offer such conceptual models or suitable contributions. At the outset, the understanding of prerequisites and the accomplishment of ‘highly-interactive’ IDS applications affords the mastering of a variety of expert topics, which are part of ongoing scientific studies and practitioners’ developments within the wider research community. In this sense, the project examples outlined in Section 2.1.3 also point to the state of the art in story engine development, especially their architectures as models for content or processing in interactive storytelling (see Section 2.2).

Fig. 2.9 reprises the abstract overview of research themes outlined before (Fig. 1.1), putting it into context of this text’s sections. The picture’s left side elements define technological approaches and concepts developed in mostly academic computer research labs. The resulting executable models, engines and also – if available – accompanying authoring tools can be seen as the technical ‘raw material’ and ‘toolsets’ currently offered for creation in IDS. The following description of the state of the art at first focuses on these contributions. A number of technical frameworks are analysed (Section 2.2), in so far as they set the stage for concrete creative realisations, and therefore may provide necessary models for authors to adopt. The available literature on research in IDS authoring is reviewed in Section 2.3. Further relevant theoretical studies within several branches of the Humanities/Design side are discussed in Chapter 4, assuming them to possibly influence conceptual thinking of contemporary interactive story creators.

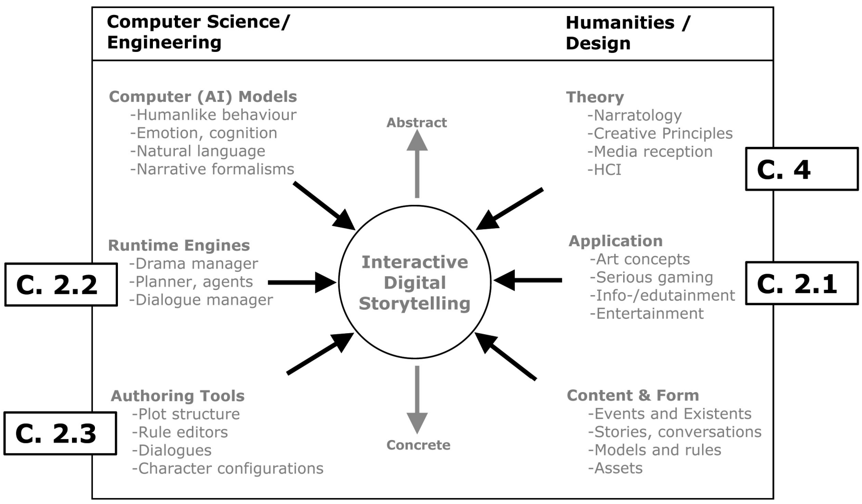


Fig. 2.9. Outline of chapters covering different research fields (compare Fig. 1.1).

2.2 Technical Approaches to Interactive Digital Storytelling

The motivation for authors to look at technology developments is that effective ‘highly-interactive’ storytelling affords solutions based on intelligent computing. Disregarding any possible comprehension gaps, 'generative' software technologies can be seen as a type of raw material for creative work, enabling achievements beyond 'manual' solutions. Completely hand-made solutions soon reach limits regarding their flexible yet adequate reaction to user input, regarding reorganisation of a plot outline under user influence, and regarding variability of the playback/experience in cases of repeated consumption of the same content.

2.2.1 Generative Systems in Interactive Storytelling

Amongst other things (and to a great extent), a storytelling experience is determined by the sequence of narrated events. In IDS, one purpose of generative systems is to produce this sequencing. Fig. 2.10 illustrates this role of generative systems within IDS in general. Here, the final event sequence is determined by three potential sources: 1) the 'Author' providing hand-crafted elements and structure before interaction, 2) the 'Engine' that generates (parts of) the final event sequence on the fly, and 3) the 'Audience' whose end-user interactions also influence the result. In highly-interactive storytelling, the outcome of the third source, which is the audience, cannot be fully determined before delivery of the artefact. It is the role of an engine to operate on two challenges: First, it interprets any end-user events during runtime, and second, it 'generates' story events in reaction that result in a believable story experience for end-users.

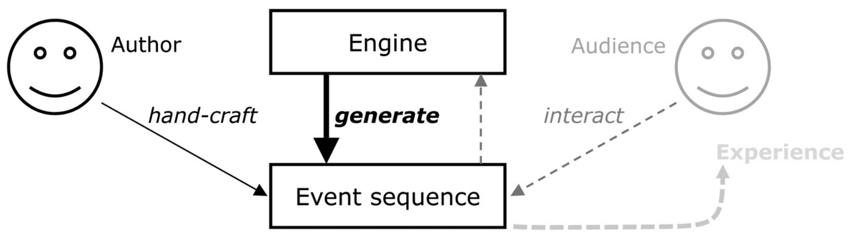


Fig. 2.10. The general role of generative systems ('Engine') in state-of-the-art IDS, as opposed to hand-crafted event sequences.

What exactly gets 'generated' on the fly can vary, depending on the applied approach. The imprecision of this general term ('to generate') contributes to current communication problems between story creators and engineers in this respect. In Fig. 2.10, there is (with intent) no connection made between 'Author' and 'Engine'. This reflects the researched state of literature on authoring for story generation (see Section 2.3), which is dominated by its original engineering point of view. However, no engine generates a story from scratch. It rather uses formal structures that need to be understood and prepared – hence, 'authored'.

This incomplete picture that excludes authors (apart from the engines' programmers) in the technical literature may result from the history of engineering generative storytelling systems. First attempts to actually create stories with computers were made about 30 years ago. These begun as exercises in computer linguistics studying human cognitive behaviour. Story grammars that were previously researched for understanding story comprehension (see also Section 4.3.1.2) were reversed in their role from comprehension to generation. First story production systems were restricted to linear text generation and limited to a few lines for a completed story using high-level plot elements, such as those identified by Propp (1968). Examples of such systems are *"Tale-Spin"* (Meehan, 1977), *"Universe"* (Lebowitz, 1984), and *"Minstrel"* (Turner, 1994). *Tale-Spin* created event sequences from plans of characters following their implemented needs. *Universe* was based on models of human memory and story understanding, going back to Schank and Abelson (1977). *Minstrel* added author goals and used case-based reasoning to create new stories in one restricted theme by reusing story elements of formerly told stories. Turner's experiment, letting *Minstrel* create short *"King Arthur"* stories, aimed at building a creative machine fulfilling all tasks of an author. The results showed that it was easier to achieve his particular goals associated with 'structure' – such as the creation of simple correct sentences and consistency in their ordering – than the goals concerned with 'creativity' – such as providing purpose and a message, art and language (or entirely 'new' content). Turner briefly defined the remaining *"storytelling problem"* as the fact that storytelling is not consistency and plausibility alone, but creativity and content. Particularly, a storyteller is no *"simulator of reality"*, merely reporting events in *"slavish consistency with real life"* (Turner, 1994), but, first of all, has an intention and purpose driving her/him to tell events and use words in a specially crafted way.

Recent revivals of this generative idea applied linguistic knowledge to the presentational level (Callaway and Lester, 2001) or re-implemented story knowledge bases by means of the *"Ontology Web Language"* (Peinado and Gervas, 2006). In addition, research in story generation has inspired the building of interactive story engines. As an ongoing research endeavour in linear story planning, for example by (Riedl and Young, 2004; Riedl, 2009), there are many cross-fertilisations of research results. All approaches require a predefined formal world description as input and re-order that knowledge based on causal or narrative constraints, often inspired by the study of narrative structure.

2.2.2 Plot-based vs. Character-based Approaches to Interactive Storytelling

In Interactive Storytelling, story engines maintain coherence during the interactive presentation of story events according to an underlying predefined story model. Taking into account a variety of users' interactions, the issue to solve is that the credibility of the story's characters regarding their short-term reactions or long-term plans is possibly at stake and shall not be lost.

There are two initially opposite philosophies on how this can be achieved:

- first, by adaptation of a more or less pre-authored plot to user interactions, providing reactions to user choices through recombining or concatenating pre-produced global components, and
- second, by automatic plot generation through simulated local behaviour calculated from parameter sets of virtual characters and ontological world descriptions.

These two approaches are also referred to as the 'plot-based' approach versus the 'character-based' approach. The first academic endeavours toward interactive drama emphasised the character-based approach in the development of autonomous 'believable agents', but still proposed some combined control at plot level. This philosophy was introduced with the *"Oz"* project (Kelso et al., 1993). The underlying assumption was that a coherent story line would emerge from the agents' autonomous behaviour, but controlled with the help of infrequent interventions from a drama manager, working with a plot representation (Mateas, 1997). Until today, plot-based as well as character-based approaches – both with generative features – are being followed up within the research community.

2.2.2.1 Plot-based Control

Plot-based approaches provide better top-down control through authors, and therefore, a better chance to obtain story coherence through explicit authoring. However, they either provide only few choice possibilities for users, or, in order to increase their number, also excessively increase the quantity of combinations that need to be explicitly prepared for. Arguments in favour of plot-based solutions have stated that the alternative – in fact a bottom-up simulation – is hard for authors to grasp, since it has to be 'programmed' and the order and effect of resulting events eventually become hard to predict. While the result shows emergent and diversified content every time the simulation runs with different interactions, there is no firm grasp of the resulting experience beforehand, because the written story is *"code that operates at a higher level of abstraction than the designer understands"* (Crawford, 2010b).

The plot-based approach lets skilled writers better conceive and define the actual actions that take place, setting up an abstract plot structure, as in (Spierling et al., 2002). This implementation of strong plot-defining rules developed by Grasbon (2001) for the *"GEIST"* project has been based on Propp's morphological structure (Propp, 1968) explained in Section 4.3.1.1. It offered control at the high-level construction of story development by varying Propp's found morphemes (see Fig. 2.11). The difficulty was then to integrate and 'carry over' into the plot the effects of user interaction, which typically happens at more local levels. Similar experiences have been reported by Tomaszewski and Binsted (2007).

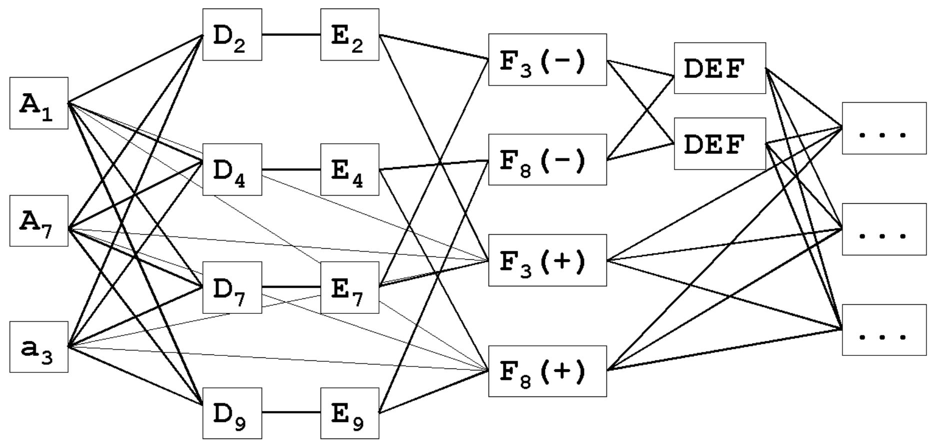


Fig. 2.11. Prototypical story graph of *"GEIST"*, using narrative rules based on Propp's morphemes (Spierling et al., 2002). Abbreviated functions A-F see Fig. 4.3.

2.2.2.2 Combining the Approaches: Drama Management

The results showed that a combination of these antagonistic approaches within one system would be more promising. Character-based approaches enable simulations of interactions between parameterised behavioural models of AI characters, representing virtual mental and psychological states as in (Lim et al., 2005), or individual plans such as in (Charles et al., 2001). The advantage is a flexible simulation game-like structure providing flexible reactions to local user actions, letting the players control the world, while the disadvantage may be a difficulty of dramatic closure and long-term coherence of actions due to a lack of high-level plot structure.

In recent research, a middle course between these extremes has been established, initiated by *"Façade"* (Mateas and Stern, 2002), which built upon ideas of *"Oz"* (as mentioned above). Many approaches pursue a combination of modelling story characters as believable agents and having a controlling agent taking care of the author's intent. The latter is a centralised software component responsible for drama management. In Fig. 2.12, *Façade's* architecture including the drama manager is shown (Mateas and Stern, 2002). It is motivated by the natural tension between *"player autonomy and designer's intent"* (Roberts and Isbell, 2008).

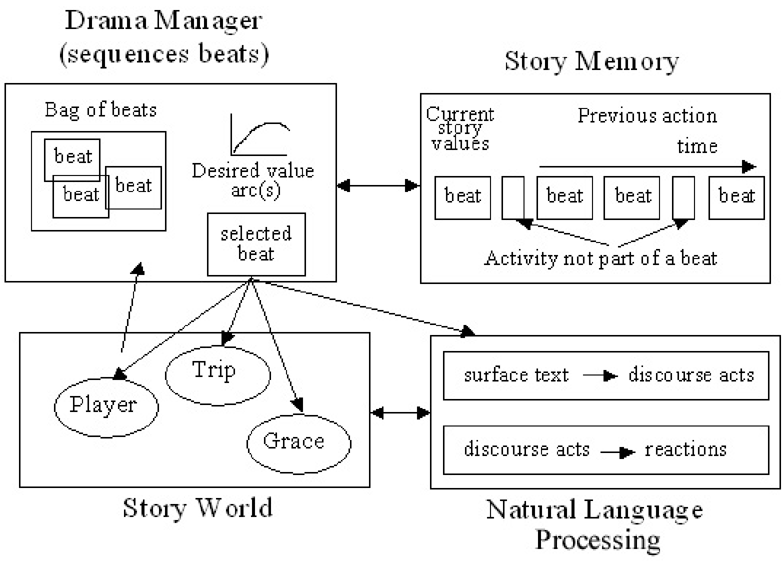


Fig. 2.12. ***"Façade"*** **architecture including its drama manager (Mateas and Stern, 2002).**

In that sense, the player's agency is tightly coupled with autonomous characters reacting believably to local input by preserving their character traits, whereas the plot progression planned by the designer needs a coordinator like a 'director' of the scene. According to Roberts and Isbell (2008), who have presented a survey on different drama manager solutions, biases are possible between an omnipotent *"micromanaging drama manager"* that corresponds to linear solutions as in traditional drama, and *"no drama manager"* that corresponds to a fully autonomous experience. The intended 'middle way' drama manager takes infrequent actions to influence the plot otherwise emerging from character interactions. Typical drama manager components are a set of plot points, a set of drama manager actions that can be taken centrally, a model of player responses and a model of the author's intent. With this information, the drama manager can select own actions to correct or guide a flow of actions towards a desired plotline (Roberts and Isbell, 2008).

For authors, it is relevant to define this guiding information, such as the setting of plot points as narratively important events, defining constraints for their ordering, and possible drama management actions, for example prompting a character to pro-actively begin with a certain action (Nelson and Mateas, 2008). Another important issue is to define evaluation functions, which are author-specified functions that capture the *"story or experience goodness"* for a specific world. Chen et al. (2009) discuss the issue that drama managers had previously been evaluated according to various technical criteria, except for their usefulness for authors. They identified proper evaluation in this direction as future work, in that *"drama management authoring"* should be compared with equivalent content creation in traditional ways based on *"script-and-trigger authoring"* – considering whether it would be reasonable to hand-author instead. Suggested criteria for comparison would be *"complexity"* and in particular *"complexity scaling with story size"*, *"ease of policy change"*, and *"variability of experiences"* (Chen et al., 2009).

2.2.2.3 Strictly Character-based Approach and Emergence

Solutions with a minimised control of a drama manager or a complete bottom-up simulation fulfil the quality of 'emergent narrative'. The term *"emergent narrative"* has been coined for Interactive Storytelling by Aylett (1999), as a philosophy of rather seeing narratives emerge from local interactions in virtual environments, than in an authorial intent to control a narrative plot in an environment that provides agency to users and virtual agents. This clash has been described as the *"narrative paradox"* (Louchart and Aylett, 2005). Aylett's group has since then fleshed out the concept and co-developed technology based on intelligent and emotional agents.

One outcome (discussed above) is the *"FearNot!"* prototype (see Fig. 2.2) created in the EU-funded projects *"VICTEC"* and *"eCIRCUS"* by a collaborative effort of different disciplines. Underlying the *FearNot!* application, the AI software *"FAtiMA"* (Dias and Paiva, 2005) simulates the decision making process of freely acting agents in an improvisation. Fig. 2.13 shows the *FAtiMA* architecture including the cognitive emotional model and the reasoning of the agent. All events including the user's actions are 'appraised' by the agent at two levels, thereby updating its world model and emotional state. Following this, a coping strategy is chosen to either correct its emotional state or to act on the problem.

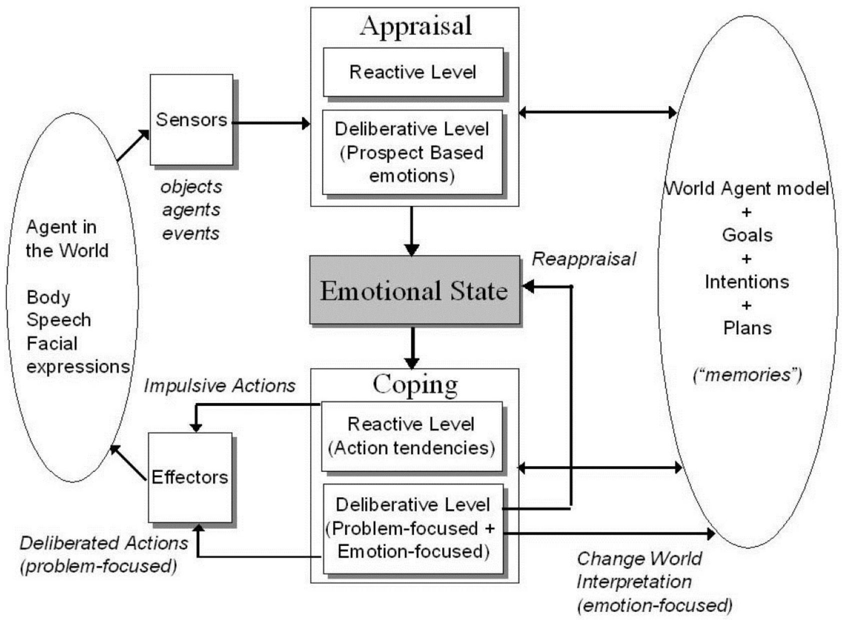


Fig. 2.13. Emotional *"FearNot!"* agent structure *"FAtiMA"* (Dias and Paiva, 2005).

This psychological model is the base for autonomous behaviour of the agent, defining its actions and reactions to any incoming events. Consequently, no authoring of actions is necessary or appropriate, except the configuration of the agent regarding psychological dispositions. In *FearNot!*, no authored plot points exist to generate an episode. However, the system implements a *"facilitator agent"*, controlling the interaction between the episodes.

2.2.3 Models of Interactive Digital Storytelling Systems

As seen in the previous section, both approaches – plot-based and character-based approach – try to solve the dilemma between full freedom of users in a virtual environment and the intent of authors motivated to express a story with a certain plot. An optional drama manager can mediate between the extremes. Apart from that, system descriptions in literature may differ concerning the ways their plots or other elements of the content structure are defined, and concerning their architectural system components and procedures. They all provide conceptual models for explaining Interactive Storytelling. However, their descriptive levels are mostly not comparable, and story creators find few connections to familiar concepts.

Table 2.2 gives a brief overview of exemplary research projects or IDS systems, partly already mentioned in the overview above, comparing their underlying 'models' regarding technical architectures. The basic philosophy of the system (plot-based, character-based or other) is categorised, differences in assumed plot structure and the availability of authoring support are indicated. Further characteristics are omitted in this overview, such as content or representation (mentioned in Section 2.1.3).

IDS project	Philosophy	Plot Structure	Authoring Tools
Façade	Middle ground between character-based and plot-based	2 levels of granularity, annotated 'beats', 'joint character behaviours' prepared	*"ABL"* behaviour programming language. Philosophy: *"artists must program"*
VICTEC/ eCIRCUS, FearNot!	Emergent narrative, improvisation scenario, facilitator agent,	Boal's forum theatre, impro episodes without prepared plot	XML definitions of character traits, goals, emotions, coping strategies on the highest level
Storytron	'Verb' philosophy of single actions, character-based and reactive to player actions	Linguistic structure, organised by reaction cycles to conditional actions, no 'plot'	*"SWAT"* editors for reaction rules, character traits and relationships
IDtension	Simulation of abstract narrative grammar	Goals, tasks, obstacles, values, probabilities	XML structure and spreadsheets
Emo-Emma	Character-based, planning towards character goals	Heuristic Search Planner, rearranging plot elements	Editors for propositions of a planning domain, operators, dynamic plan visualisation
Thespian / TLTS	2 levels of multi-agent system and a plot director agent.	Director agent, coordinating agents' partial order plans	Complex parameter tuning interface for goal fitting of agents
GEIST	Plot-based (but abstract level plot)	Propp-based plot graph	XML declarations, initial graphical scene editors
art-E-fact	Middle ground but more plot based	Directed graph plus AIML, state machine, Jess rules	*"Cyranus"*, state chart visualisation and timeline editors
Scenejo	Middle ground between character-based and plot-based	Directed graph (DG), plus AIML (Stimulus-Response elements), state machine	Plot graph (DG editor) and Stimulus-Response AIML editor

Table 2.2. Overview of selected IDS research projects (see also Table 2.1 including references).

Most of the mentioned systems started as an endeavour in computer science to approach Interactive Digital Storytelling, looking for synergies between AI models and dramatic principles (*Façade, FearNot!, IDtension, Emo-Emma*). While *Façade* also draws motivation from the arts, defining novel terms such as *"Procedural Arts"* as well as *"Expressive AI"* (Mateas, 2001), few of the systems have started from a practical storyteller's point of view (*Storytron, art-E-fact, Scenejo*). As the systems differ in their philosophies, their interaction paradigms and their technical solutions to story management, they also provide different conceptual models of how to understand Interactive Storytelling.

For example, in *FearNot!*, interactive drama is meant to be a role-playing game close to improvisational theatre (see above). As such, it models a facilitator agent and abolishes the concept of an author – as any resulting 'narrative' emerges through system parameters and by user action. In *Storytron*, a philosophy of situated reactions is implemented. Authors are required to fill a storyworld with disconnected abstract actions as possible responses to a set of specified other abstract actions.

In *Storytron's "SWAT" ("story world authoring tool")*, for each abstract action (called a *"verb"*), definitions have to be made by authors about which character can perform it, who can react to it, an evaluation function choosing a preferred reaction, the consequences of the action and more. Fig. 2.14 shows an excerpt of a reaction cycle of an 'actor' explained within the online tutorial material (Crawford, 2010a), assuming that in order to build a successfully working storyworld, it is necessary to understand the reasoning of the system.

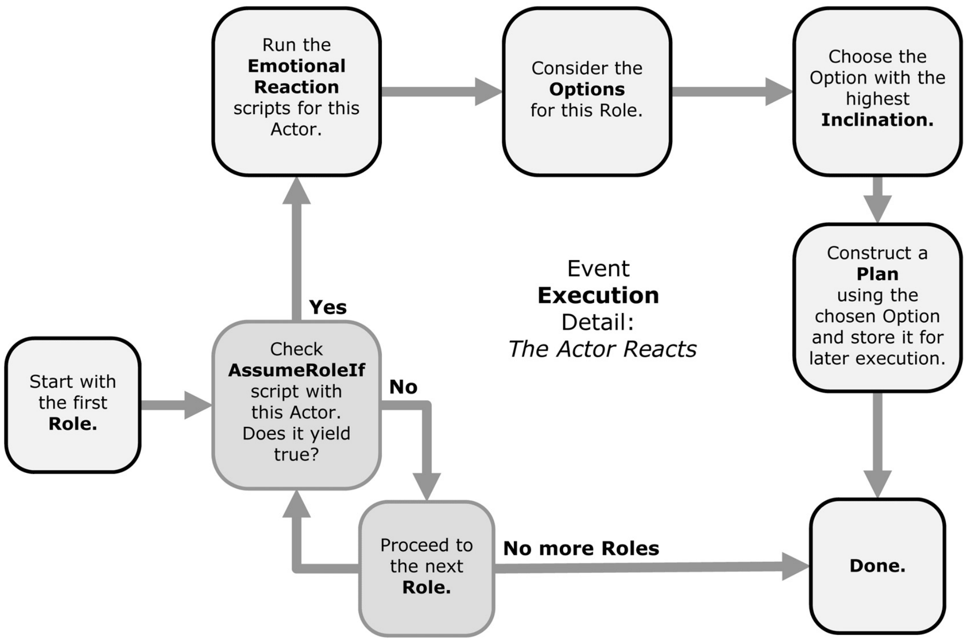


Fig. 2.14. Illustration of the processing of events in *"Storytron"* adapted from (Crawford, 2010a).

IDtension is based on a model of *"minimal stories"*, inspired by narrative theory (Szilas, 2007), among others by Greimas (short explanations in Section 4.3.1.2). The model describes a grammar of an action structure. *IDtension's* basic action element is a *"task"* leading to a *"goal",* which can be made impossible by an *"obstacle"* (Fig. 2.15). To allow the story generation system to overcome the obstacle, further goal/task structures have to be foreseen by an author, leading to deviations that solve the problem. It is a structure that lends itself easily to adventure-like stories, in which simple tasks can be solved by acquiring an object or a skill. The more complex the structure built during authoring, the more dynamic and variable the story can get.

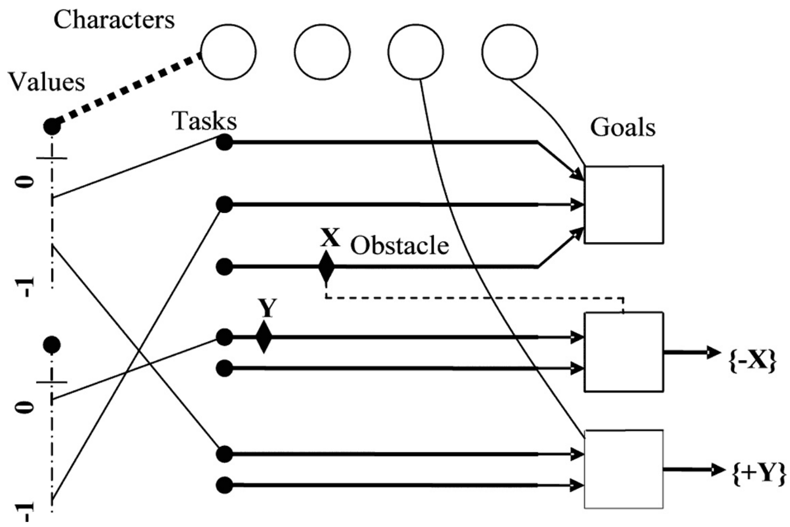


Fig. 2.15. ***"Goal-task-obstacle"*** **structure authoring for** ***"IDtension"*** **(Szilas, 2007).**

Another unique concept is to base story engines on planning algorithms of agents. For example, the *"Emo-Emma"* / *"Madame Bovary"* agent (Cavazza et al., 2009) consists of a planner, which step-by-step defines the next action to be taken during play. It compares a temporal current state with a predefined goal state, and searches its repertoire of actions to find a sequence that best leads to achieving the goal. Such a planner can reason on the consequences of an action in the sense that it can simulate the possible paths that follow an action. The authoring consists of the 'knowledge construction' of a planning domain, defining the important states (initial state, goal state) and actions in the form of operators. Fig. 2.16 shows the deliberations of the action planner of the *"Emma"* character torn between two conflicting goals. Planning can be applied to a character or a whole plot, which means it can support either plot-based or character-based approaches.

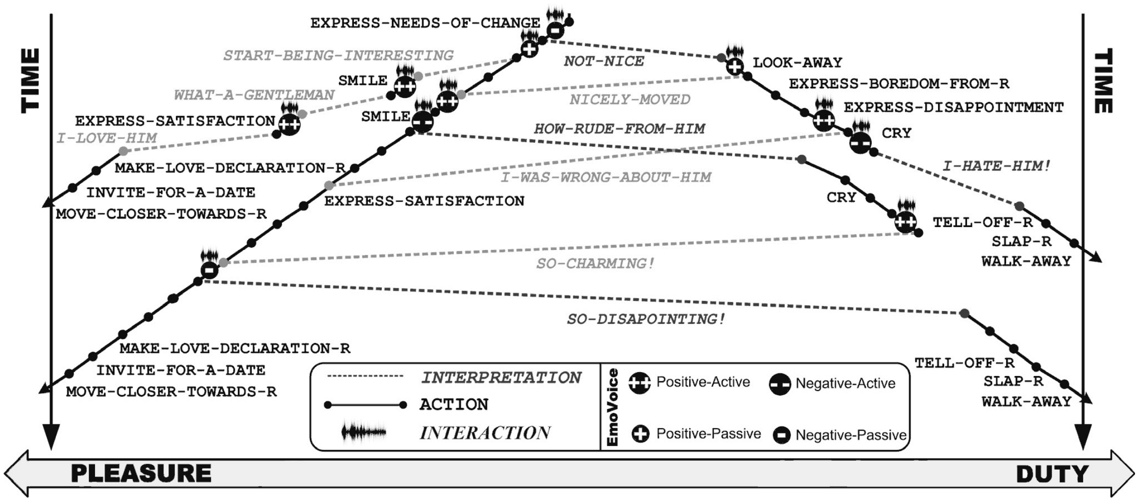


Fig. 2.16. Plan structure of ***"Emo-Emma"*****, including possible adaptation to user actions in a performance (Cavazza et al., 2009).**

In summary, the main goal targeted by the development of most IDS engines is a semi-automated presentation of dramatic actions in response to user activity. Approaches differ in their philosophies about basic concepts of Interactive Storytelling, their architectures partly based on theoretical constructs, their addressed forms of human-computer interaction and the potential role of the user, and their presentational characteristics. Figuring out similarities and differences, and thus defining genres of IDS, each of which share similar technical concepts is part of the ongoing work in the community.

The different technical approaches delimit and define the scope of possible interactive experiences and content of storyworlds to be built. Therefore, for authoring, a basic understanding of the concepts of an engine is necessary in order to anticipate the possible user experience and possible stories.

2.2.4 Conversational Systems

There is a significant motivation to use verbal conversations and dialogues between virtual characters and human participants since the success of *"Façade"* (Mateas and Stern, 2005) as the first fully working prototype of Interactive Storytelling. The reasons are:

- Frequent turn-taking following a conversation metaphor grants a level of agency to the user.
- Verbal and non-verbal conversations reveal inner traits and emotions of characters and are used between humans to maintain relationships.

Using *Façade* as a model, users do not just choose sentences from menus, but type free text to express utterances. In this case, conversations between users and virtual characters cannot be fully pre-scripted by authors beforehand, because users' contributions are unknown at the time of authoring. Following 'generative' principles of plot-construction discussed above, methods have to be used that at runtime find coherent reactions of virtual characters to user utterances, while still maintaining an interesting dialogue that fits the overall plot. These methods point to the computer linguistics field of Natural Language Processing (NLP). Interactive Storytelling poses technical challenges to NLP that overstrain current technical solutions, although research in NLP goes back to the 1960's and as such is older than research in narrative intelligence.

The consequence for creators is that in order to succeed in designing a naturally feeling and acceptable conversation with digital actors, and for designing meaningful dialogue acts as part of an interactive story, knowledge about some used algorithms in dialogue management is needed. In particular, the limitations of current NLP technologies need to be known.

2.2.4.1 Conversation and Dialogue Management

In the context of this work, one focus is placed on IDS systems enabling conversational interaction with virtual figures (see Chapter 6). Therefore, dramatic coherence is aspired to not only on high-level plot, but also on low-level acts, such as verbal utterances. Dialogue systems facilitating verbal interaction between a human and a computer are rooted in early AI experiments, which strived for a computer that 'understands' – with inventions, such as *"Eliza"* (Weizenbaum, 1966), *"Parry"* (Colby, 1974) and *"SHRDLU"* (Winograd, 1971). While the first two are based on word pattern-matching techniques applied to tele-typed text, *SHRDLU* also included a basic system of knowledge about the limited universe of blocks that it could converse about. Pioneer researchers in this field still state that the initial goal – to make the computer 'understand' – has not been achieved yet. There has been a debate in AI philosophy about 'strong AI' and 'weak AI', asking whether or not this goal would be achievable at all. It goes back to Searle's argument that true consciousness cannot be achieved by formal logic systems, as illustrated by the *"Chinese Room Argument"*. (Searle, 1980)

These conditions are not necessarily harmful in the context of this research, as the goal is not to create all-knowing fully-fledged 'virtual humans', but rather 'actors' that can act out pre-defined scripts and still respond believably to user input. Hence, models are necessary that are pragmatically sufficient in extracting enough information from user utterances to give users the right feedback to keep them active – in other words, to give them the impression that their actions are taken into account.

One of the most author-accessible (yet simple) technologies for creating conversations with agents in the tradition of *Eliza* and *Parry* is known as *"chatbots"*, such as the open source project *"A.L.I.C.E."* and related bots (Wallace, 2010) (see also Chapter 6). However, the applied functionality is mostly constrained to relatively simple pattern matching and leaves out sophisticated dialogue planning functionality. The resulting conversations with bots that are currently available on web pages follow a question-answer principle assigning the initiative to the user. They partly appear entertaining, but faulty in the event the user fails to ask the right questions. The modelled structure of the conversation is that of a huge so-called ‘knowledge base’ of dialogue patterns, such as a corpus of frequently asked questions and respective answers without a defined order.

The opposite approach to forms of human-computer conversation is a strictly task-oriented dialogue initiated by the machine, e.g. facilitated by the system *“Suede”* (Klemmer et al., 2000) or the *“CSLU toolkit”* (CSLU, 2010), frequently used in telephone call centre systems or reservation systems. The resulting conversation has no unilateral goal to entertain, but the conjoint goal to achieve a certain result, making user and system team players. The dialogue contains utility parts, such as concise prompts, confirmations on user input and repair loops (also compare Section 4.4.3.2). Further advanced systems allow for mixed-initiative dialogues, providing reactions to less constrained user input. The modelled structure of this dialogue is frequently a tree-like menu structure of questions and prompts, providing a predefined order of events. Theories of *“speech acts”* (Searle, 1969), *“dialogue moves”* or *“dialogue states”* (Larsson and Traum, 2000) and concepts of discourse analysis (see Section 4.4.3) have further been supportive to structure conversations. They have been integrated in complex research projects leading to systems for conversations in collaborative task management between a user and a system in narrow domains, for example *“TRAINS”* (2010) and *“TRINDI”* (2010).

For the majority of IDS, those extreme forms of dialogue are not applicable. Most stories come to life and develop drama through more than one modelled character. This implies that there is no simple face-to-face conversation between one human and a machine, based on a strict turn taking. More likely, it is a complex mixture of dramatic presentation with user interaction and no strictly defined alternation of turns. An interactive presentation of character groups was first developed by André and Rist (2000), with a focus on the generation of the conversations and with little user interaction. Depending on the form (or genre to be developed) of IDS, specific dialogue management needs to be designed and adjusted to the requirements of the intended interactive experience of the piece. While in the games industry, dialogues are still mostly author-written (Bateman, 2007), there are also experimental forms of structuring dialogue based on NLP insights (Brusk and Björk, 2009). In NLP research, visions are to generate language completely on the fly without authoring, for example for NPC gossip in games (Khosmood and Walker, 2010). In IDS, there are only few such implementations yet, for example in the *“I-Storytelling system”* (Cavazza and Charles,

2005) and *"Thespian"* (Si et al., 2006) for the *"Tactical Language Training System"* (Johnson and Valente, 2008).

The bottom line for successful interaction is that it is necessary to employ natural language understanding in an adequate way, in order to map user utterances to meaningful and appropriate dialogue acts in a given story context. That said, it also implies that the smart design of story context, dialogue structure and implied player tasks is a key to success. This assigns increased responsibility to designers of IDS artefacts, who not only craft a story containing characters and dialogues with dramatic coherence 'in spite of' interaction, but include careful interaction design on the dialogue level.

2.2.4.2 Beyond Verbal Conversation

In order to interact with believable representations of humanoid characters through multimodal techniques, the research field of 'embodied conversational agents' (ECA) also provides major contributions to current conversational systems that are relevant to IDS. This research lets 'dynamic' (ad-hoc) animations of virtual humans be controlled by speech script annotation. The main emphasis lies on digital 3D character representations with complex expressive gesture capabilities, as developed by Cassell et al. (1999). Emotional cues, such as gestures and facial expressions, can be described by extended mark-up languages, mainly formed by annotations to XML-based dialogue. Cassel et al. developed the *"Behavior Expression Animation Toolkit"* BEAT (Cassell et al., 2001). Another example XML dialect is RRL (*"Rich Representation Language"*), designed to be used at all levels of representation, from abstract scene representations to more or less media specific representations, determining the final output (Piwek et al., 2002). Several diverse developments have further been consolidated in defining *"The Behavior Markup Language"* BML (Vilhjalmsson et al., 2007).

For IDS, Mateas and Stern (2004) have defined their own behaviour description language ABL *("A Behaviour Language")* for the design of Façade (Mateas and Stern, 2002), integrating verbal and non-verbal behaviours. Löckelt (2008) presented an automated *"Virtual Human"* system with multimodal behaviour in a limited domain of presenting a football quiz, focusing on integrated discourse management for synchronised verbal and nonverbal actions.

Recent research projects were targeted at integrating speech-based interaction with emotional expressivity, as in *"CALLAS"* (Charles et al., 2007), and the issue of personality and long-term relationships, as in *"COMPANION"* (Turunen et al., 2008).

2.2.4.3 Conclusion on Conversation for Interactive Storytelling

Research achievements in conversational systems include highly complex systems, as well as concepts in computer-linguistics and socio-linguistics. At the moment, successfully working concepts are hard to grasp and to exploit for creation by authors without assuming a big interdisciplinary team. Accessible tools or ready-to-use system components are missing. There is enough evidence to assume that within the near future we will not be able to use a fully automatic system providing complete natural language processing for characters based on authors' configurations, specifying the conversation topic, the style, the context, and social pragmatics that are needed in storytelling, which differs in complexity from a train logistics system.

However, dialogue management as a dialogue structuring task is important and contributes to creation in an important way. The consequences for interactive story creators and dialogue writers stepping in today are:

- Create utterances by hand, possibly get trained in some template-based system with wildcards and low-level generalisations.
- Use mark-ups and annotations for attributing non-verbal properties.
- Develop system-thinking of the dialogue manager and pattern matcher.
- Understand dialogue structure and management features.
- Be aware of the shortcomings of dialogue generation and find 'work-arounds'.

For example, in interactive storytelling, especially for the understanding of natural language expressed by the user, special short cuts have been taken in the projects *"Façade"* and *"FearNot!"*:

- In *"Façade"* (Mateas and Stern, 2004), 23 pre-fixed possibilities for recognisable 'discourse acts' of the player are foreseen. These acts have no semantic, only a pragmatic level, influencing relationships by agreeing, disagreeing, flirting, etc. Players cannot be understood if they want to raise a new thematic area.
- *"FearNot!"* (Louchart et al., 2004) contains a speech act knowledge base that identifies language and physical actions in the bullying scenario in three categories: Help, confrontation and socialising. Similar to Façade, language is mainly 'understood' as a contribution to a broad pragmatic influencing of relationships. Another 'trick' is strictly keeping the initiative with the characters.

2.3 Research in IDS Authoring and Creation

This section provides an overview of currently available information and tools for authors who want to approach the field of interactive storytelling.[12]

2.3.1 General Remarks on the Research of Authoring Problems

The examples mentioned in 2.1 and 2.2 are a selection of only few relatively complete IDS artefacts that illustrate the vision of the research community. Taking these AI-based solutions as models, there is a big challenge for authors to conceive and create content in such a way that it runs smoothly. These aspects currently still hamper their take-up within industrial end-products. Previous attempts to overcome this problem have been mainly focusing on proposing so-called ‘authoring tools’, also at prototypical stage. They mostly addressed the said difficulty for authors ‘to program’ the engines by supporting them with Graphical User Interfaces (GUI), easing the effort of correct coding. Naturally, the motivation to build fully tested tools for research lab engines is limited. Many discussions in this context point to the future, stating that accessible tools are to be built once engines have reached a mature state. Unfortunately, this delay results in a situation in which authors cannot contribute their storytelling knowledge to the development of engines. On a conceptual level, there is only some sparse and tacit agreement among researchers about the harmonising of design steps for creation. This can be explained by the diversity of technological approaches. Still, more general creation principles would be helpful, even if specific to a subgroup of engines.

There are some complications involved, making it difficult to start solving or even discussing these topics:

- Existing IDS systems and intended interactive experiences are highly diverse, slowing down discussions for the need of on-the-fly definitions.
- Almost no target group of ‘IDS authors’ is clearly specified, and most of currently known storyworld examples have been written by their engine developers. The field probably has to lend authors from neighbouring disciplines (e.g., screenwriting), which involves the difficulty of ‘unlearning’.
- There is a need to specify what particular ‘authoring problem’ is talked about, each time a discussion starts. It could be the implementation of a storyworld into an engine’s structure (technical authoring on several levels of detail), or

[12] The core of this analysis has been made available in Deliverable 3.1 of the IRIS project (Spierling et al., 2009a)

it could address the conception phase of inventing a new storyworld (creative / conceptual authoring).

- In discussions inspired by AI-based approaches, there is confusion about the authors' intended responsibilities, and about what parts of a storyworld as a complex system can/shall be touchable by authors – assuming that other parts are hidden hard-coded in a drama engine. In that context, there is a debate on author 'control' about the interactive experience – whether the author *"has to let go"* or be responsible for a certain IDS experience (see below).
- In the same context, AI-based approaches to story generation are often motivated by the 'authoring bottleneck', to be overcome by letting computers with creative ability generate 'new content'. The technical requirements for achieving satisfying results are so high that only partial solutions exist, which so far have not shown much reduction of authoring effort – quite the contrary.

Researching the authoring situation has been done here with an open attitude to many kinds of Interactive Storytelling and not knowing potential target disciplines of authors, but with an assumption that authors should have responsibility for a resulting experience, and work on best-informed creative conceptions for interactive storyworlds. The research starts from a point of view of human creation approaching more procedural and generative solutions in steps. It emphasises 'highly-interactive' forms of IDS; it does therefore not consider branching stories, hypertext, collaborative storytelling and other forms which can be developed with conventional media tools.

2.3.2 Overview of IDS Research Publications on Authoring

Conference proceedings and scientific journals in the thematic area of Interactive Storytelling have been analysed as possible sources for information on how authoring problems have been defined and approached within the IDS research community, and what solutions have been proposed. These publications have been categorised regarding their contribution to conceptual models usable for authoring in IS, into areas of

- philosophy of creation concepts and methods, especially with regard to highly-interactive storytelling, drama management, planning and procedural / emergent processes, and
- specific authoring tool descriptions.

As we can see, the majority of publications in the research community present solutions for low-level authoring tasks for specific systems, with great dissimilarities. The current state of the art in 'creation' in the Interactive Storytelling community is mainly defined by 'tools', not by creative strategies. As stated above, also system architectures may contribute to conceptual models. However, only the authoring possibilities are reviewed here that these systems offer so far.

2.3.2.1 General Creation Philosophy

In academic literature, there can be found only little general advice or knowledge about conception and creation in Interactive Storytelling, beyond suggestions for concrete tools. So far, no attempt has been made to suggest theoretical conceptual models for communication between AI system engineers and authors. Still, we find several publications dealing with the more philosophical questions of their proposed creation methods. They have been chosen on the base that they are not restricted to a single system or tool, but predominantly discuss a general concept. Often this distinction cannot be made by drawing a hard line, as most publications prove their findings by a specific tool or approach that led to an IS system. Typical themes covered in these papers are

- automatic action planning, drama management;
- intelligent agents, emergent/generative narratives;
- highly-interactive storytelling ; and
- practical authoring issues.

Automatic Action Selection and Planning

A number of research papers in the area of AI-based planning not only describe generative algorithms, but also refer to authoring. It has to be noted, however, that this literature is generally hard (or even impossible) to grasp when taken as a primer for authors and creators who are not familiar with AI concepts. Certainly this is not at all the purpose of research papers targeted at a cutting-edge audience in their domain. However, it is the only literature available that makes the connection of AI planning and storytelling. It can be assumed that because 'planning' software is most often a central component of a generative IS system, authors of storyworlds run by these systems need to put conceptual knowledge about planning into practice.

Authoring for planning can mean the construction of a hierarchical task network structure (Charles et al., 2003; Skorupski and Mateas, 2009) or, most often, writing a domain based on STRIPS[13] propositions and operators (Pizzi and Cavazza, 2008). This is per se a straightforward task of knowledge engineering. Recent attempts have been made to support plan authoring including author goals for novices by visualisations, e.g. with storyboards (Skorupski and Mateas, 2010). However, from an author point of view, without practice, the consequences of own creations are hard to imagine. This is a general topic of current investigations within the research domain (Thomas and Young, 2006) not yet adequately discussed in interdisciplinary circles with authors. Pizzi and Cavazza (2008) have given an overview of a whole creation cycle involving several test runs and 'debugging' the planning domain. A planner alone can achieve automated plot, but is neither a sufficient prerequisite nor guarantee for 'highly-interactive' storytelling. The benefit lies in utilising planning as a strategy for drama management and adaptation of a plot to user actions by automatic re-planning of event sequences. A simple introduction to the use of planning has been provided by Orkin (2006), in the context of the creation of the *"F.E.A.R."* game. However, Orkin also argues about the difficulty to involve designers within a game development workflow to use goal-oriented action planning (*"GOAP"*). In such a system, in which actions and goals are decoupled with no explicit connections, according to Orkin (2004), engineers (and not the content designers) would better be responsible for the definition of the transition rules.

In the context of the IRIS project, we have co-created a physical card game explaining basics of STRIPS-like planning for an untechnical target audience. The game works as a paper prototype exploring outcomes of set preconditions and effects, and allowing the discussion of rules for selection. After testing the educational game at a conference tutorial (Spierling et al., 2010), it is further published online for download.[14]

Intelligent Agents, Emergent/Generative Narrative

The concept of 'intelligent agents' for storytelling has been used in many approaches, usually in various domains other than creative storytelling. The concept can also involve planning. Again, there is only little information about creation and storytelling from an author's point of view. Typically, agents are configured by their character traits and goals, which is a top-down approach. It is difficult to imagine concrete actions as an outcome of mere specification of high-level concepts. Current AI research investigates how goals can inversely be informed or *"fitted"* by letting authors make local changes, as these are more easily to control. Fig. 2.17 shows such an approach in the authoring

[13] STRIPS: STanford Research Institute Problem Solver.

[14] IRIS repository on authoring, http://iris.interactive-storytelling.de

framework of the *"Thespian"* system (Si et al., 2008), positioning the author in an iterative loop of fitting characters' and story goals while simulating the outcome. By creating alternative desired sequences of character actions as reactions to the simulation outcome, the characters' motivations are 'tuned'. A similar philosophy is that of a 'rehearsal' of the actions in the *"Enigma"* system (Kriegel, 2009), letting the agent 'learn' a certain reaction in a certain context by specifying authorial context information (Kriegel et al., 2007).

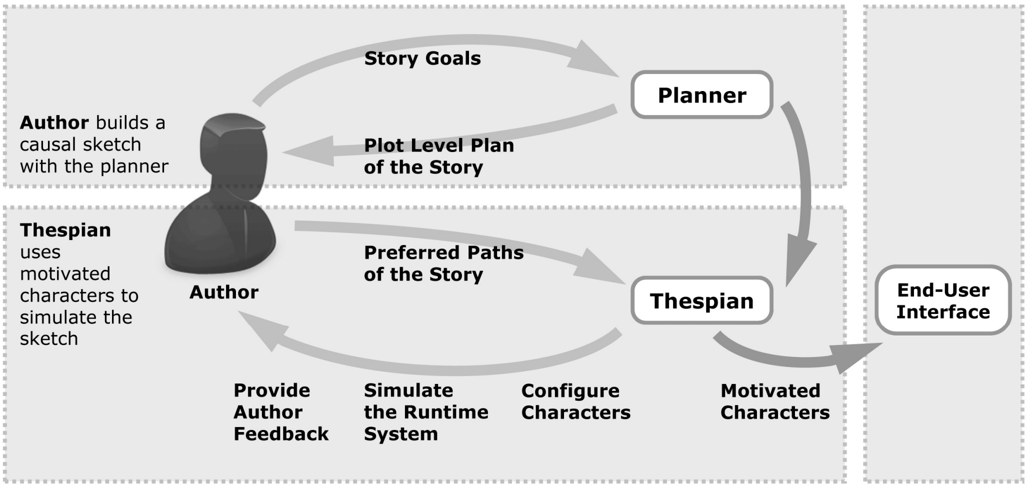


Fig. 2.17. Mixed initiative authoring framework of *"Thespian"* adapted from (Si et al., 2008).

Concerning creation principles, there is a body of publications stressing the topic of the *"narrative paradox"* of emergent narrative, discussing scopes of authoring (Louchart and Aylett, 2005). Emergent narrative can either be seen as another means to achieve higher levels of interactivity, or as an end in itself, as in improvisational theatre. Radical claims of emergent narrative actually argue that there is no justified existence of an 'author' – as emergence and design are contradictions in terms. Accordingly, the author shall be replaced by purely generative mechanisms. There are also less radical points of view trying to integrate concepts of design and emergence, with concepts how authors should partially *"let go"* of their will to control the storyworld completely (Louchart et al., 2008). An example of non-interactive emergent narrative is *"The Virtual Storyteller"* system (Swartjes and Theune, 2009).

Highly-Interactive Storytelling, Practical Authoring Issues

Similar to the previous topic, but without making extensive reference to 'emergence', are publications that report on possible general creation and authoring concepts that shall make IDS storyworlds more interactive. These are the many reports by Mateas and

Stern (2005a) on the creation of the interactive drama *"Façade"*, with the claim for the concept of *"Procedural Authorship"*. This implies that authors have to think procedurally when creating an interactive storyworld, which *Façade's* creators refer to as the ability to program. Although these papers have AI background, they contain 'untechnical' conceptual parts informing authors about general design strategies of building interactive storytelling. Another publication offering design strategies for interactive storytelling is (Crawford, 2004), elaborating on the philosophy behind the *"Storytron"* system. Also Szilas et al. (2003) have revealed general design concepts when authoring with *"IDtension"*.

Few publications cover reports on practical experiences with systems in use, pitfalls or strategies. As a potential resource, (Crawford, 2004) contains many anecdotal references to creation in practice with Crawford's *"Storytron"* approach, but without exemplary finalised storyworlds or exercises. Marsella (2008) described problems integrating storytellers in the authoring process of several pedagogical interactive dramas in the wider context of the *"Thespian"* platform. In these cases, writers only handed general story outlines to engineers who then formalised them during implementation. As a partial result of the research leading to this thesis, a report containing some of the authoring experiences described in our Chapter 6 has been published in (Spierling and Szilas, 2009), generalising the findings by comparing two authoring processes in 'Scenejo' and *"IDtension"*.

2.3.2.2 Authoring Tool Descriptions

A review of research publications reveals a variety of systems and tools created by the research community (academic or non-academic) within the last couple of years. While their 'prototypical' nature is common to almost all systems, several varieties have been found:

- There are several IS systems presented as an integrated entity, containing a runtime engine and a particular storyworld with an interface for end-users to experience IS through interaction, but not equipped with a defined interface for authoring a new storyworld. The authoring perspective is hard to see. An example is *"Façade"*.
- Further IS systems are presented as runtime engines with separated (different) storyworlds. Beyond being demonstrators for end-user interaction, they also have defined interfaces for authoring new storyworlds running on

the same runtime engine. There exist two possibilities of how authoring interfaces can look like:

- Authors would have to program the engine by accessing certain parameters, attributes and rules directly in the description language of the content file. An example is writing the XML structure of storyworlds for *"IDtension"*.
- Authors can use graphical editors as parts of special authoring tools, which save content structures (e.g. XML files) automatically. Examples are the *"SWAT" ("Storyworld Authoring Tool")* of the *"Storytron"* system and the *"Aurora Toolset"* of the *"NeverWinterNights"* engine.

An exhaustive list of research publications covering these tools is available in Appendix B.

2.3.3 Practical Experiments in Authoring

There are few publications found on possible creative principles and on the question of accessibility of authoring tools for creators. Especially for IDS-typical technical approaches, such as planning, intelligent agents, and other attempts to achieve more interactivity in IS, there have not yet been enough practical experiences to come up with suggestions for authors how to start, how to integrate the technologies into their conception, and how to overcome possible pitfalls. Only by putting technical concepts into creative practice and by describing them from an author's point of view can this lack be overcome. Getting a real and practical impression on how – in the future – creators will conceptualise, configure or finally 'write' interactive stories is difficult, because it involves long-term studies with immature software (as for example the case study described in Chapter 6). In order to get a better overview and start exchanges on the topic, the research described herein has been reflected in several authoring workshops at IDS conferences, such as (Spierling and Iurgel, 2006), (Spierling and Iurgel, 2008) and (Spierling et al., 2009b)[15]. Further, within the EU-funded project IRIS[16], we reported on studies with authors and media students (Spierling et al., 2009a) and summarised 'real-life' experiences from the creation of complete content for 'Scenejo' (also compare Chapter 6) and *"IDtension"* (Spierling and Szilas, 2009).

[15] Collection of 'Little Red Cap' workshop contributions: http://redcap.interactive-storytelling.de/

[16] IRIS project website: http://iris.scm.tees.ac.uk/

Ongoing IRIS project work regarding authoring and creation challenges – partially drawing from and building upon this thesis' research results – has been further published online.[17]

2.3.3.1 Activities in Authoring

The situation for conducting practical tests is defined by the circumstance that almost all available authoring tools are incomplete research prototypes, many of them can hardly be used by people outside that specific research group, and only a small subset of tools is available – partly on personal request – in the sense of an alpha-version for testing. Within the context of conference workshops, as well as university seminars with students, we nevertheless conducted preliminary creation attempts, to get a deeper and practical look into as many different tools as possible (see Appendix D). It has been assumed that by using available tools and by getting to play with the created end result, the functionality would be better understood. Further, metaphorically speaking, as tools in general provide 'handles' to accomplish a certain task, they also provide certain affordances for their usage. This could be, for example, terms used by the system, visualisations or an implied order of tasks.

Naturally, studies in the form of workshops and short seminars have limitations:

- Most used prototypes have usability flaws and software bugs, which require the effort of working around them. This is not only an accessibility problem, but can lead to falsified impressions of the underlying authoring concept.
- Because of these problems, it may be hard to distinguish between found generalisable principles and single solutions or simply 'work-arounds'.
- The mostly limited time of the studies can only reveal insights about a beginner's learning curve and give a first impression.

In spite of these known limitations, the experiments led to first findings about the processes of abstraction, especially when certain effects reoccurred. However, the results clearly point to future research to be done, which has to include more long-term studies.

Intuitive Conceptualisations

In several introductory seminars on interactive storytelling, participants (with different educational background from author to computer scientist) were asked to make ad-hoc

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[17] IRIS repository on authoring tools and creation methods: http://iris.interactive-storytelling.de/

drawings of their view of an interactive storytelling structure. A majority of people provided drawings showing ramified flow structures, similar to those in Fig. 2.18.

The conceptual model of ‘forking paths’ is an intuitive model that apparently can be adopted most easily by novices. However, it differs from the process and content models incorporated by the engines mentioned above. Although at runtime, a plot will occur that can be represented by such a graph, this does not necessarily apply to the structure of the prepared content. This provides a conceptual difficulty for beginners.

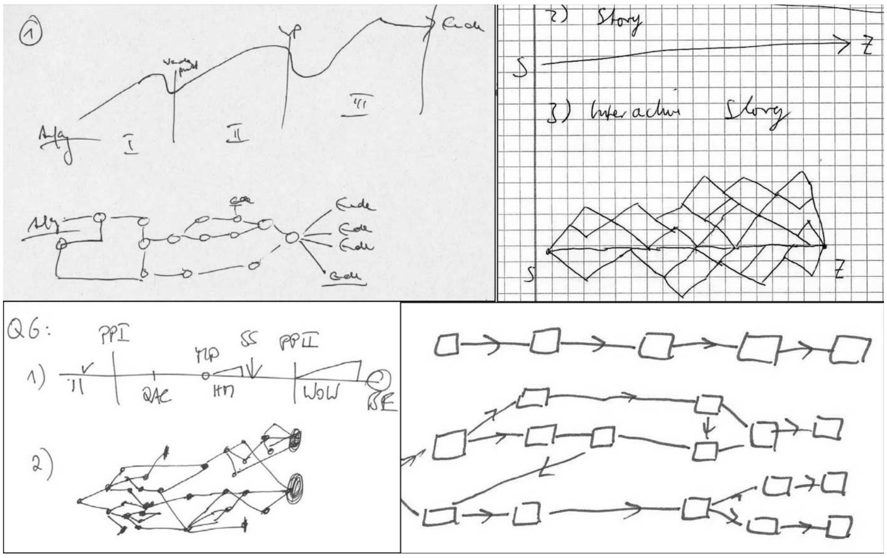

Fig. 2.18. Seminar participant drawings depicting their ad-hoc understanding of the structure of interactive storytelling (vs. storytelling).

Workshops and Studies

Within such a seminar, an authoring study has been conducted during summer term 2009 at FHE, University of Applied Sciences, Germany, with students of Applied Computer Science (Media Informatics). The goal was not to reach a rigorous user evaluation, but to get an overview of available tools and their affordances for creation. A systematic overview of the findings of this study is available as part of a project deliverable of the IRIS EU-project (Spierling et al., 2009a) and is also added in Appendix D. Eleven systems and tools were used, among which were the authoring tools of the *“Emo-Emma”* planner and *“Storytron”*, as well as the XML interface to *“IDtension”*, here referred to as ‘complex’ tools, next to less complex tools.

Some salient and memorable experiences shall be sketched here very briefly. Although the students were ‘procedurally literate’, they could not grasp the concepts of complex tools right away and needed a learning curve. Due to limited workshop duration, these tools led to fewer interactively playable results than the less complex tools. It can be said that in order to experience the dynamics of the complex systems, the prepared content also had to have a certain level of complexity, raising the bar at the beginning. Interestingly, in order to get a grip on the results, students first tried to create linear and simple branching structures, which is possible also with the 'dynamic' tools by constraining preconditions and effects. This phenomenon has been found more often, explainable by the fact that one needs the feeling of control especially at the beginning. The available seminar time was then insufficient to reach the level of higher complexity that the engines are capable of, after the learning phase.

This shall illustrate a common difficulty in the research of authoring. In order to get a deeper insight into the concepts, and to investigate learnability in the recursive process of creating and experiencing, long timeframes are needed.

2.3.3.2 Available Tool Approaches

Within current prototypes, input of content can be done by anything in a range from a readable XML structure or spreadsheet templates to be filled, over GUIs of dialogue boxes and menus, to graph structures for the layout of plot alternatives. However, although input of such structured pieces of content can be a barrier already, it is only a part of the tasks to perform. A complete tool for the creation of interactive experiences needs to support the iterative tuning and play-testing of the created pieces of content, which means, a direct connection to the runtime system is required. There are only few existing complete tools including these functions, one of which is integrated in *"Storytron"* (Crawford, 2010a). Other practically important features, such as support for team work, can hardly be found in research tools.

For plot design, 'intuitive' approaches include the visualisation and active construction of plot element in terms of a graph, building a network of nodes and transitions. This approach has been realised in several tools for interactive dialogues, such as *"Cyranus"* (Iurgel, 2006) in the *"art-E-fact"* project (see Fig. 2.8 and Fig. 2.19), *"Scenemaker"* (Gebhard et al., 2003), and 'Scenejo' (Spierling et al., 2006), see also Chapter 6. Further, graph visualisations have been used extensively in the *"INSCAPE"* project (Dade-Robertson, 2007), targeting especially media designers. Fig. 2.19 shows by comparison that graph structures are ideal to be applied to traditional conceptual maps of the flow of actions. Graph structures have also and especially become familiar in tools for interactive dialogue design, either for audio/speech interfaces (Klemmer et al., 2000) or for game dialogue (Owen et al., 2008).

However, the particular affordances of graph tools for inexperienced authors have often resulted in first creations that tended to be rather linear and determined, providing long-winded experiences with little user agency and little variety (compare also Section 6.1.5). This is a problem to be addressed with further developments of nonlinear conceptual models and design principles for the education of authors.

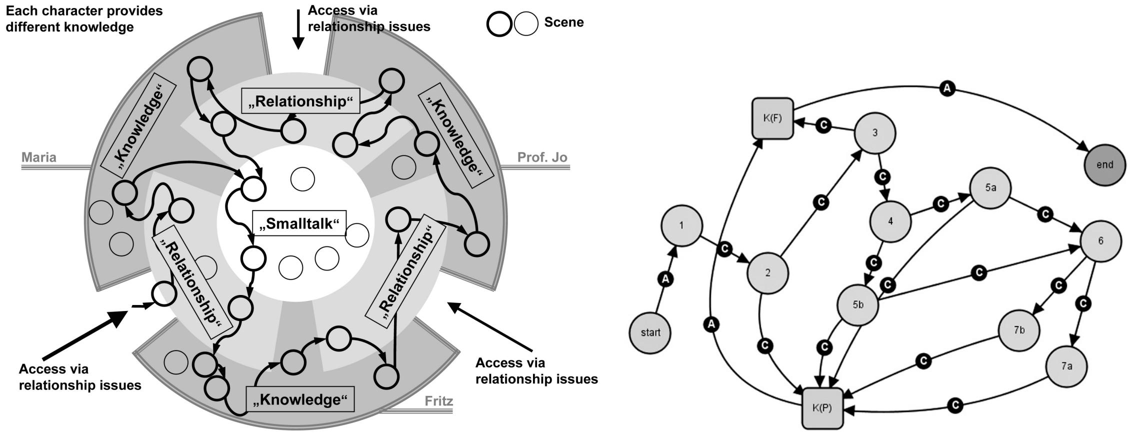

Fig. 2.19. Left: Knowledge theme map as a conceptual planning device for authors. (Spierling and Iurgel, 2003) Right: Visualisation in the interface of the dialogue graph tool *“Cyranus”* (Iurgel, 2006).

2.3.4 Summary of Existing Conceptual Models for Authoring in IDS

The situation for authors approaching ‘highly-interactive’ storytelling is complex. On the one hand, there are not many research publications yet regarding creative principles in IDS, on the other hand, there are preliminary tools, more or less mapping engine-specific technical philosophies to the surface.

Existing conceptual models can be summarised as the following:

- Procedural authorship (*“Façade”* etc.): *“Authors need to program”*, a hypothesis that on the one hand – as a most abstract observation – is finally shared with the conclusion of this work, but which on the other hand discourages creators to enter the field.
- Emergent narrative (*“FearNot!”* etc.): Authors need to *“let go”* and are more or less obsolete for plot determination, unless they configure input parameters to start a simulation, hardly getting a grip on the result.
- Planning (*“Emo-Emma”* etc.): Authors are knowledge engineers constructing a planning domain, an abstract AI concept.
- Complexity (*“Storytron”* etc.): Authors can use GUI-based tools to program and debug a story with high-frequency interaction, but low representation appeal. *Storytron*’s reaction cycle contributes an interesting concept to increase interactivity, but the authoring effort is high.

- Graph-based orderliness (*"Cyranus"*, *"SceneMaker"*, partly *"Inscape"* etc.): Authoring by visual graph structures, easily accessible, but encourages thinking in more or less linear or branching flows of events.
- Asset production and object scripting (*"Inscape"* etc.): Authors are used to object-oriented approaches from known tools, which also do not encourage procedural thinking at higher 'story' levels.

In summary, there is a gap between technically looking conceptual models of engine architectures, which require pre-knowledge in AI concepts, and the models of linear storytelling, which can be more easily visualised. This challenge was illustrated by Fig. 1.2 in Section 1.1.1. Assumedly, the topic of 'authoring tools' would build the perfect link between story ideas and the technological basis, serving as interfaces. However, in this technology-driven field, the first and easiest way for researchers to implement authoring tools has been to transfer the underlying logical engine architecture directly to the user interface. This results in tools that are still mostly incomprehensible for story creators. This may explain why few of them have dared to write stories for advanced IDS systems. These systems have usually been demonstrated with prototypical story content created by the system inventors themselves.

The gap exists between conventional forms of storytelling and the visions of 'highly-interactive' storytelling. As the state of the art shows, tools exist on both sides of the gap. However, established design principles incorporated in accessible tools on the right side of the picture do not (yet) reflect novel generative possibilities. All the same, for the latter there are not (yet) established interactive story design principles. As a prerequisite for a consolidation of this issue, these novel creation philosophies have to be found, evaluated by experiments, and enunciated.

2.4 Conclusion on Research Goals

There are many challenges and opportunities for future research in Interactive Digital Storytelling. In contrast to issues that clearly call for further technology development, this thesis focuses on conceptual challenges in combining 'accessible authoring' approaches with the new story 'generation' approaches. The work has been done in a context revealing that the field cannot be expected to provide mature solutions yet. For addressing markets beyond vanguard and academic circles, still more technological advances would be needed, especially in terms of story representation levels with more emotional depth and scalability of generated content. However, the challenge of integrating authors cannot exclusively be solved by technology.

The review of the state of the art in Interactive Storytelling lets us restate the hypotheses for research outlined in Section 1.1.2. Authors need general conceptual models of IDS, based on which further more specific design principles can be found and evaluated. Fig. 2.20 illustrates an anticipated solution aspect to the challenge of introducing generative engines (this challenge was depicted in Fig. 2.10 in Section 2.2.1; for solutions also compare Fig. 5.9 in Section 5.2.2). Fig. 2.20 illustrates that instead of the necessity to program story engines directly, authors need access to the formal structure of abstract content that engines operate with. In an ideal world assuming interdisciplinary teams, story creators are able to co-design this structure based on their authorial intents.

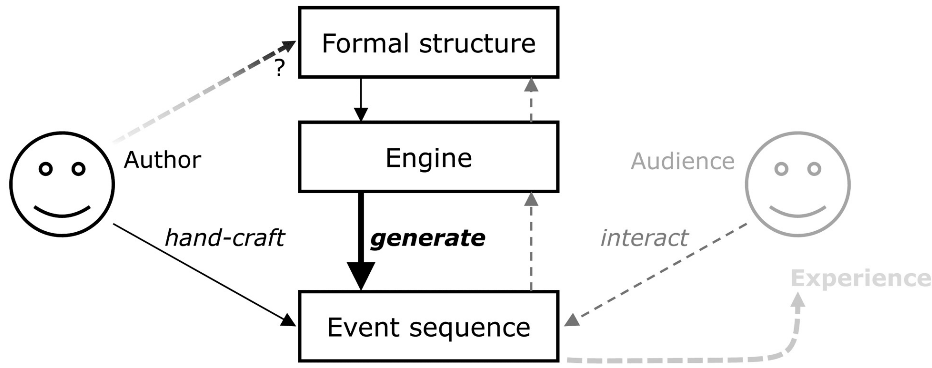

Fig. 2.20. Authoring influence on a generative system through a formal structure, separate from programming the engine.

Since engines differ in their functionality, they probably afford unique formal structuring, currently leading to different authoring tools for implementation. However, the intended 'general conceptual models' on IDS content creation would help to unify those structures in the future, and help authors to overcome involved learning curves with one particular approach more easily. Whereas in the beginning, these formal structures' characteristics are – unsurprisingly – determined by technical engine requirements, we assume to 'reshape' them to fit conceptual design processes in the future. In summary, we would benefit from non-programmer conceptual models by the following:

- We can establish comprehensible general metaphors of shared authoring control (between human authors and generative engines) in IDS,
- we can derive more detailed conceptual models as blueprints for accessible tools to build, involving authors in a user-centred tool design process,

- we ideally support IDS creation without preconditioned programming skills,
- conceptual models for the authoring process can be shared by both sides of the gap (engineering and story creation), and
- shared models help novices to get into the field more easily, by allowing to teach fundamentals in a comprehensible way.

The overall objective is to improve a formerly messy creative situation by structuring general design processes, serving as groundwork for further user-centred developments.

3 Research Method

This chapter explains the chosen research method. It gives a short overview on qualitative research, arguing that the intended research goal is a case for 'design research'. At the end of the chapter, the used method is related to the reported results and interdependencies in the following chapters are explained.

3.1 A Review of Qualitative Research Methods

The stated research aims require qualitative evaluation methods, as well as user-centred approaches to knowledge collection for the development of conceptual models. As stated before, the difficulties to start right away with user-centred evaluation and development methods lie in the fact that the field of IDS does not yet have a defined target group of authors as professional users. In the following, several eligible methods and their prospective contribution will be discussed. Concluding, the case is made for the relevance of design research methods.

3.1.1 Qualitative Research and Ethnography

For a long time, quantitative methods in user evaluation have been considered a requirement in order to achieve 'objective' and reliable knowledge. This worked best for usability measurements on relatively low-level aspects of HCI, such as the keystroke level for ideal expert performance, or for simplified and scaled-down situations. While the results appear to offer measured correctness, the scope and categories of investigated aspects is given by the researcher and the experimental setup. Moreover, as argued by Carroll and Kellogg (1989), the interpretative bridge from measured results to design decision-making is still *"essentially mystical"*. Following the increasing awareness for the failing of traditional methods in providing information about user needs and requirements, qualitative and more human-centred methods have been developed in software product development. Wixon et al. (1990) have claimed for *"contextual design"* as a new field research method, which goes beyond verbal data collected in controlled, laboratory-like environments, incorporating observations made in the user's context. Norman (1999) has described human-centred product development as *"a process of product development that starts with users and their needs rather than* *with technology"*. He stresses that when following contextual design, the step of user interface design does not start until prior tasks of data collection and interpretation are accomplished, and even later in the process chain, the design of the software and hardware structure is the very last step. This is the opposite way of how software development in Interactive Digital Storytelling has been done so far, naturally because the new ideas within the field currently arise from new technological achievements rather than from user needs. As for data collection, Norman also emphasises the value of field studies using observations in contrast to user inquiries, since users often cannot express how they want to use a product. By observation, a broader contextual view exceeding the focus of a single task can be gained.

In order to achieve this kind of requirement elicitation in interactive systems development, ethnography as a research method has been adopted from anthropology and applied to HCI. The introduction of ethnography is a response to the need for a deep understanding of the nature of any addressed work field (Hughes et al., 1995). Special emphasis is on the observation of social and organisational interactions directly within the considered setting, by using a natural perspective and avoiding artificial or experimental conditions (such as already 'decomposed' task elements or preconceptions of designers) tampering the results. Usually this is accomplished by researchers entering into the group of co-workers at a study site with recording devices for a prolonged period. The advantage of ethnography is the capturing of supremely rich data of the users' work context, going beyond the surface level and exceeding predefined questions. The data is usually collected in an unfiltered way and is best reported in the form of 'user stories' quoted in the original language of the subject.

However, Hughes et al. (1995) also identified problems of ethnographic approaches for system development. In order to achieve this first-hand account of a real-world context, researchers spend several months on-site, needing acceptance of the users at the workplace, which is often hard to sustain. Another disadvantage is the form of the reporting, which is highly discursive and lengthy and not readily usable by system designers. Since in a developmental process, not only the knowledge acquisition, but also the knowledge utilisation is a crucial factor for success of a product, reduced forms of ethnographic methods have emerged, termed *"quick and dirty ethnography"* or *"rapid ethnography"* (Millen, 2000). Proponents of rapid ethnography accept a general impossibility of achieving a complete and detailed understanding of the field setting, and rather undertake short focused studies to quickly gain a general picture of the scenario to inform design in the more strategic issues of acceptability and usability.

Still, the ethnographic fieldwork is considered useful and important, since it is capable of sensitising developers to conceptual models, attitudes and acceptability issues involved. In the end, the research goal in design is not 'the truth', but focused towards (what Simon called) *"satisficing"*[18] (Simon, 1996). However, for IDS, we still have to acknowledge that it is hard to even only observe 'users' as authors performing their art in a 'natural work field', because this does not exist yet. Especially for AI-based interactive storytelling with generative engines, the initial barriers for writers to just step in and use them have been too high so far.

3.1.2 Design Research

Over the last few years, 'design science' as a research method of its own has gained increasing interest in the research community of Information Systems. This has become apparent through several conferences and workshops in HCI discussing this topic[19], as well as by the introduction of a *"Science of Design"* programme within the American National Science Foundation. Although the field has begun to emerge in the 1960's (Buchanan, 1992), it is not yet well established, and consolidation in standardised methods is still considered work in progress (Hoffman et al., 2006). The area of research has its roots in engineering and in Herbert Simon's frequently cited *"Sciences of the Artificial"* (Simon, 1996), which he puts in contrast to natural sciences.

According to Vaishnavi and Kuechler (2004), design research complements the positivist and the interpretative perspectives by a third view of *"knowing through making"*, based upon the construction and evaluation of artefacts and the iterative measurement of the artefactual impacts on a composite system. Hevner et al. (2004) characterise design science as a second paradigm complementing that of behavioural science in the Information Science disciplines. While behavioural science methods are problem 'understanding' approaches, looking for theory explaining or predicting organisational or human phenomena, design sciences are problem 'solving' approaches that also define these circumstances. While the goal of the first is 'truth', the goal of the latter is 'utility'. Hevner (2004) distinguishes routine design or system design from design research. While routine design is the application of existing knowledge to the design of artefacts and products, design-science research addresses unsolved problems

[18] „Satisfice" is a made-up word of the components suffice and satisfy, coined by H. Simon (1996)

[19] Workshop / conference series „Exploring Design as a Research Activity" at the ACM SIGCHI conferences DIS 2006 and CHI 2007; and "Design Science Research in Information Systems and Technology" DESRIST conference series since 2006 (http://desrist.org/conference/).

and generates new archival knowledge through building artefacts. Design research is proactive. As such, while introducing new artefacts into the world, it changes the state of the researched system repeatedly, generating alternative world states (for example, in changing user behaviour) through iterative circumscription. This indicates that in design, research generally tackles so-called *"wicked problems"* (Rittel and Webber, 1973). *"Wicked problems"* contain dilemmas, such as the lack of a definite formulation or problem statement, and therewith no 'stopping rule' or a criterion indicating that the problem is solved. For perceived discrepancies, there are generally multiple possible explanations, and the choice of their explanation influences the nature of the problem's resolution.

The typical process steps and their outputs in design research are (Vaishnavi and Kuechler, 2004)

1. *"Awareness"* of a problem resulting in a proposal,
2. *"Suggestion"*, an immediate creative step resulting in a tentative design,
3. *"Development"*, generating an artefact for evaluation,
4. *"Evaluation"*, providing performance measures, and
5. *"Conclusion"*, results that constitute an improvement of the situation as solution to the problem.

By *"circumscription"*, the outputs of the development and evaluation steps get repeatedly fed back to the awareness step at the start of the cycle, influencing the updated problem statement. Many small iterations are characteristic features of any design process. General outputs of design research, on several levels of abstraction, are considered to be: *"constructs", "models", "methods",* and *"instantiations"*. Artefacts as concrete instantiations can precede more general models and constructs, such as theoretical vocabulary, pointing out the proactive nature of design research.

3.2 The Research Design

3.2.1 Integration of Methods

Given the circumstances stated above, the research aims of this work constitute *"wicked problems"* in the sense of Rittel and Webber (1973). User-centred research methods are necessary to inform the design of systems for creation that are likely to be considered accessible and used intuitively by designers. However, there is doubt that established conceptual models of storytelling stemming from traditional media will instantly lead to successful designs in the new medium of Interactive Digital Storytelling. Practical experiments and literature reviews done in the preparatory phase of this research suggested that the target group of prospective users is not clearly existent yet and may stem from diverse backgrounds. Since the typical users' context and work environment is not yet well-defined as a point of departure, prolonged in situ ethnographic studies would not deliver more detailed knowledge. Instead, introducing newly designed artefacts of drafted models, course material and of tool showcases is expected to change the subject of research, such as the attitudes of potential users, as they learn and study IDS through these artefacts.

In this research, several methods have been integrated (compare Fig. 3.1), making use of *"triangulation"* across component disciplines, as suggested by Mackay and Fayard (1997). They argue that in HCI research and design, individual research strategies are necessarily limited. The strength lies in the identification of the relationships among them; and by triangulation, the validity of research can be improved. Otherwise, in design disciplines, certain biases are unavoidable, and there is an account of non-repeatability of the experiment in the method explained above – especially at the second step of *suggestion* of a tentative design. Therefore the result has to be judged in the context of a transparent method.

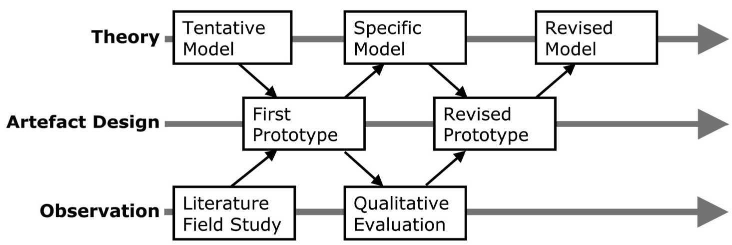

Fig. 3.1. Triangulation of methods: Interaction of created artefacts (in the centre), theory building and empirical observations, adapted from Mackay and Fayard (1997).

The concrete research has been based on first results from experiments in the field of creation and from literature studies done during prior projects, such as *"GEIST"* (Spierling et al., 2002) and *"art-E-fact"* (Spierling and Iurgel, 2003). As an outcome, a tentative conceptual model for Interactive Digital Storytelling has been presented (Spierling, 2005a; see 'level model', Section 5.1.2) featuring the potential

- to bridge theoretical concepts from 'linear' predetermined narrative structures and user interaction,
- to allow the classification of different experienced forms of IDS within one framework of terms between storytelling and interactive simulation,

- to be close to implementable software components, and
- to break down the process of creation into conceptual aspects and sub-tasks.

This list of aspects constitutes only a subset of challenges that became visible during prior work. Starting out from this level-model, it had to be further broken down and linked to practical design questions, subtasks and steps for creators, to arrive at tangible metaphors for creation. This applied, for example, to the conceptual needs (including metaphors) for the creation of verbal conversations between digital agents and users at the 'Action/Conversation' level. Addressing this, the 'Scenejo' project context (see scenejo.org) has become a testbed for building artefacts such as structures for tools and content. The artefact building and theoretical modelling process addressed unclear requirements of tasks and open issues within IDS that, due to the nature of a wicked problem, could not be described in sufficient detail without developing conceivable solutions *"ahead of time"* (Rittel and Webber, 1973).

In that same sense, the designers of *"Façade"* (Mateas and Stern, 2005b) arrived at finding that they were exploring new regions in design space. By calling their method *"Build it to understand it"*, they addressed the phenomenon that they could not learn about unexplored design spaces by studying existing games. *"Normative analyses of game design problems which are based solely on a priori theoretical frameworks or on an empirical analysis of existing game designs run the risk of being proven wrong tomorrow by a game that samples a previously unexplored region of design space."* (Mateas and Stern, 2005b).

3.2.2 Application of the Method

For the research presented herein, examples have been explored from the point of view of a creator of possible experiences, more specifically, exploring the possible paths to go as a non-programmer. It has been insufficient to rely only on experiences of others described in the literature, because so far, these reported experiences have been inconsistent, mostly derived from created artefacts with different purposes in mind, and were not able to bridge interdisciplinary communication gaps. Artefact results of this work (developed *"ahead of time"*, prior to established solutions in the sense of Rittel and Webber (1973)) are visualised metaphors and theoretical models (presented in Chapter 5), and tool concepts for the creation of interactive dialogues and the building of a running application with these tools (explained as the case study in Chapter 6). Concurrently, some of these partial results have also been presented at peer-reviewed conferences and workshops (see reference list in Appendix A). By formative evaluation and comparison with the state of the art, the built prototypes could be revised, resulting in further refinements of the models. Through triangulation across several methods, increased validity of the solutions shall be achieved.

The diagram in Fig. 3.2 illustrates the actual application of the idealised research process depicted above in Fig. 3.1. The grey arrow in the middle contains the main steps of the ‘Artefact Design’ process around the ‘Scenejo’ platform, pointing to Chapter 6. Besides local formative evaluations that were necessary to make the artefacts work effectively, the ‘Observation’ aspect (lower arrow) consisted of a constant reflection of the achievements in comparison to available models in theoretical foundations. The latter have been collected as ‘contributions from theory’ in Chapter 4. It is important to note that selection criteria for theory to include have been that these foundation inputs should be useful for practical problems to solve, and should not require catching up on a computer science course of studies (or any other specialist science) – just in the sense of the design science paradigm (see above) expressed by Hevner (2004). We are not judging the theoretical selection for ‘truth’, but for ‘utility’.

For the concrete artefact and the thereby proposed conceptual models, it was a case of establishing synergy between theoretical aspects of logic modelling and narrative sequencing in story invention and creation. The resulting conceptual models (Chapter 5) express this synergy, taking pre-existing theoretical models (Chapter 4) as input.

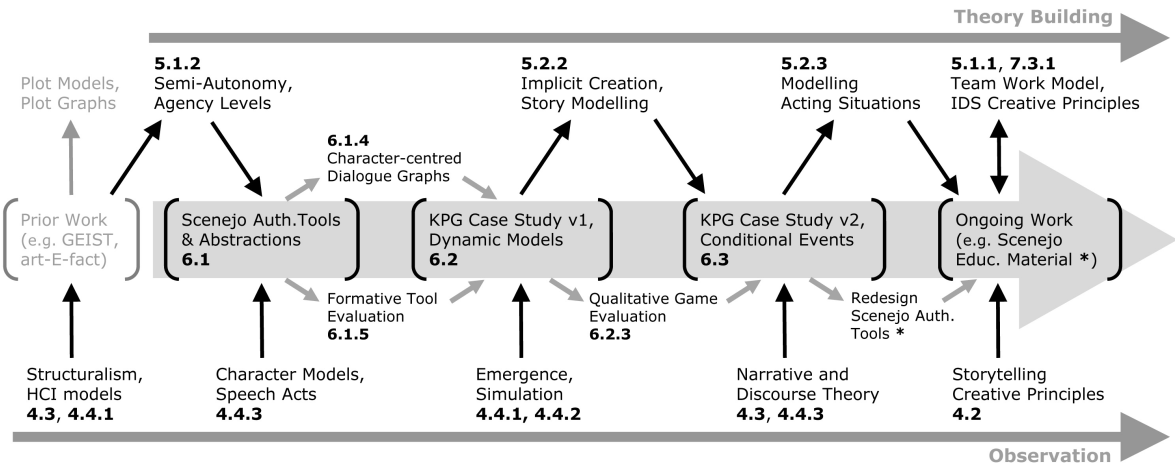

Fig. 3.2. Artefact development (middle arrow) in the context of the actually applied research method (of Fig. 3.1), including references to thesis chapters. [20]

[20] The * indicates continuous online presentations of the ‘Scenejo’ system [http://www.scenejo.org], its concepts and design principles, and educational material based on findings with ‘Scenejo’ applied as a partial result to the IRIS project [http://iris.interactive-storytelling.de].

In the upper arrow in Fig. 3.2, the resulting novel conceptual models for practical 'Theory' building in Interactive Storytelling – and their location in the thesis (Chapter 5) – are outlined. Being influenced by the practical studies and their reflection with theoretical input, they build kind of an amalgam of creative knowledge for a new profession. Whereas the actual performed procedure of 'knowing through making' is reproduced in Fig. 3.2 for documentary reasons, this is not the ideal order to present the topics. Finally, as described in the 'Future Work' section in Chapter 7, ongoing work at the end of this process includes the long-term practical evaluation of enunciated creative principles. The results are further presented in the context of the 'Scenejo' web materials (http://scenejo.interactive-storytelling.de/) and partially as an output of the IRIS project (http://iris.scm.tees.ac.uk/).

4 Contributions from Theory

In the context of the main objectives of this work (proposing conceptual models for IDS content structure and creation, and the creation of IDS artefacts), this chapter provides a selection of relevant models and solutions, directly or indirectly applicable from existing theory. It focuses on creative principles for storytelling, structural models from narrative theory and theoretical background of human-computer interactivity. In our selection, we are not searching for 'truth', but for 'utility'. We look at theory in the context of a suggested reconciliation of logic modelling and narrative sequencing for interactive story invention and creation.

4.1 Theoretical Approaches

This chapter explores theoretical models, pre-existing in the wider context of IDS, that are relevant and do make a contribution to new concepts and metaphors to be used in the field. Interactive Storytelling is interdisciplinary by nature. People do approach IDS from several directions, with different backgrounds, previous knowledge and theoretical frameworks that are regarded as proven and accepted within their discipline (for example, TV or feature film storytelling, narratology, computer game design, human-computer interaction design). This has various effects:

- Each theory contributes knowledge to the new profession. However, we can question the theories as to what extent their paradigms are (still) valid and/or valuable to understand and to define IDS.
- Each theory provides a frame of reference and a point of view for selected approaches, which can result in conflicting yet strong models for different people approaching IDS from several directions. We may have to rethink theories with new goals in mind.

The reviewed theoretical frameworks differ in their kinds of theoretical structuring and generality / universal validity, providing descriptive or predictive contributions. Descriptive theories can explain how behaviours, processes and artefacts are structured and their parts are connected. They propose models for general explanations. This applies to the theories in narratology (Section 4.3) and partly to the HCI section (4.4). Theory in the design of interactive systems is often a mixture of descriptive and prescriptive text (Shneiderman and Plaisant, 2010).

Especially in those fields strongly concerned with creation aspects, like in an art form or in engineering (for example, screenwriting and voice interaction design, as opposed to narrative theory and discourse analysis), variants in the form of 'principles' exist. Theorists try to predict certain consequences of creative decisions, for example by giving hints and providing qualitative guidelines and strategies for successful creation. Beyond HCI, this applies especially to Section 4.2 on 'storytelling principles'.

There is a wide range of potential contributions. A selection has been made here, based on criteria that these theoretical foundations have been useful as input for practical problems to solve, without requiring to catch up on a specialist science course of study (such as, computer science, linguistics or literary studies). In addition, during the parallel strands of work in this research (see Fig. 3.2), suggested conceptual models needed to be reconciled with existing theory. The judgement criterion for selecting theory therefore has been 'utility' and not 'truth' (Hevner, 2004).

The selection has been further focused on those aspects that contribute explanations or principles to our newly suggested conceptual model of 'implicit creation', described in Chapter 5. This proposition establishes synergy between logic modelling and narrative sequencing in story invention and creation. In anticipation of the results presented in Chapter 5, we posit that stories for successful interactive storytelling have to not only be 'narrated', but also 'modelled' by the creator(s). According to Bruner (1986), the *"logio-scientific"* mode and the *"narrative"* mode are two complementary modes of thought (discussed in Section 5.2.2.3). It is one of the properties of 'implicit creation' that 'interactive' storytellers need to cross this line between a narrative mode and 'model thinking', in order to achieve high interactivity by means of an adaptive system. Thinking in models of the intended story experience is a missing link between creative story invention and the required formal structuring afforded by (e.g., AI-based) story engines as adaptive systems (compare Fig. 2.19).

Table 4.1 gives an overview of the selected theories in this chapter and emphasises their contribution to the research on conceptual models for interactive story creation. The theories presented stem from the 'Humanities/Design' side in the overview graph in Fig. 2.9 (Chapter 2). As such, they are to be seen as complementary points of view to the technologically oriented models explained in Chapter 2. They are grouped into three categories: creative principles in storytelling disciplines, narrative theory, and principles/theories in designing interactive systems.

Theoretic topic (in chapters)	Motivation for inclusion and/or contribution to conceptual models for IDS
4.2 Creative Principles in Storytelling	**Analysis and comparison of existing practical creative principles with regard to the intended IDS principles.**
Screenwriting	Closest relative to models of traditional storytelling, reflecting knowledge of a big potential target group of authors. Some principles are applied in the suggested IDS models.
Videogame writing	IDS-correlating principles with regard to a potential team work model of digital artefact production (including writers). However, almost no contribution to story modelling.
Role play creation	Nearest principles involving thinking of a story as a model.
Improvisational theatre	Assumed importance for agent interaction models and models for emergence. However, little contribution to story modelling.
4.3 Narrative Theory	**Analysis of abstract story models established by scientific research that may contribute to general story modelling.**
Story and discourse	Important for story abstraction and understanding beyond event sequences. Supports model thinking, story as model for a discourse.
Form and sequence, 3 acts, hero's journey, morphology of story units, scripts/plans	Familiar and widely cited in the IDS community, especially understanding scripts / plans. Accessibility for linear event sequencing, but not much 'modelling' for interactivity.
Grammar, actant models, causal models, narrative codes	Important for engine builders and for understanding story abstraction. Grammar can be a base for models. However, these have not been applied in the case study.
Acting situations, narrative possibilities, logic of action	Important for 'model thinking', especially for understanding conditional events, has been applied in the case study,
4.4 Designing Interactive Systems	**Analysing principles of interactivity that are complementary to principles of storytelling.**
HCI principles, 4-level model	Understanding interactivity at high/low levels of interaction, understanding reactive behaviour, affordance and feedback. Feeds into intended IDS principles.
Games and simulation principles, interaction in games, FADT, dynamic models, event models and mediation	Understand existing principles of interaction design, causal models in game design. Feeds into story models of perceivable consequences, applied in the 2nd case study.
Conversational models, models of natural language, discourse analysis	Important for understanding constraints of language, conversational models as interactivity models, case-study relevant.
Interaction in games, genres, interaction styles, play classifications, player types	Important for understanding classifications of IDS. Relevant in the periphery more for general models of IDS than for the specific case study.

Table 4.1. Overview of theoretical contributions and their relevance.

4.2 Creative Principles in Storytelling

In the early stages of a new medium, it is a common approach to rely on some ancestors with known forms and creation methods, from which the new forms are developed and explored. In Interactive Storytelling, there is a need to possibly learn from the older storytelling crafts and at the same time to explore the limitations of this application and transfer. It has raised criticism – for example – to rely solely on scriptwriting techniques, as these do not account for the non-linear thinking that would be required for interactivity. Therefore, the collected presentation of principles attempts to avoid a unilateral point of view on storytelling by looking into several domains: Screen writing, videogame writing, role play creation and improvisation. These disciplines differ from the outset in their philosophy of having written design principles. Writing novels has been left out here, as much can be made up by talented individuals with a motivation to write. Apparently, the more a discipline gets industrialised, having to meet production costs or to rely on complex teamwork, the more important are general design principles, to the point of 'how-to' literature adopted in academic curricula.

Such books or articles are no scientific literature proving their paradigms, and they rarely use references to established narratology in general or to previous work of colleagues. On the other hand, they benefit from their practical development and refinements over decades, as for example the text book *"The Tools of Screenwriting"* with its roots in the 1960s (Howard and Mabley, 1993). Compared to that timeframe, the experience scope of creating videogames and interactive media is naturally smaller, as is the body of work that can be taken as examples.

Table 4.2 gives an overview on the analysed disciplines, showing main differences. These lie for example in the assumed story creators' tasks, also in the range of stories that are typically expressed, and the universal validity of existing principles.

Screenwriting (4.2.1)	**Videogame Writing (4.2.2)**	**RPG Design (4.2.3)**	**Improv Theatre (4.2.4)**
Story creator's task: • "good story well told" • find a perfect event structure • collaborate with director & film team	**Story creator's task:** • mission & dialogue • cut scenes, in-game narrative material • subordinate to lead game designer	**Story creator's task:** • 2 parts: preparation and game master (GM) • GM: adaptation and improvisation • little team work	**Story creator's task:** • N/A (at best: coach) • possibly constraints defined beforehand • decisions by actors • collaboration
Story types: • can be complex • many genres, e.g. psychological / social drama, tragedy or (romantic) comedy	**Story types:** • mostly simple, epic • achievement-based (barrier/key motive) • no tragedy (except new avant-garde)	**Story types:** • so-called adventures • depending on player types: strategic (competitive) vs. narrative / fantasy	**Story types:** • many forms • small-scale emergent story / local causality • mostly comedy (rarely tragedy)
Rating of principles: • well established • > 50 years • industrial strength • principles focus: storytelling	**Rating of principles:** • evolutionary state • ~ 10 years • industrial strength • principles focus: production	**Rating of principles:** • community-based • < 10 years • small hobby market • principles focus: experience	**Rating of principles:** • 'intransparent' • ~ 30 years • require training • principles focus: facilitation
Creative principles: • externalising internal • actions vs. activity • ellipsis/elaboration • planting / payoff • avoid exposition	**Creative principles:** • player agency • pacing, funneling • narrative delivery • write "alternatives" • story for exposition	**Creative principles:** • player types • build a story universe • model by rules • prepare to be locally spontaneous	**Creative principles:** • internalise local rules • preparation rules • 'golden rules' as reaction rules (listen, don't block, etc.)

Table 4.2. Overview on story creation principles.

Most theoretic work – especially when considered a serious source used in academic teaching – includes a foreword with disclaimers against preaching any dogma. Robert McKee in *"Story"*:

"Story is about principles, not rules. A rule says, "You must do it this way". A principle says, "This works … and has through all remembered time". […] "Anxious, inexperienced writers obey rules. Rebellious, unschooled writers break rules. Artists master the form". (McKee, 1997)

For Interactive Storytelling, it is a necessity to find these media-unique creative (dramatic/structural) principles, which needs to happen in co-evolution with the development of many more interactive storyworlds and IDS artefacts.

Table 4.2 further provides keywords on found principles, which are elaborated in the sections below. In a conclusion (Section 4.2.5), we reflect how these principles relate to IDS creation, especially to the affordances of thinking in models.

4.2.1 Script Writing, Screenwriting

Screenwriting, as a main creative task in contemporary filmmaking, can be considered a dominant industrial form of successful and established story-inventing and storytelling. The domain has developed strong principles that are taught globally at universities, for example especially in the metropolis of film, Los Angeles. Two well-established books from Hollywood scholars are the source of our summary on creative principles in screenwriting, although there exist many more. The goal is not to deliver an exhaustive list of available literature – it is rather to have a look at general storytelling principles and to discuss how different approaches in the periphery of Interactive Storytelling can cross-fertilise to be the base for newer principles. The two sources are:

- *"The Tools of Screenwriting. A Writer's Guide to the Craft and Elements of a Screenplay"* by David Howard and Edward Mabley (Howard and Mabley, 1993) and
- *"Story – Substance, Structure, Style, and the Principles of Screenwriting"* by Robert McKee (McKee, 1997).

4.2.1.1 The Screenwriter's Role / The Creative Process

The goal of a screenwriter is – according to both sources – a *"good story well told"*. This implicitly refers to a theoretical distinction between *"story"* and *"discourse"* made by Chatman (1978), stressing the fact that the *"discourse"* in the film medium is what counts for the screenwriter (see explanation in Section 4.3, esp. Fig. 4.1). Howard and Mabley state: *"The screenwriter's job is called story-telling, not story-making."* Well-told means well-narrated, skilfully structured and plotted, and finally adequately fitted to the film medium. The result presented by the screenwriter is not the finished film, but a script or screenplay. Screenwriters keep in mind that although their work is not the final form of delivery to the audience, it is only that final audience that counts. Still, according to Howard and Mabley (1993), screenwriters – different from creators of a novel, an essay or a poem – first communicate their story to team members and inspire them. All of these, such as directors, actors, costumers, cinematographers, sound designers, production designers, editors etc., add their talents to the final form. However, a screenwriter is considered to be author of the film, often together with the director. *"Although others will eventually interpret the writer's words and story, the original vision of a film is first the exclusive domain of the screenwriter."* The screenwriter does not necessarily have to be skilled in the other disciplines involved, but *"must know how the various arts of cinema can be utilized to give the impression of reality on film to what was originally born in his head"* (Howard and Mabley, 1993). It is only with this knowledge that unique 'film' design principles like *"Don't say it, show it!"* can be realised within the script.

However, the question of authorship or who is *"the auteur of a film"* has also been raised. *"The interdependencies of the family of filmmakers who produce, shoot, and edit a film are much too strong for any one contributor to be the sole author of the work"* (Howard and Mabley, 1993). Emphasised is the relationship between the screenwriter and the director (and next, with the producer and actors). In some cases, the roles of screenwriter and director are assumed by the same person.

McKee (1997) also stresses the important point of the budget involved in big Hollywood productions due to the large teams of contributors. He directly relates principles of screenwriting to these budget questions. For this given reason, his book is focused on *"classic"* plot design, targeted at huge audiences, while he also acknowledges more experimental forms using *"Miniplot"*, *"Antiplot"* or even extremely *"Nonplot"*, and discusses the existence of an *"art film"*. Classic plots *("Archplot")* mean that more people can relate and understand them, because the classic design is a *"mirror of the human mind"*. His statement is *"If the audience shrinks, the budget must shrink. This is the law."* (McKee, 1997).

For the purpose of this overview, considering production realities is an important context for a storyteller. Screenwriting is challenging as there is a proportionality of cost involved and target numbers in terms of audience. This insight can be applied to IDS as well.

4.2.1.2 Structure of the Content

As stated before, no story models in the sense of formula are provided in terms of 'how to' structure the linear plot, in contrast to analysed structures in narrative theory (see Section 4.3). The literature at hand justifies the absence of strict story *"rules"* and stresses the importance of *"principles"*. In the best possible way, scriptwriters step back as narrators of a story and let their characters speak directly. Some screenwriters report that they are driven by their characters, not the other way round. Doing so, it is more crucial to develop characters and *"listen to them"* than following a certain model of event sequences as a formula.

McKee's notion of a *"classic plot"* addressing a wide audience is based on principles such as: *"Causality", "Closed Ending", "Linear Time", "External Conflict", "Single and Active Protagonist", "Consistent Reality"*. There are also other forms that violate these principles, for example by having inconsistent realities or open endings – which would then probably address a smaller audience. According to McKee, the first task in creating a story structure is the *"selection of events"* from a character's possible life stories, which are composed into a strategic sequence to arouse specific emotions and to express a specific view of life. *"The mark of a master is to select only a few moments but give us a lifetime"*. (McKee, 1997)

What makes up an event is largely discussed. An event is something that is caused by or that affects people. Event choices must be *"composed"* according to a certain purpose of the storyteller. The first difficult choice is what to include or what to exclude. Next comes the question of the order of told events.

"A story event creates meaningful change in the life situation of a character that is expressed and experienced in terms of a value. […] To make change meaningful you must express it, and the audience must react to it, in terms of a value. […] all those binary qualities of experience that can reverse their charge at any moment are story values." (McKee, 1997)

Events are then structured (put in order) into scenes. The ideal assumption for good storytelling is that there is *"no scene that doesn't turn"*, meaning a turn in the character's life, or change of a value. *"Look closely at each scene you've written and ask: What value is at stake in my character's life at this moment? Each scene should change some of these values."* (McKee, 1997)

If a scene *"doesn't turn"*, this can happen for example because it only contains *"activity"* instead of actions as events that change values. Both McKee and Howard/Mabley note this distinction of *"activity"* and *"action"*, and suggest to eliminate scenes with mere activity. Another reason to add or keep scenes could be that the scene is necessary for *"exposition"*, also a concept stressed upon by both sources. 'Exposition', as an important element of a story, means the conveying of information that is necessary to understand the story, mostly occurring at the beginning. McKee: *"If exposition is a scene's whole justification, a disciplined writer will trash it and weave its information into the film elsewhere."* This statement again stresses the *"Don't say it, show it!"* paradigm immanent to the film medium, which mainly consists of mimetic performance as a delivery technique. It contains the challenge of *"externalising the internal"* (see below).

For McKee, the smallest element in a screenplay is a *"beat"*. *"A beat is an exchange of behaviour in action/reaction.*" 'Beat by beat' these changing behaviours shape the turning of a scene.

In contrast to naïve imaginations of 'linear writing', most screenplays get refined and rewritten many times. The selection of events to show is based on an imagined 'world' of a story. McKee describes that *"creative limitation"* is vital to story world creation.

"The world of a story must be small enough that the mind of a single artist can surround the fictional universe it creates and come to know it in the same depth and detail that God knows the one He created. […] Small […] means knowable […] You must possess a commanding knowledge of your setting." (McKee, 1997)

He also perceives an existing irony of *"setting vs story"*:

"The larger the world, the more diluted the knowledge of the writer, therefore the fewer his creative choices and the more clichéd the story. The smaller the world, the more complete the knowledge of the writer, therefore the greater his creative choices." (McKee, 1997)

In order to make creative choices, it is necessary that far more story material is created than one can possibly use in a film of limited length. This (McKee's) point of view is interesting from the perspective of Interactive Storytelling. In recent discussions on IS authoring problems, a hypothesis has often been found that creating a storyworld for interactive exploration is much more work than writing 'just a linear story'. Although this is possibly correct, it has to be acknowledged that also 'linear' storytellers create a greater storyworld before told events get selected in many iterations of work.

The difference is that the ultimate selection of experienced events and their order is not anymore the exclusive domain of the author, therefore the laborious creation of ‘possibilities’ of events is what replaces the time-consuming polishing of the linear story structure.

4.2.1.3 Film Storytelling Principles

Out of an excessively long list of storytelling principles for the film medium found in the literature, a selection is made here that offers an interesting comparison with current problems in interactive storytelling.

“Externalising the Internal”

As Howard and Mabley state, in most films, the screenwriter is constantly confronted with the problem of how to show what is going on inside a character at any given time. This problem is matched with a design principle of “*externalising the internal*” resulting in a phenomenon called *“subtext”* of shown actions. It is about the difficulty to show inner conflict, complex thoughts or emotional states, as well as motivations for the character’s actions. In a film, and in contrast to a literary novel, usually this can or should only be revealed through the characters’ shown actions.

“Finding actions that reveal complex inner emotions is one of the most difficult tasks a screenwriter faces. […] The beginning screenwriter usually rushes to dialog to fill the gap, but this is not a very satisfactory solution. What we end up with is a whole host of characters who talk openly and honestly about their feelings; the only drama in the theater is in the audience stampeding for the exits.” (Howard and Mabley, 1993)

This illustrates the difficulty of a medium that relies on showing events rather than telling them. It is of course possible to have acting and speaking characters, but dialogue and action can even be juxtaposed in mismatched opposition:

“If wee see a character sneak up on another with a butcher knife hidden behind his back while he speaks of his undying love for the other person, which do we believe, the dialog or the action? [...] The juxtaposition gives us the clearest picture of the inner world of the character.” (Howard and Mabley, 1993)

Skilful screenwriters use scenes that are rich in subtext. This is meant to increase the audience’s enjoyment and participation in the story, because the audience has to work (mentally) to understand the happenings. It means that not just the mimetic way of ‘acting out’ a given sequence of events – revealing inner conflict and emotion – determines the subtext, but the ‘choice of events’ as a decision of the scriptwriter.

McKee calls that principle "*Writing from the Inside Out*": He assumes that during creation of a scene, writers must find their way to the centre of each character and experience it from his point of view. He stresses that it is not enough to ask oneself *"How should someone take this action?",* because this leads to clichés and moralising. It would be preferable to ask "*If I were this character in these circumstances, what would I do?"* By acting out the role during writing, the screenwriter presupposes what actors only follow in the script. McKey's book shows by examples of concrete screenplays how the writer slips into the different characters' minds, one after the other *("settle into the character's psyche")*, to determine what would be their next most plausible actions. He writes out inner monologues, puts a scene into ultra-slow motion, gives words to what would be *"only flashes of insight"* (implicitly, by actions of the characters). McKee states that it could take days or even weeks to write what will be minutes or perhaps seconds on the screen.

It would be interesting to compare how this kind of writing could apply to Interactive Storytelling. Basically, it puts the author in the position of an agent in a simulation – being put directly at the decision points of a story, at which options for actions have to be compared and the best narrative possibility has to be chosen. This can either be useful for considering the preconditions for virtual agents' actions, or for the anticipation of user actions. There is a connection to the narrative theory going back to Claude Bremond (Bremond and Cancalon, 1980; see Section 4.3.1.3), determining 'acting situations' and describing the deliberation of action possibilities by an agent. In an early version of the story engine *"Storytron"*, Crawford (2007) presented a similar mental 'walk-through' along the calculations of the story engine, in a tutorial about the *"Inclination"* function of actors:

"Well, Inclinations are just such labels, which you, the storybuilder, put on each Role's Options, so that some Actors in that Role are more inclined to take one Option over another, all based on their personality. There's Pete walking over to the Option shelf for his current Role, Kissee: "Hmm, let's see… StrokeHair sounds exciting! Oh wait, there's an Inclination on it that says 'Sensual'. Says right here in my personality profile that I'm not at all sensual. Oh well. Hey! Kiss sounds just right! Oh, darn, its Inclination reads 'Doubly Sensual'. So if I were Sensual, I'd take Kiss over StrokeHair, but as it is, I'll pass on both. How about ShyAway? Now that's an Option! Its Inclination reads 'Timid'. Sounds like me, according to the personality profile my friend, the storybuilder, gave me. Patience Pete, mama always said, read all the Options before you choose a reaction. Oh, look at that last one, ProposeMarriage! Its Inclination says

'LovesKisser'. Mary is the Kisser, and I do love her a lot - just look at my personality profile, it shows I'm hopelessly taken by her. I am Timid, true, but I'm not hopelessly timid. I am hopelessly in love with her, though, so I'll ProposeMarriage to her!" Heartwarming, isn't it?" (Crawford, 2007)

The problem with the story engine was that nothing of that internal process was revealed on any representational level for the end-user/player, but only the resulting action taken was narrated in one sentence. It is exactly that design problem of *"externalising the internal"*, when only abstract choices are available for representation, but no telling of inner states.

More Creative Principles, "Screenwriting Tools"

Howard and Mabley (1993) called their book *"The Tools of Screenwriting"*, while the term *"tools"* refers to their found principles of storytelling, when turned into design strategies. Many of the concepts relate to similar principles mentioned by other experts, suggesting their generality. A thorough analysis on how these screenwriting principles are useful or limited for other media than film is yet to be done – a research endeavour to start when IS authoring is more widely available.

At first sight, there are some obvious and often-discussed concepts that certainly span media boundaries, such as "*Protagonist and Objective"*, "*Conflict"*, "*Obstacles"*, "*Premise and Opening"*, "*Main Tension, Culmination, and Resolution".* Also *"Theme"*, *"Unity"*, and *"Characterization"* appear quite common, although they address more subtle attributes. Special 'tools' address the design of the plot, which – if they would be transferred to interactive media – would possibly only survive with some conceptual changes or losses. Examples are: "*Development of the Story"*, "*Dramatic Irony"*, "*Preparation and Aftermath"*, "*Planting and Payoff"* (also: *"Setup and Payoff"*), "*Elements of the Future and Advertising"*, "*The Outline and the Step Outline",* and *"Plausibility".*

A special principle is dedicated to *"time and the storyteller"*. Analogous to the analytical theories of Gerard Genette (1980) in *"Narrative Discourse"*, techniques called *"Ellipsis"* and *"Elaboration"* are mentioned as design strategies to shortcut or stretch *"screen time"* in relation to *"real time"*, in order to enhance certain causal relationships or increase tension. As time in a film is always too short to tell a story in every detail, timing is an important concept. Howard and Mabley defined three kinds of time in a film story: *"Real Time"*, the objective duration of an action, *"Screen Time"*, the depiction of action on screen (*"Bad screenwriters get stuck in real time"*), and

"Time frame", a deadline that the audience can anticipate to increase attention and tension.

"Exposition" is the important concept of having to convey crucial information that the audience needs to know in order to appreciate the story. Much effort is done and it is seen as a critical and difficult task in screenwriting (see above: *"don't say it, show it!"*), while for example in videogame writing (see below), exposition seems to be the only reason for 'telling something' instead of playing.

Interesting concepts for adaptation to interactive story are the considerations of *"Activity and Action"* as well as *"Dialogue"*. Together with *"Visuals"* and *"The Dramatic Scene"*, they refer directly to the representational levels of events. In short, they re-emphasise the claim that each shown element should lead to a change or effect in the story as briefly as possible, and unnecessary elements should be found and cut as much as possible. For example, it is recommended to use dialogue sparsely, as audiences get bored and do not want to listen. Revealing facts (exposition) by spoken dialogue should be done only in case of extreme need. *"Never pass on exposition unless the missing fact would cause confusion."* (Howard and Mabley, 1993). Actions and activity should be distinguished all the time, while only action leads to meaningful changes in the story, whereas activity is a means to embellish scenes, which should also not be overdone.

"Rewriting" is the last principle, referring to the above-mentioned writing process within the production realities of teamwork.

The authors of the book have added detailed discussions on how the various tools introduced in the book have been put into practice in existing films.

4.2.1.4 Conclusion

The over 50 years of experience that have been going into these books is something that Interactive Storytelling still has to develop. In comparison with 'real-world' authoring exercises, a huge gap is revealed that shows the struggle with technology as the one and only motivation determining the current state of the discussion in the IS community. Compared to that, the focus in screenwriting literature is solely on the storytelling and there are almost no technical principles explained, although screenwriters need to know the production pipeline very well.

As the literature on principles is extensive, only a few of the principles were selected and emphasised in this section. They concern the finding of a perfect event structure that allows conveying typical features of a story in mimetic ways ('showing' it, not ‘saying’ it): for example, externalising internal conflicts and states, and the ‘changing’ purpose of event choices.

In the literature, most of the principles could be explained by providing examples of screenplay abstracts, which make up huge parts of the books. For Interactive Storytelling, more examples are needed that can then serve as educational material, speaking for themselves.

4.2.2 Videogame Writing

Videogames have recently become a big industry, but literature on design guidelines has not been found on book shelves before the year 2000. Since then, many books on game design have been added every year. When looking specifically for ‘videogame writing’ (not computer game design), first publications have appeared only recently. We analyse particularly those sources that are dealing with the writing of narrative aspects of videogames, which is otherwise often mentioned in game design books with a somewhat negative note. (A reason could be that the videogame industry must have made negative experiences with writers changing over from screenwriting, who at first delivered too linear stories for games that should instead put the player at the centre of all design effort). The two selected books are:

- *“Game Writing: Narrative Skills for Videogames”* edited by Chris Bateman, and published with the support of the International Game Developers Association IGDA (Bateman, 2007), and
- *“The Ultimate Guide to Video Game Writing and Design”* by Flint Dille and John zuur Platten (Dille and zuur Platten, 2007).

4.2.2.1 The Creative Role and Process of Videogame Writing

One of the main differences to screenwriting is that the role of the so-called *“writer”* is described much different from the ‘writer’ role in film, as he/she has less responsibility for the end result. The writer is a small part of a big team, which is led by a lead game designer. Unlike in film, the writer does not ‘invent’ a game – this is done by the game designer. *“Writers do not create videogames.”* (Dansky, 2007)

Game writers know that their work needs to be integrated with that of the producers, concept artists, modellers, animators, programmers, game designers, and voice actors. Writer tasks can include crafting the story, writing dialogue lines and supporting text, cut scenes and scripted events. This has to be done in conjunction with financial and technical issues. Sometimes, it includes coaching voice actors.

Given that role description, it is obvious that even more than in film production, the writer has to subordinate to technical production issues. However, these do not seem to be very established rules, as the field is still considered rather young in comparison with film. One of the authors of the IGDA-book edited by Bateman (2007), Richard Dansky, states that although game writing is more complex than it might seem at first, it is also the place where new ground is being broken for future forms of Interactive Storytelling.

In a game production, the lead game designers and game writers work closely together. The lead game designer has a similar role as a director in a film: He is responsible for *"characters, worlds, core gameplay, level layout and design, core mechanics, weapons, player character abilities, story, usable objects, inventory systems, game-shells, controls".* This implies necessary collaboration with all other members of the development team. Within that context, the game writer is responsible for a subset: "*story, characters, worlds, mythologies, creatures, enemies, or mystical powers".* (Bateman, 2007).

Both analysed text books suggest a writing process emphasising the dominance of production issues, such as

- property analysis,
- story overview / story design (which is often given to the game writer by the developers)
- narrative design (which means to determine expositional needs and dialogue if there is a *"complex dialogue engine"*),
- cut scene creation,
- full design / level analysis,
- in-game narrative materials,
- initial testing and checking (script checked in situ via subtitles or by staff, looking for clashes in dialogue),
- dialogue recording, and
- final testing and checking.

Also Dille and zuur Platten (2007) point out that content creation in video games differs from linear creation, as it is dominated by 'iterative' design. *"Changes are part of the process."* It is necessary to continually add elements to the game and test it directly. *"It is important to remember that your story is working in unison with* *gameplay. The more your story can be told through gameplay, the better. Much like the film axiom 'Don't say it, show it', you should be thinking in a similar fashion for the game: 'Don't show it, play it.' "* (Dille and zuur Platten, 2007)

4.2.2.2 Structure of the Content

Game writing is described as being a challenge in comparison to screenwriting. Author of the IGDA book (Bateman, 2007) Richard Boon states: *"... the primary concern of the game writer is that almost every narrative element in the game is triggered by an action on the part of the player."* (Boon, 2007) By stressing the aspect of 'remediation', he notes that in this medium, 'interactive' is what drives the narrative, not the other way round.

Interestingly, he also uses the same distinction between 'story' and 'narrative', which was discussed in screenwriting as *"a good story well told",* and which is also a concept found in narratology (Chatman, 1978; see Section 4.3). However, here it is used with a different flavour. It refers to the distinction of what changes a player can make – changes to the 'narrative' or changes to the 'story'. In the first case, it could mean that the player interaction just triggers a piece of dialogue, which would otherwise not have been experienced. Otherwise, when making changes to the story, talking to one character and not to another means something for the long-term development of the story or game. *"The first job of the game writer [...] is to understand possible interactions between player and game and determine how these actions may be used to enhance the narrative experience."* (Boon, 2007)

A typical narrative technique in this regard is the definition of a so-called *"story spine"* with optional possibilities, sometimes also called *"spinal story and side-quests"*. This can lead to 'simplistic' narrative choices of players of where to look (compared to camera control) but not really changing a story. Interactive Storytelling is seen critical: *"Just because deeply interactive storytelling is theoretically possible, doesn't mean that it's a suitable goal for every game project. Sometimes more modest goals are appropriate."* (Boon, 2007) Boon considers emergent narrative forms, or interactive story as a risk not only for the writer, but for the game designer, because of the uncertainty of development. However, he states that *"some understanding of games as systems – and the possibilities this presents for narrative development – is recommended for game writers. [...] While playing a game, consider which events are pre-scripted and which are due to system interactions."* (Boon, 2007) The usual task of game writers is not to design such systems, but rather, to deliver the content for more pre-scripted methods, for example writing the dialogue. *"Formal narrative elements (such as dialogue) may be triggered from game system interactions, as long as the game writer has predicted that specific interaction."* Interactive narrative in this sense is to *"work with a predictable set of natural gameplay outcomes and reinforce through scripted elements. […] Naturally, creating enough formal narrative material to cover all situations is an impossible task …"* (Boon, 2007)

Further, narrative is used mainly for 'expositional' purposes, for example, explaining the mission to the player, or notifying the player of certain checkpoints reached. Thus, dialogue can be used to "*provide gameplay information and advise*". Dille and zuur Platten (2007) comment: *"Great screenwriters and great novelists have suffered horrible fates in the game space […] a great deal of gameplay dialogue is too expositional […] A novelist isn't expected to write compelling dialogue to tell somebody how to use the controller to open a door …"* (Dille and zuur Platten, 2007).

Remarkably, most examples mentioned in this book are taken from action/racing games or adventures. The most 'interactive' story in this context of writing is one in which the player actions have direct consequences for the story as a whole, giving the player a degree of control over the plot – meaning more or less unlocking of previously blocked paths. Several authors in the IGDA book on videogame writing assume that more complex systems lie beyond the scope of the book. It is therefore hard to compare with the principles on screenwriting, as the definition of 'a great story' seems to be different from the outset. There is no account of character goals and plans, or relationships other than 'friend vs. enemy' mentioned.

In the community of Interactive Storytelling, there have been several informal discussions on this point. For example, Chris Crawford has long been arguing with members of the game industry about these different concepts of 'story' (Crawford, 2004).

4.2.2.3 Creative Principles

The main principles with regard to narrative design are described by Boon (2007) as three basic concerns of a game writer:

- *"Player Agency"*. Game writers must consider the player's role in the game. They must know what actions of the player are possible.
- *"Pacing"*. Writers must understand that players want to dictate the pace of the game. Games incorporate a *"progress structure"*. Game designers pace a game by means of barriers, coupled with the means to bypass them (e.g.,

keys). Dialogue can provide appropriate notification of a barrier passed. Progress structure dictates the narrative structure.

- *"Narrative Delivery".* This is the choice of media used to deliver content, such as full motion video or written text, including varying *"levels of cost"* in between.

The book authors mention budget and technical effort as the main determinant for the choice of a medium. For example, using text is motivated by low costs and by 'last minute' decisions in the production process. Further it is stressed that the length of the text is a crucial factor for acceptance (the shorter the better). This applies even more to spoken dialogue, such as in traditional writing, with the production issue that dialogues have to be recorded.

In addition to the same reasons why dialogue should be short and reduced in film, for games, 'repetition' is a crucial factor. According to Dille and zuur Platten (2007), the writing of alternative lines is one of the most challenging tasks of a game writer. While screenwriters only need to write one piece of dialogue once, game writers have to write many alternatives (so-called *"alts"*) of it. There are more problems with this than at first sight. It is at first hard to find up to a hundred ways of rephrasing a line of dialogue, which might reoccur very often. However, it is even more difficult to stay 'in-character', as with the number of variations, the subtext of strong 'character' vanishes.

The use of a *"progress structure"* over a *"narrative structure"* has its reason in gameplay, as game elements are *"added incrementally to avoid overwhelming the player with possibilities"*, and small events build up to a series. Principles integrated in these structures are for example *"funnelling"* and *"gating"*. 'Funnelling' means leading the player back to the main spine through dialogue. 'Gating the story' refers to a plot that unfolds as linear series of checkpoints that the player unlocks. Mary DeMarle in (Bateman, 2007) advocates the creation of *"illusion of agency"* in a linear plot through *"gating the story"* for the problem of resources and development costs: *"No game yet has definitely turned interactive story into a profitable endeavour."* (DeMarle, 2007)

Another technique of *"layer in the detail"* suggests to determine a *"relevance rating"* of any detail for the story (with numbers *"1 to 6"*). One should make sure that every player encounters details with rate '1', so that the main story is always understood, a technique reminiscent of Barthes' distinction between *"nuclei"* and *"satellite"* events in narratives (Barthes, 1966; see Section 4.3.1.2). Details with higher numbers are there to embellish the story or game, but are not elementary for understanding it. Another method is using index cards. Reshuffling them is considered a base technique for testing to what extent 'order' matters.

Summarising again, several authors within the edited 'game writing' text book featured by the IGDA (Bateman, 2007) point out that *"more complicated methods"* lie beyond the scope of the book. It says: *"Whatever approach is chosen, the illusion of player agency can be created and maintained through interactive narrative techniques and particularly by reflecting player actions in dialogue and set pieces. In the future, it may be possible to render true nonlinear interactive stories by procedural methods, but at the moment, such mechanisms are fanciful at best."* (Bateman, 2007)

Dille and zuur Platten (2007) make a distinction between *"writer-friendly"* and *"writer-difficult"* formats, with the conclusion that the more linear the game, the more writer-friendly it is. Less controllable is an open-world design leading to many situations in which writers will have to write *"endless alternatives"* or *"generic exchanges"* with NPC characters. *"A consequential story offers a way of balancing free-flow and structure. The idea here is that the world is alive and remembers things and there are consequences for your actions."* (Dille and zuur Platten, 2007)

4.2.2.4 Conclusion

Compared to the principles of screenwriting, principles for videogame writing seem to be still in their infancy with regard to storytelling. They also differ by nature in some ways:

- The motivation, purpose and range of possible stories are different. There are more simple stories having to do with achievements (racing, adventure, etc.).
- The role of the writer is different. The game designer has more decisive power, and all is catered to the player experience.
- The distinction between story and plot, (*"good story well told"* etc.) is similar. However, the main challenge is 'the player'.
- In the literature, there is more emphasis on development and production issues than on what makes a good story, in comparison with screenwriting principles.
- The found principles are unrelated to story engine authoring and conception.
- Game writing principles are less underpinned with successful examples of their implementation in the found literature (compared to screenwriting).

The philosophy behind the elaborations on narrative in games is very often the 'barrier and key' motive, which is common in adventure games. There is no point in ‘externalising the internal’, and there is almost no account of ‘character’. Exceptions are that in extra chapters of the books, creating ‘character’ is being discussed, but not in the context of developing narrative. Very often, the account of character is mostly concerned with externally perceivable attributes, such as physiognomy, clothing, and equipment, sometimes ‘skills’. Main motivations for narrative are ‘exposition’, ‘mission briefing’, and ‘rewards feedback’.

Connections of game writing and story design for Interactive Storytelling are not made, sometimes left out explicitly with an argument why this would overstress current possibilities. In this context, some experts refer to the difficulties writers have with the necessity to understand games ‘as systems’.

In the preface of the IGDA book, the editor Chris Bateman (2007) states: *“It cannot be overstressed that whereas the narrative language of theatre, novels, films, and television has become largely codified and consensually agreed, the narrative language of games is still very much in a state of evolutionary flux. We do not know what the final narrative language of games will be like – likely we will not know until all the technology pertinent to games has been developed, and this could take decades or even centuries. Therefore, everyone working in the field of game writing strives toward an ideal that lies somewhere beyond the horizon.”* (Bateman, 2007)

4.2.3 Role Play Creation

Bateman (2007) mentions in the IGDA book on Game Writing: *“Tabletop RPG writing might be the closest to video game writing, but even then there are major differences. RPGs are about open-ended experience and adjusting things on the fly, whereas videogame writing is a closed experience, focusing on keeping the player satisfied with the options and actions available.”* This statement points to fundamental differences between the creation of what has been called a video game in the previous section and the special case of role play. ‘Role-playing game’ (RPG) is the generic term for a broad variety of games. It implies that players adopt roles of certain characters, by assuming their attributes and skills as constraints for playing. They collaborate or compete in creating a joint (mostly social) experience, resulting in ad-hoc narratives or combats. There is a variety of possible sub-genres falling into the realm of RPG. On a higher level the field can be divided in ‘pen-and-paper role-playing games’ (P&P RPG, also called ‘table-top RPG’), ‘live-action role-playing games’ (LARP) and role-playing video games (or computer role-playing games). This analysis mainly concentrates on pen-and-paper (P&P) RPG.

For a long time, role play was not in the focus of scientific investigations. Existing theories mainly arose out of practitioners' communities of players, and started to get increasingly discussed with the advent of the Internet as a communication platform. One of these communities was *"The Forge"*[21], organised and influenced by Ron Edwards, but stalled in 2005 and archived since then. Models and theories derived from that early work include mainly the classification of several ways and purposes of role play, such as in a so-called *"threefold model"* of 'game', 'drama' and 'simulation' (therefore also called *"GDS model"*). Similar theories include different possible creative agendas or player types (see below), one of which is close to seeing role play as narrative activity.

More recently, within the scientific community of Interactive Storytelling, role play has been taken up as a potential inspiration of concepts also for digital solutions of 'game mastering' (such as drama management engines). The number of scientific publications has been increasing also from a Game Studies perspective, analysing possible structures, forms and the cultural context. Examples for recent publications in the IS community are (Hitchens and Drachen, 2008) and (Drachen et al., 2009). In these publications, reference models for the design of story engines supporting highly interactive artefacts are researched, which are able to show 'emergent' narrative features. In Scandinavia, where LARP is very popular, the *"Knutepunkt"*[22] role-playing conference exists since 1997. It is focused on LARP and provides regular publications since 2003. Söderberg et al. (2004) have experimented with integrations of LARP and digital media within a newly established domain of *"pervasive gaming"*.

It is hard to find established literature on creative principles for the design of non-digital (such as P&P RPG) role-playing games, as there is not a big industry involved. Only until recently, P&P RPG has had the status of a hobby endeavour of marginal or even sub-cultural character, addressing a small target group of dedicated players, compared to the huge audiences of video games or cinema.

"Robin's Laws of Good Game-Mastering" by Robin Laws (Laws, 2002) is an internationally widely-cited small handbook for creative principles. The book states that it is not a primer – it is hard to get information from outside 'the scene'. Other books on

21 http://www.indie-rpgs.com

22 http://www.larpconference.org

design principles have appeared in the small German RPG community (Berger, 2009; Wäsch, 2009).

4.2.3.1 Forms and Creative Roles

In role-playing games, an important distinction exists between the preparation of a story (often called an *"adventure"*) and the actual role-play experience (during the running of the game). Characteristic for most non-digital RPGs is the existence of a *"game master"* (GM), a special player who is responsible for managing a collective experience during play. While other players more or less freely determine the actions of their played characters, the game master judges their success or failure depending on underlying rules and/or their influence on a story progress. The GM also describes outcomes of actions intended by players. For the representation of the story, the GM verbally describes the game world and impersonates its 'non-player character' (NPC) inhabitants when players interact with them. Depending on the chosen degree of interactivity and freedom within the game, the players and the game master may improvise freely and shape the direction of the story. In P&P RPG, all story events are verbally described by the participants (in indirect language, only sometimes with 'mimetic' direct dialogue elements), whereas in LARP, all in-character actions are acted out by the players and game master.

Berger (2009) distinguishes between *"tactical"* and *"dramatic"* role-playing. The precursors of tactical role-playing are ancient conflict simulation and miniature war games with roots in military tactical maps and models used over centuries. 'Tactics' is the key element of tactical role-play. The game master presents a challenge and players try to find an intelligent and effective solution. These games concentrate on a (mostly) complex set of rules describing the game mechanics. The success criterion for tactical role-playing games is the effectiveness of the found solution through players. Only later, 'dramatic' elements – lent from literature and film – have been added that linked the independent challenges to an overall plot. Emerging dramatic role-playing reduced tactical elements to focus on rich dramatic storytelling and the quality of the narration. Today, the field consists of both tactical and dramatic role-playing, which can occur in different kinds of mixtures and shades.

For our research, it is interesting to look at the 'dramatic' role-playing variants, as these are forms of non-digital interactive storytelling. The understanding of a game master's role and skills as functions of the role-play experience has been a key inspiration for the design of story engines or digital drama managers, providing a conceptual model of shared control.

'Player Types' as a Principle

According to Laws (2002), the main objective of the game master is to know his players. The direct feedback and the usually small playing groups lead to a strong connection and relationship between players and their game master. Laws points out that the differences among the players influence the kind of play and lead to different challenges for the game master during the creation process. A concrete game experience is often created for specific known players, therefore their personal tastes and desires may be incorporated in the creation process. Laws (2002) presents a classification of various role-playing forms depending on *"player types"*. Within IDS, this distinction has also been taken up by Thue et al. (2008) to offer different experiences according to a playing style. Player types have also been a topic for video game design (Bartle, 1996). The player types defined by Laws (2002) are: *"Power Gamer", "Butt-Kicker", "Tactician", "Specialist", "Method Actor", "Storyteller",* and *"Casual Gamer"*. Two of them are most interesting to look at for purposes of interactive storytelling:

- The *"method actor"* type sees role playing as a medium for personal expression. He bases his decisions on his understanding of the character's psychology, and does not accept rule systems (which are common in combat or tactics forms, where the role of dice may decide on further actions). He is most entertained with situations that test him as an actor, and dislikes events that contradict with that role.
- The *"storyteller"* type is also interested in role play and less in *"numbers and experience points"*. However, unlike the method actor, he is more interested in taking part in a fun narrative than in strict identification with his character. In order to move the story forward, he is quick to compromise. He appreciates interventions of the GM when it leads to a more interesting plot.

Compared to the distinction of Berger (2009), above types fall into the category of *"dramatic"* role-play, having an opposite motivation as the others, who are more challenge-oriented. In summary, RPG per se is not necessarily a storytelling technique, as it can also be purely game-based. Applied to IDS, we also can assume that it is generally difficult to reach 'player types' who cannot enjoy storytelling aspects and would fall into the *"power gamer", "butt-kicker", "tactician"* category or similar.

4.2.3.2 Structure of the Content

Several authors of role play literature propose graph structures to describe different kinds of interactive story creation strategies and concepts, for example (Berger, 2009), (Laws, 2002) and (Wäsch, 2009). Graphs are common tools to visualise a planned story at an abstract level, often used by the GM in the preparation phase of an adventure. They are easy to create and to understand, and shape the base plot of the story. The possible story structures range from linear sequences to complex networks with multiple transitions between scenes (or places, or events). Berger (2009) proposes a graph that incorporates the duration of play, signalising to the GM points on the timeline when he or she must move the plot further or change a state in the world. Based on this chart, the rest of the story graph is not tightly connected, so that several spontaneous mixings are possible. Most important for Berger (2009) is the awareness of the GM to control the disclosure of necessary story bits as essential information at points within the play, and have enough additional material to optionally embellish the experience. In any case, such a story graph has a different quality as in digital interactive storytelling. In the latter case, a simple engine does not have the same freedom to deviate from the prepared structure as it is the case in the situation of the GM, who, case-by-case and depending on his talent, can switch to free improvisation. However, also for talented GMs, any situations of improvisation may be constrained by their possibilities of ‘staging’ spontaneous events due to a possible lack of prepared material (music, props, etc.).

An RPG adventure is not only defined by its plot construction during play. An essential structural element in the preparation of a story is a rule set that describes potentially changeable and adjustable attributes or effects of events. Depending on the game symbols, artefacts and general approaches used by role-playing groups, the rule set may be designed to include possible random effects by letting the players roll dice, or to mix random values with more or less complex arithmetics based on a designed system. This also assumes mostly that characters and props with lists of attributes have been designed before (by the GM or negotiated by the role-playing group). The result is a ‘model’ of a story setting, in which a plot can unfold, partly also based on contingent events. Thus, the prepared parts of a story are setting, characters and rules, such as sets of attributes with directions how they can be changed, possible event structures in a combat, graph structures and more.

4.2.3.3 Creation Methods

For a game master who also invents adventures (Berger, 2009), both parts – preparation and play – shape the entire creation process, while players are normally only involved in the actual game. The proportional bias between the two creative phases can vary. Depending on game styles and the experience of the GM, the preparation phase can be left out (free improvisation) or take up a big proportion of the overall creation time. During play, the GM moderates and facilitates the player interaction using pre-authored elements and by spontaneously adding new ones. The GM needs to constantly negotiate between the prepared base plot structure, the players' actions (which may turn out as anticipated or not), tests performed with foreseen rules to follow, potentially available pre-authored media elements for embellishment and his or her own imagination.

Robin Laws (2002) suggests *"tools"* for game masters, for example a *"player goal chart"* in line with his 'player types' theory. It is a simple table with the names of the players, their preferred player type and the emotional experiences they seek from the game. The GM creates this chart based on prior experiences with the same players, or openly in cooperation with them. This player goal chart can be revisited during the creation, preparation and the actual play. A successful adventure contains scenes for each participant, meeting their desires and styles of role-playing. Further, depending on the personality and experience of the game master, the mood of players can be appraised during the game. If the GM finds the interest decreasing, he can use the player goal chart to improvise new challenges or opportunities to catch the player's attention. Other tools during play are 'public' information for the players, such as *"character sheets"* with goals and attributes, and maps or setting descriptions, as well as 'private' charts and calculation sheets for the GM's 'bookkeeping' of the unfolding plot. It is important to distinguish between character goals and player goals. Character goals are important for the initial story and part of the prepared material.

The creation of source stories and predefined material for role play is also a profession of experienced RPG writers for a (rather small) hobby player game book market. Beginners in game mastering often prefer to acquire published adventures. Also experienced GMs can reduce the time consuming preparation phase by adapting written material to their players and game style. RPG writers mostly have been experienced game masters before. Commercial publishers of role-playing systems offer either collections of adventure ideas, story structures and facilitation material, or even complete adventure campaigns.

Publishing houses often require RPG writers to address existing intellectual property role-playing *"universes"* with their stories, including certain settings and even rule sets (such as, for example, the 'universe' of the German *"Das Schwarze Auge"*[23]). These can also be franchises of existing TV series or books. The material often also includes assets to simplify the game masters' tasks, such as dialogues to be read out, illustrations, portraits of NPCs, props and maps ('public' or for the GM only). Such material is being added during a structured editing process, in which a team of different authors may contribute to these elements, following the publisher's universal rules. RPG writers are urged to think ahead and address more than one player type at once, including a mix of elements addressing puzzle solving, challenges, drama etc. This rich material can then be used by a GM with players in a strict way by reading along the prepared plot, or the GM can use it to partially improvise with it, depending on talent and experience. By some RPG writers, any potential GM is seen as a co-author and a filter for their own story ideas, which also requires to include 'editing stages' for adapting the rules (similar to a 'debugging' phase mentioned as a principle for IDS).

4.2.3.4 Conclusions

Compared with the state of the art and level of establishment of storytelling in videogame writing, principles for good role play creation are even harder to find and less established, due to its non-mainstream character. On the other hand, these principles are interesting for Interactive Storytelling, as they address more intended interaction with the flow and structure of the story than writing for video games. It is worthwhile, though, to clearly focus on those kinds/genres of RPG adventures, which address player types (according to Laws, 2002) of *"storyteller"* or *"method actor",* and less on tactics- or combat-based forms.

Remarkably, in comparison with other storytelling methods, creation principles for role-playing come closest (so far) towards a potential attitude of thinking about story in 'models'. The creation of so-called 'story universes' includes sets of attributes and more or less complex rules, affording 'model thinking' in storytelling. We can hypothesise that these principles are more related to the intended IDS creation than screenwriting or writing for video games. Still, the success of such a designed story model for narrative experiences depends largely on the improvisational talent of game

[23] *"Das Schwarze Auge"*, abbreviated *"DSA"*, English version *"The Dark Eye"*. Information on RPG writing has been provided through personal communication with Thomas Römer, experienced DSA writer. The 'DSA cosmos' is also used for the design of several computer games, such as *"Drakensang"*, *"The River of Time"*.

masters. Applied to IDS, this game master would be replaced by AI algorithms, which raises the bars concerning the necessary quality and completeness of the prepared model. However, creation principles for IDS from a non-digital perspective can possibly be derived from these strategies, as much as they can inspire the creation of digital story engines.

4.2.4 Improvisational Theatre: Emergent Narrative

Improvisation is a performance (of anything), in which no plan exists before acting. In improvisational theatre – also ‘improv’ or ‘impro theatre’ –, dramatic actions are decided on the fly by actors, mostly in direct response to stimuli coming from the environment. Therefore it is highly interactive; however, roles for ‘storytellers’ are hard to find. Improv is a medium with creative principles mostly targeting actors instead of authors of a story. Further, similar to RPG, it is hard to find established ‘story creation principles’ for improv theatre in literature. Keith Johnstone (1999) is a widely cited author of principles of improv theatre. He refers to improv techniques as *“theatre sports”*, a term that partly addresses the challenge for actors and historical motivations for using this form with competing teams, playing for the favour of the audience.

Besides that, improvisation has been widely used in theatre as a training component for actors. Johnstone (1999) refers to the Russian actor and director Constantin Stanislavski for his acting teaching method. He derived theory from practical studies with exercises to *“remove the blocks”* of acting. Johnstone (1999) has gathered lists of exercise games and tasks referring to it as *“Fast-Food-Stanislavski”* exercises, which are loosening-up experiences for actors.

Although improvisation forms can be found in history, it is only recently that improvisation theatre has become more widely disseminated as a genre for general audiences. Popular improvisation theatre mostly uses comedic styles of acting. Serious and dramatic performances can also occur, but are more difficult for entertaining an audience. Serious topics have been used in the *“Theatre of the Oppressed”*, invented by Boal (2002). By using Brecht’s *“Verfremdungseffekt”* (‘alienation effect’) (Brecht, 1957), the convention of the ‘fourth wall’ between the actors and the audience can be broken. Several actors may turn directly to the audience, each asking for advice in a conflict. The audience’s ‘coaching’ input to several characters is then used to ad-hoc generate a next episode with the interacting characters. This theatre style has been the model for the conceptualisation of the *“FearNot!”* prototype (see Section 2.1).

4.2.4.1 Rules for Improvisation

Several rule systems exist for improv actors, one of which Johnstone (1999) calls *"additive improvisation"*, suggesting it as the *"poetics"* of improv theatre. Additive improvisation incorporates a principle of *"give and take"* at the centre of all communication, transferred to a fictional reality on stage. It allows actors to 'add' to contributions of other actors. A contribution on stage is called an *"offer"*. A technique for actors to adopt is how to *"accept"* such offers, taking the played event as a given and including own actions that do not contradict the situation that this offer created. It is regarded as bad style or disability to reject offers. Another similar thing to avoid is *"to block"*. The challenge for actors is to collaborate with unexpected events to create something that makes sense in the end, a narrative that emerges from local interactions.

There are techniques for preparation and coaching of actors. A strategy can be to prepare certain information, for example, about the character to play, the emotion, the location, and the situation. When entering the stage, the actors should have an idea who they 'are', in terms of age, profession, physical characteristics, family, etc. Any details that actors can add to enrich the character are welcome during the preparation. A coach could also provide more background information regarding a character than the actor can effectively integrate. This can help the actor to better express the 'character' or add more variation.

There are no rules concerning eventual plot points. If the actors decide on a certain plot beforehand, more preparation is needed, but more often, the story emerges by local rules of interaction. Concerning the local interaction, there are 'golden rules' to follow for actors. These rules are easy to define, but require much experience to be mastered by actors. Some most important example rules are given here:

- *"Listen!"* Since no script exists beforehand, actors could tend to concentrate on 'their' own story they have in mind, rather than listening to what other actors propose. Instead, actors are requested to adopt a listening attitude, to be able to connect with other actors for a successful performance.
- *"Be consistent!"* Actors must keep their actions and utterances in mind during the performance to avoid contradiction. For the case of inconsistencies, special ways to cope with the situation can be trained.
- *"Never say 'no'!"* Rejecting an offer of another actor, even if it seems reasonable, is said to 'kill the improvisation', especially when the performance is left with nothing to continue. There are ways of saying *"yes,*

and" (preferred) and occasionally *"yes, but"*, but *"no, but"* raises difficulties. It is considered 'impolite' to reject offers right away.

The book (Johnstone, 1999) contains further strategies regarding on-stage behaviour of actors, collections of rules, tricks, and games for training that help actors to keep the story moving, get the audience engaged and increase the quality of the performance.

4.2.4.2 Conclusion and Application in IDS

The motivation to look at improvisational theatre from the perspective of IDS is – as for RPG – the search for 'natural' and non-digital ways of interactive storytelling. The IDS research community looks at 'improv' for proposed local rules of interaction and to find ways of implementing them in virtual characters. Examples for research and prototypes in this domain are (beyond the *"FearNot!"* project) the *"Virtual Storyteller"* (Swartjes and Theune, 2009) and research by Magerko et al. (2009). They point to a future branch of IDS technology based on agents that incorporate these creative rules in a simulation. Still, for the authoring of interactive storytelling, useful principles are hard to develop without complex software that is already capable of improvising. For now, 'authoring' does not exist in improvisation, not even in the form of 'story modelling' similar to RPG models. The authoring of rules in digital 'improv' is at best a configuration of virtual agents, targeted at digital simulated 'actors', not the story as a model. Further, the design of direct reaction rules (such as in a dialogue, for example of a chatbot) may be related to the thinking in local reactions. In order to drive an emerging story further, plans may also be constructed, to be run in an open-ended simulation with an appropriate engine.

4.2.5 Conclusion on Prescriptive Theories in Storytelling

In this section, the principles of screenwriting, video game writing, role play creation and improvisational theatre have been explored from literature. From the first to the last, there is an increasing amount of non-determinism in the resulting form, which creates different tasks and responsibilities for story creators. It also affects the way of being able to teach design principles. While in screenwriting, a screenplay exists that can be printed in a book, and a film exists that can be studied in parallel, this kind of study is more difficult with the interactive forms. Looking from videogame writing to RPG over to improv theatre, a gradually decreasing amount of information can be prepared in advance. Also, less information remains in a form that can be easily analysed and compared with the end result, which again is hardly storable for education (at least only in a complicated way).

It has been shown that design principles and guides for good storytelling exist from different perspectives. They are all based on heuristics and practical experiences, showing what has worked and what has not. By their nature, they are neither the result of systematic scientific research nor subject to a scientific proof. What has been shown, however, is that only by going through the complete making of story experiences can authors (as writers, artists, designers, game masters, performers) develop principles, which in turn can influence technological development. Especially the development of authoring tools, but also story engines, could benefit from stronger visions of how to create rich interactive storyworlds.

The review has shown differences between the characteristics of the disciplines:

- Screenwriting: There is a defined and potent role for the writer, the production process is clear. A 'good story well told' is the main focus. It is the most mature creative discipline, with a strong industry behind it. Therefore it is profitable that people get education. There are many principles directly concerning the style of representation and form of the end result. However, it is the only analysed form without any user interaction.
- Game writing: The writer role is not as important, the game designer is more important. Guidelines are more about the production process than about how to accomplish good storytelling. Stories are still debated for their usefulness, and are mostly functional to the game play, providing exposition and state descriptions for missions and rewards. The industry is strong, so there is potential profit in education. Interactive Storytelling is mentioned as a future prospect, mostly out of scope of current literature. There is acknowledgement of the fact that there is still a lot to do.
- Role play/game mastering: It is the most interactive form. However, it is not an industrial endeavour, mostly performed as a hobby, and therefore there is almost no educational practice. It is hard to find literature, and the principles are not yet commonly grounded. More than in video games, there are forms that foster strong storytelling. Personal communication at authoring workshops revealed that there is much interest in getting in touch with story engines. A main difference, however, is the fact that it does not strive at a closed system of options, rules and actions, but leaves authority to a game

master who (to some extent) can make up new content pieces on the fly during runtime (with differences in possible representational depth).

- Improv theatre: It is the most open-ended form. Creative principles are more directed at actors than at authors, as it is the most emergent traditional 'storytelling' art form in this study. They can provide valuable insight what can be created merely by applying local principles of how to react. They certainly provide rules, which, on the other hand, are difficult to apply for authors in the creation of digital Interactive Storytelling (IDS).

The review has been done with the hypothesis in mind that future authors in IDS could potentially be recruited from one of these storytelling areas, or at least would like to develop principles based on these. Academic education in storytelling disciplines, for example, is dominated by traditional approaches such as literature and film making. Richard Dansky as an author on videogame writing in (Bateman, 2007) mentions that an understanding of single disciplines such as literature writing in general, RPG creation, or scriptwriting, is indeed helpful in understanding videogame writing, *"... [b]ut videogame writing is all of these and none of them, and anyone relying too heavily on another medium's techniques as a panacea will doubtless run into difficulties sooner or later."* (Dansky, 2007)

The definition of guidelines relies on a huge variety of cases. For IDS so far, such number of cases has not yet been produced within the community. However, regardless of the commonalities of story structure and story understanding that are shared by all the existing disciplines, there are differences in creation principles that have become obvious, none of them addressing IDS directly.

Relevance of Story Creation Principles to Model Thinking in Storytelling

For IDS, we enunciate 'novel' conceptual models for creation (see Chapter 5) to build a bridge towards the necessary technical formalisation of a story idea. We need to express a story as a model with potentiality, which requires 'model thinking' (also compare Section 4.4.2). This relates to the previously discussed creative principles as follows.

- In screenwriting techniques, it is essential that causal structures are crafted iteratively and perfectly plausible – however, these causal structures are never expressed directly as a causal model, but lie implicitly behind the expressed events in the form of a linearised narrative. Still, writing principles address the awareness of conditions for characters' action choices and of the 'turning' effects of events and scenes.

- In videogame writing, game writers are not held responsible for the story experience and do not create a model of it. This role is assigned to the game designer – however, the story structures covered so far in the literature do not allow much interactive variability, focussing instead on player progress and achievements.
- RPG creation / writing comes closest to the idea of thinking in models, in that it is (in parts) about modelling a 'universe' of rules for a story. The remaining difference to IDS is that the models do neither need to be formal nor complete, as during play, a game master with improv talent can co-create an unfolding story on the fly.
- Creators in improv theatre are actors with strategies to react locally to situations. The existing principles do not give hints for story modelling, except for situational reaction rules. These are mostly internalised by the actors, rather than being consciously reflected as a model.

In summary, we assume that we need to bridge a communicative gap between disciplines with conceptual models of creation that connect technical formalisations (such as those of architectures described in Section 2.2) with known creative principles of the above storytelling domains. RPG creation seems to be closest to thinking of a story as such an abstract model. However, we also need to point out the new models' relation to screenwriting offering the most established storytelling principles and addressing a wider spectrum of story genres.

4.3 Narrative Theory

Narrative theory or 'narratology' is the study of narrative. Historically, the motivation was the discovery of structures in narratives, in the sense of a 'grammar' not at sentence level but at the level of whole stories. The topic emerged in the 1950's with Russian formalists (e.g., Propp (1968)) and French structuralists, such as Todorov, who coined the term *"narratology"* with the motivation to combine research on plot-structure that he called *"histoire"* and text-structure that he referred to by *"discours"* (Pavel, 1985). Research in narrative theory has traditionally been mostly concerned with the structure, perception and experience of literature (as opposed to 'the craft' of creation, which has been the focus of the previous section). With the advent of new media, narrative theory has been further developed to explain contemporary narrative forms, such as film and nonlinear storytelling. Beyond analysing the mere structure of a story, it is therefore especially interesting to have a look at theories that span media forms including film (Chatman, 1978; Bordwell, 1985), and to look for models that bear the potential to include interactivity (Ryan, 2006). Such discussions refer to the important distinction between *"story"* and *"discourse"* as sketched in Fig. 4.1 (Chatman, 1978).

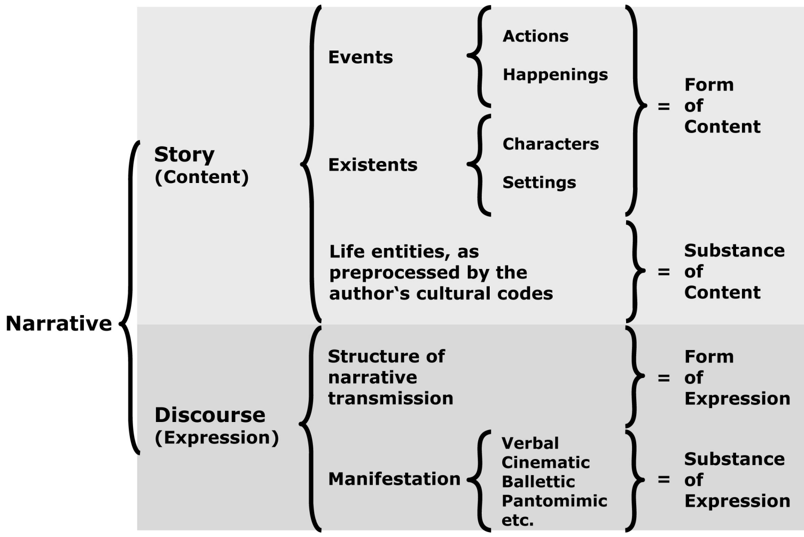

Fig. 4.1. *"Story"* and *"Discourse"* as elements of a narrative theory (Chatman, 1978).

Similarly, Bordwell assumes a *"[...] difference between the story as it is represented and the actual representation of it, the form in which the perceiver actually encounters it."* (Bordwell, 1985, p. 49). Bordwell, by referring to Russian formalists, uses the term *"fabula"* for the *"story"* – which is the *"imaginary construct we create, progressively and retroactively"*, assumed and inferred by perceivers of a narrative (for example, in a detective story). The term is opposed to the *"syuzhet"* (or spelled *"sjuzet"* by Chatman (1978)), which refers to the order of information given in the narration. Bordwell adds *"style"* as a third category, denoting the *"systematic use of cinematic devices"* as an ingredient of the medium. While Bordwell's goal is a narrative theory of film, Chatman's approach is more general, as he looks for *"elements of a narrative theory"* that he presents as a graph (Fig 4.1). His mentioning of the *"manifestation"* as part of the discourse can be related to Bordwell's *"style"*, while Chatman points out the important difference whether the expression of a story is done by *"recounting"* or *"enacting"* the events (simply put, 'telling or showing') – which corresponds to a classic distinction widely discussed (e.g. by Genette (1980) as going back to Plato's narrative modes of *"diegesis"* and *"mimesis"*.

In an abstract sense, it is a semiotic approach – that understands narrative in terms of (variable) signs to express a meaning – of having nested signifiers (the discourse/expression) of a signified content (the story). The distinction between ‘fabula and sjuzet’ (or ‘story and discourse’) has influenced current discussions on story adaptation across media, especially of reconciling story and narrative with interactivity (Ryan, 2006). It has been adopted by this study to reflect upon the concept of storyworld modelling (see discussion in Section 5.2.2.3).

Another driving motivation for the technical Interactive Storytelling community to analyse narrative theory has been the search for calculable formalisms, applicable to serving as grounding for algorithms in story engines. From this point of view, Cavazza and Pizzi (2006) have presented a summary of the most important narrative theories that influenced recent story engine architectures, mainly based on structuralist approaches. The following overview extends their selection of sources, however, it can only present a small section of narrative theory in a sketchy way. The emphasis is laid on story structure and story models, focussing on relevant models that have been considered for implementation in the technical IS research community so far.

4.3.1 Story Structure and Story Models

The following examples of structural theories refer to sources that are most frequently discussed within the IDS community. Studies within IDS have mostly been instrumentally motivated by looking for ‘story models’ to inform story engine function design, such as done with Propp’s theory in an earlier example (Spierling et al., 2002). In the context of creative work, each theory has to be reviewed whether story creators will have advantages knowing these structural models beyond the creative techniques explained above (Section 4.2). For understanding ‘highly-interactive’ IDS, the models are suitable to varying degrees. Also, the relevance of a model depends on the question whether it can serve as the base for a story engine’s autonomous decisions (and authors merely need to configure the mechanism), or if the model is to be creatively applied during authoring.

The narrative models were originally found and analysed on the base of non-interactive literary works. Still, for almost any presented theory there exists a computer implementation partly including interactions, with differences at the levels of granularity and universality of possible choices. With our pragmatic focus on interactivity, the theories are here reviewed and clustered for their potential to allow changes to the flow of narrative actions through interaction, without breaking the structural model. In the following three sections on story structure, we therefore group the presented examples by their structure-defining aspects of ‘form and sequence’, ‘grammar’, and ‘acting situations and conditions’.

4.3.1.1 Story Structure Based on Form and Sequence

Aristotle: Three-Act-Structure

Aristotle (384-322 B.C.), in *“Poetics”* (Aristotle, 1965), laid the foundation for almost any later theory, first of all with the notion of the three-act structure, consisting of beginning, middle and end, with the functions of exposition, complication, and denouement.

Further, as then applied by Laurel to Human-Computer Interaction (Laurel, 1993), he formulated a theory of dramatic principles consisting of six qualitative elements of structure in drama. These elements are connected by formal and material causes, which have been depicted by Laurel (1993) in hierarchical levels (see Fig.4.2).

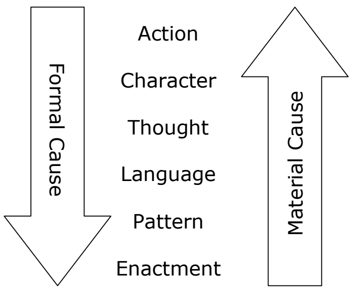

Fig. 4.2. The six qualitative elements of structure in drama adapted from Aristotle (Laurel, 1993, p. 51).

From the highest level down to the lowest, these elements are*: “Action”, “character”, “thought”, “language”, “pattern”* and *“enactment”*. Upper levels provide *“formal causes”* for lower levels; lower levels provide *“material causes”* for the upper levels, in that their experienced properties shape the next higher level – and finally the whole artefact – in the eyes of the audience.

According to Laurel, the use in going through these causes lies in the disciplined way of thinking about the design relationships in a ‘play’ or, as in an interactive application, by *“both constructing and debugging activities”* (Laurel, 1993, p. 49). This model has influenced Mateas (2000) to present a *“Neo-Aristotelian”* theory including user influence, as well as work presented in Chapter 5 herein (compare Fig. 5.5 and 5.6). Cavazza and Pizzi (2006) argued that for interactivity in storytelling, Aristotle’s structural approaches for story, in particular the three-act-structure, are not fine-grained enough, leaving out the level of concrete actions, but that he also laid a foundation for it by the concept of *“proairesis”*. ‘Proairesis’ (or *“prohairesis”*) refers to the concept of the ‘agent’, empowered by the ability of rational choice in reaction to impressions, distinguishing human beings from all other creatures.

Propp: Morphemes and Narrative Functions

The first researcher known to have analysed narrative structure at a fine-grained level has been Vladimir Propp (1968). He did his research in the 1920s on a corpus of about 100 Russian folktales and found a common structure among them. His book *“Morphology of the Folktale”* (Propp, 1968), widely cited in the community of IDS, presents 31 narrative functions or *“morphemes”*, occurring according to basic rules of sequencing. They describe abstract actions in context of their place in the whole tale. A given example explains that a concrete action, such as marriage, is something different depending on whether the hero marries a king’s daughter or the father marries a widow with two daughters. Identical actions can be morphologically different depending on their meaning in the course of actions, and one function can be expressed by several concrete action possibilities. Propp introduced a notation for the representation of the functions (see Fig. 4.3).

“Function is understood as an act of character, defined from the point of view of its significance for the course of the action.” (Propp, 1968, p. 21) *“The sequence of functions is always identical.”* (ibid., p. 22)

	Notation	**Definition**
	α	Initial Situation
1	β	Absentation (of family members)
2	γ	Interdiction
3	δ	Violation of interdiction
4	ε	Reconnaissance of villain
5	ζ	Villain receives information
6	η	Trickery
7	θ	Involuntary complicity
8	**A**	Villainy or Lack
9	**B**	Mediation – the connective incident
10	**C**	Beginning counteraction
11	↑	Departure of the hero
12	**D**	Hero is tested / donor's first function
13	**E**	Hero's reaction to donor
14	**F**	Receipt of magical agent / object
15	**G**	Spatial transference, guidance
16	**H**	Struggle (between villain and hero)
17	**J**	Hero is branded
18	**I**	Victory of hero
19	**K**	Liquidation of initial misfortune
20	↓	Return of the hero
21	**Pr**	The hero is pursued
22	**Rs**	Rescue of the hero from pursuit
23	°	Unrecognised arrival of the hero
24	**L**	False hero presents unfounded claims
25	**M**	Difficult task proposed to the hero
26	**N**	Solution of task
27	**Q**	Recognition of the hero
28	**Ex**	Exposure of the false hero
29	**T**	Transfiguration of the hero
30	**U**	Punishment of villain
31	**W**	Wedding of the hero

Fig. 4.3. Propp’s 31 morphological functions (Propp, 1968).

Further, Propp studied the functions of abstract character roles he called *“Dramatis Personae”*. Examples for dramatis personae are “*hero, villain, donor* *(provider), helper, princess (a sought-for person), dispatcher, false hero"*. Action functions are distributed among the dramatis personae, which results in overlapping so-called *"spheres of action"* corresponding to their performers. For example, the 'sphere of action' of the 'villain' is constituted by the morphological functions *"villainy (A)"*, *"struggle with the hero (H)"*, or *"pursuit (Pr)"* (compare Fig. 4.3).

For IDS, this resulting formalism raised interest for its proximity to calculable solutions, as for example suggested by Murray (1997) and implemented by Grasbon (2001). The advantage at first sight has been its level of abstraction, allowing to fill in details of a story, such as concrete characters and their deeds. Further, there are rules allowing some variation concerning the occurrence of the functions, but not their re-ordering. For example, a test of the hero (notation: D) by a donor is followed by the reaction of the hero (E) and the provision of a *"magical agent"* (F), for example, a flying horse or a magic potion. This subsequence is fixed in order but can be left out completely. For interactivity, Grasbon (2001) introduced branching structures, for example allowing a negative outcome of the test (D, E) and inserting a later re-test of the hero (compare Fig. 2.11). In the end, Propp's structure alone is quite limited as it has been built mainly by focussing on the 'form' of the narrative (Herman, 2002), leaving out causality or acting situations for deliberation of possibilities. Tomaszewski and Binsted (2007) pointed out that most of Propp's functions detail events that are *"inflicted upon"* the hero, but the influence of the hero on decisions for actions is rather limited.

Campbell: The Hero's Journey

Joseph Campbell (1946) researched a structure common to all stories in human mythology, constituting the *"hero's journey"*. He found that myths from all over the world seem to be built from the same elementary ideas. Within the course of a story, *"the hero"* travels through 12 stages, beginning with the *"ordinary world"* and a *"call to adventure"*, which is first refused, then committed to; then he goes through stages of tests and fights, and finally comes back to the *"ordinary world"* with a reward. The structure and nature of the 12 stages have similarities with the model proposed by Propp, in which also two morphemes correspond to the *"departure of the hero"* and *"return of the hero"*. They are grouped into three bigger sections of *"departure"*, *"initiation"* and *"return"*. Christopher Vogler (1992) in *"The Writer's Journey"* makes a close reference to Campbell's *"hero's journey"* while addressing film script writers. The 'hero's journey' has often been used as a model for a perfect linear story. It has gained attention because of its wide use in the film and game industry, especially by George Lucas in *"Star Wars"*.

Scripts and/or Plans

Herman (2002) pointed out the relevance of other theoretical contributions (outside narratology) to the understanding of narrative, for example the research done in cognitive sciences. For instance, Schank and Abelson (1977) contributed their concept of *"script"* to the understanding of sequences. Scripts are structured episodes representing standardised or rather stereotyped situations. Outside these stereotypes, actors have goals and make plans to satisfy the goals. The concept is famous for its example of the *"restaurant script"*. This illustrates that the situation in a restaurant has many standardised aspects leading to expectations about events that are likely to happen, including their (partial) order. The situation involves typical roles, props, entry conditions and results, as well as conversations (with the waiter). Schank and Abelson (1977) have implemented a computerised version in their programme *"SAM"*. However, for drama and interactivity, the concept of scripts is less interesting as a formal model for implementation, than for using it as a backdrop of 'common-sense knowledge'. Against this backdrop, events can stand out that change the ordinary script. Leaving the path of the script (as a given sequence) requires deliberate goals and plans, which are structurally more similar to story grammar (see below).

4.3.1.2 Story Structure Based on Grammar

Greimas, Actant Model and Semiotic Square

Greimas performed influential research from the 1960s to 1980s in search of a narrative grammar (Katilius-Boydstun, 1990). He contributed a semiotic approach to narratology. Most important was his notion of an *"elementary structure of signification"*, which consists of a bundle of at least two elements in binary opposition, building a *"semic unit"*. It implies that its elements are only meaningful in relation to each other, but also opposed to one another, which results in a *"semiotic square"* (see Fig. 4.4). A connection between square elements can be one of the types *"contradiction"*, *"contrariety/opposition"* or *"complementarity"*. In other words, if one element is an *"assertion"*, then it is the contrary of a *"negation"* and the contradictory of the *"non-assertion"* (Pavel, 1985). Negation is complementary to non-assertion, and non-negation is complementary to assertion. This model can be used to denote the semantic course of a narrative, corresponding to a movement along the semiotic square by leading from a given value towards its contrary. Cinderella for example could be read like a) 'being' a princess → b) 'not being' (lost position to stepsisters) → c) 'appearing' like a princess (by a fairy's spell) → d) being unmasked by spell time-out, 'not appearing' → a) recognised as 'being' a princess by a prince. (Pavel, 1985)

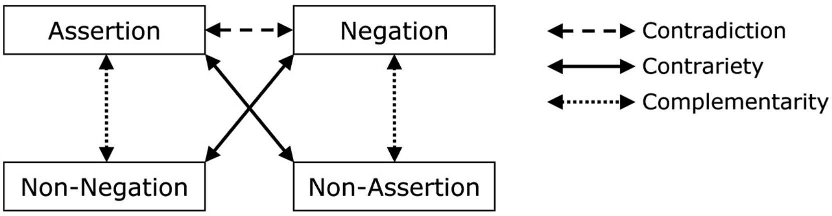

Fig. 4.4. Semiotic square model by Greimas (Pavel, 1985).

Greimas further introduced the typology of *"actants"* as a more abstract replacement for Propp's *"dramatis personae"*, finally resulting in a kind of syntax with which all narratives (and other discourses) can be expressed (see Fig. 4.5).

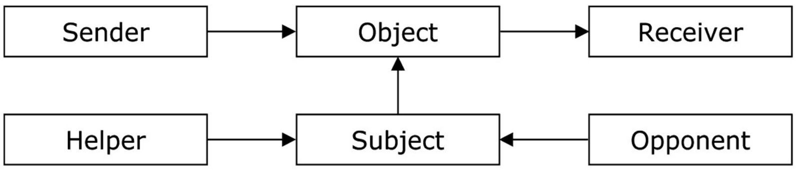

Fig. 4.5. Actant model by Greimas (Pavel, 1985).

While still showing its roots in Propp's mythical role descriptions, it is a simplified and more generalisable model of narrative structure in form of a grammar that can not only be applied to a whole story but also at sentence level. The hero then can be in the actantial role of 'subject' in one situation (for example, in a struggle against an 'opponent' with a 'helper') and in another situation fulfil a second actantial role, that of a 'receiver' in the attainment of an object as a result of winning the struggle (Katilius-Boydstun, 1990). The semiotic square, as a complete semantic micro-universe, can be seen as a *"deep level"* of conceptual narrative structure (Pavel, 1985). At the surface level, narrative sentences consisting of the figurative elements refer to the deep structure, for example by mentioning two actants who embody the abstract elements.

Story Grammar in Story Comprehension

In the 1970 and 80s, story grammars and similar structures have been analysed within the field of cognitive psychology, driven by the goal to understand story comprehension in general and especially children's adoption of it. A popular example is the story grammar theory of Mandler and Johnson (1977), which is based on the definition of a collection of *"rewrite rules"*. The findings were based on experiments with individuals who had to retell stories. Mostly, the recall followed certain patterns, involving the story characters' conflicts, and how they reacted to them in short-term reactions and by long-term plans, finally solving the conflict. Brewer (1982) pointed out that in experiments with children who had to retell stories, goal-directed stories were better recalled than non-goal-directed stories, and actions higher in the plan hierarchy could be recalled better than those lower in the hierarchy. If actions in the original story were presented not in the proper order of a plan, in the retelling they were shifted to their 'original' position. These experiments led to story grammars as schemata for *"well-formed"* stories, which support plan understanding as an important component.

A rewrite rule allows for the replacement of a given element in a string by one or several other elements (Prince, 2003). A simple example for rewrite rules according to Mandler and Johnson (1977) is given below (as an excerpt of the full set):

1. Story → Setting + Episode*
2. Episode → Beginning + Complex Reaction + Goal Path + Ending
3. Complex Reaction → Simple Reaction + Goal
4. Goal Path → Attempt + Outcome
5. Beginning → An event that initiates the Complex Reaction
6. Simple Reaction → an emotional or cognitive response
7. Goal → a state that the character wants to achieve

The * means that an element can occur multiple times. A simple reaction is an immediate effect as an internal response of the character, followed by a goal with an attempt leading to a complex reaction. A well-formed simple story can be described by this simple scheme, capturing its most important aspects. Interesting stories have multiple episodes, interrelated in a hierarchical structure, which occurs when a new episode is launched within a complex reaction.

Causal Networks

In contrast to the strictly hierarchical model of grammars, Trabasso et al. (1982) introduced a network metaphor for narrative representations. A causal network connects key concepts as nodes with causal links by specifying the logical type of connection. In principle, it builds upon grammar structure, except that it does not model a hierarchy but a network with qualified types of connections. The statements in the nodes are categorised similar as in grammar approaches, for example as *"setting, event, reaction, goal, attempt, outcome"*. However, the connections between the nodes follow certain criteria of causality, such as *"physical"* or *"psychological"* causality, or *"motivation"* and *"enablement"*. It is assumed that common sense knowledge beyond the presented statements is necessary for full comprehension, which is called *"circumstances"*. The result is a mental *"situation model"* of the happenings in the story, which is updated constantly with every added statement. Causal relationships are implicitly inferred, such as by the order of narration. For example, the order *"A. The dragon grabbed the princess. B. The princess screamed."* leads to a construction of a causal relationship of A being a cause for B because of their sequence. All elements can be depicted graphically in a network structure (Fig. 4.6).

These mental 'situation models' have been used to research story comprehension with children in their development process. Eventually, children learn to express causal relationships, after stages at which they first only can report isolated states and actions. Graesser et al. (1996) argue that story grammars were limited to express oral stories with a single protagonist solving a problem, whereas Trabasso's causal networks can describe a larger scope of narratives. However, it depends on the integration of background world knowledge, which can lead to different 'interpretations'. Tapiero (2007) used causal networks to analyse differences in individual interpretations of stories resulting in different model representations, concluding that in many cases there is not one 'correct' so-called 'situation model' to achieve.

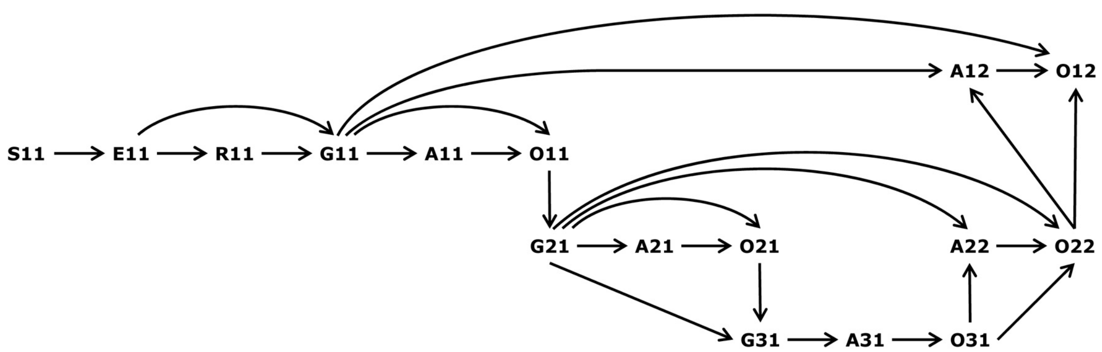

Fig. 4.6 Causal network of a story according to Trabasso (Graesser et al., 1996).

Within the realm of IDS, Swartjes and Theune (2008) have based the conception of their *"Virtual Storyteller"* system on Trabasso's causal network theory, by using the network as a story model, the *"fabula"* as a base to let an automated narrator present a narrative. However, their system does not include a concept to involve user interactions beyond an authorial user, configuring the initial conditions of then varying ‘emergent’ simulations.

Barthes, Narrative Units and Codes

Roland Barthes (1966) introduced many concepts for the interpretation of story, for example the notion of *“noyau”/”catalyse”,* translated by Chatman (1978) into *“kernel”* and *“satellite”* units of narrative (other translations of kernels have been *“nuclei”* or *“cardinal functions”*). It refers to a hierarchical structure of two kinds of events in a story. Kernels as major events build the backbone of the story, and cannot be deleted without destroying the narrative logic. Satellites as minor plot events can be deleted without losing the overall message, but the deletion will *“impoverish the narrative aesthetically”* (Chatman, 1978). A kernel or cardinal event can function as a *“dispatcher”* (not to be confused with one of Propp’s ‘dramatis personae’), which points at future events and connects narrative units by implied consequences. This can be associated with the *“hermeneutic code”*, one of five codes that Barthes identified in reading literary works, especially Balzac’s *“Sarrasine”* in *“S/Z”* (Barthes, 1970). He introduced five codes of interpretation of a written narrative ‘text’: *“semic”* (SEM – the implication of the word choice), *“cultural”* (REF – references to a shared cultural context), *“action/behaviour”* (ACT – ‘proairetic’, the single actions that constitute the plot events), *“symbolic”* (SYM – reference to human values, often as binaries of good/bad etc.), and *“hermeneutic”* (HER – interpretative, ‘filling the gaps’ between actions). The hermeneutic code signifies an interpretative reading of gaps, elements of mystery or cues to future events (such as a *“dispatcher”*).

In the search for applications of narrative theory to IDS, Cavazza et al. (2002) referred to Barthes’ theory when they introduced on-stage elements working as affordances for interaction, seeing an analogy in ‘affordance’ (compare Section 4.4.1.1) and Barthes’ notion of the *“dispatcher”* (the HER code), for example as ‘an object’ with which choice is associated. Fencott (2003) discussed Barthes’ codes in the context of virtual environments, elaborating on the ACT code, which is predominantly visible in computer-based interactions. He suggested that careful design shall enable the perception of the other *“voices”*, which would lead to more ‘storytelling’, exceeding action-based computer games. Barthes’ theory is interesting for IDS as it broadens the perception of stories beyond looking for story-mechanical logic.

4.3.1.3 Story Structure Based on Possibilities for Action (Acting Situations)

Bremond, Narrative Possibilities

In contrast to causal networks and grammars, which – as stories typically do – look backwards on causes for actions in a narrative, Bremond introduced a point of view at the action deliberation of an agent. Cavazza and Pizzi (2006) have highlighted Bremond's approach for its usefulness in Interactive Storytelling, which includes the consideration of the situation of a possible action and anticipated consequences for selection of the next action taken. He also first built upon the work of Propp, criticising its limitations of flexibility. Bremond introduced more abstract roles: the differentiation of *"agent"* and *"patient"* with regard to actions, which he called *"processes"*. Processes are related to either agents or patients, where an agent initiates the process and a patient is affected by the process. Further roles include *"influencer"*, *"enemy"*, *"frustrater"*.

Another, much simpler concept of Bremond's narrative theory is that of the *"elementary sequence"* (Bremond and Cancalon, 1980) of three functions for (or steps of) an action: 1.) the possibility for action, 2.) the actualisation itself, and 3.) the result of the action (see Fig. 4.7). This concept contains a simple progressive logic, one in which choices are considered to be made by the agent, instead of the teleological finality of story denouement orientation. Because step 1 determines a possibility, step 2 also contains the option for a choice to refrain from the action, and step 3 can consist of either success or failure of the actualised action.

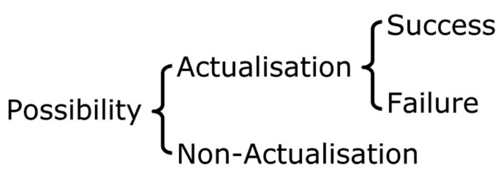

Fig. 4.7. Bremond's elementary sequence, following a logic of progression instead of a logic of finality (Bremond and Cancalon, 1980).

There is some relationship to Greimas' semiotic square, by posing negations at stages 2 and 3. Even if in a linearly told narrative these negations are not actualised, they are possibly considered as a backdrop of what would be if the agent decides otherwise, or fails instead of to succeed. The achievement of Bremond's model is drawing the attention to the possibility stage as an own categorical function, opening up for agency as a matter of choice. The prerequisite for perceiving any possibilities for action is the appraisal of an acting situation, which can be attributed to the acting character in the storyworld, but which is as well performed by the audience.

Logic of Action

Herman (2002) refers to von Wright's *"logic of action"* as relevant for narrative theory, where he gives a similar definition of three steps as Bremond, but related to the concept of 'state'. For v. Wright, the smallest descriptive action unit is actually a state description. According to this point of view, the most important aspect of action is a change in the world, respectively, the change of some *"state of affairs"*. This structure is similar to a creative principle proposed by McKee (1997) to writers, to judge every event according to what it 'does to the world' (see Section 4.2.1.2). The three parts of an acting situation are, according to von Wright's logic:

1) the initial state of the world,
2) the end state after completion of the action, and
3) the state in which the world would be without the action.

This model is interesting for IDS, because a 'state change' is the emphasis for action, bringing it closer to computational models of state machines or models of dynamic worlds in games and emergent systems. The concept is somewhat related to what Prince has called *"minimal stories".* Minimal stories consist of three conjoint events, two of which are static events, connected by an active event, which causes the transformation between these static events, such as in *"John was poor, then he worked very hard, then, as a result, he was rich."* (Prince, 1974). However, while the minimal story is a simple grammatical structure, within 'logic of action', an action is mainly judged by its potential for world transformation. G.H. v. Wright, quoted in (Herman, 2002, p.74): *"An agents life situation […] is […] determined […] by his total life behind him and by what would be nature's next move independently of him."* The term 'nature' here includes actions of other agents. The quote also refers to those necessary actions that prevent something from happening.

Herman (2002) illustrated by comparison of different theories such as of Vendler and Frawley, that there are possible linguistic constructions that make it hard to distinguish between actions (and other event types) and states in literary narrative. His example: *"She is taking a swim out in the ocean"* can refer to her action of swimming that leads to a state change, but also to a state itself, implied by the continuous verb tense. Also, the problem of parallel compositions of actions with durations has not yet been tackled properly by that simple state description. In practice, events are often equated with actions, as they change states in the world. However, some event types have been distinguished (Casati and Varzi, 2006), for example 'actions' as certain types of events, which are intentionally executed by agents to accomplish (immediate) goals.

In the AI discipline of 'planning' widely applied to IDS research projects (Barros and Musse, 2007), the definition of a triad of *"pre-condition – action – post-condition"* as a representation of a possible event is very common. It can be compared with v. Wright's and Bremond's minimal sequences. For example, when using a STRIPS[24]-like planning formalism (Russel and Norvig, 2003, p.377 ff.), it is necessary to specify facts (propositions) about each possible action. These propositions specify pre-conditions that are first to be checked as being true to execute an action, as well as a list of changes to the world appearing after the action would be executed, mostly by adding or deleting sentences about facts and properties in the world. In short, while using a formalised description language, situations for possible actions are described.

4.3.2 Conclusion on Narratology for Interactive Storytelling

This section provided a rough sketch of narrative theory's main conceptual models for story structure recently discussed within the community of Interactive Digital Storytelling. Our clustering into the categories 'form and sequence', 'story grammar', and 'acting situations' denotes a rising potential to model the interactivity attempted in interactive storytelling. For the sake of brevity, many theoretical contributions from narratology have been left out and the descriptions have been kept superficial.

Story structuring approaches based on narrative theories have been most influential in the last several years for the engineering of story generation engines. For conception of interactive content, they have not yet explicitly been applied. There is only little synergy between structural concepts of narratology and creative principles in storytelling. The best known concept put into practice is *"The Hero's Journey"* (Campbell, 1946), a linear model. For interactive storytelling, Bremond's model of acting situations with *"narrative possibilities"* can be applied to thinking in terms of situations with preconditions and effects. This is illustrated in Chapter 5.

[24] STRIPS stands for STanford Research Institute Problem Solver.

4.4 Designing Interactive Systems – Principles and Theories

Creating experiences by means of Interactive Digital Storytelling artefacts involves the creation of interactive digital systems. These systems are comparably complex and need to be 'used' by end-users in order to obtain the designed experience, which is assumed to grant these users control and 'agency' while participating in a virtual story world. The subjective user experience depends on a variety of aspects, of which the diegetic 'story' or 'fabula' is only a part[25]. Put the other way around, as users may not distinguish between subjective experiences concerning interaction and experiences concerning the story, we can also assume that the design of the user interaction is part of the complete storyworld content. It constitutes an important aspect of the 'discourse' or 'sjuzet'. Also within games development, designing game interaction styles is not a separated discipline. Instead, it forms a part of the game itself, often co-defined by the game genre (Saunders and Novak, 2007).

Research and practice in interactive systems design reconciles several disciplines since the emergence of personal computing within the early 1980's. Human-Computer Interaction (HCI) has since then evolved as an academic discipline and practical field of experience. In the beginnings, its multidisciplinarity comprised two broad fields – computer science as its *"original academic home"* (Carroll, 2009) and cognitive science. Further, human factors research methods have been included, offering established processes for the analysis of artefact usability. The field has since then constantly diversified. According to Carroll (2009), the community is multifaceted and *"loosely bound by the evolving concept of usability"*, with a commitment to value human concerns (and not functionality engineering) as the primary consideration in creating interactive systems. Beyond usability issues, within the last decade, 'user experience' has been considered an increasingly important factor for interaction design (Preece et al., 2002). The experiential aspects of interfaces have first been discussed by Laurel (1990), who pursued the research of improving interfaces by narrative aspects.

In an interactive storyworld, end-users shall be enabled to express themselves by means of human-computer interfaces, get feedback about their actions and experience immersion in the story, preferably not even recognising the interface. This involves several design disciplines in interactive systems, each assuming conceptual models of their trade. Without the attempt to give an exhaustive account of HCI issues, this section

[25] 'Fabula' and 'sjuzet' denote the distinction between a story (*"what is told?"*) and its discourse (*"how is it told?"*), see Section 4.3 and (Chatman, 1978).

focuses on selected models that have been perceived as relevant for interactivity design in Interactive Storytelling:

- Selected general models and principles in Human-Computer Interaction
- Models from game and simulation design
- Conversational models, discourse analysis

4.4.1 Models and Principles in Human-Computer Interaction (HCI)

Literature on practical principles in the field of Human-Computer Interaction is extensive, addressing several disciplines. A prevalent text book mainly serving the academic field in computer science, usability engineering and other disciplines is *"Designing the User Interface"* by Ben Shneiderman (Shneiderman and Plaisant, 2010), first published in 1986 and revised several times up to its fifth edition in 2010. Since the beginnings of the discipline, many aspects of designing user interfaces have changed, because the variety of user groups and application fields has increased immensely. At the same time, also the quality of interfaces has improved and the demand for quality has reached a high standard. More than that, some requirements of novel entertainment applications and social media seem to turn certain established guidelines of traditional task-oriented systems upside-down.

Because of this diversity (including contradictions), it is important for the context of this work to look at universal models and metaphors that are abstract enough to be potentially relevant and applicable to the field of Interactive Storytelling.

4.4.1.1 Understanding Interactivity

This subsection presents selected descriptive theories in HCI, which at their general and established level support conceptual models of understanding users' conscious interactions with a computer. They are independent of or integrating most of all interaction techniques. Even though the state of the art of input technologies continues to advance, we assume them to be universally effective.

Conversational Metaphor

For the creative field of IDS, one of the first to reason about interactive principles has been Chris Crawford, game designer and IDS pioneer. According to (Crawford, 2000, p.51), interactivity is defined as a *"cyclic process in which each actor alternately listens, thinks, and speaks"* (Fig. 4.8). Crawford's assumptions about the quality of this process claimed that the amount of information flowing through this *"interactive loop"* should be high enough and should be symmetrical between the two parties of the conversation. All three aspects *"talk", "listen" and "think"* should be equally important in this conversational metaphor to *"have good interaction"*. By radically applying this conversational metaphor to interactive storytelling (Crawford, 2004, p. 30), certain forms of new media storytelling are to be discarded from falling into the realm of Interactive Storytelling, for example mere *"reactive"* forms, in which users do not have the same bandwidth of expressing actions as the system and therefore the conversation is not symmetrical. Increasing the bandwidth of expression for humans implies a huge challenge for the design of an interactive system. In Crawford's terms, it means that computers are better at 'speaking', than at 'listening' and 'thinking'. Making an artwork listen and think is the challenge of Interactive Storytelling in the sense of Crawford.

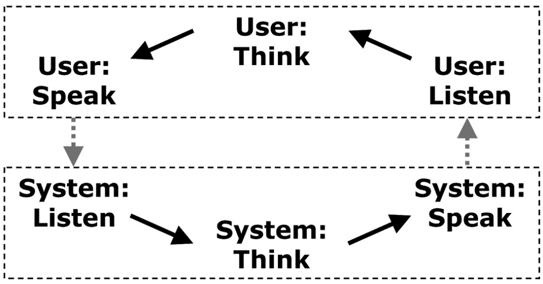

Fig. 4.8. Crawford's model of the 'interactive loop' (Crawford, 2000).

These assumptions have been persistently shared by many researchers in IDS, raising the bar for building interactive storytelling artefacts that fulfil this requirement, as many existing presumably interactive stories would not meet the requirement of a member of the audience being an equal participant in the conversation. Kelso et al. (1993) have established the term *"highly-interactive"* for interactive drama, where the *"interactor"* determines the action, being dramatically present in a compelling story, as opposed to a hypertext in which the user is given only a small number of fixed choices.

Another more general and influential 'loop model' between a user and a system composed of seven stages was proposed by Don Norman (1988). At the lowest possible granularity (for example, of issuing commands), seven stages of a user's action – depicted in Fig. 4.9 – take place between *"forming the goal"* and *"evaluating the outcome"*. This perception-action loop from the point of view of a user contains two problematic steps to overcome for successful interaction: the *"gulf of execution"* between stages 2 and 3 and the *"gulf of evaluation"* between stages 5 and 6. The gulfs occur because systems and devices typically can only deal with primitive actions. In order to grant users compelling experiences, careful interaction design is required to support the user's mapping of his/her intentions to system-relevant actions, or to allow interpretation of the system state. For IDS, this mapping needs to integrate smoothly these primitive actions with the story semantics. For this conceptual integration, the next model with levels is helpful.

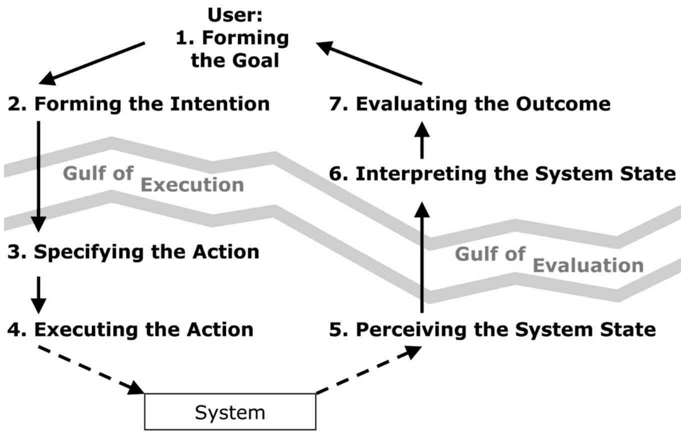

Fig. 4.9. Norman's *"seven stages of action"* model, according to (Norman, 1988).

Models with Separating Levels

Shneiderman and Plaisant (2010) have identified a theory development approach of separating concepts on a vertical axis in levels, inspired by software engineering and ergonomics. An example is hierarchical task analysis with its roots in the industrial age of the early 1900s, where complex actions are decomposed into smaller actions. Shneiderman and Plaisant suggest that a division into levels, such as the 'four-levels model' (see below) has proven convenient for designers, for its modularity of different concepts and the possibility of a top-down design approach.

In the pioneer time of research into computer graphics (CG), also the basics for graphical interactive systems have been developed and investigated, making reference to hierarchical levels of psychological closure (Foley and Wallace, 1974) relevant for system response times to user actions. Foley et al. (1995, p. 394) further describe Human-Computer 'dialogues' by means of CG, and see dialogue design as a CG discipline. They divide dialogue design tasks into four levels, of which the decisions at the top level affect design decisions at lower levels (Table 4.3).

Although originally drafted with a graphical desktop system in mind, this model is universal. Applied to games or interactive storytelling with a game controller interface, the conceptual level can mean the design of the principal story and interaction genre; the functional design can be the design of possible story events including user achievements and failures; the syntactical level describes the sequence and forming of user input with the game controller, and the turn taking with story characters; and the lexical level is defined by the hardware and graphical primitives chosen.

Conceptual Level and Design: Definition of the principal application concepts that a user must master. It builds the user's mental model and is sometimes described in a real world's analogy (for example, a spreadsheet). This conceptual level defines the typical objects, their properties and relationships, as well as possible operations of an application.
Semantic Level, Functional Design: Definition of the functionality of the system, including the meaning of user-initiated functions, or 'user actions' and their results, specification of possible errors and error handling.
Syntactic Level, Sequencing Design: Definition of the ordering of inputs and outputs as part of the form of the interface. This comprises rules of forming sequences of user actions or of 'units of meaning', which cannot be further decomposed without losing meaning. This level includes temporal and spatial factors especially of outputs, affecting also the graphical layout of information display, and its sequencing.
Lexical Level, Hardware Binding Design: Definition of the most basic form of the interface. The design includes the specification of input and output devices, display primitives and their attributes, and the precise mechanisms with which users specify the input syntax (for example, keystrokes, mouse clicks, body movement, etc.).

Table 4.3. Four-level model described by Foley et al. (1995).

The levels model inspires thinking about Interactive Storytelling and its interaction design requirements in a similar way (compare Section 5.1.2), with the user's role concept designed in the story at the top level. It also supports seeing interaction design as a necessary design principle for interactive storytelling.

4.4.1.2 Principles of Interaction

IDS design includes users as participants in a storyworld. Therefore, the user actions and their possible scope is a design step to be considered at several levels (see above). At the most abstract level, principles of interaction design include the choice of interaction paradigms as well as conceptual models for interaction, and lastly concrete interaction styles that depend on the paradigms used. Also at a most general level (independent of the chosen interaction style), there are abstract principles that are important for structuring the conversational loop and therefore applicable to any storyworld design. The choice of the following selection of theory has been motivated by the question how interaction can be modelled as a conversational loop, independent of a concrete choice of interface.

Conceptual Models, Interaction Styles, and Novel Interaction Paradigms

In the text book *"The Design of Everyday Things"* (Norman, 1988), Norman has identified the building and supporting of conceptual models by design as a major responsibility of system designers. Conceptual models are mental representations of how the world works, models that users form of a concept in their world.[26] Examples for general conceptual models of *"activities"* in HCI have been presented by Preece et al. (2002), such as *"instructing"*, *"conversing"*, *"manipulation and navigation"* as well as *"exploring and browsing"*. Also *"objects"* can be models for interaction as metaphors of the real world, such as the *"spreadsheet"* or the *"desktop"*. However, an important point of view for interactive storytelling is that of the *"primacy of action"* discussed by Laurel (1993, pp. 125 ff.) in *"Computers as Theatre"*, as opposed to earlier approaches seeing the computer merely as a tool: *"Focus on designing the action. The design of objects, environments, and characters is all subsidiary to this central goal."* (Laurel, 1993, p. 134) She introduced the term *"human-computer activity design"* (instead of interface design), and critically contributed to the paradigm shift from the metaphor of 'computer as a tool' to 'computer as an agent'.

These conceptual models represent high-level activity models (see the 'levels model' in the former section), which can then be mapped to various more concrete 'interaction styles' defining the lower levels, such as the syntactical and lexical form of allowing user input and presenting output. Shneiderman and Plaisant (2010) suggested that the choice of interaction styles (in a typical desktop environment, such as menu styles or direct manipulation) shall follow the identification of tasks to perform.

Beyond this desktop model, several 'paradigm shifts' for alternative interaction possibilities have been identified and investigated for years by the IDS research community. For example, 'Virtual Reality' installations (Pausch et al., 1996) allow for more immersion in a dramatic storytelling situation simply by way of the user interface. A significant amount of contributions to the conferences of the IDS community[27] covers multimodal interaction and Mixed Reality concepts. These may merge input modalities, such as speech and gestures, either as a matter of choice or with sensor fusion techniques. For example, merging speech and pointing input channels to one perceived user action can result in a user expression of *"put that there"* (Bolt, 1980). The advent of commercial products like Microsoft's *"Kinect"* and related open source libraries[28]

[26] Within the research presented herein, potential conceptual models of the design process for authors and creators in IDS are investigated (results see Chapter 5). At the same time, we assume that our target authors (or the team of authors) are also interactive system designers to some extent. They are to present design solutions by which they influence the conceptual models of their end-users participating in the designed interactive storyworld.

[27] Conference series website: www.icids.org

[28] http://openkinect.org/

contribute to visions of seamless interaction in fictive worlds. In the most up-to-date practical guides on interaction design (for example (Benyon, 2010)), multimodal interfaces and other new paradigms are mentioned, but special design guidelines are still underrepresented. Other emergent technologies that constitute novel paradigms of 'natural interfaces' with a high relevance for Interactive Storytelling and games include multi-touch systems, tangible interfaces, mobile and wearable computing, as well as affective and pervasive computing. In future interactive storytelling experiences, users may be enabled to express dramatic actions and communicate face-to-face with virtual agents. This includes the expression and experience of emotions, the consideration of rich context, and spontaneous playful actions directed at the conceptual and semantic levels of a system (see above). The low levels (lexical level, syntactic level) are necessary to make the system work – but more importantly, their design constitutes the media representation of the interaction scope in a storyworld. In an integrated view of IDS, as will be presented in Chapter 5, the design of these interaction and input levels needs to have equal importance as the media representation levels of the story output.

Abstract Principles of Good Interaction Design

Until the field of Interactive Storytelling produces mainstream guidelines, Norman's high-level principles of designing *"everyday things"* (Norman, 1988) can be applied to novel designs, as they are general enough. They concern traditional GUI-based interfaces as well as novel interaction paradigms. As future work, they may lead to concrete IDS guidelines, based on necessary heuristics that need to be established. Norman's meta-principle is the design of a conceptual model, which has been discussed above. Further selected principles include:

- *"Affordance"*. The concept of affordances in user interfaces has been adapted by Norman from perceptual psychologist James Gibson, defining it as: *"...the term* affordance *refers to the perceived and actual properties of the thing, primarily those fundamental properties that determine just how the thing could possibly be used."* Norman distinguishes between real affordances and 'perceived affordances'. He focuses on the latter, being an important product design issue by providing strong clues on possibilities for action.
- *"Feedback"*. Understood as 'immediate' feedback, it indicates to the user the way of performing the own action (such as a cursor), as well as immediate effects of the action (such as changing states of graphical

elements). Without appropriate feedback, users cannot be in control of their own 'virtual' actions.

- *"Mapping"*. Norman promotes 'proper and natural mapping' between the visible parts of an interface and the actions that they support. Good mapping of visualised affordances to known concepts of the user support the easy learning of an application, for example relating layout and directions of elements.
- *"Constraints"*. Limitations to only appropriate actions ease interaction within complex environments, for example the physical constraint of navigating the camera upright and at eye's height through a virtual world. Especially in complex interaction contexts, constraints play an important role. They can be physical, cultural or logical.

This list cannot be exhaustive in terms of usability design, as many more principles exist, in particular those dealing with possible user errors.

For interactive storytelling, the two principles of *"affordance"* and *"feedback"* have to be emphasised. Perceived affordances define the preconditions for user actions within narrative situations, in which the user can and wants to express him-/herself. These need to fit the users' role and scope of action in the storyworld. Immediate feedback shows users that their actions have been recognised by the system, which is an important aspect of experiencing agency. Some new 'natural' interface paradigms try to reduce typical 'computer-ish' constraints. Also for Interactive Storytelling, we have emphasised the vision of a seamless integration of user interaction into the event structure of a storyworld (see Section 2.1.2). Especially in complex interactive worlds with loosened technical interface constraints (for example, natural language interaction or free gestures), affordances and feedback are important design issues (Norman, 2010). Ideally, these are part of the designed content model of the story world.

4.4.2 Game Design and Simulations

Designing interactive systems is something that the interactive entertainment industry has been coping with in the context of game development, achieving masterly success, during the last 30 years. The development accelerated within the last decade, as since about the year 2000, game design books and guidelines have begun to be published and academic discourse has started.

Within the context of this work, games and simulations are perceived as near relatives to interactive storytelling. This sub-section presents selected concepts from literature that can be assigned a certain importance for the discussion of conceptual models in Interactive Storytelling to be discussed later. It cannot be exhaustive on game design principles or structures, which have emerged in the last decade with a huge body of literature.

4.4.2.1 Interaction in Games

Though meanwhile many game design books and online information exist on the market, there is not much scholarly literature to be found on interaction design or interface design guidelines for games. One explanation for that could be that the interface design is an essential part of the conceptual game design. In one of the few books dedicated solely to *"Game Interface Design"* (Kevin and Saunders, 2007), it is pointed out that game 'interfaces' can refer to anything that helps the player interact with the game. It includes the choices and design of hardware such as input controllers or display technology, or graphical game components that provide 'feedback' to players' actions, such as 'health bars', also 'crosshairs', and even game characters.

Applied to interactive storytelling, this is another argument why interaction design should be considered as a part of the interactive story creation task, because at the lower levels of the discourse (syntactical, lexical), interface renderings form part of the representational levels of the whole IS experience. According to Salen and Zimmerman (2004, p. 264 ff.), 'meaning' in a game is represented not only visually (lower levels), but also by attributions of roles (higher levels), possible actions or other contextual elements. Visual elements such as *"game stats"*, for example, can have multiple interrelated meanings at several abstract levels, such as the health of a character and the skill of a player. Interaction in games is central to the whole experience, as mainly player actions are what constitutes or makes up the game.

Formal Abstract Design Tools in Game Design

Doug Church was one of the first game designers to warn the game community about a lack of a common design vocabulary (Church, 1999). At an abstract level, he suggested formal design tools that show some similarity with Norman's stages-of-action model (discussed in 4.4.1.1). The components are (again) a reactive cycle of forming goals and perceiving consequences:

- *"Player intention"* is the process of accumulating goals, in response to understanding the world (the game play options), making a plan and then acting on it.
    - Players are encouraged to form their own goals and act on them,
    - players know what to expect from the world, thus feel in control of the situation, and
    - goals and control are supported at different time scales, such as low-level and high-level goals.
- *"Perceivable consequence"* requires a clear reaction from the game world to the action of the player.
    - Players feel more connected to, or responsible for, their actions, and
    - players are likely to realise reasons for attempts going wrong.

Church (1999) discussed an ideal realisation of this simple principle with the example of the *"Mario 64"* game, which is a simple 'platformer' based on 'jump-and-run' actions and collecting items. He acknowledges the difficulty of implementing this same concept in RPG genres, because these games are less direct about presenting consequences. In RPGs, players often cannot distinguish between actual long-term consequences of former player decisions and randomness. In *"Mario"*, perceived consequences are the immediate result of player actions. Perceivable consequences should therefore be attached to actions that are perceived as intentional actions with consequences. Tools of storytelling, such as foreshadowing, could be used. On the other hand, Church argues that integrating too many actual consequences takes away control from the story author, because it is difficult to build. *"By taking control away from the player in some spaces, the designer is much freer to craft a world full of tuned-up moments in which the designer scripts exactly what will happen."* (Church, 1999)

Taking an integrated view at presumed interaction levels in Interactive Storytelling, we observe a challenge for integrated design. In a storyworld, we are interested not only in short-term reactions, but foremost in long-term consequences of actions and events. The design challenge (of interaction design as well as story design) is to scaffold appropriate feedback that lets users perceive these underlying consequences.

Relating Interaction and Storytelling to Game Design

Publications on principles for successful game design can be assumed another rich source for looking at established conceptual models. However, we need to position

Interactive Storytelling in relation to games in general. Differences within the broad range of available game principles in the literature are expressed in terms of

- game genres,
- classifications of playful experiences, and
- classifications of player types.

For interaction design in games, Kevin and Saunders (2007) have classified established ‘game genre’-specific interface conventions. Categorising different games into genres has been especially helpful to deal with an increased need for preciseness, not only in academic discourses, but also for game designers. Crawford (1982) delivered a first *“game taxonomy”* in the early days of computer games, interestingly distinguishing between two big categories *“skill-and-action games”* and *“strategy games”*, each subsuming six genres. Wolf (2002) presented 42 genres based on differences in interactivity (and has been criticised that this number be too high to be useful). Unlike the genres in film and literature, computer game genres do not refer to settings or theme (for example, romance, mystery, etc.), but to a style of ‘gameplay’. Different gameplay directly relates to the varieties in interaction styles and the technologies used (for example, persistent online worlds or car racing). Game designers Rollings and Adams (2003) name the following as major ‘high-level genres’: *“Action, adventure, strategy, role-playing (RPG), simulation games”.* The academic discourse on proper classifications has not yet provided a consistent canon.

In search of defining interaction styles for games, Kevin and Saunders (2007, pp. 104 ff.) use Crawford’s top-level distinction (Crawford, 1982) as *“action game style”* and *“strategy game style”*. The main difference lies in the complexity of the players’ actions and therefore in different needs to provide ‘feedback’ to players through visual representation. There is little discussion on usability issues, as mastering the interface belongs to mastering the game. Table 4.4 gives an overview, distilled from (Kevin and Saunders, 2007).

It is interesting to note that from the point of view of these considerations about game interfaces, the player actions are at the centre of the experience. All visual elements are regarded as ‘feedback’ elements, designed with the one and only purpose of giving players’ actions context and guidance, and representing their meaning.

Genre	Sub-Genres	Interface Specialties
Action Genres		Whole screen for action, reduced statistics (sometimes 'head-up') displays (health, ammo etc.), often on consoles (or PCs).
Action	FPS (first-person shooter)	Motion of one (invisible) character to be played; 'movement system' and 'combat system'; basic standards about 'stats'. Movement system WASD[29] (on PC) or using game controller.
	3rd person 'platformers'	Jumping, many items to collect.
	3rd person fight games	Complex hardware controls with syntax.
	Racing	Graphical elements straightforward and limited; special hardware controls.
Strategy Genres		Resource management in focus; high amount of information; complex interfaces; mostly on computer platforms.
Strategy	RTS (real-time strategy)	Complex menus; selecting: keyboard shortcuts; many controls; support of real-time multi-tasking such as exploration, resource management and combat. Complex and standardised interfaces, fixed on screen (one section reserved for action, another section for interface).
	TBS (turn-based strategy)	As in RTS, but turn-based with more time for the player, therefore even more complex interfaces, for example different full-screen interfaces for switching.
	RPG (role-playing games)	As in RTS, but characters can be advanced in power. No emphasis on items to find, but on story and dialogue. Unique features: 'Levelling', 'playing a role', conversational choices as additional element. Movement system: WASD (as in FPS) or left-clicking on destinations.
Simulation Genres		Special interface needs determined by the kind of 'reality' that is referenced in the simulation.
Simulation	Vehicle simulation	Similar to action genres.
	Process simulation	Similar to turn-based strategy genres.
Adventure Genre		Genre loosely defined, very different interface styles can occur. In general, the goal is puzzle solving instead of reflexes. Can be text-based or menu-based turn-taking, real-time graphics, or other.

Table 4.4. Interface specialties of different game genres.

It is almost impossible to position Interactive Storytelling within the above genre list. There are indeed several forms on their own behalf, some of which can be demonstrated by novel interaction styles, others follow some styles of the above list. Examples for novel styles are storyworlds in which players can have a real-time, emotional, and direct discourse conversation with virtual characters, as in *"Façade"* (Mateas and Stern, 2005) or *"Emo-Emma"* (Cavazza et al., 2009). Another more conventional style, using a turn-taking principle by choosing actions from menus in 'indirect discourse' is present in *"Storytron"* (Crawford, 2004) or *"IDtension"* (Szilas, 2007). In an ideal view of IDS, participants have influence on story-related content elements, such as dramatic actions. As such, in the above list this would be closest to 'RPG', 'process simulation' (given that social processes are the theme) and 'adventure

[29] WASD movement system refers to using the standard PC keys W, A, S and D with the left hand for 4 directions of movement.

games' (given a structure based on strong narrative principles and less on combat or puzzles). There is often a mix of genres. *"The SIMS"*[30] as an example for a social simulation game has in fact also elements of strategy and role playing.

Beyond and long before the existence of computer games, several theories on categorising playful experiences have been developed. One of the most influential is that of Roger Caillois (1958). Caillois presented a definition of play together with a classification of games. Caillois' classification has two dimensions: on the one hand, four fundamental categories of play motivations, and orthogonal to these, a continuum between *"turbulence"* and *"rules"*, which refer to 'free play' and 'institutionalised game' (see Table 4.5).

	PAIDIA		**LUDUS**
AGON: Competition. Equal probability of success, skill.			
	Wrestling (not regulated)	⟷	Soccer, Chess
ALEA: Luck, Chance. Players cannot exert any control over outcome.			
	Counting-out rhymes	⟷	Roulette, Lottery
MIMICRY: Mask, Simulation. Players pretend to be someone else.			
	Childish imitation	⟷	Theatre
ILINX: Vertigo. Attempts to disrupt regular perception patterns.			
	Merry-go-round	⟷	Acrobatics

Table 4.5. Classification of games according to (Caillois, 1958).

Caillois named the poles of this ranked order *"paidia"* and *"ludus"*. These were connected by a continuum of possible game forms in each of four categories, named *"agon", "alea", "mimicry"* and *"ilinx"* (translations see Table 4.5).

Among the four categories, 'mimicry' is the most suitable for IDS, as it can stand for role playing and simulation, even theatre plays. Caillois emphasised that there cannot be drawn strict lines between the categories, as games exist with aspects that fall into more than one category, for example, skill-based competition games with a luck component, as in card games.

More recent classifications of game experiences from design practice include the taxonomy of fun by game designer LeBlanc (2000), constituting *"eight kinds of fun"* such as *"sensation"* (game as sense-pleasure), *"fantasy"* (game as make-believe), *"narrative"* (game as unfolding story), *"challenge"* (game as obstacle course), *"fellowship"* (game as social framework), *"discovery"* (game as uncharted territory), *"expression"* (game as soap box), and *"submission"* (game as mindless pastime). Costello and Edmonds (2009) presented an attempt to reconcile six theoretical

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[30] The SIMS, Electronic Arts, thesims.ea.com/

categorisations (like the two above) on game experience into one framework. It is interesting to see that the components of the models intersect at an abstract level, but that there are reasons why different classification systems are still being used for different purposes. IDS scientists (of media studies and psychology) only recently commenced researching the structure of subjective IDS end-user experiences, for example Roth et al. (2009).

Finally, the games community has long been interested in taxonomies of 'player types' to get a grip on the market structure. LeBlanc (2000) argued that his eight kinds of fun (see above) can also be used to describe which kinds of fun are preferred by individual players. Also in non-computer role-playing games (see Section 4.2.3), player types have been perceived as central to the whole design process. In the domain of video games, Bartle (1996) first suggested four player types interested in multi-user dungeons (MUDs): *"Achievers", "explorers", "socialisers",* and *"killers"*. This early work has led to the *"Bartle-Test"* taken online by half a million players. Yee (2005) criticised Bartle's 'types' as a too rigid assignments of types to players, and presents an alternative model resulting in mixed types. Yee's main components are *"achievement", "social"* and *"immersion"*, which subsume 10 subcomponents in total. The *"immersion"* component is a home for storytelling with the subcomponents *"discovery", "role-play", "customisation"* and *"escapism"*.

The 'player types' discussion influences the way we can expect to engage players in interactions at the narrative level. Tanenbaum and Tanenbaum (2008) discussed agency in interactive storytelling by distinguishing between *"players"* and *"performers"*. They made the crucial observation that a wide-spread consideration of ludic play assumes that *"players will place the pleasures associated with winning over the pleasure of story". "Performers"*, in contrast, engage in the act of "*constructing a story in collaboration with the designer of the system".* (Tanenbaum and Tanenbaum, 2008)

Concluding on these continuing discussions, we can assume that the field still has to distinguish concrete interactive storytelling 'genres', which will – in the end – also influence conceptual models on their creation. The discussions also suggest that the kind of chosen interaction design influences the building of these categories. Within these categories so far, the case study presented in Chapter 6 is closest to a conversational simulation with a first-person interface based on natural language. It addresses 'performers' in a 'narrative' and 'mimicry' kind of experience.

4.4.2.2 Creation Principles in Simulation

Simulation is not just one genre of computer games, but a discipline on its own. Storytelling and simulation have often been discussed as opposite to each other, for example by Aarseth (2004) and Frasca (2001), and in practice of current computer games, simulation and story have often been kept distinct by letting interactive play and cut scenes take turns. On the other hand, many approaches in Interactive Storytelling try to integrate simulations for story production (Riedl et al., 2006; Swartjes and Theune, 2008), especially when following a goal of achieving emergence of events (Aylett et al., 2005). Mostly, these approaches implement psychological models of agents or a story model.

Also the two aspects 'game' and 'simulation' can be viewed as separate concepts to be designed, but for the success of a simulation game, both rely on each other. According to *"The SIMS"* designer Will Wright (2004), the simulation is 'inside' the artefact as a model of the structure and process of the simulated world. What then counts most for the success of his game is a five-second feedback loop between the player and the system. This functional goal of the game, namely 'to entertain', is the main goal which drives the model design, as opposed to anything following strict ontologies of a real world. Wright was reported to say for this combination (with regard to the game *"SimCity"*): *"Usually the game is separate from the simulation. Games can be based on conflicts and goals that are external to the simulation itself. The simulation goes on doing its thing, and the user can play different games with their own sets of goals. The simulation does not consider fires spreading between buildings to be an error condition or a source of conflict – that's just the way the simulator's supposed to behave. But the user might…"* (Hopkins, 1996)

Dynamic Models

The imagination of an emergent storytelling system implies that story events will be generated by a digital process, as in a simulation. In the beginnings of his book *"Emergence – From Chaos to Order"*, John Holland (1998) has explained the phenomenon of emergence as *"much coming from little"* by examples of growing plants from seeds and of board games, where agreement on a few rules gives rise to extraordinarily complex games. The same is true for established physical models of gravity and other forces as a base for a flight simulator. Although the overall system of a chess board, for example, is fully defined, an outside observer has difficulties to predict the next happenings. Holland explains that to some extent predictions are possible – depending on the required level of detail. Weather forecasts are typically working well at high levels of abstraction regarding large masses of atmosphere over short time spans, but for more precise predictions, too many detail variables are unknown. Holland motivates the discovery of the *"building blocks"* that are at work in a complex system, possibly blocks at a high abstraction level. The challenge is the construction of a dynamic model, by finding *"unchanging laws that generate the changing configurations"*.

Fig. 4.10 (adapted from Holland, 1998, p. 47) illustrates this model building. It shows the general concept of transition functions building the core of a dynamic model. By observation at several points in time, building blocks of the model are identified together with their change rules. This observation is typically done at a certain useful level of detail, which is chosen well if it is *"faithful to the system being modelled"*.

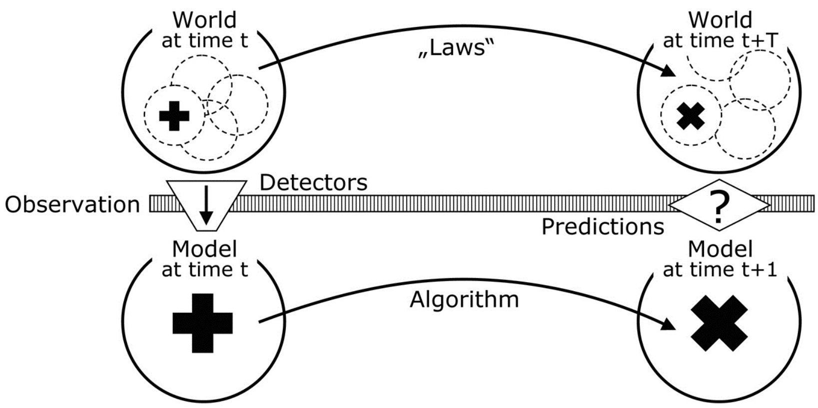

Fig. 4.10. The observed world configurations and their identified 'laws of change' (top) have to be transferred to a dynamic model (bottom) of states and calculable transition functions ('algorithm'). Illustration adapted from (Holland, 1998).

According to Holland, a *"perfect model"* would result in a complete detailed mapping of real world configurations to model states and of laws of change in the real world to transition functions in the model. In this perfect case, the diagram in Fig. 4.10 could be considered as *"commutative"*. Commutativity means that two paths to follow within the diagram should create the same result: a) the observation of the world at time t, followed by execution of the model's algorithm up to time t+1, and b) an observation of the world at time t+1. This perfect case would enable predictions by execution of the model's functions. However, as Holland points out, the art of model building lies in selecting the *"right level of detail"* that is useful for the purpose, distinguishing salient features from the non-essential and capturing the laws of change at the chosen level. It is very unlikely that we manage to observe the world successfully in every detail, and doing so would result in a model that is way too complex.

These principles are not only known in the domain of computer-based simulations, but are also elements of design for non-digital gaming simulation, such as for training, learning or organisational change, as discussed for decades in the community of 'gaming simulation' (Duke, 1974)[31]. For the design of such a serious simulation game, often stress situations, intercultural encounters or organisational issues are analysed to inform the design, mostly by the search for critical incidents and other effects of mostly intertwined factors. According to Kriz (2000), it is important to maintain a level of abstraction and not to model too many parameters, as an educational simulation depends on pragmatic issues to be effective.

Iterating Event Models and Mediation

A practical introduction to simulation modelling for game developers with a programming background has been given by Flynt and Vinson (2005). In their introduction, they pointed out that for game designers, simulation modelling may subvert classical storytelling. Talking about *"choices, challenges, and destinations"* as a game designer refers to a plot, whereas simulation means *"plotless interaction"*. However, they assume the context of a simulation as an important factor for even designing or finding a model.

Simulation in general can have multiple uses and values, with the effect that model building is always goal-driven. Axelrod (2005) highlights the various purposes of simulation in the social sciences: *"prediction, performance, training, entertainment, education, proof, discovery"*. Flynt and Vinson (2005) distinguish two kinds of simulation contexts affording different kinds of modelling:

- *"Objective simulation"*. Modelling starts out from a hypothesis about an assumed part of the world and develops by collecting sensory data. The goal of the simulation can be the construction of experiments to test hypotheses.
- *"Experiential simulation"*. Modelling starts from memory and is based on subjective experiences of events and their explanation. The simulation goal can be the mediation of experiences for others, emphasising a given theme.

The goals of both kinds are a form of 'mediation' of the simulated model – either by elaborating on a hypothesis or by enabling an experience. Also, both kinds start out with a sort of 'high-handed' goal working as a filter on parameters, events and rules to be found and included. Hence, every model creates a bias to a certain extent,

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[31] See also: ISAGA, The International Simulation and Gaming Association, Homepage: http://www.isaga.com/ .

and is likely to distort data. The quality of the model can only be perceived by such a mediation process. Therefore, it is necessary to iterate through stages of model design and mediation (running the simulation) as a designer. It is improbable that a dynamic model is designed at the first draft stage with full effectiveness toward the set goal.

Conclusion for the Design of Interactive Storytelling

In the previous section (4.4.2.1), the focus has been on discussing player interaction within different forms of games, of which 'simulation' is one possibility. In contrast to that, this section (4.4.2.2) has been concerned with the design of a simulation model, running 'underneath' the interaction, being – as such – part of a computer game or being built for other purposes. Looking at principles of simulation design supports the thinking of a fictional world in terms of a model. It is therefore highly relevant for the claims made before, to build a bridge between technical formalisations of generative engines and narrative storytelling by means of 'modelling' the intended story experience.

Principles of building dynamic models have been influential for the resulting conceptual models of 'implicit creation' of storyworlds in this thesis, which is elaborated in Section 5.2.

4.4.3 Conversational Models, Discourse Analysis

"Façade" (Mateas and Stern, 2005) is often quoted to be the first working prototype of Interactive Digital Storytelling. The system uses conversation as the central means of interaction and of content, in a highly-interactive experience. Own experiments with 'Scenejo' (reported in Chapter 6) have adopted this vision, in spite of the difficulties involved especially with the need for coherence in continuing conversations, as well as the pace of the interaction with frequent turn-taking. In RPGs, non-violent and educational games referring to human relationships, the consequences of communicative behaviour on emotions and relationships are in the focus. Humans mainly use conversations and dialogue for interaction. Human conversations in the broadest sense include verbal dialogue as well as non-verbal signs, the latter either as visible and audible non-verbal cues accompanying the verbal dialogue, or in the context of multimodal body- and sign-language representing dialogue contributions.

These aspects build the major motivation to look at conversational systems and their underlying theories to inform models for interactive storytelling.

4.4.3.1 Disciplines Involved in Natural Language Interaction

Natural language interaction with computers is one of the oldest visions of human-computer interaction, demonstrated frequently in science fiction artworks like *"2001: A Space Odyssey"*[32] or *"Star Trek"*[33]. Starting from philosophical discussions about thinking machines (Turing, 1950) and first systems in the 1960s, the topic has come a long way from simple question-answering machines to more sophisticated systems, which still have not reached 'maturity' in the sense of a coequal conversation partner. Research has to continue, because current systems indeed work well in constrained contexts, but are limited in broader use and require a huge development effort of several sub-disciplines based in AI and linguistics. An overview of selected systems is provided in Section 2.2.4. Here, a simple overview is given on the specialisations involved, to then focus on author-relevant aspects of the whole task. Fig. 4.11 shows a generalised model of a speech-interaction system, inspired by several sources (Harris, 2005; Kopp, 2006; Löckelt, 2008).

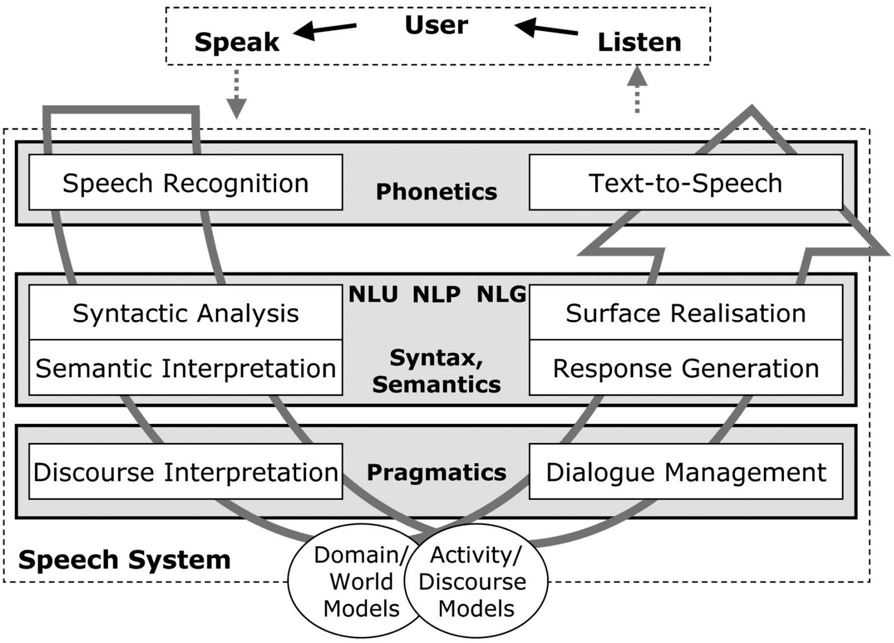

Fig. 4.11. General model of a spoken dialogue system.

The grey blocks in Fig. 4.11 summarise complex operation steps, with input processing on the left side and output generation on the right side. The drawing implies that all steps are automatically processed by the system. However, in systems for interactive storytelling, it is imaginable that only partial automation is implemented, and

[32] Film by Stanley Kubrick, 1968 (original author: Arthur C. Clarke)
[33] TV series, original by Gene Roddenberry, 1966

manual solutions are chosen to work around technical difficulties or unpleasant artefacts. From top to bottom, the study of natural language can be divided into three main levels:

- 'Phonetics' is the study of speech sounds. 'Speech recognition' technology decodes sounds into a sequence of words. A 'text-to-speech' system (TTS), as the name implies, turns text into synthetic audible speech. In practice, this layer can be ignored with a typed-text-based user interface. *"Façade"* uses typed text as input and recorded human sentences as the output. 'Scenejo' uses typed text as input and TTS as output. Speech recognition is still error-prone and synthetic voices often do not convince the audience.
- 'Syntax' and 'semantics' are the study of structural relationships between words and the study of meaning. 'Syntactic analysis' determines the utterance structure, and 'semantic interpretation' leads to the understanding of a word's or a sentence's meaning. 'Response generation' composes meaningful dialogue acts ('what to say') that are then turned into direct wording ('how to say it') by a 'surface text realisation' based on correct grammar, taking into account styles and diction (Hovy, 1998). This level contains technical challenges that are currently tackled in several sub-fields of 'natural language processing' (NLP) with the two aspects of NL 'understanding' (NLU) and NL 'generation' (NLG). (Kopp, 2006)
- 'Pragmatics' is the study of language use in practice, its goal-directedness and its implied actions. Discourse analysis is the study of conversational structure. 'Discourse interpretation' analyses what the user intends by taking into account the discourse context. In 'dialogue management', goals and plans are carried out to either respond adequately or to obtain the initiative in the dialogue. (Harris, 2005; Löckelt, 2008)

Beyond these levels, the themes to talk about (a propositional domain) and the situational context need to be known. Knowledge of one domain is often not enough, because a successful conversation also needs to be based on common-sense knowledge to feel natural. Discourse models can range from formal conversations at a ceremony to completely free small-talk. Formal models, such as for a booking dialogue, are easier to implement and maintain, and users are in general more cooperative than with free conversations (Harris, 2005). This is again a reason why fully automated speech interaction for entertainment has not yet been realised successfully – only at low bandwidth (text-based) with restricted grammars as in text adventure games.

In Fig. 4.11, the items of 'domain/world models' and 'activity/discourse models' are placed at the system's side, but knowledge bases like that are needed at almost every processing level. For successful speech recognition and semantic interpretation, hypotheses can be built based on domain knowledge or simply a vocabulary. Most often, a 'corpus' of spoken dialogues for a certain domain is built by annotating hours of field recordings as a resource for reference. On the generation side, responses are based on knowledge of domain-specific task structures or discourse models including conversation-functional aspects like 'repair cycles' and 'grounding'. Also surface realisation can better be formed with particular domain language knowledge ('register').

Relevance for Authoring in IDS

Contemporary game writing principles (see Section 4.2.2) involve writers in dialogue creation tasks. Stemming from script writing, dialogue writing is an art form with aesthetic rules. For example, it is crucial to follow natural speech patterns, but exclude unessential fillers. Schütte (2002) promotes an ideal of terse dialogue that provides information, displays emotions, and reveals traits by its diction.

In the extreme case of a fully automated speech system, talented writers are obviously obsolete. The writing task is superseded by the demands to provide domain models and world facts (ontologies), a task structure and planning domain for the system to follow, to model grammars and templates with natural register and vocabulary, and to write expressive behaviour rules for non-verbal output. However, what works well for task-based systems poses huge challenges for storytelling in terms of complexity. This is a reason why up to date, partial or completely manual solutions are used for interactive storytelling. Undoubtedly, the adoption of automated technologies in interactive storytelling systems denotes a crisis from the point of view of creators, as they are becoming redundant in the creation process. Still, they are relevant for creation in partially automated systems, where authors fit into an interdisciplinary team. Harris (2005) points out that conversational systems require lengthy development phases, which are data- and labor-intensive. For the domain of interactive voice service systems, he outlined the necessary team roles as *"interaction architect", "lexicographer", "interactive-dialogue writer", "soundscape designer", "quality assurance prime", "usability prime", "research prime", "speech technology expert",* and *"subject-matter expert"* (Harris, 2005).

As a general conceptual (meta-) model of the creation task, we can assume that whenever narrative subtasks are solved by automation, artistic expression has to be performed by model building instead of directly shaping the textual output. The whole team participates in that task (see Chapter 5). Harris (2005) expresses a refreshing pragmatic point of view for designers, regarding the vast amount of conversational theory with elaborate nuances available from linguistics, sociology and related fields. He recommends that we not stick to a strict version of a theory, but opportunistically take what we can use. *"If I can jerry-rig two approaches together sufficiently to generate something useful for voice-interaction design, that's good enough for me."* (Harris, 2005, p. 28)

Finally, for authors and story creators who consider to use verbal exchanges with users at the interface of their storyworld, it is a necessity to know the technical limitations involved.

4.4.3.2 Discourse Analysis

From the point of view of interactive storytelling, the 'pragmatics' level of discourse and dialogue management in the interactive system (see Fig. 4.11) are closest to the actual story discourse (the sjuzet) to be designed for. The levels that are closer to physical user actions can be perceived as the concrete representation levels of the discourse. It is assumable that even if the media representation of spoken language is not generated but recorded conventionally and/or is partially human-written, for example as in *"Façade"*, at discourse level, more dynamic models are helpful for variations during interactivity. Together with story models as a base for dynamic drama management, knowledge about discourse modelling can support interactive story creators (as will be shown in Section 6.3).

Dialogue as Action: Speech Acts

For conceptual models of storytelling, and to link to other models such as 'story grammar', 'actants' and 'agency', seeing verbal utterances as 'actions' is a crucial concept. The concept of *"speech acts"* has first been introduced by Austin (1962) and has been further developed and systematised by Searle (1969). Austin identified a variety of different *"acts"* one can *"perform"* during speaking, which can be categorised into three aspects (all can be present within one utterance).

- *"Locutionary act"*: The simple act of producing an utterance, either by saying something, or even by a *"phatic"* act (that has no further *"illocutionary force"*).

- *"Illocutionary act"*: An intended *"performative"*. This can be a statement or a change of dialogue context, for example, a question, a promise etc., categories that have been refined by Searle (see below). It refers to the 'intended' act of the speaker.
- *"Perlocutionary act"*: The actual act of *"doing things with words",* the effect on the relationship to or the actual effect on the hearer. This act not only depends on the intention of the speaker, but also on the context and the hearer, rendering an illocutionary act successful or unsuccessful (or *"infelicitous"* in Austin's words).

For example, as shown in Table 4.6, an intended illocutionary command can be expressed by different locutionary acts, and can result in different perlocutionary acts. The expressed command can have different effects on the hearer, depending on whether the hearer follows the command or how he/she takes it. The success in performing a perlocutionary act depends on a complex state of the situation, including the roles and presuppositions of all involved.

Locutionary Act (Possibilities)	Illocutionary Act	Perlocutionary Act (Possibilities)
• "Jump into the water!" • "Come on coward, jump!!!" • No locutionary act (using whistle and hand gestures)	Command to jump into the water.	• Persuade • Irritate • Amuse • Annoy

Table 4.6. Correlation of locutionary, illocutionary, and perlocutionary act.

Searle (1975) provided a more detailed categorisation of illocutionary acts by stressing that *"illocutionary force"* depends on participants' presuppositions as well as the *"illocutionary point"* of the act. 'Illocutionary points' can be:

- *"Assertives"* say how things are.
- *"Commissives"* commit speaker to doing something.
- *"Directives"* attempt to get other people to do things or to answer.
- *"Declaratives"* change the world or bring about a state of affairs by the utterance.
- *"Expressives"* express emotions and attitudes.

The presuppositions can contain aspects of preparatory states, conditions of a mode of achievement (such as the authority due to position), and aspects of the sincerity of the situation. These are complex conditions under which perlocutionary acts can be made, where nuances in the conditions can distinguish between – for example – a threat and a promise.

'Speech act theory' is relevant in many aspects of Interactive Storytelling, especially in those where at the user interface, a form of direct speech is used. The illocutionary act can be seen as a form of abstraction that can be expressed by many explicit forms of expression (verbal, non-verbal). As such, many user utterances can be parsed and bundled to one single anticipated speech act, instead of trying to 'understand' a huge variety of possible verbal clauses. This principle has been used in *"Façade"* (Mateas and Stern, 2004), 'Scenejo' (see Chapter 6) and *"FearNot!"* (Louchart et al., 2004). Further, the concept of perlocutionary acts can be used to make the effect of an act depend on a changing state of the storyworld, for example, only being able to successfully persuade a character if the necessary preconditions of trust have been arranged.

Dialogue Management: Turn-Taking, Repair and Grounding

When people converse with each other, it is not only meaningful content that is the matter of utterance exchanges. In human-human dialogues (as well as in human-computer dialogues), misunderstandings occur, which have to be resolved by meta-dialogue and repetitions. Further, people take turns in speaking, a process which is mostly managed non-verbally according to some underlying rules. Sacks at al. (1974) have introduced an analysis of a *"simplest systematics of turn-taking"* at work in human multi-party conversation, which has served as a theoretical fundament also for dialogue management with the computer. It is especially useful with more than two interlocutors.

According to Sacks at al. (1974), a speaker's turn is constructed as a pragmatic unit, which can consist of one word up to many sentences, and/or one or more speech acts. Speakers typically construct a turn with a recognisable potential end, a *"transition relevant place"* (TRP), offering that someone else can take over, and may use subtle non-verbal cues for addressing a next speaker. Sacks et al. (1974) have identified the following 'simple' rules:

- *"Current speaker selects next"*. Within a turn-constructional unit at a TRP, the current speaker can involve the use of a *"current speaker selects next"* technique. If so, the selected party has the right and the obligation to take the next turn to speak.
- *"Self-selection"*. If the current turn is constructed without using a *"current speaker selects next"* technique, self-selection for the next speaker may (but need not) be instituted, and the first starter acquires the right for the turn.

- *"Speaker continuation"*. If no next speaker is selected and no other speaker self-selects, the same speaker may (but need not) continue.

A typical example of a 'current speaker selects next' technique is the use of certain conversational acts that occur in pairs, such as a question requiring an answer or a greeting followed by an expected greeting in return, so-called *"adjacency pairs"* (Schegloff and Sacks, 1973). In general, humans take turns in conversation, with a minimal overlap. If longer overlaps accidentally occur, normally a *"repair action"* is taken, by stopping a turn, excusing, etc.

"Grounding" is another conversational technique (Clark and Brennan, 1991), establishing mutual understanding (knowledge, assumptions) within a dialogue. These are techniques of verification, such as by back-channeling (e.g., non-verbal head-nodding or verbal interjections, like "I see"), by making a relevant next turn (e.g. in an adjacency pair), or by repetitions in a repair dialogue, which are extra turns dedicated to reach a common ground in conversation.

For human-computer dialogue, even or especially in cooperative task solving such as in a voice-based booking dialogue, the elements of *"flow-regulating"*, *"grounds-keeping"* and *"repair"* are important design factors (Harris, 2005). It is important to design unambiguous prompts and discourse markers, to include confirmation dialogue as unobtrusively as possible, for example by combining a repeating of the understood elements with the next question, and to be prepaired for repairs (Spotlight, 2001). In this context, the concept of speech acts has been extended to *"conversation acts"*, including core speech acts and speech management acts (Traum and Hinkelman, 1992).

Dialogue Structure: Adjacency Pairs, Initiative, Dialogue Chunks, Dialogue Games

The concept of an adjacency pair is a pattern of communicative exchange with two parts: The first part is an *"initiating move"* (IM) and the second part a *"resolving move"* (RM), together forming a complete "*dialogue chunk"*. Levinson (1983) defines that adjacency pairs are 1) adjacent, 2) produced by different speakers, 3) ordered as a *"first part"* and a *"second part"*, and 4) *"typed"*, meaning that a particular first part requires a particular second part as an answer. Levinson (1983) also found that there exist *"preferred"* and *"dispreferred"* second parts. For example, with 'requests', 'offers' and 'invites', 'acceptance' is the preferred second part and 'refusal' the dispreferred. An 'assessment' as a first part prefers 'agreement' and disprefers 'disagreement', whereas a 'blame' prefers a 'denial' instead of an 'admission'.

Chunks in general are recognisable units of discourse (Dooley and Levinsohn, 2001), which can get more complex when the resolving of the initiating move is delayed by a *"countering move"* (CM) that initiates a clarification dialogue. They illustrate a complex chunk by an example adapted from (Longacre, 1996, p.132):

A: I'm inviting you to dinner with me at 2 pm Thursday. (IM, Pro)
B: Can I bring one of my sons? (CM/IM, Q)
A: Bob or Bill? (CM/IM, Q)
B: Does it matter which? (CM/IM, Q)
A: Yes, it certainly matters. (RM, A)
B: Okay, Bob, the older one. (RM, A)
A: Very well. (RM, A)
B: Okay, thanks, we'll be there. (RM, Res)

Longacre also categorised the dialogue acts (or moves) as *"question/answer"* and *"proposal/response"*, abbreviated by Q/A and Pro/Res in the above example. A third pair defined by Longacre (1996) is *"remark/evaluation"*. The example shows that the initiative in a dialogue can quickly be changed by introducing counter-questions. Notions such as *"initiating"*, *"resolving"*, and *"countering moves"* are helpful in analysing dialogue. Longacre also discussed that not every exchange has a symmetrical closing like the above one.

In human-computer dialogue processing, the need to respond to open questions and to close dialogue chunks was taken up by Traum and Allen (1994), introducing the term *"discourse obligation"*. They applied it to *"TRAINS"*, a human-computer dialogue system for cooperatively solving tasks. Jameson and Weis (1996) additionally pointed out the usefulness of the *"obligation"* concept for modelling situations in which the participants do not have common goals. Further, it does not only affect question/answer situations, as simply posing a remark may result in an obligation for the other party to respond. In their example of a car selling situation, the remark *"For me, safety is the most important thing"* leads to an obligation to address safety-related features (Jameson and Weis, 1996).

Exceeding pairs and chunks, the concept of a *"dialogue game"* has been introduced by Levin and Moore (1978) from the point of view of language comprehension, inspired by Wittgenstein. Dialogue games as multi-sentential knowledge units can explain regularities observed in naturally occurring dialogues. They are goal-oriented units, rather specifying the kinds of language interactions in which people engage than the content of these interactions. Levin and Moore (1978) name as basic examples of such games "*helping, action-seeking, information-seeking,* *information-probing, instructing, griping".* This kind of functional organisation of language interaction is maintained through cooperative processes involving the parties 1) in recognising when a dialogue game is proposed, in 2) using their implicit knowledge to comprehend utterances within a given scope, and 3) being able to identify when the interaction is to be terminated.

The connection to 'joint goals of participants' makes the concept of dialogue games suitable for computer implementation with a plan-based approach. This has been undertaken in the German *"SmartKom"* project (Reithinger et al., 2003) and further extended for the German *"Virtual Human"* project (Löckelt, 2008). According to Löckelt (2008), dialogue games are *"recipes"* for joint actions, consisting of dialogue moves. He based his model for generating multi-party behaviour on a combination of dialogue game models, each made up of different typical dialogue act types. Planning-based agents make use of joint actions in shared sub-plans. An example within IDS, *"Façade"* (Mateas and Stern, 2005c) used so-called *"social games"* as a concept to structure joint behaviours of agents into contained sequences. However, although the pragmatic result is similar in pre-structuring certain forms of exchanges, the underlying theory of 'social games', dealing with transactional analysis (Berne, 1964), is different.

Classifications of Dialogue Moves, Dialogue Coding

From the IDS point of view, in a human-computer dialogue it is important to perceive utterances as actions. Ideally, these actions shall influence storyworld states, having perlocutionary influence or at least illocutionary meaning. The same motivation has led researchers in 'dialogue systems' to develop notation schemes and coding strategies for the identification of dialogue acts from human conversations. One of the first standardised annotation schemes developed in a joint effort of several research groups has been *"DAMSL"* or *"Dialog Act Markup in Several Layers"* (Core and Allen, 1997). Within the research project *"TRINDI"* (Cooper et al., 1999), a consolidation of schemes from different sources has been undertaken, resulting in a classification of the most common dialogue moves. The scope of acts to be coded varied and increased over the time, from an initially limited group of mainly task-oriented actions to adding more dialogue moves concerning human informational coordination. Table 4.7 summarises the consolidated scheme of Cooper et al. (1999). However, this scheme leaves out forward-looking acts for 'grounding', such as a request for acknowledgement.

Function		**Dialogue Moves**
Core Speech Acts		
	Forward-Looking Function	Statement • Assert, Reassert, Other-statement
		Influencing-addressee-future-action • Open-option • Directive o Action-directive, Info-request
		Committing-speaker-future-action • Offer, Commit
		Conventional • Opening, Closing
		Explicit-performative
		Exclamation
	Backward-Looking Function	Agreement • Accept, Accept-part, Maybe, Reject, Reject-part, Hold
		Answer
Grounding Acts		
	Backward-Looking Function	Understanding-act • Signal-understanding o Acknowledge, Repeat-rephrase, Completion • Correct-misspeaking
Turn-Taking Acts		Take-turn, Keep-turn, Release-turn, Assign-turn

Table 4.7. Classification of dialogue moves used in *"TRINDI"* (Cooper et al., 1999).

4.4.3.3 Relevance for Interactive Story Creation

Research in 'discourse analysis', concerning the structure or higher-level inter-utterance 'grammar' of human conversations has been continuously applied from research in sociolinguistics to computer linguistics, partly intertwining their efforts. Basic structures have here been summarised from simpler to more complex forms. For conceptualising IDS with verbal exchanges, especially at direct discourse level but also in indirect speech, these concepts are of interest. In the context of the discussion of 'agency', dialogue chunks and dialogue games point to situations in which not every single action is deliberately chosen by freely deciding agents. In dialogues, there are indeed 'preferred' answers that are more likely to be given. On the one hand, this can facilitate the mapping of user speech inputs to a limited choice of possibilities by 'prompting' certain expected answers. On the other hand, it also offers likely abstractions for dialogue structure between virtual characters, which can serve as templates. An example of an application for design is shown in Chapter 6.

4.4.4 Conclusion on Interactive System Design for Interactive Story Creation

The principles and theories that describe structures and design issues of interactive systems have different influences on conceptual models for the creation of interactive storytelling. The search for these principles has been motivated by the intuition that 'highly-interactive' storytelling should naturally have something to do with issues of interaction. Despite this, recent trends in the IDS research community predominantly emphasised narrative theories to be referenced as theoretical background. The contributions to our concepts are twofold. First, we acknowledge the design of interactions as an integral task in the interactive story creation process. Second, we adopt the development of dynamic models for the general creation of a storyworld, and consider discourse models in the design of verbal exchanges.

The 'conversational model' in several stages and the classic 'four-level model' (4.4.1.1) can be used to differentiate between several design problems that IDS story creators have to solve. For IDS, we assume that semantic choices have to be offered to users, to let them influence higher levels of the story content. Such granting of 'agency' depends on properly designed affordances and feedback also at lower levels. It is essential to let users experience the consequences of their actions. The style levels of interfaces are then comparable to the story representation of the 'output' (see Section 5.1).

In authoring for automation, the general process of abstraction in 'simulation modelling' is a crucial concept to identify important dramatic states and actions, including their transition rules, and to structure possible actions into more general groups. Such an abstraction process of story content establishes links between the concrete actions (lower levels) and their semantic value (higher levels).

Models based on 'discourse analysis' give hints for structuring interactive exchanges and user expectations, as well as for abstraction of user acts (see Section 6.3), especially if direct discourse is involved as an interaction style. Creators need to know at which level (partial) automation occurs and what remains to be authored.

4.5 Conclusion on Contributions from Theory

This chapter has summarised several categories of theory existing outside Interactive Storytelling, which contribute to new conceptual models for Interactive Digital Storytelling. The selection has been made based on the theories' assumed suitability to persist as a theoretical foundation, potentially influencing future integrated theories of creation in IDS. The assumptions about their relevance have been tested partially by applying them to the practical case study reported in Chapter 6, and partially by reflecting them in the context of suggesting new conceptual models described in

Chapter 5 (compare Fig. 3.2 and further references in the named chapters). Their relevance, in relation to other results reported in this thesis, is explained as follows:

- Conceptual thinking in storytelling needs to move away from a linear sequencing of events. Therefore, not only storytelling principles (4.2) are relevant, also ‘model thinking’ has to be included in the conception, which is part of simulation design principles (4.4). Further, interaction design principles (4.4) need to be included to obtain a complete storyworld. An example of progressive model thinking (starting from linear sequencing) is demonstrated in Chapter 6, including models from discourse analysis (4.4).
- Screenwriting techniques (4.2) do not only contain principles for sequencing that need to be overcome, but also principles that are probably useful for model building as well. These include the ‘writing from the inside out’, thinking about ‘acting situations’ and about what each action ‘does to the world’. These concepts, which have similarity with Bremond’s structural approach (4.3), have been applied in the redesign of the artefact (Chapter 6). With regard to storytelling techniques, much can be learnt from RPG design (4.2), a direction currently followed by several research groups.
- Models from narratology have been presented in three groups, depending on whether a model is based on sequential arrangement, on grammar-based structure or on a structure of acting situations (4.3). The latter is apparently the best structure within this selection for modelling flexible options of actions. However, it does not explain the high-level structure of a story. A choice of the kind of story model may influence the highest level represented in the designed level model (Chapter 5).
- For the realisation of user agency, it is worthwhile looking at principles of ‘interaction design’ (4.4). Local principles of affordance and feedback have to be in place to avoid a lack of subjective agency due to delayed perceived consequences of own actions on the story development.
- Interactive story design has to have a clear concept on the user’s role and motivations. Therefore, the study of player preferences (4.4) can be relevant to have realistic expectations about the target group. It may be unsuitable to target too much storytelling at power gamers, for instance.

5 Conceptual Models: Structure of IDS Content Creation

This chapter presents the result of the research towards conceptual models. The models are presented as a suggestion, by design, and are justified by reference to existing problems in the understanding of IDS structure, its creation and its elements. The suggestion is informed by literature review (partly described in Chapters 2 and 4), and by practical experiences in constructive projects (see Chapter 6). In two sections, the models explain the structure of IDS content incorporating roles of authors and end-user interactivity, and the demands for 'implicit creation' that reconcile traditional narrative skills with abstract modelling.

The analysis of current Interactive Storytelling artefacts and their authoring tools shows that there is a broad variety of approaches (see Chapter 2). For authors, it is difficult to see a shared general principle behind the variety and to grasp their relationship with traditional story conception. Pioneering creators have experienced that they cannot just go on with traditional ways and quality criteria of storytelling, if they want to embrace the novel algorithmic forms of IDS, which are closer to the engineering of knowledge bases. A case study of such a creation process is described in Chapter 6. The perceived problems point to the fact that we face a 'novel form', which requires a novel – 'different' – way of conceiving story.

The main objective of this research has been the proposal and evaluation of general conceptual models for content creation in future Interactive Storytelling. The results are described in this chapter. Based on categorised problems perceived from the point of view of current creators experiencing the described gap between the disciplines, solutions are proposed to structure the creation process. The enunciated concepts follow the guiding principle of 'implicit creation', subsuming creation philosophies opposed to traditional 'explicit' crafting of concrete and linear story representation. The novelty of the result lies in the formulation of the conceptual models as communication tools between disciplines, especially targeted at the domain of story creation.

It is unavoidable that this part, as a step of *"suggestion"* of models in the process of 'design research' (Vaishnavi and Kuechler, 2004; compare Section 3.1.2), contains assumptions as position statements that serve as a differentiation and constriction of the problems tackled. Each subsection is guided by a certain conceptual problem currently present in the IDS authoring discussion, which is addressed by a solution proposal that forms part of a conceptual model.

5.1 Dynamic Interactive Content: The Product of Creation and Authoring

One problem in current discussions within the IDS community is that there is no agreement on what actually ‘authoring the content’ means, because ‘authoring’ as well as ‘content’ are ambiguous concepts in highly-interactive storytelling. ‘Authoring’ can range from conceptualising an interactive experience over writing a script to programming engine code. Naïve considerations assume graphical or media assets as ‘the content’, separating it from the processes of the runtime programme – ignoring the aspect of ‘dynamic content’. This can result in confusion, particularly in team work, because role models and responsibilities for the resulting experience may stay unclear. Further, there is a great variety of roles and involvement of targeted end-users, their influence on this dynamic content and their interaction possibilities, modes and styles. The presented content models that also include end-users help categorising these different forms.

5.1.1 Content Creation Structure and Processes in IDS

Problem(s)	How does an ‘interactive story’ look like? Can authors ‘write’ it?
Solution(s)	Models of the artefact according to production roles: • Boundaries of authoring tasks • Collaborative model of authoring • Content abstraction model, different representations

This subsection tackles assumptions on the borderlines of the authoring process, which have been discussed widely in interdisciplinary research projects (Spierling and Szilas, 2009), as well as a suggested team work model and examples of data (and process) structures as results of authoring. Whereas so far, too general notions of ‘the author’ and ‘the content’ were leading to confusion in discussions, we suggest novel terms and structures, giving consideration to the complexities in the IDS design processes.

5.1.1.1 Assumptions on Authoring Borderlines

In this work, types of Interactive Storytelling (IS) are discussed, in which users experience a narrative by interacting with a digital system of agents during the unfolding of said narrative. Such a system of digital agents including all necessary knowledge about the story is considered to be the created ‘Interactive Storytelling (IS) artefact’ – the actual product that can be delivered to end-users (the audience). It consists of

- an IS ‘storyworld’, running on
- an IS ‘runtime engine’.

The IS ‘runtime engine’ enables the performance of general agents' autonomous or semi-autonomous behaviour, which means that agents are able to act independently of the author after the actual authoring phase of the storyworld is finished. This engine is a software architecture including specific IS platform components (e.g., story structure manager, drama manager or planner, interaction/dialogue manager, representation engines tackling generative graphics or dialogue, etc.).

The IS ‘storyworld’ constitutes the actual ‘content’. It is created by a creator or author (or a team of creators / authors), and uses the agent (or other procedural) functionality of the IS ‘engine’. For example, authors need to define the storyworld’s specific characters as instances of the engine’s generic agents, along with their story-related behaviour. As a special difficulty, the targeted user is as well an active agent (maybe a character) of the storyworld; the creator has to consider this when making up the storyworld. Beyond containing components and assets explicitly controlled by authored scripts, the content is also made up of rules and conditions that determine the occurrence and actions involving those entities, as well as their effects on the storyworld. As such, the created content ends up being code running on the IS engine.

Examples for such IS artefacts are *“Façade”* (Mateas and Stern, 2005a) and *“FearNot!”* (Aylett et al., 2007), which are IS projects with integrated storyworlds and agent engines. Other IS research projects have built story engines that allow for various storyworlds to be authored. Examples are: *“Storytron”* (Crawford, 2010a), which can run several storyworlds such as *“Balance of Power 2K”*; or examples of the IRIS project, among others *“IDtension”* (Szilas et al., 2003) with *“The Mutiny”* and ‘Scenejo’ (Spierling et al., 2006) with the ‘Killer Phrase Game’ (see Chapter 6). In each case, there is an end-user who interactively experiences the storyworld by playing a role in it.

Authoring means delivering content for somebody else’s (an end-user’s) experience. It is different from the potential kind of co-creation that can take place when end-users interact with a storyworld, sometimes also referred to as co-authoring a story following a paradigm of user-generated content. Therefore, there is a blurry borderline between authoring a storyworld as a delivered artefact, and the end-user’s co-creation during the ‘runtime’ experience. In Fig. 5.1, this blurry line is symbolised between the ‘interaction’ level and the ‘storyworld’ level (a part of the ‘IS artefact’). Another blurry line is drawn between the ‘runtime engine’ and the ‘storyworld’, both within the artefact. This refers to the circumstance that an IS storyworld can only work in co-existence with a runtime engine, which (historically) was developed by a team of computer scientists. Again, practice shows that it is sometimes hard to distinguish between engine development (as adding generic functionality) and authoring (story-specific rules).

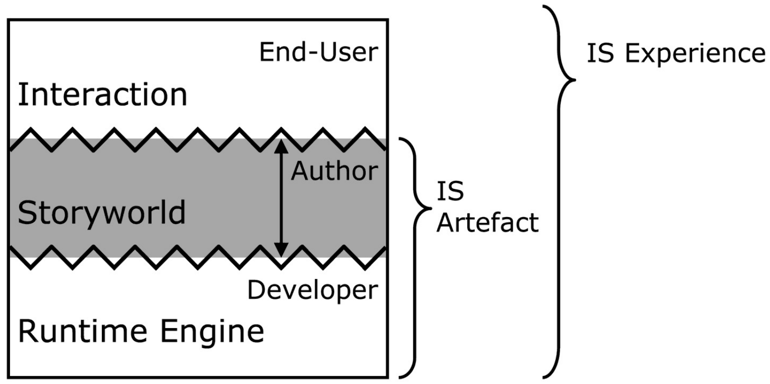

Fig. 5.1. The boundaries of authoring between engine development and story experience (Spierling and Szilas, 2009).

Interfaces, Authoring Tools

An IS artefact is a complex system. The same is true for each of its components, the runtime engine and the storyworld, which means that there exist potentially many more parameters, rules and attributes making the complex system work than would be wise to display to the next ‘higher’ level. In that sense, the mentioned borderlines in the above model demand interfaces, by which the next higher level can access the lower level.

For example, an ‘authoring interface’ in an abstract sense would first of all consist of a subset of the complete rule set by which the engine works. Therefore, the first step of designing an authoring interface is a well-considered selection of accessible elements and functions for authors, and further, tools can build upon that, giving the tasks and workflow a certain shape. Recent discussions suggest that there can be levels of detail regarding the revealed complexity, as there can be assumed different roles and expertise of target groups of authors – analogue to the choice of a 5-parameter audio equaliser for a consumer and a fully-fledged mixing desk for a sound engineer. An important concern of developing authoring tools is at first negotiating possible author interfaces in the sense of potential accessible parameters.

Since also the storyworld is a complex system, quite naturally it is necessary to also think about the access to the storyworld that will be offered to end-users. Creating this interface must actually be part of the decisions of 'authoring', because the shape and depth of that access are part of the IS experience, for which authors – in the sense of this model – are responsible. For example, authors could potentially design a storyworld in which the end-users' roles have to do with creating elements, for which in turn they are equipped with creation interfaces. In that sense, 'interface design' is also assumed as a task of conception and authoring.

5.1.1.2 Team Work Model

Target Groups and a Gap in Disciplines

The above model (see Fig. 5.1) assumes that the so-called 'developers' of the story engine potentially are computer scientists and that 'authors' probably include people from creative media fields, for example writers, designers etc. There has been extensive discussion about delimiting these distinctions by terminology. It would be unwise to draw too hard lines at this moment, as research on these questions is currently ongoing. For example, there have been computer scientists and engineers with cross-disciplinary motivations 'authoring' complete storyworlds, and there are media designers regarding themselves as dynamic content 'developers' as well. There have also been debates to which extent it is possible to demand for authoring tools that will allow creative media experts the creation of a dynamic storyworld without programming know-how (see discussion below).

Further, it is currently untested how the ideal distribution of roles and tasks in a potential development team looks like. Below is a suggestion of a distribution of the authoring tasks in 'creative authoring and conception' and 'technical authoring and implementation', integrated into a whole team. Typical production processes of video games already implement a similar distinction of roles. Still, their progress reportedly seems to stall regarding the development of more dynamic and highly interactive stories, making full use of AI-based or generative ideas. We perceive a gap between writers' narrative background knowledge and experience, and the novel concepts underlying story engines that are hard to free from their technical 'smell', often only understood by computing experts. As Section 4.2.2 on video game writing showed, a widespread result of that gap is a model in which writers deliver scripts to media engineers who then finish development on their own responsibility.

In order to fully embrace the procedural storytelling possibilities, this gap will have to be reduced so that the technical potential mates not only with suitable but also compelling ideas. A further vision is that in the end, storytellers can join in and get involved in defining the engines' functionality.

Suggestion of a Collaborative Model of Authoring

Fig. 5.2 depicts a collaborative model. It is the result of interdisciplinary discussions about an ideal, future model of development for interactive story artefacts; it is not known to have been implemented within the IDS research community yet. Reportedly, this is due to resource issues because of the academic research character of these projects. In an ideal conception of the development process, the following roles would have to be taken:

- 'Conceptual authors' (CA) / writers come up with ideas of experiences they want to create for their audience, the end-users, and follow their idea through to implementation and verification, comparable to directors in film or lead game designers. They are advocates of the end-users and envision their experience.
- 'Technical authors' (TA) are able to operate authoring tools to directly implement a storyworld. If they are not the same person as the CA, they work together with CAs in a tandem manner. It is important for CAs to get feedback of their conception and change it accordingly and repeatedly, requiring that storyworld versions can be built in an iterative process.
- 'Story engineers' (SE) are responsible for the functionality of a story engine. 'Tool builders' (TB) implement authoring tools, the gauges and handles of which are negotiated between TAs and the engine's functionality (the SE). While the IS engine and the storyworld together are components of the delivered artefact, the authoring tool is not.

It can be assumed that individuals take more than one role at once, for example, as conceptual author and technical author in one person, or that the roles are even more distributed (more than one conceptual author, etc.). The concurrence of roles has been the reality in recent research projects with generative engines (see Chapter 2). However, this situation has also been reported to be improvable, in order to allow specialists in storytelling and engineering to concentrate on their expert knowledge, as well as to scale up future projects. Distribution of roles implies that the communicative effort increases. A model has to be found which goes beyond the form that conceptual writers just hand a written outline to the technical implementers of the experience, as they need to co-design with the generic features of the engine (Spierling and Szilas, 2009), in order to maintain shared control over the end-user experience. Adopting pair programming techniques from agile software development (Cockburn and Williams, 2001) and finding intermediate draft representation forms is envisioned as something that future work should include.

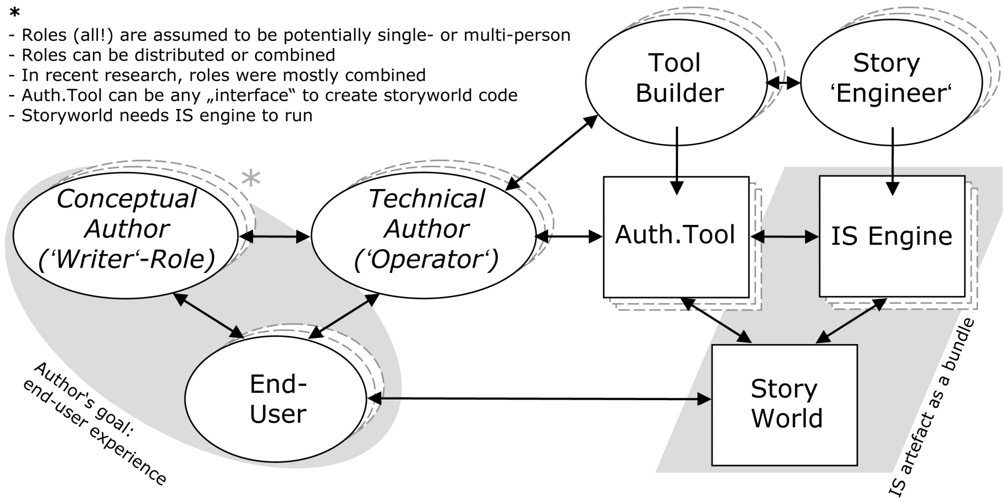

Fig. 5.2. Envisioned model of development of an interactive story artefact. Note: The graph focuses on story development; details/elements are still missing that would be needed to complete the whole application (visual representation, media connection, interfaces). The mentioned persons are 'roles', not 'individuals'.

5.1.1.3 Technical Form of the Content

From the engine's point of view, the 'content' – as the result of the authoring process – is storyworld code, saved as a data structure. Mostly, it contains not only declarations of entities and their parameters, but also rules as code that the engine can operate on. For many existing story engines, unique / proprietary XML dialects have been developed, which mostly structure the declarative parts of a storyworld in readable terms that are lent from narratological domains. Examples are *"IDtension",* 'Scenejo'*, "Storytron", "FearNot!"*. Other examples exist where the code refers to technical domains, for example to 'planning', by directly using PDDL[34] code as technical content representation (Porteous and Cavazza, 2009) or simulation, by using Prolog (Swartjes and Theune, 2008). Authors need to be able to express causal relationships in a storyworld. Crawford suggested: *"You need a language that allows you to express with clarity and precision the exact nature of each causal relationship […]. I have good news and bad news for you. The good news is that this language has already been developed; the bad news is that it's mathematics."* (Crawford, 2004, p. 101) Also Stern argued that *"authors must program"* – apparently for the same reason (Stern, 2001).

[34] PDDL: Planning Domain Definition Language.

Authoring tools shall provide an easy way for non-programmers to create that code without typing it, by using a GUI. However, as illustrated in Fig. 5.3, the translation of a written script into code cannot be assumed to be a straight-forward process. Section 5.2 will elaborate this point and discuss possible solutions.

A premature assumption and claim has been that authoring tools have to be ‘usable’ enough to be used by non-programmers to implement their interactive story ideas directly; for an example, see argumentations of the *“Inscape”* project including even *“inexperienced computer users”* (Dade-Robertson, 2007). This viewpoint has been used in projects with ‘branching’ story content, offering simple possibilities of interactive influence following ‘forking paths’, which easily can be authored ‘explicitly’ (disregarding the effort of creating all possible paths). For more open forms, causal influences have to be designed on abstract levels through ‘implicit creation’ (see section 5.2). Therefore, the transformation into code within the interdisciplinary team is assumed to be a bi-directional multi-step process, which assigns creative roles to each of the members and which requires short feedback cycles. Conceptual authors need to examine the effects of their decisions and base further iterative design steps on them – just like a painter would appraise a painting perpetually during creation.

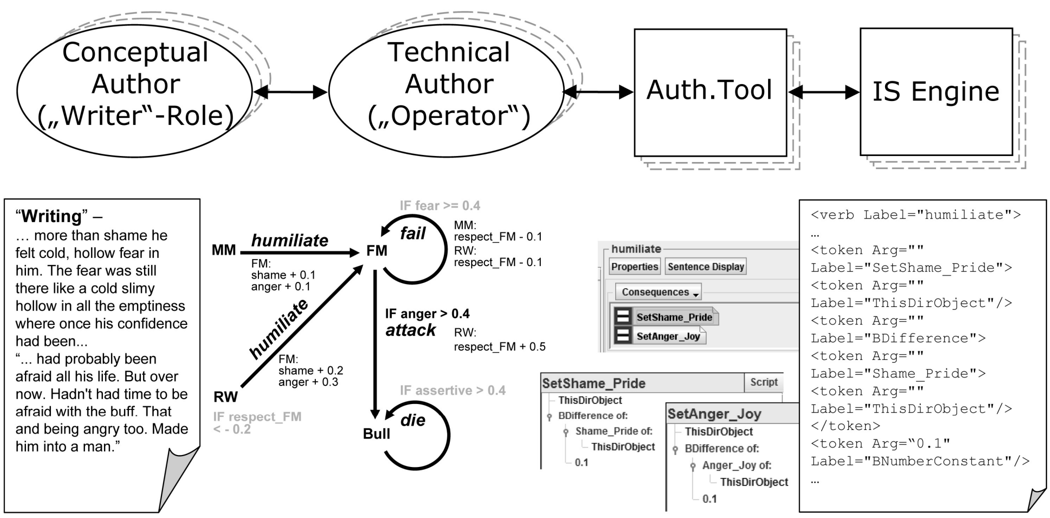

Fig. 5.3. Content abstraction example of an adaptation of a Hemingway short story to an interactive version for *“Storytron”* (Spierling and Hoffmann, 2010). A novel informal ‘modelling’ step builds the link between the written form and the authoring tool, shared between conceptual author and technical author.

Many of the currently existing XML-derivates for storyworld descriptions, such as for the use with *“Storytron”*, ‘Scenejo’ and others, contain textual story information readable by authors, and interwoven additional control information that – although readable – is only important for the working model of the engine, making the reading uncomfortable. This can either be seen as a side-effect of the immaturity of the whole field, in which storyworlds and story engines have been developed as research projects in parallel, or as a sustained characteristics of this domain with overlapping responsibilities (Spierling and Szilas, 2009), possibly requiring new engine functionalities with each new storyworld idea. As a conclusion, again there are blurry borderlines within the content file, between conceptual models of how the storyworld 'behaves' (relevant for authors) and how the engine works as an abstraction of that (relevant for engineers and tool builders). Finally, interactive behaviour as a holistic end-user IS experience also depends on the representations of the end-user interface, including interface devices and modalities. In many of the mentioned state-of-the-art systems, these are either unchangeable for authors, because they are a fixed part of the system (see 'Scenejo' and *"Storytron"*) or are defined in components independent of the story content (see *"Emo-Emma"* and its authoring tool). In an ideal world, authors would have design influence on the way of interaction.

5.1.1.4 Discussion

This conceptual description of an authoring process differs from reported team models in videogame writing, as it contains more intermediate representations of dynamic content between the writer (conceptual author) and the engine. Conceptual authors should be able to find forms and visualisations producing increasingly abstract forms of 'dynamic' content descriptions. For example, in Section 6.3, it is reported that paper prototyping in the form of a card game can represent a model, disregarding for a moment the peculiarities of a complex authoring tool for the sake of conception. These representations do not need to be formal. In a potential pair programming process of a 'conceptual author' and 'technical author', the design process can be alleviated by letting the conceptual author maintain an informal (yet abstract) level, which the technical author transforms into tuned numbers and precise conditional expressions.

Aarseth (2004) defined: *"Any game consists of three aspects: (1) rules, (2) a material/semiotic system (a gameworld), and (3) gameplay (the events resulting from application of the rules to the gameworld)."* (Aarseth, 2004) At first glance, our distinction made in the beginning (Fig. 5.1) looks like a similar division, if one would assume analogies between *"(1) rules"* and a story engine, *"(2) a gameworld"* and a storyworld, and *"(3) gameplay"* and interaction. However, it has to be admitted that the storyworld in our definition is more than semiotics (especially symbolic level) of the representation form, as it contains its own ruleset for generating events at the interaction aspect. Crawford (2004) has pointed out repeatedly the difference between data and process, and the creation of Interactive Storytelling being rather concerned about the 'processes'.

5.1.2 User Interaction as an Integral Part of Interactive Storyworld Structure

Problem(s)	Where is the user in the model of a storyworld? Which content part is interactive / can be influenced by end-users in interactive storytelling? Can we have a generalised view of possible user agency?
Solution(s)	Model(s) with concepts separated according to levels: • Breakdown of local and global user agency to several levels • Ranges of semi-autonomy (at each level) to describe various possibilities to incorporate users

This subsection describes a model using levels that distinguish between several design dimensions. It has been revised since its first publications (Spierling et al., 2002; Spierling, 2005a) and generalised to cover more forms of Interactive Storytelling than in the former versions. The limitations of separating levels in a model are discussed.

5.1.2.1 Design Decisions for Potential User Interaction (Agency) at Several Levels

A constant point of discussion in the community of Interactive Storytelling is the topic of user 'agency', considered as a crucial experiential quality of a successful IDS artefact. Murray (1997) mentioned as characteristic pleasures of digital environments *"immersion"*, *"agency"* and *"transformation"*. She defines: *"Agency is the satisfying power to take meaningful action and see the results of our decisions and choices"* (Murray, 1997, p.126). Laurel (1993) described 'agency' as a key component of first-person, *"mimetic"* experience, and elaborated on *"Interface as Mimesis"* (Laurel, 1986). In her sense, doing simple things can be an expression of agency with a direct *"breakthrough"* experience in virtual reality, while doing complex things with a delayed indirect or mediated achievement can reduce the feeling of agency. Following the established principles proposed by Norman (1988) for interaction design (see Section 4.4.1), not only 'affordance' but also 'direct feedback' is important to let people feel in control. Also game designer Church (1999) advocated *"perceivable* *consequences"* as a major abstract design tool. In an interactive storyworld, it is therefore important to conceive immediate user feedback as well as longer-term consequences, carrying over the results of user actions. The level-model of Foley at al. (1995) has been suitable to describe user actions at several levels, from the lowest lexical level up to a conceptual level (see Section 4.4.1).

Derived from that, we suggest creators to envision possible agency of participating users at such similar levels. In the following, a four-level model is presented, describing several design dimensions to include user agency. It is here explained starting out from a perspective of producing linear animation films, also to build a conceptual bridge to linear production models.

In Fig. 5.4, a traditional modus operandi for the creation of computer-animated fiction films – non-interactive – is sketched at four abstract levels. This number of four can also vary from project to project – depending on its complexity. Authoring a linear animation is by all means a top-down-approach. The authorial intent of telling a story that finds closure lies at the highest level, being a binding proviso for all other levels. The end result is delivered as a final-form artefact to the audience. This differs e.g. from improvisational theatre, where low-level actions can turn around a story at the high level.

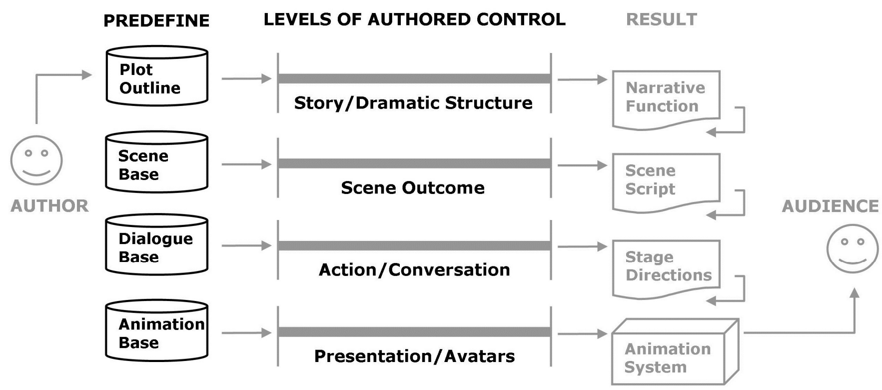

Fig. 5.4. The definition of a linear animated story at four abstract design levels.

At the top level or in the beginning, the overall story and dramatic outline is sketched. A timed arc can be divided into narrative functional elements, such as 3 acts or the 12 situations of Campbell's *"hero's journey"* (Campbell, 1946), or any other kind of structure. Further, authors break down the story into scenes (as typical for the film medium), which are handled at the next lower level of conception. Each scene has to end with a result that establishes a certain plot point in the dramatic arc, and is defined by a scene script. Within a scene, dialogues and interactions between actors are designed, and lead to concrete storyboarding and stage directions. These directions are precisely mapped onto virtual actors by skilled animators, who define the exact way the virtual actors move and behave. The scenes and directions are ordered in time according to the planned course of narration.

It is now proposed to adapt this to IDS in a virtual graphical world, by granting the audience influence at each described level. In Fig. 5.5, the animation model has been extrapolated for introducing user agency. Opposite the author, a participant is modelled who now may contribute to the result of each level.

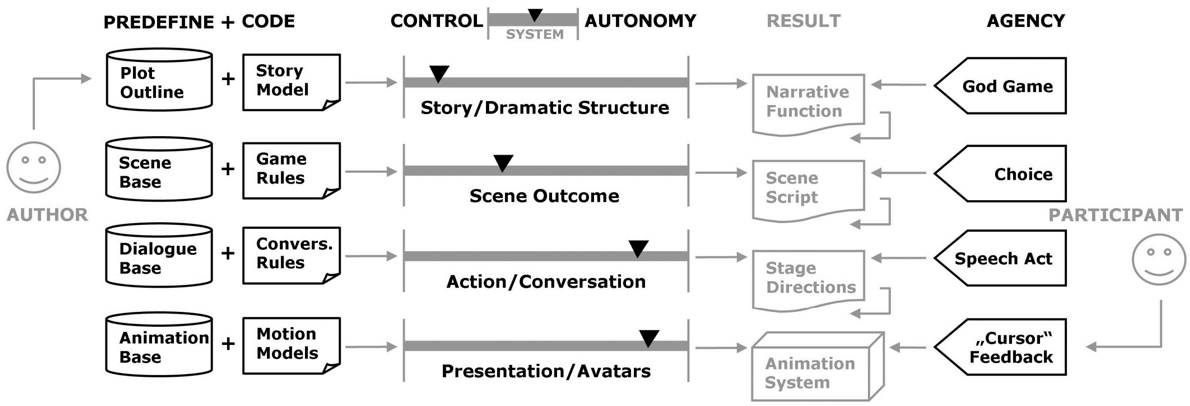

Fig. 5.5. Four levels of 'semi-autonomy' or 'double-agency' (agency in the authored content as well as for the user/participant – the more dynamic (or 'agency within') the content, the more agency can be experienced by users).

At the lowest level, which corresponds to the 'lexical' and 'syntactic' levels of input (see Section 4.4.1.1), users participate in the (graphical) representation. They experience agency when they get direct feedback to their actions and are recognised. At the level of 'action and conversation', they can contribute actions equivalent to the actions of authored storyworld inhabitants. If they influence the 'scene outcome', they experience agency in changing the plot. Letting users influence the 'dramatic structure' at the highest level is the special case of a simulation in which users may define their own narratives.

If authors intend to let users influence the resulting experience, the first implication is that it is not enough to just predefine databases of descriptions, as was the case in the linear model. In fact, user choices cannot be fully scripted as they are partly unforeseeable (if anything, they can be a matter of good anticipation and affordances). Additionally to story descriptions, authors need to express rules and to provide simulation models, which drive an autonomous and adaptive behaviour of storyworld entities at each level in reaction to the participants. That means, increasing the user agency at one level results in a demand for more agency (or autonomy) of story entities (such as virtual agents) at the same level. Agency is therefore a quality that first has to be realised in the authored content by making it more 'dynamic', in order to be experienced by participants – if one follows the assumption that the more intelligently the content can react, the more agency users can experience. The complex task of expressing many contingencies is subdivided conceptually by the levels. As a step to break down the intricacy of the whole into practicable pieces, it also allows for better distribution of subtasks.

However, design decisions at these levels are still mutually dependent. For example, the draft of possible speech acts for users at the 'action/conversation' level may not only depend on story design, but also on the possibilities of recognition and concrete interaction design provided by the lowest level, including its hardware. In our example of Section 6.3, we see how design decisions such as the choice of speech acts have been influenced by technical constraints of the used system and by their desired integration with the user's assigned role in a story setting. For successful design, creative decisions at each of the levels need to be concerted and integrated.

Material and Formal Causes

The division into levels has also some theoretical equivalence to the Aristotelian model of six qualitative elements of structure in drama, which has been discussed by Laurel (1993) for its applicability to human-computer activity (see Section 4.3.1.1, Fig. 4.2). In the terms of Laurel/Aristotle, user interactions may build the *"material cause"* for the next higher level, because they shape the material that the upper level is made of. This is the reason why the participant in Fig. 5.5 is depicted as starting at the lowest level – the 'representation' of story elements including interfaces is the 'material' for interaction. Mateas (2000) has presented a *"Neo-Aristotelian"* theory adapting Laurel's depiction of Aristotle's levels (see Fig. 5.6). His model included user agency only at the level of the *"character"*. However, he also noted: *"A player will experience agency when there is a balance between the material and formal constraints"* (Mateas, 2000). We propose that in fact all levels below the character level have to provide the material causes for agency at a higher level. That implies that from a story creator's point of view, 'all' levels are important design levels. Also Tomaszewski and Binsted (2006) argue that we depend on the *"medium"* at the lower levels to express or experience 'action'.

In a similar sense, Mateas and Stern (2005b) have distinguished between *"local agency"* and *"global agency"* – where 'local' means having short-term influence on the direct discourse with agents, and 'global' means the possible influence that interactions can have on outcomes of the whole storyline.

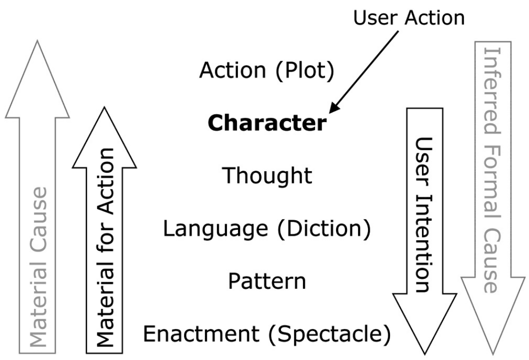

Fig. 5.6. Mateas' model of *"Neo-Aristotelian"* poetics for interactive drama (Mateas, 2000).

5.1.2.2 Semi-Autonomy and User Agency

Additionally to layer structuring, the concept contains gradations of granted agency versus authored determination. Within Fig. 5.5, this is indicated by the 'slide controls' between 'control' and 'autonomy' (of character agents) at each level. The implied 'sliders' illustrate a theoretical scale between complete control of the author on plot details (sliders on the left side) and maximum influence granted to the user (sliders on the right side). At a full level of influence, users can play with the storyworld in the sense of an open-ended simulation, the outcome of which depends on their actions. They can expect adequate responses of agents to their actions, co-creating the final plot.

Applied to the layered model, it means that at each level, authors can allow more user agency by giving that level more autonomy (for example, reaction rules or character plans) to respond dynamically to user actions. As a theoretical consideration (without assuming that there is a precisely spaced dial), it is possible to imagine intermediate gradations of authored determination and artefact autonomy in different proportions, leading to more or less user agency at each level. Then, the whole artefact can display various qualities of semi-autonomy by integration of the different levels. It has to be assumed, again, that the states of levels influence each other. There are some constellations that seem more likely than others, for example, that user influence on a lower level ('local agency') is a precondition for also changing upper levels of story results. In many video games of the shooter-genre, the upper ('story') level is often linearly specified by design, with agency entirely on lower levels.

Discussing Semi-Autonomy and Adjustable Autonomy

The notional semi-autonomy scale in Fig. 5.5 operates between 'full autonomy' and 'no autonomy' of the 'content'. 'Full autonomy' story content is fully 'generable' at runtime by reactions to any situation (or user actions), while 'no autonomy' relates to story content that is predefined by the author at design time (therefore, fully controlled by the author). In that sense, it is different from the concept of 'adjustable autonomy' (AA), which refers to dynamically adjusting the level of autonomy (coined in the context of human/robot real-time teamwork). In AA, the scale lies between full autonomy (robot is independent and can be neglected by human operators for a period of time) and human tele-operation (robot receives concrete directions in real-time) (Goodrich et al., 2001). In these systems, agents can vary their own autonomy during the collaborative performance, for example, by transferring the control back to a human user in certain circumstances (Scerri et al., 2002). This is assumed to be different in our conceptual model for IDS artefacts. Here, our 'human-in-the-loop' of the co-creational task is the role of 'authors', who are not present when their created story agents (as artefacts delivered by authors) operate on their behalf. The result of our semi-autonomy is a mix of autonomy (as independency of a strict script) and scripted narrative direction, in fact all by 'prescriptions' (scripts or behaviour rules) configured by authors at design time (also compare (Riedl and Stern, 2006)).

However, approaches of authoring exist in which a kind of collaboration loop of authors and agents leads to fine-tuning the characters motivations and goals, such as in *"Thespian"* (Si et al., 2008; see Fig. 2.17). Yet also in this case, during end-users' interactive experiences, that authoring teamwork is finished in the delivered artefact.

Incorporating the End-User with Semi-Autonomy

There are many possibilities to shape an interactive artefact and its associated user experience. Some examples are given in Table 5.1. In 'highly-interactive' storytelling, the user would be able to participate to a high degree. The level model with semi-autonomy can explain constellations of that varying degree.

'Scenejo', 'The Killer Phrase Game' (see Section 6.2)	High agency on conversational acts; some agency on scene outcome; little agency on plot structure
"Emo-Emma" speech-driven demo (Cavazza et al., 2009)	High agency on the scene outcome due to influencing Emma's decision plan; low agency on lower levels (predefined animations); no full story level
"Heavy Rain" by Quantic Dreams (Quantic, 2010)	High agency on story and scene outcome; lower agency on the action level (predefined choices and animations for exchange), but again agency on the lowest lexical level

Table 5.1. Variants of distributions of agency over the hierarchical levels.

At the highest possible degree of participation, it would mean that many of the 'sliders', on all levels, tend to be positioned towards the autonomy of the system. In cases with turn-taking systems, this turn-taking must be frequent enough to be highly-interactive ('Scenejo', *"Façade", "IDtension", "Storytron"*). Another condition for 'highly-interactive' is the processing of user actions as 'diegetic'[35] actions within the story ('carrying over' from lower to higher levels). Further, these user actions ideally should exceed simple bifurcate choices and contain many possibilities for considering or acting out own decisions.

It is imaginable that participants only experience agency on the lowest level, as a feeling of presence in a scenario. In this case, although everything is predefined, avatars would still react to the visitor giving cues of recognition, comparable to a cursor feedback. In the *"GEIST"* project (Fig. 2.7, left), user interaction occurs by walking through the historic site of the Heidelberg castle. In effect, tourists cannot alter the storyline; at the most, they can change the order of scenes slightly, depending on the route they choose. All the same, this is interactive storytelling with semi-autonomous agents. The constellation of the 'autonomy-sliders' over the model's levels shows user agency experienced at the lowest level, but not on the higher levels. Users feel recognised and addressed personally through the adaptive behaviour of the animated agent, and their route history is accounted for, while at the end of the day, a predetermined story is presented.

At the conversation level, participants can, for example, have agency in an entertaining and informative chatbot dialogue with the characters. They may not even be able to affect anything in the story logic, but may participate at the dialogue level with speech acts. Agency at the scene level would result in real choices about the outcome of a scene. For example, the story of the game would have to change according to a user's actions. On the top level, players would influence the whole genre of the application, if the 'agency slider' were at 100% at the extreme right. For example, a simulation such as *"The Sims"* (Electronic Arts) can be put into this classification, since players are the ones who eventually create stories with the toy.

In contemporary video game production, 'carrying over' results from lower levels to higher levels is considered a high-effort endeavour. It means that actions in an early scene of the game would still influence actions towards the end, which is mostly solved through 'branching' (separating complete branches of the story after turning points). For example, the game or 'interactive film' *"Heavy Rain"* (Quantic, 2010) has 18 different possible endings, all of which had to be produced as separate paths. A branching-based production can only afford few of such long-term influential actions.

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[35] 'Diegetic' here refers to elements being an inherent part of the (fictional) storyworld.

5.1.2.3 Engines Based on Layers

The level model serves as conceptual frame for designing features of IDS storyworlds. Shneiderman and Plaisant (2010) endorsed conceptual design models in HCI based on levels due to their easy correlation to software architecture (see Section 4.4.1). There is indeed a relation of the conceptual levels presented above and the construction of a number of existing story engine systems. An analogue description of similar levels as software components (see Fig. 5.7) was provided in (Spierling et al., 2002). There, the sketched interactive storytelling software consists of a story engine, a scene engine, several character engines / conversation engines (one for each occurrence of a character), and corresponding avatar animation engines. These are responsible for running the authored 'code' in the sense of the specific rule set created at each level. The technical view is of course an important issue to be considered, as a storyworld has to run with (a) designed engine(s) (see 5.1.1) that is/are responsible for the autonomous behaviour (the system agency), and therefore, design model and technical model find a correlation here.

In short, according to the levels, these models can be:

- 'Story model' and/or 'plot model', including character descriptions. Rules determine the story entities and flow of the 'plot'. In the *"GEIST"* project (Spierling et al., 2002), a model based on Propp's formalism has been used (Propp, 1968). Albeit our conclusions that this sequential model has limitations for interactivity, a more dynamic model for 'drama management', such as a high-level plan, could also be designed here. The interrelationships of episodes (such as scenes), if any, are defined.
- 'Scene models'. Rules and functions determine the turning points of concrete actions and settings within episodes, as input for a drama manager engine. Analogous to the story model, rules and plans here model the interdependencies between different single actions, as well as their effects for the scene result.
- 'Conversation / reaction models'. Rules let characters' reactive behaviour stay consistent in terms of their attributes, depending on local emotions and goals. They influence the direct interaction between characters and the user. Ideally, at this level an 'a-modal' conversation instruction is the result, independent of the mode of representation (e.g., voice, gestures or text).
- 'Representation models'. Rules determine how the 'a-modal' instructions of the conversation engine are turned into perceivable actions of animated avatars, text- or voice systems, including attributes specifying expressiveness.

Rules also specify affordances and feedback for user actions, depending on and controlling interface modalities. These models are dependent on the media and platforms (including hardware) used.

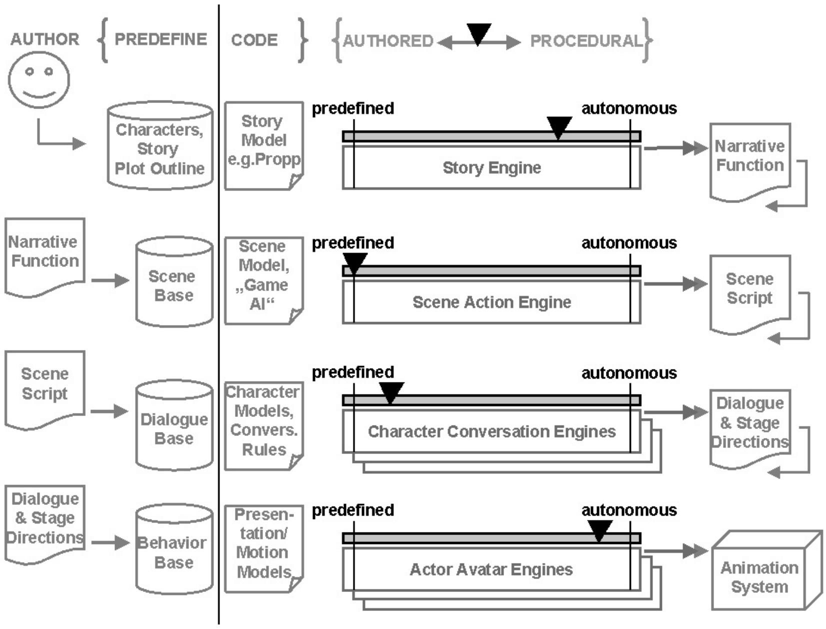

Fig. 5.7. Levels of engines or components (Spierling et al., 2002).

Again, this prototypical depiction of an IDS system at exactly four levels is not a mandatory description. Systems other than (Spierling et al., 2002) may use less or more conceptual levels of influence and agency, depending on their scope and subgenre defined by interaction styles and depending on technologies involved. The usefulness of a conceptual division into levels can be determined by the work-sharing conditions and responsibilities within a development team, or the used technology.

5.1.3 Conclusion on Dynamic Interactive Content Structure

This section described models explaining the structure of dynamic content as 'the product' of creation and authoring. Closely related to that, also the borderlines of authoring in a team have been brought to mind. The new conceptual models have been suggested by applying and integrating existing concepts, as referenced in the text. Most influential have been models by levels, which existed in HCI as well as in narrative theory. Novel contributions of the concepts are summarised as follows.

- The suggested concepts distinguish between several roles of authors, abandoning the notion of 'the author' as a single person widely-used in the community.

- Existing unclear notions of ‘the content’ and its borderlines are resolved by integrative descriptions including its procedural qualities in addition to (and distinction from) procedures of a story engine. These fit to concepts expressed by other interactive story researchers, for example Szilas et al. (2003) and Crawford (2004).
- The models include conceptual story creators as team members in the creative loop of programmed content creation, making them responsible for the suitable abstraction of the storyworld. Traditionally, that was considered a task of ‘the programmer’, but here it is argued that it is part of the content creation.
- The resulting content model of a storyworld has been structured to include user agency (or the potentiality of user influence) as a design responsibility of such ‘conceptual authors’. It changes a wide-spread view that authoring and user agency are irreconcilable. Breaking down the storyworld concept into levels allows for more precise descriptions of several kinds of influence to grant.
- Of similar use is the semi-autonomy concept, which can also generally help explain different scopes of agency in various forms of interactive storytelling.
- As the level breakdown is likely to have similarities to software implementations, interdisciplinary communication about technical design steps is supported.

5.2 Story Generation and Emergence – Relationship with Creative Authoring

Highly-interactive storytelling includes ‘intelligent’ elements in terms of ‘code’. This presents us another conceptual borderline, that between narrative and simulation. As explained in Chapter 2, ‘emergent narrative’ has been proposed as one concept to interpret interactive storytelling in virtual environments (Aylett, 1999). In its extreme interpretation, advocates of emergent narrative argue that authors have to *“let go”* and give up their control, which has been an issue of many discussions in the community. This section presents models and metaphors tackling the relationship between implicit creative control and emergent narrative.

"Emergence is a property of a complex system that strikes when the designer of the system writes code that operates at a higher level of abstraction than the designer understands." (Chris Crawford, 2010b)

5.2.1 Unified Models for a Contradiction in Terms: Creation and Evolution

Problem(s)	Ideals of 'emergent narrative' and 'authorship' appear to be irreconcilable. This has at times led to confusing assumptions about excluding creative authors from the development process in Interactive Storytelling.
Solution(s)	'Implicit creation' as a philosophy and a creation metaphor • Gardening metaphor • Metaphors of sharing control

This subsection presents a position statement about an inclusive philosophy of creation, in line with Section 5.1.1 that included a 'storyworld' part and an 'engine' part with blurry borderlines to form the delivered 'artefact'. Metaphors are presented that assign partial control to authors, giving them 'implicit creation' power. The notion of 'implicit creation' has been first presented in (Spierling, 2007b).

5.2.1.1 Gardening Metaphor: Explicit Authoring vs. Implicit Creation

The way story 'writers' craft their work changes significantly with the introduction of interaction. This is especially true in the creation of a piece to be run on a multi-agent platform allowing emergent narrative, where it is impossible to define every little detail explicitly, in advance of the user interaction. An *"emergent property"* is one that exhibits *"perpetual novelty"* (Holland, 1998) each time the system runs, under the influence of a sequence of input combinations. Hence, such a concept supports user agency by generating a variety of constellations at runtime, which are, on the other hand, hard to foresee, and can only be addressed 'implicitly' by a designer.

The traditional method of creation, shaping every detail of the plot, is referred to herein as 'explicit authoring'. In contrast, 'implicit creation' becomes necessary, where configurations of states 'imply' certain behaviours of agents. As for a conceptual model of creation, new metaphors are needed to explain the main difference constituted by this indirect form of design.

Fig. 5.8 illustrates this difference by using the metaphor of 'gardening'. This comparison was made previously by Will Wright for simulation games, such as *"SimCity"* (Pearce, 2002). The left side of the illustration shows that with 'explicit creation', the hand of the creator designs content that serves as the predefined template for the runtime narrative to follow the given form, such as is the case in 'branching' interactive storytelling. In this metaphor, the result is a paper flower, crafted 'explicitly' by the author in full detail and beauty. By contrast, the right side – with 'implicit creation' – shows that a runtime narrative actually has to be 'planted' beforehand by a creator. All details emerge while the plant is growing, and untypical variations can also occur in the runtime narrative. The difficulty of 'crafting' finally lies in the design of the 'seeds', independent of any ability to code. As such, this sketched creative process is the same as found in the design of simulation games. Moreover, the vision to 'get a grip' on a purely emergent process is likely to shape up as an illusion, as the definition of emergence implies. As Holland (1998) has put it: *"Much comes from little"* – meaning that 'emergence' is defined by its unpredictable attributes, letting *"few rules give rise to extraordinarily complex situations"*.

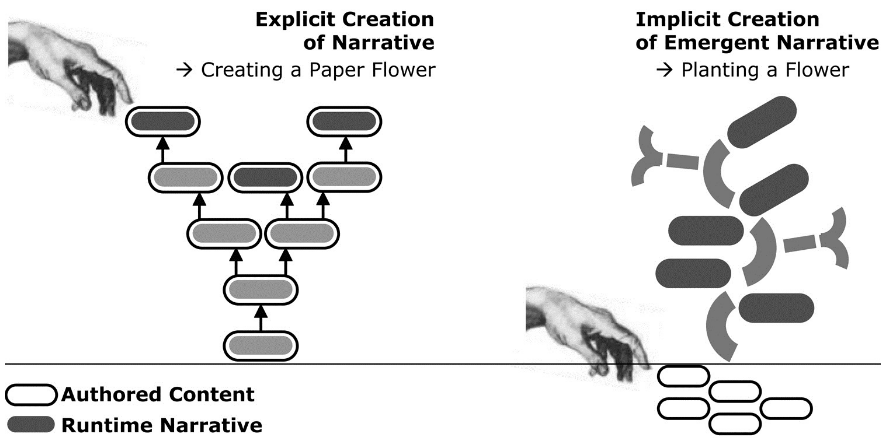

Fig. 5.8. The 'gardening metaphor' explaining the difference between 'explicit' and 'implicit' creation for generating a narrative structure during runtime.

IDS is herein considered to be a combination of story, simulation and games – therefore, the art form requires more than traditional story creation as a telling of events. For a simulation game, a critical design step is the design of a dynamic model. Chapter 4, Section 4.4.2.2 presented the general concept of transition functions building the core of a dynamic model. According to Holland (1998), a *"perfect model"* would result in a complete mapping of real world configurations to model states, but the *"art of model building"* lies in selecting the *"right level of detail"* that is useful for a purpose. It is very unlikely that we manage to observe the world successfully in every detail, and doing so would result in a model that is way too complex.

For IDS, it is this 'right level of detail' that has to be identified in order to apply emergent features. In other words, the claim is made that the design of a model as an abstraction, leading to emergent behaviour of a 'desired' sort, must be a part of the creational process and, as such, part of the content. The modelled behaviour is not (only) the responsibility of the underlying runtime engine, which more or less provides underlying environmental conditions (for example, psychological and physical models resembling 'reality'). It will further be assumed that for each storyworld created, there is a need to identify the usefulness of 'emergence' for selected narrative elements and make this a part of the design workflow – also considering that narrative properties exist that don't necessarily have to show 'perpetual novelty', and therefore don't need to be modelled as emergent features, and can be scripted in a more traditional manner. An example of applying this distinction and finding a middle way is presented in Chapter 6.

5.2.1.2 Other Metaphors for Sharing Control

Understanding 'shared control' is a fundamental requirement that helps finding a job-related new self-image for creators including tasks and responsibilities for 'implicit creation'. Therefore, in brief, more metaphors from real life experiences are explored here, sometimes already existent as components of systems to be used. Several situations of real life or fiction can be taken as models for negotiated agency or implicit control. It is the agent technology itself that is based on a metaphor of delegating tasks to external entities by setting goals, and by letting 'agents' (or e.g., staff members) do work on one's own behalf. In reality, this does not necessarily mean an abandonment of responsibility of the principal concerning the delegated tasks. The following table summarises some basic metaphors that can be discussed within the context of shared control.

Another issue in this context is that users interact with (or possibly co-create) storyworlds, while only having partial or incomplete knowledge about a character they are supposed to play. Therefore, further metaphors in Table 5.2 deal with that incomplete knowledge of interacting users (cooperative users are a premise here). These can also be considered when defining user roles in the design phase of a storyworld, as one way to have more 'control' or at least anticipation of the end-users' influence.

Metaphor	Type
	Sharing authorial control at the creation level
'Gardening'	There is never full control in gardening, only by choosing (or even now 'designing') the seeds and tending the garden.
'Agent/staff delegation'	Depending on trust factors, constant or occasional monitoring and adjustments (observation/direction) are performed, retaining responsibility.
'Horse riding'	Control of a horse depends on the experience of the rider, and on whether the horse is tame, wild or performing. Wild horses require more rider competence.
'Improvisational theatre'	Actors need skills beyond human average (lifelong training, art form).
'Director'	Directors have only indirect influence on theatre actors, also through negotiations, depending on personalities and situations.
	End-user roles with partial / incomplete knowledge in a setting
'Role-playing'	Several forms of established interactive story are thinkable, with focus e.g. on acting, performing, rehearsing (see 'holodeck'), gaming, or learning/training.
'Holodeck'	*"Star Trek"*s archetype model enables user performance based on a known script; the immersive interface is the most interesting part of 'interaction'.
'Dollhouse'	User has maximum control, simulates own real experiences within the model.
'Amnesia'	User plays 'mystery plot' not knowing his/her identity in the story at the beginning. The following two are subsets of the 'amnesia' metaphor.
'Detective'	Clear 'double-layer' role for interacting with an unknown background story.
'New acquaintance'	Meet new people at a 'regular's table' who know each other already.
'Make-believe'	Play a role (given by the story) convincingly without being disclosed by story characters, e.g. 'stay undercover' or 'pretend'.

Table 5.2. Metaphor examples for the shared responsibility between author, platform and user.

5.2.2 Creative Control in 'Modelling'

Problem(s)	When the control is shared between engine and author, what exactly are the conceptual tasks of authors apart from a traditional view of programming the engine?
Solution(s)	Assuming an abstract storyworld model as the target of creation by modelling, and identifying a dual concept of 'story interpretation' and 'model for generation'. • Communication model integrating story 'telling' and story 'modelling' (bottom-up and top-down) • Potential of an abstract storyworld to describe two dimensions of generative storytelling, as well as a mixture of implicit and explicit authoring

This subsection argues that implicit story creation is an act of 'modelling' an abstract storyworld. The concrete 'fulcrum' of creative decisions moves away from representation levels to an abstract level, even if authors would like to imply concrete possible actions. The model has been presented in (Spierling, 2009). An assumption of this model is a prerequisite for further assumed creative principles.

5.2.2.1 Bottom-Up, Top-Down: Duality of Creative Control

Fig. 5.9 illustrates a dual meaning of a storyworld. First of all (Fig. 5.9, left side), a storyworld can be seen as a mental model constructed by the audience (Herman, 2002). According to several scholars in narrative theory (Abbott, 2008), our experience of story is actually a construction, something *"put together"* by inference from what we see, hear or read – from concrete representations of events, actions and states (also compare the interpretation of *"situation models"* in Trabasso's *"causal networks"* (Trabasso et al., 1982), Section 4.3.1.2). Not only characters' actions, but also conditions for these actions are inferred by the audience solely from their representation. When storytellers succeed in illustrating alternative options for action, this contributes a lot to the suspense and immersion of the audience. Suspense is at work even if these possibilities are not at all explicitly shown, but just implied in a shared cultural background.

On the other side (Fig. 5.9, right side), generative approaches to Interactive Storytelling, in which representations of events and states are generated automatically from behavioural models of AI-based agents, turn this concept upside down (Young, 2000). What the author needs to define is not the explicit order of events, but rather the abstract story as a dynamic world model of states and rules, from which appropriate actions and events can be implicitly inferred through a story engine or a digital drama manager (also compare examples of engine models in Section 5.1.2.3). During runtime and the interaction of a user with the content, this generative technique may lead to more flexibility in the possible reactions to user events than with explicitly authored actions. Hence, during IS authoring, not 'sequences' but 'situational conditions of events' have to be made explicit in order to let an engine generate the action progression (select proper actions) for characters dynamically.

"If the user had no influence on the world, the creator could use the writer's traditional method of carefully planning the exact sequence of story events. However, the user is not a peripheral element. Indeed usually the whole purpose of the world is to give the active user a certain kind of experience. Thus, the creator must convey to the director enough general information about stories and enough specific information about the intended kind of experience to allow the director to achieve the creator's goals. This must be done in such a way as to leave the user with an undiminished feeling of free will." (Bates, 1992)

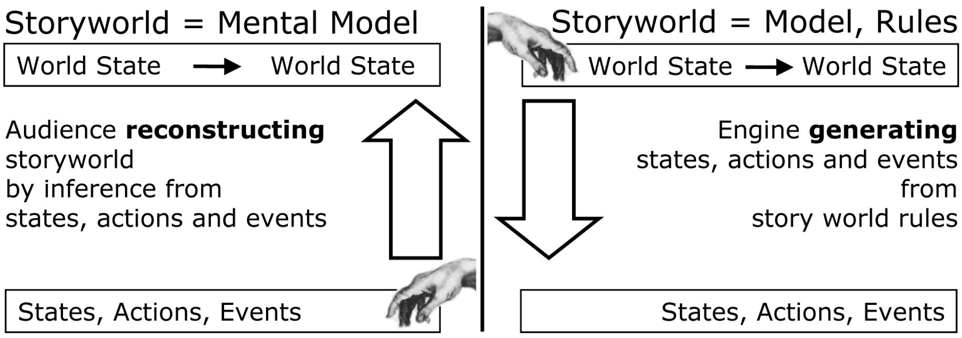

Fig. 5.9. Perception and generation of a storyworld. Two meanings of 'storyworld': Left, the recipient's mental model, built from interpreting created states, actions and events, according to (Herman, 2002). Right, the designer's created dynamic model, leading to generated states, actions and events, after (Young, 2000).

This image (Fig 5.9) is presented here as a novel concept for authors to think about story modelling and their implicit role as creators. The aspects of the left side and the right side of the picture had each been presented before alone by other theorists. The novelty here lies in the image as a communication model between disciplines. Unlike proponents of the 'story generating' area of expertise, conceptual authors would not program a story, but benefit from this mental image in their conception of interactive story ideas based on 'model thinking'. As authors need to do both – think of the representation and of the model – we can explain with the image a creative circuit, in which creators alternately 'model' and 'tell' – delinearise and linearise the content.

In the first version of the case study (see conclusion in Section 6.2.4), it was found helpful to arrive at a theoretical model for the interdependencies of actions and their state conditions for bots and the user. Derived from the model, conditions for bots' acts could be defined, and user affordances were made clearer. However, the first abstract model alone could not be used to explain the whole story. It was necessary to imagine the resulting order of sentences and their 'voice' during a phase of concrete 'writing', and then again go back to more abstraction. These first loops applied already before using a generative engine – when the 'model' was only theoretical and not yet technically represented.

5.2.2.2 Two Dimensions of Implicit Creation

In order to be able to create events implicitly, it is necessary to anticipate to a certain extent what is going to happen under the specified conditions. Working with a specific engine means that authors in the end need to have applied knowledge about the engine's 'mind' or employed generative formalism and rules. It has been found useful when authors are procedurally literate, which often has been compared with 'being able to program' (Mateas and Stern, 2005a). But it is more complicated. With implicit creation, there are several 'unknowns' at the time of creation. Authors have to conceive at a high abstraction level, and leave detail to an engine. There are two dimensions of concretion following from implicit stipulations (see Fig. 5.10).

Both dimensions in Fig. 5.10 refer to automatic generation of actions. First, the arrow to the right is related to the ad-hoc selection of the best next actions and events suited to build the narrative flow, as a sequence of events. The generation mostly consists in searching a possibility space for suitable and fitting events (Bates, 1992). The arrow downwards concerns the situated shaping of the representational levels. This can e.g. stand for 3D rendering and behavioural animation (Badler et al., 1991; Perlin and Goldberg, 1996), or for automated dialogue generation (Hovy, 1987; Hovy, 1998). Sengers (1998) has pointed out this distinction by stressing the importance of letting agents not only *"do the right thing"* as *"action selection"*, but also *"do the thing right"* as *"action-expression"* (Sengers, 1998). She elaborates on the 'action-expression' problem of an agent as to best communicate its goals and activities to the user.

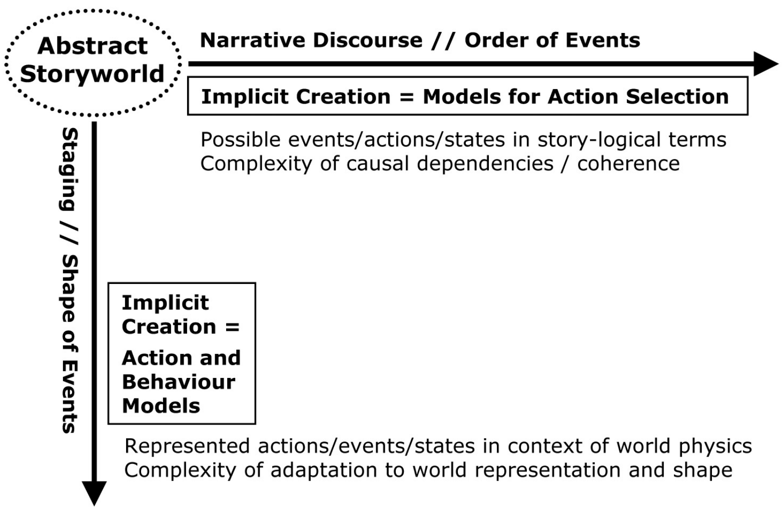

Fig. 5.10. Two dimensions of potential influence from abstract levels.

For example, defining rules for facial expressions and nonverbal behaviour of virtual humans is 'implicit creation' concerned with shaping and staging. Defining a plan for selecting actions associated with pre-animated movements concerns the action selection more than their (unchangeable) staging. *"Façade"*, for example, can let its characters dynamically move through the room and uses rule-based facial animation to display generated reactions to users, before next actions are selected. On the other hand, *"Façade"*s spoken text is pre-written, sentence by sentence, and recorded in a studio –

an example for explicitly authored representation. In contrast to that, *"Thespian"* uses natural language generation, which combines plans about 'what to say when' (this would refer to the horizontal axis of implicit creation) with 'how to say it' (generation on the vertical axis of shaping events).

The two dimensions are highly dependent on each other. In an ideal of a fully computational storytelling system, it would be necessary to formalise and therefore abstract all actions. However, due to the complexity of this goal (and the repeatedly discussed current impossibility of this ideal), current prototypes are often based on incomplete dynamic models, meaning that the demand of generating all story events would be too high for state-of-the-art formalisms. Furthermore, the merit of 'completely generated' interactive stories is also unclear, and still needs to be researched. Therefore, alongside algorithmic decisions, explicitly written content as well as hard-coded shortcuts in the engine are often used to make ends meet (Spierling and Szilas, 2009). In practice, there is more likely to be a combination of explicit and implicit authoring, or in other words, a combination of authored and generated events.

The model of two dimensions is here presented to state more precisely the potential scope of implicit creation and required dynamic modelling. As for the artefact creation with 'Scenejo' (Section 6.1), the system requires authors to 'explicitly' phrase utterances. Having the fixed wording puts constraints on the potential variability in the order of sentences. In the case study, an abstract model of dialogue has been chosen that takes care of associated sentence pairs while mixing the order of 'initiative' events.

5.2.2.3 Discussion: Storyworld Modelling vs. Storytelling

It is herein proposed as a conceptual model that the act of creation in highly-interactive storytelling moves away from the concrete telling of events towards building abstract simulation models. This needs to be discussed facing critical theory that opposes storytelling and simulation or model building. At first, outside interactive media or game studies, educational psychologist Bruner (1986) claimed that there are *"two modes of thought"*, or complementary ways of constructing reality and ordering experience, which are *"irreducible to one another"*. He called them the *"paradigmatic"* or *"logio-scientific"* mode on the one side and the *"narrative"* mode on the other side. Paradigmatic arguments convince of their truth, narrative stories of their lifelikeness. Each mode has its own criteria of *"well-formedness"*. *"Efforts to reduce one mode to the other or to ignore one at the expense of the other inevitably fail to capture the rich diversity of thought."* (Bruner, 1986, p.11). Bringing this in agreement with IDS concepts presented herein, it points to the necessity that the model alone does not constitute IDS, but that the kind of narrative experiences resulting from it determine goals by which to judge the model. This has been discussed in Section 4.4.2.2, where model 'design' and model 'mediation' are meant to alternate in the design process. Compared with Fig. 5.9, one can assume that there are iterations of top-down and bottom-up processes.

From the point of view of game studies, Aarseth (2004) postulates: *"Simulation is the hermeneutic Other of narratives; the alternative mode of discourse, bottom up and emergent where stories are top-down and preplanned. In simulations, knowledge and experience is created by the player's actions and strategies, rather than recreated by a writer or moviemaker."* Aarseth refers to 'narrative' and 'simulation' as *"modes of discourse"*, taking the point of view of the experiencer, not of the creator. The context in which Aarseth presented this quote was an argument against attempts to reconcile games and storytelling, one of many contributions within the so-called *"Ludology-vs-Narratology"* debate (Frasca, 2003). Also Frasca argued in the same direction, opposing *"simulation"* with *"representation"* (Frasca, 2001), where he equated simulation with games on the one side, and representation with narratives on the other side. This notion is not shared herein, as it ignores that the experience of simulation can only be mediated through a level of representation, and that (sequenced) narration (in the sense of 'sjuzet') is a chosen representation of an underlying (timeless) story model ('fabula').

Indeed, the concepts of emergence and automatic generation can be contrasted with the notions of storytelling and creation. The phenomenon of patterns created by an ongoing emergent process is usually seen as the opposite of anything based on intentions, such as creation. However, there is a creative, inductive process of finding rules that attempt to model patterns of interest – a selection. *"Emergence must somehow be bound up in the selection of the rules (mechanics) that specify the model, be it game or physical science. […] Knowing what details to ignore is not a matter of derivation or deduction; it is a matter of experience and discipline, as in any artistic or creative endeavor."* (Holland, 1998, p. 113)

There is a correlation between the above concept and writing a novel or other forms of 'traditional' storytelling. Herman, who provided an integrating view on narrative theories including other disciplines (Herman, 2002), defined the notion of a *"storyworld"* as an *"ecology of narrative interpretation"* from the perspective of recipients. Actions, events and states are parts of the inventory of *"local principles of storyworld design"* (Herman, 2002, p. 27). Presented actions in a story are mostly incomplete and *"under-specifying"* the storyworld – much of it is only implied, without being explicitly articulated during narration. For example, one pithy dialogue line in a film can have three functions (Schütte, 2002): 1.) provide information, 2.) display emotions, and 3.) reveal traits by its diction. The art of storytelling and the art of model building both rely on omitting details. Nevertheless, they are not the same and have to be distinguished.

'Implicit creation' in IDS (in its utmost degree) is the content creator's task of letting actions, events and states result from automatic generation during narration, by specifying a dynamic model (a storyworld). Various engines with underlying dynamic models for the generation of perpetual variations of actions already exist: scientific models from physics and psychology, such as for gravity, vision, kinematics, emotions, cognition and linguistics. However, actions based on models of 'reality' alone do not tell a story or provide a storyworld. The concern with developing unique storyworlds as a basis for coherent actions is part of the content creation, not of engineering. Faced with the complexity of procedural systems, content creators need to approach implicit creation in steps, starting with explicit creation methods for their greater accessibility. In Chapter 6, an example of such a process is given. Furthermore, the extreme systems that fully generate (sense-making) narratives from models without explicit content specifications have yet to be built. Nevertheless, there is a need for future research in identifying appropriate steps and developing supporting tools.

5.2.3 Implicit Structure of Event Sequences: Acting Situations

Problem(s)	Authors currently get presented a negative image of 'what not to build': a 'sequence of events'. Interactive story creators instead need a constructive model to circumscribe the dynamic/ad-hoc sequence of events – implicitly.
Solution(s)	Adopt a conceptual model of acting situations and their conditions that is in line with technical solutions as well as with findings in narrative theory. Introduce an abstract layer of modelling 'acts': Define what they do to the fictional world. • Regarding all events as 'conditional' for conception • Two perspectives of thinking about acting situations: 'action-based' and 'reaction-based' perspective

This subsection presents a model of structuring events, actions and states in an implicit way. It is perceived as a problem if authors are presented a negative goal of 'what not to build': a 'sequence of events', following the *"let go"* maxim that has been widely discussed in the context of the concept of emergent narrative. Instead, authors need a positive concept of 'what to build': 'conditional events', acting situations or rather conditions for action. Further, there has to be a clear model about what each action 'does (or can do) to the world'. Some of these models for action have been presented in (Spierling, 2009). Corresponding examples of artefact building are provided in Chapter 6.

5.2.3.1 Conditional Events

During conception of any story, such as in screenwriting (compare Section 4.2.1), authors are aware that concretely and orderly described actions of a character are situated in a range of possibilities. Often, they put themselves inside the minds of their characters and deliberate on their possible and plausible actions. The conditions for these actions are then to be inferred by the audience from the action expression alone. If done well, such conditions including goals and motivations are 'created' implicitly by the author(s), to be indirectly perceivable at the representational level. As shown in Section 4.3.1 in the context of Bremond's theory of *"narrative possibilities"* (Bremond and Cancalon, 1980), actions have been represented by a triadic structure: 1) the possibility for action, 2) the actualisation of the action and 3) the result of the action (compare Fig. 4.7). In Bremond's model, the agent has options to refrain from the possible action and to either succeed or fail when choosing to act. The action is embedded in a whole acting situation, which includes the appraisal of the situation and anticipated consequences (performed by both the story characters and the audience).

We have discussed (Section 4.3.1) that this model of deliberation of an agent can be seen as relative to concepts of describing planning operators used in AI (Russell and Norvig, 2003), stemming from logical formulas for actions and states. The use of planning techniques for interactive storytelling has been proposed by Young (1999) derived from early story generation (see Section 2.2.1), referring to Schank and Abelson (1977) amongst others. Using AI planning is today one of the prevalent technical approaches to IDS engine design. When authoring a storyworld in form of a planning domain, the definition of a triad of *"pre-condition – action – post-condition"* as description of possible events *("operators")* is very common, e.g. in (Min et al., 2008) and (Pizzi and Cavazza, 2008). However, with its typical technical formalism and terminology, it is often understood as an 'alien' concept of programming by conventional authors.

In current visions of highly interactive storytelling, also the user is an agent in the above sense, influencing the world's state changes (bring about changes or prevent changes). Creating a model that leads to acting situations with narrative interest for users is a task of authoring an interactive storyworld. The general concept including 'pre-conditions' and 'effects' of actions is so crucial for modelling acting situations that it is suggested here to be a requirement for authors to adopt, when authoring for IS engines. Given that it also relates to narrative theory and to some creative principles of screenwriting, it should be expected that without programming skills, the concept is learnable. The difference to linear forms such as screenwriting is that instead of only implicitly knowing the conditions of an acting situation, these now have to be made explicit and put into the model. However, a gap between design 'cultures' may frequently occur when having to specify complex conditions in a formalised 'math-like' language. According to Crawford (2002), who elaborated on the problem, this can only be overcome by creative partnership between engineers and artists (as suggested in Section 5.1.1.2). The artists' share is to *"endeavour to express their needs to the engineers as clearly and precisely as possible"* (Crawford, 2002).

Still, because there are cases of actions that are not yet properly covered (e.g., parallel and enduring actions) the above concept may be perceived as a rigid formula that in some cases will be counter-intuitive or inappropriate to use. Another drawback is that with complex conditions, it might get hard for authors to anticipate the resulting flow of events, and they have to rely on (again complex) supporting tools, such as planners.

The application of this conceptual model of *"pre-condition – action – post-condition"* to an authoring process is portrayed in Section 6.3. There, the conclusion has been that by internalising this concept as a creative principle, more interactivity could be achieved in the redesign, although the system was not incorporating this concept within the authoring tool. Again, this is in no way a proposal for a certain kind of technical implementation; it is rather a proposal to adopt the notion of an acting situation for conceptual modelling. Radically speaking, we thus propose as guiding principle: "In interactive storytelling, there are no unconditional events!" This head note reminds us at always conceiving interactive story 'situations', even if there might finally be events with an 'unconstrained' condition.

Goals and Plans

When using a planner to accomplish automatic selection of next actions, it is technically necessary to define an initial state and a goal state. Goals and plans are concepts in line with traditional storytelling, and necessary even if instead of using planning software, manual scripting is performed. Then, the characters' action selection strategies (or reaction strategies) should be implemented so that there are no conflicts with goals (unless these are made plausible). At this stage, the 'art' of storytelling begins, as it lies in defining interesting goals and subgoals for designed character constellations, whether or not automatic planning is used. The definition of simple goals that are never conflicting leads to quickly ending and boring plans.

Abstracting Actions: Grouping to Pragmatic Meanings

During conception of the effects of actions on the storyworld, a model is built that can be expressed by a causal network or a concept map. In this context, it has been found useful if actions are abstracted into groupings of similar effects and meaning, thereby abstracting the storyworld model (or simulation model). In (Spierling and Hoffmann, 2010), this has been demonstrated for an example to be realised – by way of trial – with the *"Storytron"* system. In the artefact development presented in Chapter 6, this concept of aggregating several different concrete actions at the surface level to fewer actions at the semantic level has been realised by the grouping into 'dialogue acts'. Abstracting dialogue actions is a common approach to interactive dialogue systems and interactive storytelling (see Sections 2.2.4 and 4.4.3.2). It alleviates the conceptual question of what a dialogue act can 'do to the world'.

Issues of Visualisation

The visualisation of emergent processes is difficult. Typical graph and plan structure visualisations offer affordances for linear or branching thinking; therefore, strictly visual thinking can hinder highly-interactive storytelling. Authors have to find ways of 'dynamic visualisations', for example by paper-prototyping with a card game. Such an approach is sketched briefly in Section 6.3, in which the differences between an action-centred and a reaction-centred design approach have been explored. We also used a card game in a tutorial (Spierling et al., 2010) to explain the process inside a story planner[36]. It is recommendable to use several forms of visualisations to illustrate different points

[36] Tutorial material (ongoing work) available at http://iris.interactive-storytelling.de

of view on the same elements in different contexts. State charts, going back to Harel (1987), are typical visualisations of reactive systems. If used as a strict and only formalism, they can lead to linear and branching thinking – in other words, create ‘paper flower’ models as in Fig. 5.8 (left), hindering ‘implicit creation’. Pizzi and Cavazza (2008) have demonstrated a progressive plan visualisation within their authoring tool for the *“Emo-Emma”* system, which includes a built-in planner in the authoring process. It shows that at each step of tentatively executing a storyworld, ad-hoc planning leads to a different, updated state chart, taking the actual position as the starting position. Without such a tool, it is hard to imagine how planning and re-planning based on pre- and post-conditions of operators can open up new possibilities of further connections. The graph cannot be completely drawn manually at the authoring stage.

5.2.3.2 Acting Situations: Action-centred Design vs. Reaction-centred Design

Our authoring studies with different tools (‘Scenejo’, also *“Storytron”* and *“Emo-Emma”*) have led to the finding that when designing actions for different IDS systems, there are two opposed conceptual strategies how conditional events can be thought of. One strategy is ‘reaction-centred’, the other one is ‘action-centred’. This is not only suggested by concrete technical tools. Discussing an anthropologically motivated philosophy of ‘action’ in human-machine communication, Suchman (1987) criticises a planning model of interaction favoured by AI researchers, stressing the importance of *“situated actions”*. Apparently, for IS creation, both aspects – story planning and story interaction design – are important.

- ‘Reaction-centred’ acting situations: This refers to a ‘stimulus-response’ principle. Starting from a stimulus coming from an external source, a character reasons about the possible reactions to the stimulus. This concept is for example used in the chatbot principle that underlies the platform ‘Scenejo’ (see Section 6.1.3), as well as in *“Storytron”*. In the latter, the authorial conception of dynamic content starts by looking at each (designed) verb as an event that can possibly happen, then thinking about the conditions and options to react upon it (also see Fig. 2.14). With this strategy, it is harder to think of pro-active actions as part of an agent’s plan, and easier to define concrete reaction rules to anything.
- ‘Action-centred’ acting situations: This is the typical approach used in planning software. The conception starts by thinking about all ‘goal-directed’ actions that an agent may want to do and what their effects are on the world state (in order to reach goals). Then, pre-conditions are defined that constrain the situations in

which they may occur. With this concept, the problem of user interaction can be left out at the beginning – which also means, it can be easily forgotten and is harder to be integrated later. On the other hand, it is easier to think about the effect of an action for the story.

Both ways of defining acting situations are related to each other, but they afford different ways of conceptualising the interaction structure. In Section 6.3, the experiment has been performed to test both strategies tentatively, although the used tool 'Scenejo' a-priori supported only 'reaction-based' implementation. It has been found that depending on the kinds of situation (managing the flow of arguments or being within an argument), one or the other approach are more useful, and the implementation had then been translated to the inherent tool structure. We conclude that the introduction of 'informal' conceptual modelling levels between the 'story idea' and the concrete tool affordances (suggestion in 5.1.1.3, Fig. 5.3) offers to choose both approaches for conception depending on the characteristics of the content rather than of the tool.

During conception, it has to be considered that conditions in IDS have to contain real alternatives for action (Crawford, 2004). For example, the options presented within Bremond's elementary sequence (compare Fig. 4.7) of *"actualisation"* vs. *"non-actualisation"* are no real alternatives for a given acting situation, as they only refer to one possible action description (based on linear storytelling). The 'non-actualisation' of an action is part of this model for reasons of a formally complete 'single' action description, but 'not doing' something is not an alternative that would drive an interactive storyworld. It is a design challenge for authors to design meaningful alternatives for acting situations, which must be well-grounded in their interrelation with represented character attributes, goals and plans. In (Spierling and Hoffmann, 2010)[37], we concluded that a linear storyline typically does not contain enough 'real' alternatives. For adaptation to an interactive form, it therefore must be significantly expanded, eventually up to areas beyond close resemblance with the original.

5.2.4 Conclusion on 'Implicit Creation'

In this section, the notion of 'implicit creation' has been introduced. It paraphrases concepts and metaphors (such as the 'gardening' metaphor) for authors who attend to the building of more 'emergent' or at least more 'variable' interactive narrative, even though possibly not all narrative structural aspects need to be defined as emergent or

[37] See also Appendix D.3.

autonomous properties. The difference to explicit creation is that the created content does not fully describe the resulting actions, states, events or order of these elements in every detail, but it 'implies' them. Recent advancement in the research community on authoring systems mainly focused on GUI-based tools that free people from programming, in the sense of replacing the code building form of typing by clicking. While this is commendable, it is not the only problem for authors. Instead, conceptual models for implicit creation still have to be learned and communicated.

Further, the description of acting situations has been emphasised for IDS. Thinking of actions and events being 'situated' in a changing world state leads to better interactive conception than thinking of 'sequences' of events. Acting situations for human participants must be created by providing affordances for action, and by mapping anticipated action patterns to meaningful storyworld events. Broadly, the creation of a collection of possible actions that change storyworld states is comparable to building a simulation model.

Since the field of 'highly-interactive' storytelling wants to stay away from simple branching mechanisms that explicitly define forking paths of all events, authors need to familiarise themselves with the specifics of abstract modelling required by a software drama manager or agent reasoning approach in a certain system of choice. Referring back to Section 5.1.2, there is likely to be a work-sharing process with involved specialists of different disciplines. However, creative conception affords general knowledge of this modelling process. Future tools can help authors if they get integrated with dynamic visualisations.

The here proposed conceptual models are novel as communication tools.

- They communicate a point of view that shall help authors in the future to be better integrated in design teams with a responsible role.
- They also require that authors learn new concepts of story modelling and of thinking in terms of abstraction. It is a new consideration that this 'learning' does not mean learning 'to program', but learning to use their creativity to model, and to communicate about interactive informal and formal models with programming developers.

5.3 Conclusion

This chapter has been concerned with the finding of general structural conceptual models of the 'content' in Interactive Digital Storytelling. The results take into account theoretical considerations from narratology as well as formal/technical models existent in current story technology research. A non-technical perspective has been taken, which nevertheless has to accept certain blurry borderlines towards technical modelling, especially at the point where story engines contribute to the intended experience. Given this premise, the expression of authorial intent is partly based on the definition of a rule system that can be seen as a simulation model of the intended storyworld, forming part of the content.

It has been assumed that every system built so far and to be built in the future shows unique properties in the details of how exactly 'implicit content' is technically authored. Also, differences are to be expected regarding a certain bias in the proportion of 'generative' features within the whole content, leading to a combination of 'explicit' and 'implicit' authoring tasks. Nevertheless, these therefore informal conceptual models address a present confusion in the community of potential authors. The confusion is rooted in the differences of current systems, leaving an impression of irreconcilability, combined with currently poorly developed authoring interfaces and documentation. Further, a gap has been perceived between established creative principles for 'traditional' storytelling and the way that 'highly-interactive' storytelling systems present themselves towards potential authors.

As solutions for these issues, we proposed models and points of view that – ideally – better integrate authors in the design process in the future. Besides (anyway) possible other improvements on the side of 'better tools', this also requires that authors with traditional backgrounds change attitudes and acquire 'model thinking', which has been underpinned by the concept of 'implicit creation'. What is still missing is a derivation of general 'creative principles' that address this novel design process and design steps. This has been identified as mostly future work, however already broken down by a first concrete suggestion of such principles (see Chapter 7).

The explained models were partially inspired by literature research, which has been discussed at several places in the presentation. Further, the models were strongly influenced by practical experiences. The next chapter reflects on a case study of artefact creation. It takes up some of the models, especially the principle of 'implicit creation', and elaborates how they are applicable to inform the design of a 'highly-interactive' storytelling application.

6 Case Study: Scenejo Authoring Tool Design and 'The Killer Phrase Game'

This chapter describes the development of working examples (artefacts), consisting of the conception of a tool set for authoring conversational interactive storytelling and an example authoring process. The study serves as illustration and evaluation of conceptual models. The main result of the example conceptualisation and implementation is a serious conversational game – the 'Killer Phrase Game'. User feedbacks and qualitative evaluations are summarised. In a redesign process, the step-by-step application of 'implicit creation' has led to increased variability in the game. The conclusion discusses the influences of these developments on the resulting models and the derived creation principles.

It has been assumed (in this thesis and by many referenced co-researchers) that the principles of story conception differ significantly between traditional (especially linear) media production and Interactive Storytelling with AI-based engines. One of the objectives of this research has been to develop interactive story artefacts and thereby find and/or evaluate better suited, novel design models for creators. While in Chapter 5, these new models (under the umbrella term 'implicit creation') have been generally proposed and discussed, this chapter describes the conceptual and technical steps taken in a concrete artefact design project. At the same time, the elaborations serve to exemplify the conceptual models. The designed artefacts are an authoring tool for the platform 'Scenejo' and the authored application of the 'Killer Phrase Game'.

The work started out from a perspective of a non-programmer and media designer, approaching the field from rather traditional concepts of media scripting towards increasingly 'generative' methods. As explained before (see Fig. 3.2), the two tasks of artefact development and theory modelling have not happened in a strict sequence, but intertwined. For example, issues occurring along the design process could provoke giving consideration to consult more theory, to be included in the concepts. Conversely, already enunciated models could be tested during creation for their suitability, judged by their ability to explain the concrete case.

The following explanations are structured into three parts:

- The Scenejo system with an emphasis on the authoring approach (6.1)
- The description of the first version of the Killer Phrase Game (6.2)
- Redesign of the game's structure, considering increased 'implicit creation' and conditional acting situations (6.3)

6.1 The Scenejo System and Authoring Approach

This section outlines the system Scenejo, and gives background information on its architecture and content structure. The name "*Scenejo*" is an Esperanto term for 'stage'. The conversational storytelling platform has been used to realise a serious game about conversations, embedded in a short story – the Killer Phrase Game. While in the next section (6.2), details of this application and its design are in the focus, this section shows the available functionality for realisation. The emphasis lies on the description of the authoring tools and their affordances for creation. The motivation to look at the system is to understand the starting conditions under which the following case study of content creation could be done. The connection of the technicality to conceptual authoring can be explained with the model of graded content abstraction of a storyworld (see Fig. 5.3 in Section 5.1.1.3). At the outset, the code used by the engine is the most abstract form targeted to be finally achieved by authoring. Creators (technical authors firstly, but also conceptual authors, see section 5.1.1.2) need to have a conceptual understanding of the constraints implied by a targeted engine.

In this research, a first step in artefact creation has been the conception of graphic representations for authoring of the given content structure (Section 6.1.5), which partly happened intertwined with the design of the content. Such a tool is a first pillar of a bridge towards conceptual models for authors – however, this first version has still been fairly close to the engine's concepts.

6.1.1 Background and History of the Scenejo System

Scenejo is a system for conversational digital storytelling (www.scenejo.org). It is a low-budget / no-budget project, which has been started in 2004 independently by academic researchers[38]. The motivation has been to have available an experimental platform for the easy design of interactive conversations.

The project was initially inspired by

- previous knowledge and experience from prior research projects in chatbot authoring (Spierling, 2000) based on the AIML[39] language (AIML, 2010),

[38] Ulrike Spierling, Wolfgang Müller, Sebastian Weiß.

[39] Artificial Intelligence Markup Language

- previous experiences in the context of the conception of the *"Cyranus"* authoring tool built within the EU project *"art-E-fact"* (Spierling and Iurgel, 2003), and
- the widely known IDS project *"Façade"* (Mateas and Stern, 2002) as a role model.

It has been developed collaboratively in several steps, following pragmatic requirements of some test applications, and has led to a number of publications, describing the core idea of synchronised chatbots in a conversation (Müller et al., 2005) and a working demonstration of Scenejo (Weiß et al., 2005).

Following this, a first authoring tool (described below) has been conceived and implemented (Spierling et al., 2006), and in an overlapping endeavour, the serious game application of the Killer Phrase Game (see Section 6.2) has been designed and implemented within the project 'Interparolo'. This involved using and testing the tools, thereby improving them, and enhancing its state machine. This application has been used since to revise the authoring concepts and to derive design principles for Interactive Storytelling. Further published papers describe

- educational game requirements for the moderation game and design variations based on the Scenejo concepts (Spierling, 2006),
- the concept of 'implicit creation' involved in the design of this goal-oriented interactive conversation (Spierling, 2007b),
- a report on the design process of the Killer Phrase Game (Spierling, 2008), and
- a revised strategy for implementing dialogue actions for Scenejo as a conceptual model that leads to increased interactivity (Spierling, 2009).

As a follow-up and as ongoing work, the Scenejo platform has been redesigned. The content structure has been revised to be more flexible, and a new generation of tools is under development (www.scenejo.org; see also Appendix C.1).

6.1.2 Scenejo End-User Interaction Principle

Scenejo is a prototypical system that – as many others in the research domain of Interactive Storytelling – predefines a certain paradigm of interaction. The paradigm is based on text-based communication similar to the kind of conversations with chatbots. While users can type unconstrained text on a standard keyboard in 'natural language', several virtual characters respond with 'spoken text'. At the end-user interface, this spoken text can be rendered in different ways, depending on the kind of graphical representation unit attached to the dialogue system. The initial system connected one animated 3D talking head to each chatbot, audibly speaking via a text-to-speech (TTS) system (see Fig. 6.1). Later developments of the system also let consider other graphical representation styles, such as using comics (Weiß et al., 2009). However, the experiments reported herein have been concerned with dialogue creation and its structure, and were therefore primarily independent of the graphical representation.

Examples of other IDS systems with a similar performance goal as Scenejo are *"Façade"* (Mateas and Stern, 2005), *"art-E-fact"* (Spierling and Iurgel, 2003) and *"Crosstalk"* (Gebhard et al., 2003). In each of them, as in Scenejo, conversational turns can be taken by virtual or human actors, resulting in performed dialogues between several virtual characters and dialogues as interaction between them and a human user. Differences between these systems regard the complexity in calculated emotional depth and dialogue context for autonomously generated behaviour. The unique feature of Scenejo in this context is having its main focus on accessibility for writers and authors. Scenejo also differs from *"art-E-fact"* and *"Crosstalk"* by its character-centered design approach (see below).

In its simplest form, the Scenejo actors are independent chatbots and can be used to experience randomly emerging dialogues or conversations between them, where technically no difference is made between virtual and human actors using the question/answer principle. Further, more goal-directed conversations can be authored, approaching a middle ground between narrative presentation and interactive conversation, or including simulation-like structures.

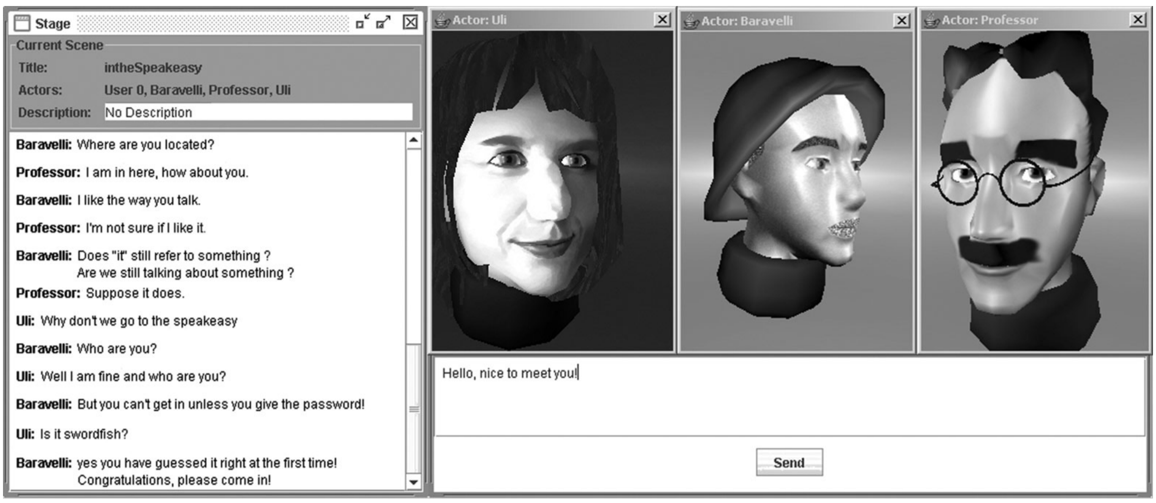

Fig. 6.1. Example screen of an early version of 'Scenejo': Emerging small talk between several virtual agents (3D talking heads) and one user represented by a text interaction window.

The range of meaningful interactive stories that can be created with the system is therefore constrained – by the interaction principle – to situations, in which the participation in or the interruption of ongoing conversations between characters is part of the story's goal. In *"Façade"*, this is about the intricacies of being forced to take sides in a marital conflict between friends. In the later described Killer Phrase Game (see Section 6.2), the user is a moderator of a conflict between the bots. Other early attempts to find suitable content for multi-party dialogue systems included quiz-like interactions assigning direct questions to the user, for example, in applications of the project *"art-E-fact"* for mathematical learning (Spierling, 2005b) and of the project *"Virtual-Human"* for a football quiz (Pfleger and Löckelt, 2008).

In the case of the prototypical experiments described here, the chatbot interaction principle is the only way of interaction. However, for generalisation purposes in the future, the principle can be thought of being extended and integrated with a full GUI interaction for controlling parameters, or with the possibility of being embedded via navigation in a 3D world, such as in the *"Façade"* homely environment, or moving around at a virtual dinner party in a beergarden (Endrass et al., 2009), meeting several group constellations of conversation partners.

6.1.3 Scenejo Architecture

In general, the architecture of an IDS system poses constraints on the possibilities of story designs that can be realised. This can be explained by the fuzzy borderline within the content model proposed in Fig. 5.1 (Section 5.1.1.1), indicating that – for example – concrete agents' behaviour may be specific for one storyworld, but it has to be enabled by general engine behaviour. This implies that there is a motivation for authors to understand the behaviour constraints of an engine, on a conceptual level. This section explains such constraints for Scenejo. The most unique ones are the philosophy of turn-taking of the implemented chatbots, the difficulty of anticipating user input, the character-centred approach, and the fact that all bot utterances are modelled as 'responses' to input, implying a 'reactive' approach in designing actions.

The Scenejo implementation in Java has originally been based on a simple architecture (Weiß et al., 2005), connecting several chatbots in a conversational loop of turn taking, employing the public licence chatbot technology A.L.I.C.E. (AIML, 2010). In its simplicity, AIML supports accessibility for authors who enter the field as novices in dialogue programming. The content structure has been extended by the Scenejo engineering team[40] with Scenejo-proprietary constructs called SCAIML ('Scenejo-AIML'), introducing operators on AIML predicates and further elements allowing the communication with the dialogue manager, called 'Dramatic Advisor'.

The Meeting Point / Stage

Fig. 6.2. sketches the central communication principle underlying the Scenejo conversations. The Scenejo architecture combines a character-centred response generation (by each 'bot') with a direction facility, called the 'Dramatic Advisor' (DA). All information is exchanged at the 'Meeting Point' as the central component, which runs in steps, one at a time (conversational turns). 'Bots' are the equivalent to characters as agents in 'bottom-up' or emergent approaches, and the 'Dramatic Advisor' (DA) is a simple drama manager element allowing top-down plot control.

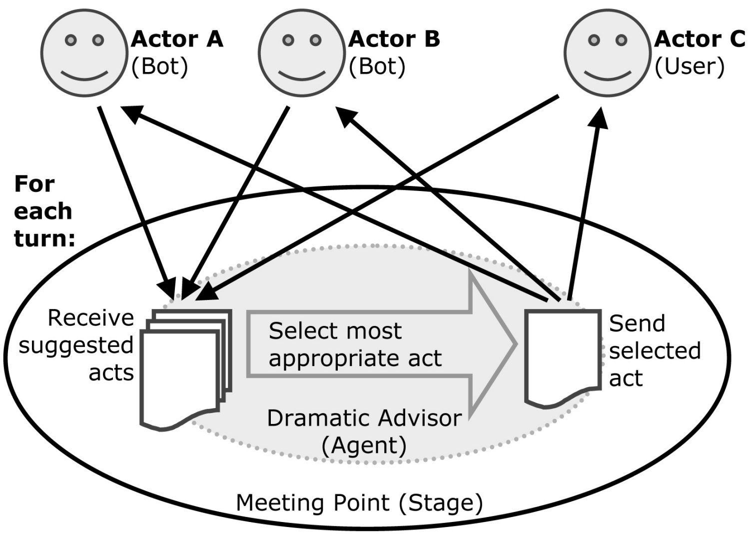

Fig. 6.2. Basic communication principle of Scenejo. The 'Dramatic Advisor' selects actions from incoming verbal utterances, which are provided by chatbot responses and/or user input. The DA can also take central actions (not rendered), such as 'trigger' a bot to initiate a new sequence.

For each participating agent, the meeting point acts as a broker for one bilateral dialogue. Fig. 6.2 shows that for each turn, each bot sends an utterance as a response 'proposal' to the meeting point. The DA selects one of these contributions, and the meeting point sends this choice to all participants, except the originator of this utterance; and the next turn begins. With this simple mechanism, all utterances are 'public', being internally 'heard' by all participants and letting all participants propose answers at each turn. Only the DA arranges the final selection and turn-taking perceived

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[40] See Appendix C.1 for the distribution of responsibilities in the teamwork.

by the end-user. Acts addressing the end-user are rendered at the 'stage'. The stage is defined by the chosen interface to the end-user, in other words by the representation level. In Fig. 6.1 on the left, a text window displays the history of the dialogue, updated in real time, while the current utterance is also spoken ad-hoc by TTS. As stated above (and indicated in Fig. 6.3), this form of interface can be designed independently.

The Stimulus-Response Principle

Each chatbot works according to a stimulus-response principle. Assuming a dialogue made up of adjacency pairs (Schegloff, 1992), it generates one answer (a 'second-half') to a question ('first-half') that is required as an input. The finding of a single response, performed by each bot programme at each turn, is a search process within a database of possible matches of word input 'patterns' and associated 'templates' defining the response. This co-called knowledge base has to be authored (or generated/acquired otherwise) before play time. The *"Alicebot"* (or other bots following the same principle) generates a search graph based on all defined input patterns before runtime, following certain priority rules. For authors of such a database of input patterns, it is interesting to know these priority rules to anticipate the possible outcome, especially when wildcards (expressed as '*')[41] are used as (or within) the patterns (Wallace, 2007a). Simple context variables can be used to delimit the search to a smaller section than the whole database, for example the definition of a certain topic or an expected answer to a question.

The response template can also include checking for necessary pre-conditions to provide alternative answers. Authors can freely define variable attributes and parameters for each bot, which can be accessed as states of the conversation during runtime. These predicates can be global or only affect one bot, and they can be changed by authored arithmetical operations.

The Dramatic Advisor

The reasoning of the Dramatic Advisor (DA) for the selection of 'the best suitable' answer has been conceived to include author-defined rules on local and global attributes. For example, local attributes can include comparable values or traits of actors, such as assertiveness and topic expertises. Future developments of the DA include the extension of these possible rules to discourse context, such as statement relevance, and the

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[41] See Appendix C.2 for more details of AIML concepts applied in Scenejo.

inclusion of author-defined events to be used as triggers. The DA has the following functions:

- Controlling act selection at each conversational turn (see above)
- Playing out hidden 'triggers'. This is necessary for implying a possibility of proactive/ initiative bot behaviour. Otherwise, because of the bots' stimulus/response principle, the conversation would be determined to wait for a first stimulus of the user.
- Controlling an overall plot succession of scenes, by triggering scene changes. Scenes are a possibility to delimit the search space of possible AIML patterns. For each scene change, the database can be initiated. Further, a scene is described by the participating actors; such, it is possible to change actors with each scene.
- Future: The DA shall be able to include more complex rules for automatic action selection. It shall include manual turn-assigning and general turn-taking rules (Sacks et al., 1974).

Understanding the DA is helpful when making a choice for a certain scene structure. In Scenejo, a scene has a technical implication (constraining the search space); therefore, the scene structure is not just a matter of story design.

The Periphery

The afore-mentioned components build the core of the Scenejo engine. The engine consists of the independent bots and the meeting point with the dramatic advisor, producing text strings at each turn that then can be transferred to a representation engine. The first representation solution used was a connection to Java-3D-based avatars developed in the project *"Embassi"* (Müller et al., 2000). This component can automatically animate the talking heads with 'lip-sync' based on the given text. Further, markup annotations in the text allow the control of facial expressions. Fig. 6.3 shows an overview of the Scenejo system with its periphery.

Finally, also the graphical authoring tools are part of the whole system of Scenejo. They can be used to create AIML with SCAIML extensions processed by each bot, including the configuration of actor attributes. Further, they support the structuring into plot elements, such as scenes, and at this level allow the configuration of the Dramatic Advisor.

In summary, the Scenejo architecture combines a character-centered approach with author-friendly simple tools of structuring the content. The complexity of the 'DA' component's action selection mechanism is comparatively shallow, serving at first as an experimental platform for authors. In future work, it can and will be enhanced on authors' requests.

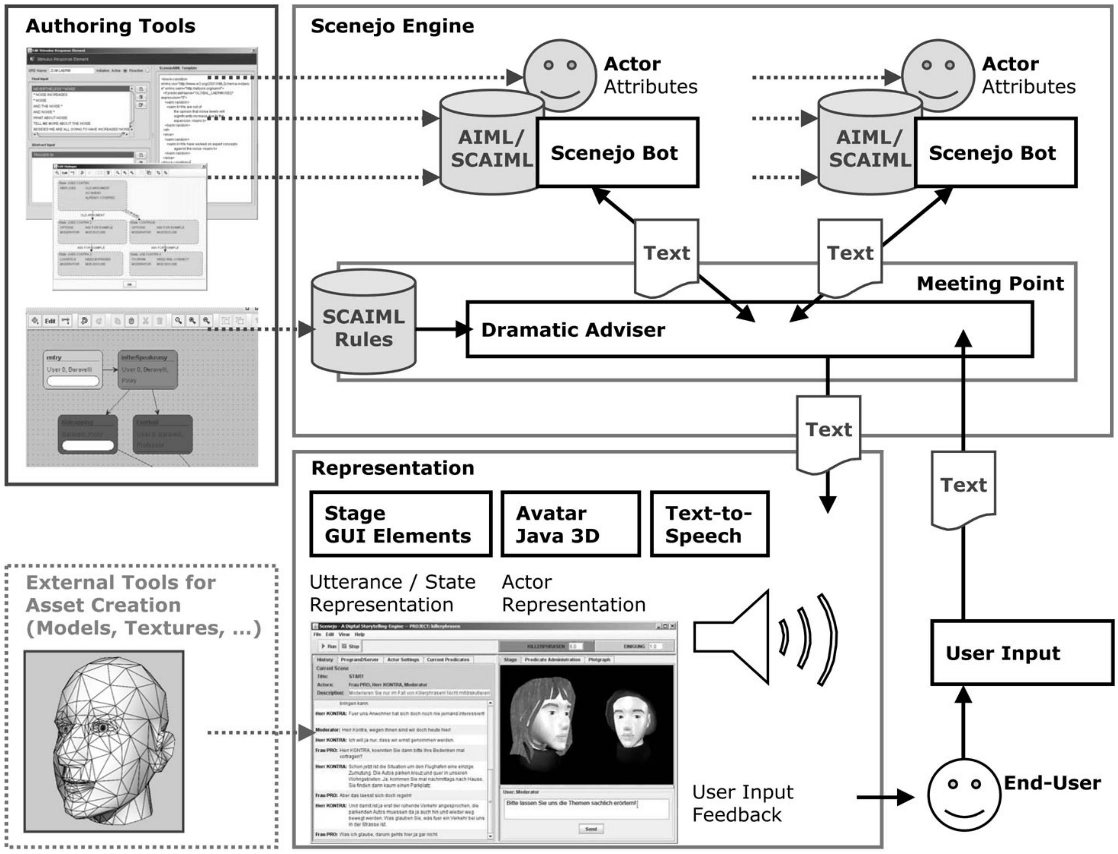

Fig. 6.3. The Scenejo architecture including its authoring tools and the representation components (used in the application described in Section 6.2).

6.1.4 Scenejo Content Structure and Technical Authoring Principles

6.1.4.1 Bottom-Up versus Top-Down

The central aspects of the content structure used by Scenejo follow conventions imposed by the chatbot principle. One initial way to begin working with Scenejo as an author is to write AIML as a knowledge base for each actor using a text editor or any available AIML creation tool. That way it is possible to stick together chatbot knowledge bases – 'bottom-up' – that have been created by different authors independently or have been acquired from public license resources such as (Wallace, 2007b). The result of such an experiment may turn out as surprisingly funny or as plain nonsense due to the high probability of non-sequitur situations in the dialogue (see Fig. 6.4). However, this illustrates how Scenejo introduces certain bottom-up flexibility for possible dialogues.

On top of the bottom-up philosophy, it is possible to create more structured conversations – ‘top-down’ – with the help of transition graphs in a graphical interface of the authoring tool (see Fig. 6.5). At the highest structural level, a so-called plot graph is used to build a predefined plot structure made up of scenes. At least one scene is required, as a scene makes the connection to available actors on stage and allows some configurations for the Dramatic Advisor. This results in 3 main content aspects to be authored:

- Plot graph, scenes: configuration of scene participants and possible transitions.
- Actor configurations: assignment of AIML databases, predicates, bot properties, connection to representation (graphics, models, voices).
- Databases of AIML categories or SCAIML constructs. The use of dialogue graphs is an optional help for the authoring of structured AIML, but not an own content aspect.

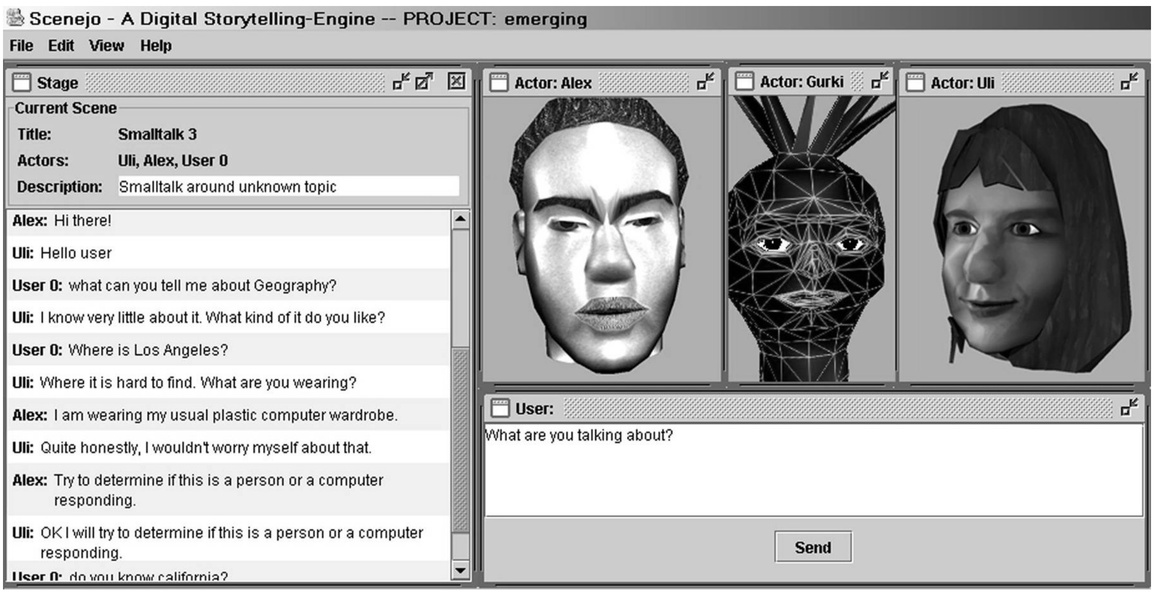

Fig. 6.4. Unforeseeable dialogues emerging (‘bottom-up’) from the arbitrary connection of free online AIML resources to Scenejo bots.

The impact of the dialogue graph structure on the content is different – for example – from the concepts used in the project *“art-E-fact”*. With *“art-E-fact’s”* authoring tool *“Cyranus”* (Iurgel, 2006), from the outset, a visualisation of transition networks is offered and required. A similar philosophy is present in *“SceneMaker”* (Gebhard et al., 2003). In *“Cyranus”*, each node of the network can be filled with several instances of actor participation, containing whole dialogue threads of several parties. Edges define the conditions for the nodes’ execution, for example for letting authors define possible user interactions as external events between these threads. With this concept, *"Cyranus"* implements a-priori a plot-based approach (as opposed to the character-based approach in Scenejo). It then has been enhanced by rule-based possibilities to introduce more flexibility, which, in the first instance, demands that authors program these rules in Jess[42]. In the beginning, the problem with this approach was the likelihood that authors would come up with rather linear plots, supported by the affordance of the transition graph tool as the only means of creation. User interactions were only possible at positions explicitly defined by authors.

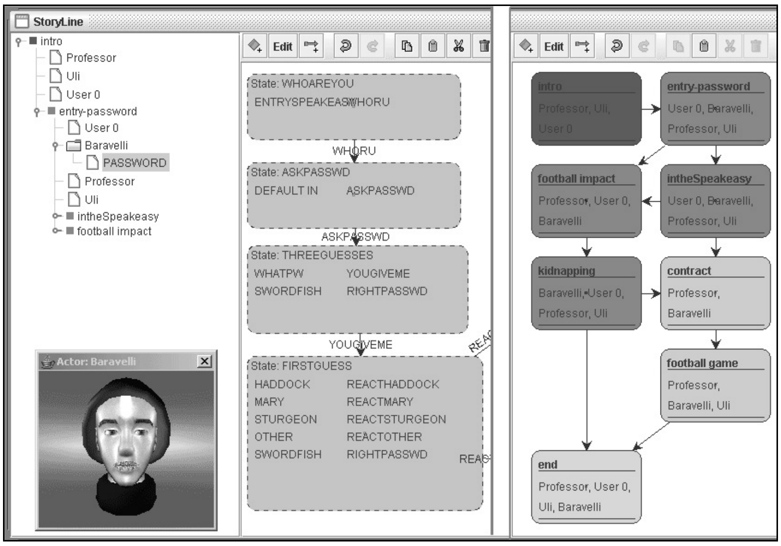

Fig. 6.5. Transition graphs used in the Scenejo authoring tools for [optionally] structuring dialogue exchanges at the utterances level (left) and [required] plot structure at the scene level (right).

This was a reason to design Scenejo in a different, character-centred way. At plot-level, scenes can be created as containers of actors and scene parameters. The dialogues however are authored separately for each actor. This enables more implicit user interactivity, because theoretically, users can intervene in the dialogue at every single turn. It is the task of authors to now install meaningful situations for user interaction, and to keep track of matching turns of two dialogue partners, if synchronised bot dialogues are desired.

6.1.4.2 Special Scenejo Constructs of Dialogue

The Scenejo XML-based content structure extends the philosophy of AIML (2010). A detailed description of the integration of AIML in Scenejo is given in Appendix C.2.

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[42] Jess rule system: http://herzberg.ca.sandia.gov/jess

Matching Bot-Bot Dialogues

All utterances are responses to given stimuli as necessary preconditions that have to be anticipated during authoring. Given that two bots shall conduct a linear dialogue like in a film script (see Table 6.1 and Fig. 6.6), this can be done by defining each bot’s utterance as input for the other bot, letting them prompt each other for their next line. This stimulus has to be translated to the AIML pattern expression syntax. At the same time, it can be reduced to contain some wildcards. As chatbots can only react, Scenejo’s Dramatic Advisor (DA) can deliver a ‘prompt’ to trigger a start of a certain dialogue, for example in a new scene.

Bot A, INPUT PATTERN	***Spoken Utterance***	
	Bot B, INPUT PATTERN	***Spoken Utterance***
SPEAKEASY TRIGGER	***Who are you?***	
	WHO ARE YOU	***I'm fine, thanks, who are you?***
I AM FINE *	***I'm fine too, but you can't come in unless you give the password.***	
	* YOU GIVE THE PASSWORD	***Well, what is the password?***

Table 6.1. Excerpt of a film script[43] performed by two bots. Each performed utterance has to be ‘prompted’ by a matching text pattern (AIML expression syntax). Any initial pattern has to be ‘triggered’ by the DA.

Dialogue Acts / Stimulus-Response Element (SRE)

As part of the authoring tool (see below), the following additional constructs have been conceived and added to be used during authoring.

- Patterns always represent concrete wording, while the possibilities of end-user utterances (stimuli) in natural language appear to be endless. Therefore, an intermediate structure of ‘dialogue acts’ has been introduced, serving as a pseudo-semantic level, herein called ‘abstract input/output’. This is summarised in a ‘stimulus-response element’ (SRE) in the authoring interface (compare Fig. 6.10).
- Changing initiative between actors in a dialogue is difficult to handle, due to the stimulus-response nature, making every possible utterance an ‘answer’ dependent on a ‘question’. An ‘initiative’ element has further been introduced that is independent of a stimulus and can be concatenated to a given utterance.

Technically, the introduction of the stimulus-response element (SRE) at first only had impact on the Scenejo authoring tools and not on the runtime engine, as it can

[43] Text excerpt from: Horse Feathers (Marx Brothers, 1937)

be completely mapped to AIML/SCAIML structure. As such, it introduces only an authoring level of dialogue abstraction. In addition to writing AIML directly (which is always possible), SREs support the authorial planning of dialogue lines by an intermediate abstract structure. Metaphorically, this is comparable to using reported speech in a story treatment and fixing concrete utterances later in the refinement stage of the script.

Providing Context / Dialogue Graphs of SREs

The Scenejo dialogue graph editor is used to 'draw' single SREs for each actor separately, or to draw conversational threads simply by combining several SREs with arrows (transitions). Through connecting certain SREs of one bot, a situational context constriction is generated, resulting in situational preferences regarding possible patterns anticipated as input by this bot, and allowing addressing these answers with the next dialogue act (SRE).

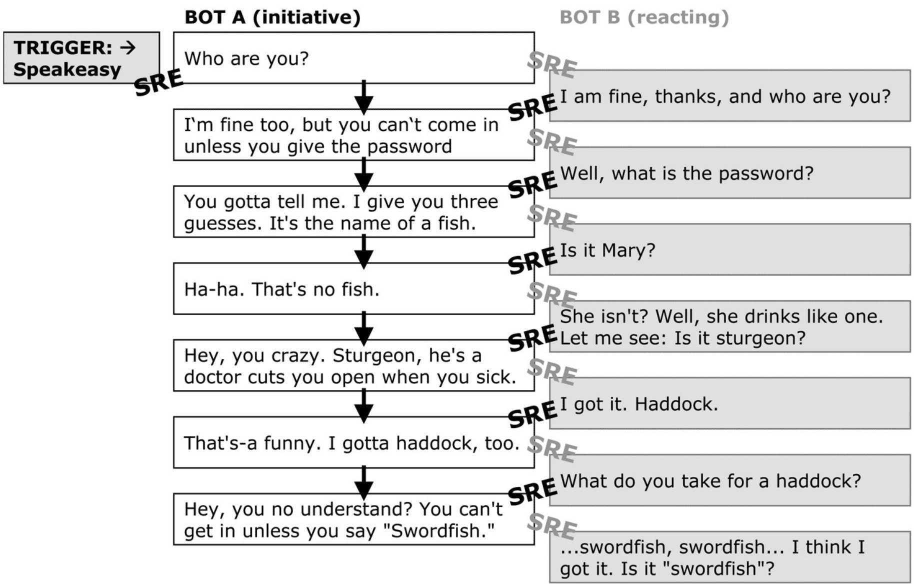

Fig. 6.6. Connections between SREs in a graph belong to one bot only. The construct can be used to keep the initiative with one bot. Combined with the use of a wildcard as input (see Table 6.2 below), the bot continues with the next utterance.

With such a construct, the bot using transitional connections is designed to have the initiative in this dialogue. If another bot is addressed as a conversational partner providing these anticipated answers, it makes technically no sense to also connect that bot's SREs with transitions (see Table 6.2). The search priority rules of each bot let it anyway first find matching word patterns (including any wildcard) within the narrowed context declared by the transition network.

Bot A, INPUT PATTERN	*Spoken Utterance*	
	Bot B, INPUT PATTERN	*Spoken Utterance*
SPEAKEASY TRIGGER	***Who are you?***	
↓	WHO ARE YOU	***I'm fine, thanks, who are you?***
*	***I'm fine too, but you can't come in unless you give the password.***	
↓	* YOU GIVE THE PASSWORD	***Well, what is the password?***
*	***Aw, no. You gotta tell me. Hey, I tell what I do. I give you three guesses. It's the name of a fish.***	

Table 6.2. Each performed utterance of Bot A is now 'prompted' by a wildcard pattern, while the narrow context is provided by the graph connection.

Only in cases of no match within, the dialogue abandons the dialogue graph and continues searching in the wider pattern base of that bot. Finally, if no 'better' matches are found, it will find the most open wildcard, a *-pattern, and continues with that. Table 6.2 shows how the use of arrow connections (contextual constraints) as illustrated in the example of Fig 6.8 allows to let the input pattern of Bot A be unconstrained.

Dialogue graphs can also be used to express a possible branching of a thread based on different anticipated input patterns. Fig. 6.7 illustrates two alternative prepared answers of Bot A in the constricted context of a question. It also shows that after the direct response, a next initiative element can be concatenated, which is independent of the answer.

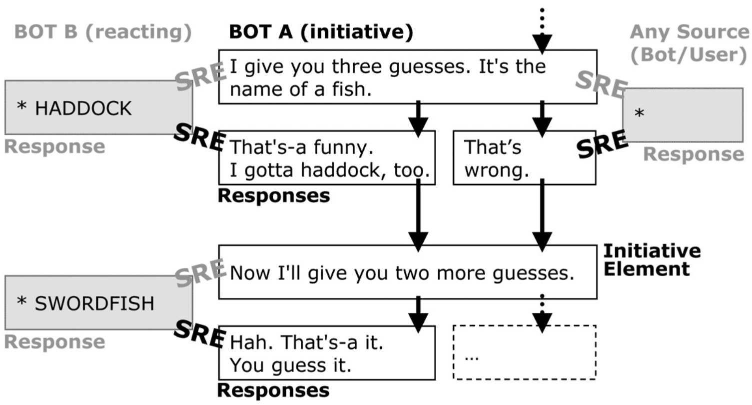

Fig. 6.7. SRE structure including a prepared alternative response to a 'wrong' quiz answer (which may be unanticipated inputs from any source matched by at least the wildcard) and continuing with concatenating a next 'initiative' element.

Built-In Turn-Taking

In Scenejo, the Dramatic Advisor (DA) chooses the next partner to speak at each turn. Two bots simply alternate after each utterance. In cases when a third actor (such as a user) provides input, the DA has to apply a turn-taking rule. For pragmatic reasons, these rules have been kept simple in the first generation of Scenejo, but are planned to be enhanced on demand, depending on specific story contents. The simplest rule regards an 'assertiveness' value applied to each dialogue participant, determining the next speaker by comparison of that value. 'Assertiveness' values can be set for specific cases (at SRE level) by authors to control turn preferences after user input. For end-user satisfaction (mainly usability reasons), the following defaults are built in to give the user the highest assertiveness:

- When a user starts typing a comment, the system waits until it is submitted.
- Any user contribution is given preference and it is chosen as the next utterance.
- The 'simplest systematics' for turn taking (Sacks et al., 1974) suggests general defaults, such as, if the concluding speaker selects a next speaker, then that speaker should take the next turn (see Section 4.4.3.2). The user can therefore either have a possibility to address one of the bots, or it can be implicitly assumed that the user interrupts or gives an answer to the last speaking bot. Therefore, that bot gets the next turn (after a user turn) again.

Abstraction Levels of One Bot

Another context constriction, besides using graphs, is the use of additional pre-conditions at any matched pattern by checking the states of variable attributes (the 'condition' of 'predicates' in AIML). It is another way of branching a dialogue (see below, Fig 6.14), or to trigger a scene change based on reaching a certain threshold value. In each SRE, also possible operations on such predicates can be defined. In summary, an SRE is a node in a dialogue graph, representing an 'action' of one bot, by defining the content of that action as utterance, its pre-conditions (e.g., the input pattern and state check of attributes) and its possible effects, where the latter can be state changes or transition rules in the graph.

Beyond the philosophy of how sequences of actions can be formed, the content structure has a vertical interrelation of abstract levels (comparable to the vertical axis in the model of Fig. 5.10, defining the 'shape' of actions in implicit creation). Determined by the introduced intermediate level of a dialogue act and dependency on conditions, abstraction of utterances is possible. Fig. 6.8 illustrates the vertical levels present in the content. While the lowest level allows the writing of a dialogue as utterances in direct speech, the dialogue acts refer to a more abstract level of indirect speech, and the upper levels require the construction of rules specifying conditions and effects on a world state defined by designed attributes.

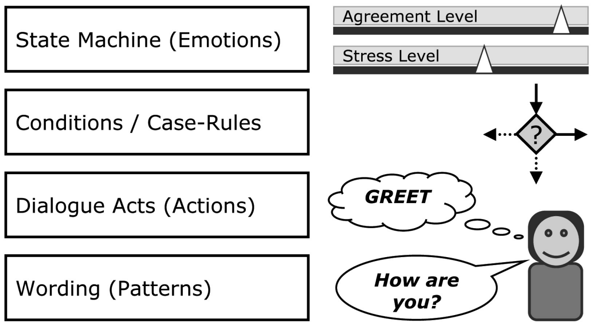

Fig. 6.8. AIML allowing simple levels of abstraction from explicit wording to more implicit constructs.

Hierarchical Graph Structure

As explained above, any dialogue graphs belong to one bot separately; their connection to other bots and to the user is made only by matching patterns. They are further structured into scenes, which make up a plot graph (compare Fig. 6.5 above). A scene defines which actors participate. Conditions for scene transitions are defined within an SRE, for example by depending on reaching a certain state value or at a certain input pattern. Fig. 6.9 illustrates the nesting of SREs and dialogue graphs in scenes.

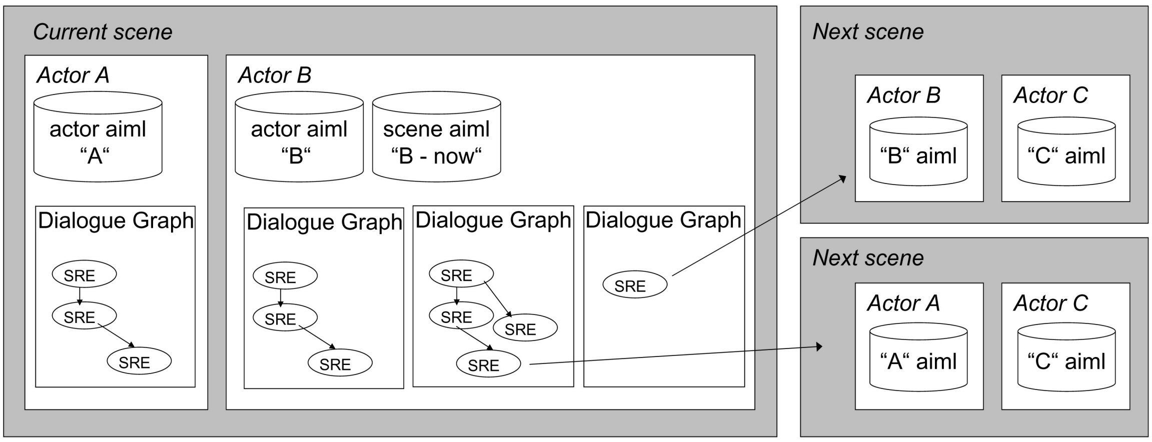

Fig. 6.9. The hierarchical concept: A scene contains actors, each actor owns dialogue elements. Dialogue graphs show one actor's potential conversational threads within a scene. Together with potentially associated plain AIML, they form the knowledge base.

6.1.4.3 Summary of the Content Structure

In summary, interactive dialogues in Scenejo are defined by input patterns and matching templates as knowledge bases, graph and rule structures restricting context, and conditions/effects to express state transition rules. The main content file is an XML structure with element descriptions and the fully embedded dialogue structures, possibly including links to external AIML files. A summary of the technical content elements is given in Table 6.3.

Content Element	Relevance, Runtime Information	Ways of Authoring
Plot graph, minimum = 1 scene	**Informs DA:** Scene order and structure as directed graph	Graph drawing configuration of transition network
Scene configuration	**Informs DA:** active actors and AIML bases to be loaded in a scene. Optional config.: duration etc.	GUI configurations, dialogue boxes, file browsers
Actor(s), minimum = 2 actors	**Informs DA:** Define participants (can be of type 'bot actor' or 'user actor')	GUI configurations, dialogue boxes
Bot Actor configuration	**Informs each bot:** lists of predicates (variable states) and default values **Informs representation:** connections to A/V parameters / config files	GUI configurations, dialogue boxes
User Actor	**Informs representation:** Input window	GUI configurations, dialogue boxes
AIML categories and SCAIML elements, belonging to one bot	**Informs each bot:** possible dialogue acts to perform, including input patterns and predicate state tests as pre-conditions, utterance text, and optionally operations on predicates as post-conditional effects **Informs DA:** SCAIML elements for transition conditions between scenes	• Text/XML editor for plain AIML • Dialogue Graphs: Graph drawing configuration of transition network • SRE: GUI configuration, text editors, drop-down menus

Table 6.3. Summary of content elements in Scenejo.

6.1.5 Basic Tool Affordances and Authoring Strategies

In general, we can regard technical content structures – as the one explained above – as constraints for the design of dialogues that shall be run with a specific engine, here Scenejo. Compared to Fig. 5.3 illustrating steps of content abstraction, this view is far away from the creative conception of a story (or conversation). Moving towards the point of view of creation, designed graphical authoring tools provide 'affordances' for technical authors to construct content. While there is still a remaining gap towards the creative conception, this section explains such affordances of realisation, mainly for technical authors.

First, the Scenejo core being based on chatbots implies that technical authors need to have an understanding of the AIML pattern expression syntax and of the Scenejo architecture in general terms (as described in Section 6.1.3). The latter probably also applies to 'conceptual authors' (compare team model in Fig. 5.2) who do not need to technically implement the dialogues, but be aware that all designed utterances are 'responses' to something. Any experience with chatbot authoring is advantageous in order to avoid too many disturbing 'non-sequitur' responses or even abortion of the dialogues. Good strategies for providing default reactions to the *-pattern wildcard are essential, for example by varying the default depending on introduced variable predicates.

6.1.5.1 Abstraction of Utterances

The graphical user interface designed for SRE authoring (see Fig. 6.10, showing Scenejo's first tool generation) prompts authors to provide an abstract description of each concrete bot utterance and input pattern as a 'dialogue act', usually consisting of an abbreviation or abstraction of the utterance. The final wording of dialogue lines can then be understood as specific representation forms of general dialogue acts, which can vary according to stylistic preferences.

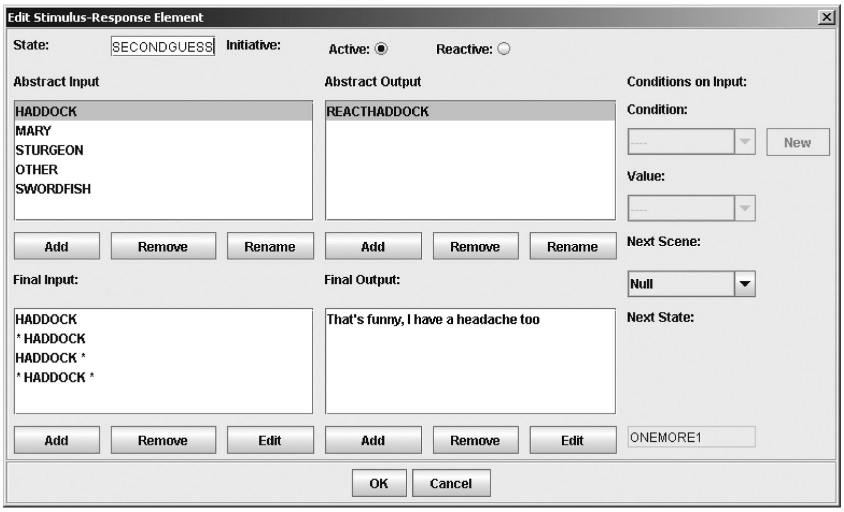

Fig. 6.10. SRE-Editor for a 'stimulus-response element': Abstractions of utterances ('Abstract Input'/'Abstract Output', upper text fields) are freely defined dialogue acts that can be used to better plan the dialogue. 'Final Input' are AIML patterns, 'Final Output' are concrete utterance templates (lower text fields).

Authors can conceive a conversational turn on the dialogue act level (as abstract input and output in the upper level of the editor) and provide concrete utterances in the lower level of the editor. Each abstract stimulus defined on the left has to be answered with at least one abstract response on the right. This abstraction is introduced as an intermediate level of the authoring interface, only for purposes of better conception.

Using abstract dialogue acts for conception has several advantages:

- For 'bot-to-bot statements' or general conversations: A design level is introduced that facilitates
    - an easier overview in the conception phase,
    - conception of the effects of dialogic actions by including post-conditional operations on predicates,
    - the wording of alternative utterances (to be chosen randomly by the engine) representing one dialogue act, to reduce repetitions in cases of SRE reuse,

    - and last but not least, the possibility of re-editing final bot utterances to adapt to certain character style or language.
- For 'user-to-bot statements': An abstraction level is introduced that allows an aggregation of many possible concrete utterances as 'final inputs' to one 'abstract input', representing a user dialogue act. This can be used in a strategy to reduce the number of possible user dialogue acts, alleviating the burden of having to react to many different possibilities. Similar general input aggregation strategies have also been employed in *"Façade"* (called *"many-to-few mapping"*) with the utilisation of *"discourse acts"* (Mateas and Stern, 2004) and in *"FearNot!"* with *"speech acts"* (Louchart et al., 2004), also see Section 2.2.3.

6.1.5.2 Dialogue Graph Affordances

At times, creators also can (or have to) 'work around' the Scenejo maxims to make ends meet. For example, authors can use different ways of structuring the progression of the conversation. Authors who are familiar with programming may prefer to use a simple scene, including all contextual dependencies of utterances on the varying states of the bots' predicates, which requires the definition of many conditions close to programming. Alternatively, one may subdivide a plot graph into smaller components (scenes or dialogue graph elements) and thus create many states or stages of the conversation with a narrowed context. The second approach – when supported by the graphs of the authoring tool – is more visual (see Fig. 6.11) and therefore more likely to be used by non-programmers.

Fig. 6.11 shows such an extreme case of linearly modelling a dialogue. This dialogue graph also includes 'initiative elements' that are independent on any input pattern, appending it to a 'normal' SRE, as an opportunity to give an actor the initiative in an ongoing dialogue, unlike original AIML concepts. This is equivalent to concatenating several utterances of one actor to build longer turns.

The specific affordances of such graph structures in authoring tools can be critically discussed for Interactive Storytelling. They seem intuitive, because they match conceptual thinking in branches of the flow possibilities, without programming – which means, without using terms like 'if-then' or nested conditions. On the other hand, their exclusive use leads to linear structures that are not very flexible in the end. Further, although they support structural overview in the case of simple dialogue threads, the picture can quickly become unclear once the threads are longer or more complex.

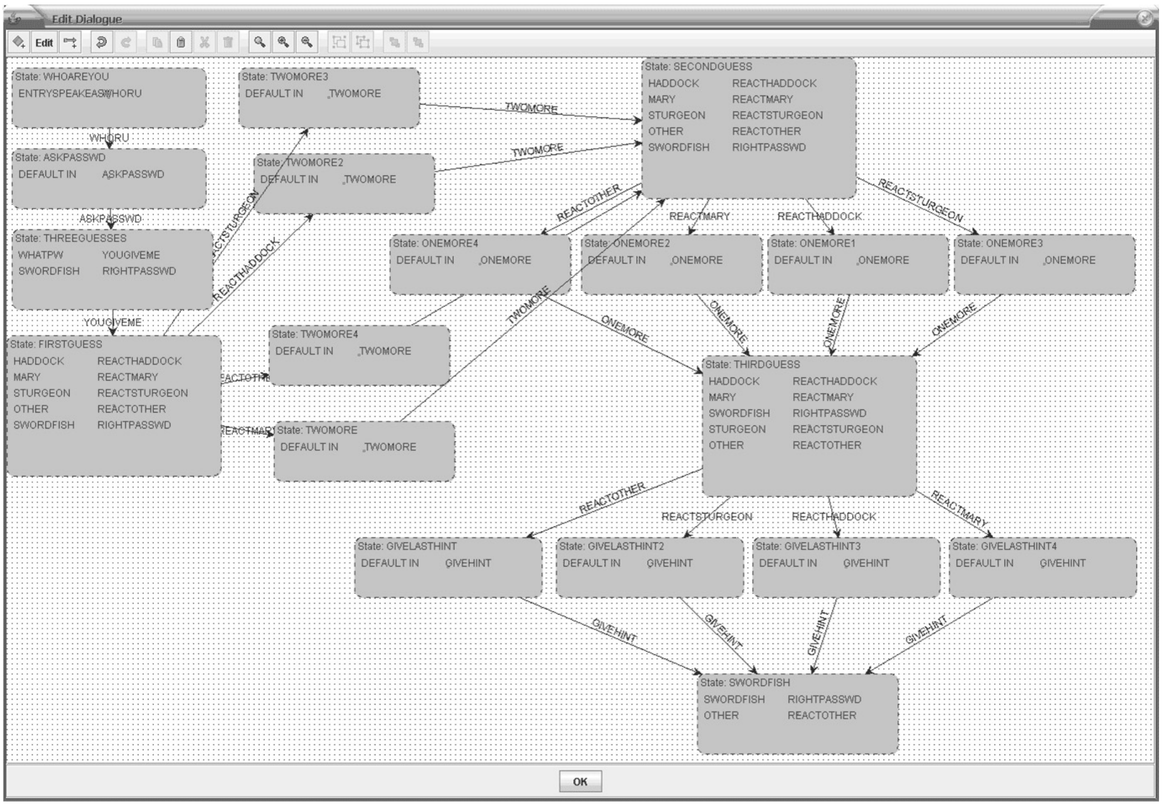

Fig. 6.11. The SRE dialogue structure used by a non-programmer to implement the situation *“You have three guesses”*, with several expected answers. From a programmer’s point of view, this is an inelegant solution, but it visualises the possible flow of actions.

User Acts

Authoring user acts is done by filling in anticipated user utterances at the left ‘input’ fields of the SRE (Fig. 6.10) and providing a bot response at the same time. Technically, at any point, users can intervene in the dialogue and their text input is taken into account for finding matches in the bots’ databases. Including end-users does not afford different strategies in terms of dialogue graph structuring. However, user input is a particular challenge of the whole design task for authors. One of the challenges is the inclusion of many anticipated word patterns that form the potential user input to be processed, similar to chatbot design. However, that anticipation of user input is part of the whole story design, including

- the overall assumed role or task of the user in the conversation,
- the preparation of meaningful user turns, even if as interruptions, such as
    - the situational prompt design for encouraging user actions, or
    - the situational anticipation of user interruptions,
- the anticipation of certain abstract user ‘dialogue acts’ (see Section 6.1.5.1) in general and in certain contexts,

- and finally, a long list of anticipated concrete utterances forming these user dialogue acts.

If many user inputs are expected to be addressed within a dialogue graph, it is a tedious task to include them at every linked SRE. If user input does not match within a graph, the system will find a match outside of the graph – abandoning the structure. It is a matter of careful design to consider wild cards in constricted contexts (graphs or conditions). The authoring tools do not really support this mainly 'conceptual' challenge.

6.1.5.3 'Delinearisation'

Linear dialogues between two bots can be conceptually created by juxtaposition of a bot utterance and its reuse as a pattern for the partner bot, as illustrated above in the film script example (Tables 6.1 and 6.2). Technically, however, the dialogue contents of two bots are separate databases of reaction rules, representing a one-sided 'dialogue' only, as illustrated by Fig. 6.12. From the point of view of one database, or in other words, from the point of view of one bot, there is no difference between input coming from another bot or input coming from a user (in the first generation of the system). Here, the one-sided graphs have been found to be a bit counter-intuitive. Exact juxtaposition is not supported by internal authoring tools. Instead, spread sheet software can be used.

Fig. 6.12, Fig. 6.13 and Fig. 6.14 illustrate schematic views of interlinked dialogue chunks, in which Bot A has the initiative and Bot B provides the matches in between. These patterns to be matched can be authored precisely, or loosely, such as by wildcards (anything would match in this context).

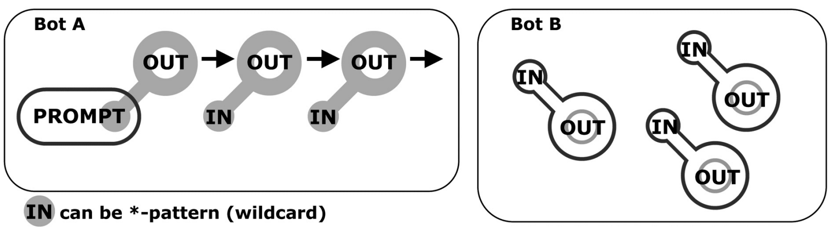

Fig. 6.12. For each bot, an own reaction rule database is saved separately. Matching input patterns are necessary, but are independent of its source (bot or user). Left (Bot A): initiative thread with narrow search context (indicated by connecting arrows in the graph) for following turns. Right (Bot B): simple reaction rules (unconnected).

In order to break up and 'delinearise' the content for better disposition to include user utterances, it is recommended to find a middle way between using linear graph structures and the extreme chatbot-principle of a context-free single answer to one stimulus. Networks of 'connected' SREs are therefore only recommended to be built by authors for selected pragmatic cases, where certain 'chunks' or 'dialogue threads' are expected to take place, for example

- in cases when the bot expects a second part of an adjacency pair (a response act), but the initiative shall be kept in order to continue, or
- in cases of so-called 'storytelling sequences' (Schegloff, 1992), which give one initiative partner several turns to express an argument, interrupted by subordinate utterances of the interlocutor. These can also be parts of so-called 'dialogue games' (Levin and Moore, 1978) as macro-structures of conversation.

The entry into such a structure has to be actuated by a 'prompt', a designed pattern with a keyword triggering the dialogue chunk (see Fig. 6.12, Fig. 6.13 and Fig. 6.14). This trigger can be designed to be the outcome of certain other dialogue chunks between bots, or can be issued by the DA at a certain event, or can be foreseen to be 'unlocked' by a user in a designed context.

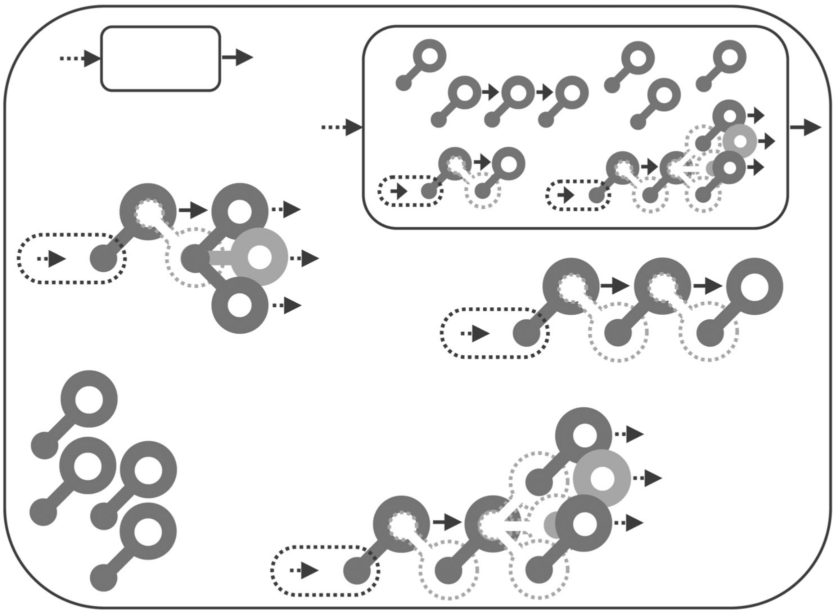

Fig. 6.13. Database of one bot, containing several forms of partly structured one-sided dialogue, such as single response rules and prepared forms of connected dialogue chunks including anticipated responses (dotted outlines represent external database of conversation partner). Arrows at the beginning and the end indicate that keywords can be used as connecting patterns (such as, prompting a next chunk).

Branching and Random Variations

There are two types of explicit branching structures to be used in the stimulus-response-based dialogue, which are rendered in the GUI as arrows between SREs (see Fig. 6.11):

- Authors can provide several possible cases of responses to one stimulus, based on evaluating current states of variable predicates of the bot (Fig. 6.14, left). This is especially useful in cases of recurring stimuli in different conversational contexts, either to avoid repetitions or to advance dialogue states.
- Another possibility is to anticipate several optional input patterns (Fig 6.14, right). This method is important in order to be able to react differently to diverse inputs either from varying sources (such as, user or bot), or to several possibilities from one source, such as in a typical 'quiz' situation.

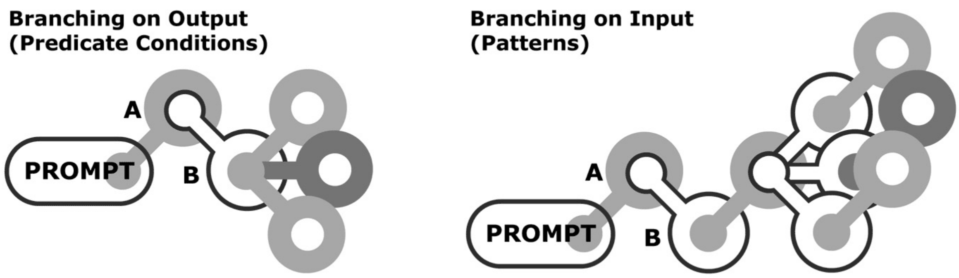

Fig. 6.14. Branching possibilities. Left: 'Bot A' has 3 different output options at one input pattern, based on checking further pre-conditions defined through the current state of predicates. Right: 'Bot A' expects 3 different possible inputs to continue differently from there.

Depending on the desired goal for interactivity, it may be essential that flow variations between instances of repeated re-play of the interactive piece are achieved. With the constructs above, the only possible variations depend on user inputs; that is, in case of no or identical user decisions, the system will behave deterministic. Therefore, it is also advised to include some randomisation, which is possible by using the AIML random list function on utterance outputs (see next subsection).

6.1.5.4 Conclusion on Authoring Tool Affordances

Scenejo's authoring tools display affordances to authors, as is the case with any other tool. Experiments with users have shown that independent of the tools, inexperienced authors first attempt to design 'linear', 'branching', 'quiz-like', or 'barrier/key motive' structures. This is a similar finding made in experiments with other tools, see brief conclusions on *"IDtension"*, *"EmoEmma"*, and *"Storytron"* in Section 2.3.3. In Scenejo, it is even easier to start with these linear structures. This exposes the approach as a coin with two faces. In the first place, beginners get a quick start, but on the other hand, it fosters the conceptual model of thinking in linear structures.

The SRE and graph visualisation of the first Scenejo generation allow easy accomplishment of the following tasks with the authoring GUI:

- Abstract dialogue act design,
- inclusion of operations on output and state conditions on input, and
- achieving branching structures based on state conditions and on input variations, visualised through graphs.

Less easy to accomplish, but feasible if authors take care of it in conception outside the tool, are the following tasks:

- Inclusion of randomisations and concepts of delinearisation (which is mostly a top-down planning process), and
- modelling complex chunks of dialogues with designing appropriate prompts (the dialogue structure has to be hand-crafted).

Still missing (and planned for future work) are the following GUI features:

- Maintaining better overviews on created SRE effects after authoring higher amounts of content, and
- monitoring and debugging the pattern matcher during runtime.

6.1.6 Conclusion on the Scenejo System

This section (6.1) provided a general introduction to the authoring perspective of the Scenejo system, comprising information that technical authors – and partly also conceptual authors – need to know to design interactive content for Scenejo.

Basic strategies for design have been detailed in 6.1.5, whereas the next section (6.2) shows how these strategies have been applied in an application development. It has been shown here that the system allows a certain complexity in dialogues, the management of which is a (sometimes tedious) task of technical authors. On the other hand, the system is easy to approach for non-technical authors. In this respect, it takes a unique position within comparable systems, showing the following features:

- Simple local principles of 'next-action' selection and a shallow dialogue management on a higher level. Conditional variety can be approached in steps starting out from linear branching.
- No complex 'generative' natural language, no AI knowledge required.
- Hand-crafted structuring and wording of dialogue lines, allowing writers to use language creatively and not forcing them to fill in grammatical templates or to write grammar rules.

- Manual design of user input patterns.
- In summary: For complex solutions, the authoring effort is high, but the tasks are easy to learn and accessible to non-programmers. The system is suited for getting started with simple solutions for Interactive Storytelling.

'Levels' of Incorporation of the User in the Storyworld

The system can be explained with the four-level model (Fig. 5.5 in Section 5.1.2.1), which determines the way users can be incorporated in an IDS storyworld, as follows.

- Main interaction possibilities for users are provided at the second lowest level of 'action/conversation', offering users to contribute speech acts. It is up to the author to define either a strict set of user acts, e.g. in a graph structure with little change possibilities, or more open structures letting bots give general answers to each user utterance. In the latter case, it requires much authoring effort to build a broad enough pattern base.
- At the second highest level – the scene outcome – authors can also design influence possibilities for users, by letting dialogue acts change certain states that turn out in different endings. This has been done in the following case study.
- Agency at the lowest level depends on designed feedback in the representation. In the used version of Scenejo, the presentation of avatars does not change in reaction to the user. The animation and voice are generative, but only at a verbal level. Variable states can be rendered as data field in the GUI. Other graphical representations of states could be designed with more effort, but it was not in the focus here.
- For agency at the highest level, there are no dynamic drama structures or high-level event managers incorporated in Scenejo. Authors can pre-define a high-level plot by connecting scenes with static links. The following of links can be state-dependent.

6.2 Case Study of Content Creation: The Killer Phrase Game

The main emphasis in artefact creation was the realisation of a case study in content authoring. This section describes significant steps and results from a conceptual point of view, in contrast to the technical perspective taken in the last section.

The case study has been conducted in a pedagogical project presenting a real-world application of the conversational storytelling paradigm of Scenejo: The 'Killer Phrase Game'. The human actor (user/player) has the role of the moderator in a debate between two virtual actors, in which the main challenge is to react upon so-called 'killer phrases' uttered by the bots. It has been an experience providing insights and conclusions in several aspects of authoring:

- 'Conceptual authoring' of the application and the content: In an interdisciplinary team, an apparent gap between pedagogical/instrumental goals and functional limitations had to be closed.
- 'Technical authoring' and the content structuring process: Exemplifies the authoring process and leads to conclusions for further developments.

The case study concludes with a description of lessons learnt, and a discussion of system-specific and general design principles. At a generalised level, conceptual models (suggested in Chapter 5) and derived design principles can be illustrated, which also leads to a redesign phase described in Section 6.3.

6.2.1 Background of the Project and its Application

The case study consisted in using the Scenejo platform for a conversational learning game. The building of the first prototype was embedded in a real-world context, presenting several constraints regarding

- the pedagogical use context of the envisioned application, including its target groups within educational institutions,
- limitations of funding, only justifying content development with little technical research, and
- time constraints with a firm deadline for conducting a game evaluation.[44]

These conditions narrowed potential artistic goals by the pragmatics of the project context. Besides having to find compromises between restricted engine functionality and educational objectives, time and team limits were reasons to 'keep it small and simple'. The results achieved within the project were usable as a first playable prototype. It could be evaluated and refined afterwards, leading to further research in content conceptualisation, content restructuring, and being used as a test case for redesigning the software Scenejo. Here, the project context is described.

[44] The team was: U. Spierling (IDS / authoring concepts), R. Eizenhöfer (moderation expert) and D. Linke (programming); the time frame was 6 months part-time.

6.2.1.1 'Interparolo': Conversations with Digital Characters

The objective of the designed educational game was given by the university-based project 'Interparolo', an interdisciplinary endeavour to create e-learning content that offers interactive text chat dialogues for learning. *"Interparolo"* is an Esperanto term for 'conversation'.

The learning topic of 'moderation and mediation' was a course at the FH Erfurt, University of Applied Sciences, within the faculty of transport and communications. Students learned how to moderate a discussion between several parties with stakeholder interests in the context of urban planning. Naturally, these types of discussions bring together people with contrasting, even antagonistic positions and with varying skills in expression and discussion. As a moderator of a meeting, one can run into situations that are difficult to master. These include deadlocked positions that make discussion impossible, dealing with difficult people, or with time pressure, just to name a few.

The pre-existing course material included a collection of instructions and work sheets presenting factual background knowledge. However, the core skills necessary for moderation are foremost dependent on tacit knowledge, including the competence to identify situations and the ability to react accordingly. Hence, the traditional learning methods utilised within the seminar are largely focussed on 'learning by doing', for example, by employing live role playing games, which allow simulations of cases and situations. In 'Interparolo', it was therefore envisioned to transfer principles of role playing to electronic learning material by designing a simulation game.

Scenejo appeared to be suitable for implementing virtual conversational sparring partners in such a digital role playing game. Conversely, the moderation example was an adequate application for Scenejo's underlying interaction paradigm. The idea was that the user plays the moderator role by interrupting the ongoing dialogue of two agents, by phrasing appropriate text.

Thus, the envisioned digital role playing game simulates a live role playing game for learning (albeit up to a certain point), while showing several significant differences, which had to be negotiated with the educational project partners. The differences include disadvantages, since nothing seems to be as suitable for training a real-life situation as rehearsals in live-action role playing. On the other hand, also advantages of using simulated environments over real ones were identified. The result was no proposal of a virtual game as substitution for existing methods, but rather to enhance the learning material with additional possibilities.

Basic Game Idea

The resulting learning game tackles the topic of how to identify and react to so-called 'killer phrases' within a discussion. Killer phrases are 'creativity killers', often used in a knee-jerk manner, which can destroy new ideas before they are discussed with solid arguments. The designed game assumes a scenario with two parties, 'planners' and 'residents', arguing about upcoming plans for an airport expansion. The partly predefined conversation between the two parties, carried out across a table, contains such killer phrases. The learner plays the role of the moderator and has to manage the meeting (see game screen in Fig. 6.15).

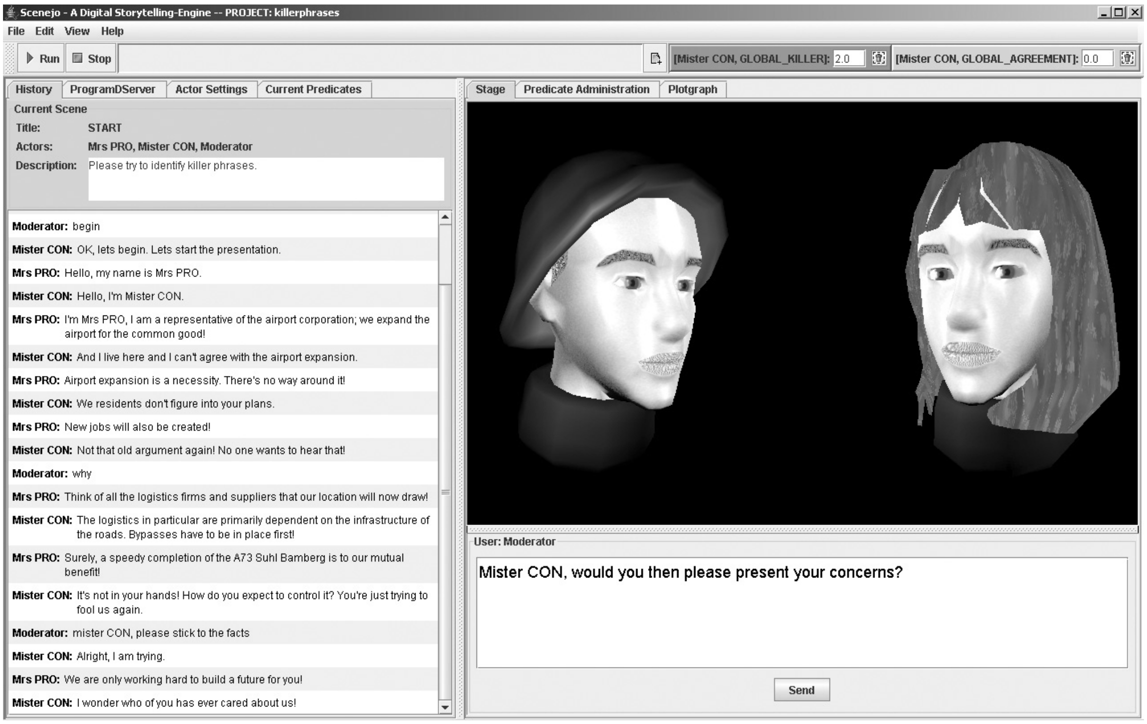

Fig. 6.15. The 'Killer Phrase Game' prototype running in the 'Scenejo' Platform.

The objective of the moderation is to identify killer phrases and react upon them by the textual input of appropriate phrases, which have been discussed before in correlated preparatory course sessions. The game goal is achieved when the two debaters reach a concluding compromise, which only occurs if the so-called 'killer phrase level' is kept low by the moderator. The game can be 'lost' when that stress level increases over a threshold, which happens when the bots' killer phrases remain unrecognised by the moderator.

Learning Game Design

After having identified advantages – as well as disadvantages - of a virtual simulation over real/physical role play for learning and fun, assumptions on the effectiveness of such a game have been included into the considerations. One advantage has been seen in the safe space of 'just playing' within the digital realm, which is more clearly defined than with live participants and allows for playing extreme situations. Further benefits of the computer version include the potential adjustment of timing and pacing to user needs and the independency on classroom realities. A drawback may be the lack of realistic complexity in the digital situation. By omitting nonverbal factors, the transfer of knowledge is considered more difficult. A discussion of these points has been presented in (Spierling, 2008).

As a general assumption, in addition to merely simulating a conversation in Scenejo, there can be further designed games and sub-games with several stages of complexity, for example, 1.) to let the agents model an ideal or a dysfunctional interaction of the moderator without user-interaction; 2.) to increase situation awareness by letting the learner simply identify occurring killer phrases, earning points on hits; 3.) a partial simulation (receiving coaching advice) or a full simulation of a moderation situation, with optionally making visible the influenced parameters; and 4.) reflecting the finished simulation by possibilities of replaying it during a debriefing phase linked to a classroom course. Stages 2.) and 3.) particularly benefit from digital agents, where the material is tolerant, uncomplaining, and repeated interaction with it is harmless. In any case, the digital material was not assumed to stand alone, as it was to be embedded in a course curriculum within a blended learning strategy.

The prototype finalised within the project addressed the second stage of a possible sub-game with the simulated dialogues. It can be used to identify killer phrases, and to remember simple moderator reactions. The expected learning effect is the raise of awareness, including the experience of 'stories' containing exemplary emotional and verbal situations that can be results of killer phrases.

6.2.1.2 Versions of the Application

The first and full version was implemented in German language, in line with the scope of the research project. The duration of play with the finished prototype ranged from about 10 to 20 minutes. It has been evaluated in several sessions with end-users in Germany, the majority of which were students.

Afterwards, the dialogue content was translated into English, for the purpose of presenting the application at an international conference for Gaming Simulation (Spierling, 2007a). Due to the dialogue abstraction explained in Section 6.1.5.1, this was technically quite easy to achieve, by 'simply' translating the final wordings of utterances and the final input patterns, but leaving the original structure of abstract acts and internal predicates in German language.

Following up on user- and expert evaluations and steps of structural redesign after the termination of the original project, further structural prototypes (on paper and digital) have been achieved with the same dialogue material, which is described in Section 6.3.

6.2.2 Design Steps

Although within the project, we called the application a 'game', there are also elements of narrative expression and of simulation. Therefore, the design of the whole included several tasks, such as

- the development of a narrative, containing characters and actions (performed as utterances/dialogue lines), as well as changing story states and turning points for possible endings,
- a simulation model made up of world states and transitions,
- and finally the game design defining local objectives for the player, including the testing and tuning of the gameplay experience.

The design conditions for the game and the conversational content were affected by its educational purpose. Rather than by artistic motivation, the work was done in iterative brainstorming sessions within the interdisciplinary team of instructors of the course 'moderation and mediation' and Scenejo designers (see 'background' above), which constituted an interdisciplinary authoring team.

Project realities required that several developments had to be achieved in parallel: Imagining the content for the dialogues, accomplishing the learning goals of the game, making first experiences with the technical authoring process and, at the same time, addressing the feasibility conditions of the available technical platform by the design, through adapting ideas to the engine logic and partly also by work-arounds. While the 'technical party' (responsible for authoring concepts and programming) provided the logical frame for the computable conversation, such as the concept of dialogue acts, states and rules, the domain experts (of moderation) were supposed to provide its exemplified verbal content – conversational examples including critical states and rules for the story's turning points.

6.2.2.1 From Linear Dialogue Scripts to Dialogue Acts

It turned out that the easiest way to develop the content was, at first, letting the domain experts deliver linear scripts of imagined conversations from the seminar material, such as a 'best case' and a 'worst case' scenario of an optimal and a dysfunctional progression and ending of a debate moderation (see excerpt in Table 6.4). These conversations consisted of extensive dialogue lines and included utterances of the user/moderator – a form which cannot directly be used for a game that grants a user adequate agency, because rules for reaction to user actions are missing.

	Dialogue from preliminary script	**Draft dialogue acts**
Mister CON	… and we've only discussed the idle traffic - those parked cars have to be moved occasionally. Can you imagine what kind of traffic we have on our streets? We live on a residential street where children normally play, but our children can't play, there is much too much going on and the cars also speed. That constitutes a great risk! But no one has ever cared about that! Talk about noise! Now, it's just the passenger flights, but soon there will be the supply planes overhead ... there's going to be some real noise when those heavy things go to land. That's just too much to bear!	Arguments: 'Traffic Overload', 'Noise', Killer Phrase: 'Reproach Careless', 'Sensitivities'
Mrs PRO	I want to clarify something first: the fact that cars don't travel at walking speed on your street has nothing to do with the airport expansion. That is a phenomenon that you can find anywhere, airport or no airport. But think of the effect on employment in our area! New jobs will also be created!	Argument Objection, Argument: 'New Jobs'
Mister CON	Now, don't give me that! The cars come, because of the airport! But that's no skin off your noses, because you live out in the countryside, where you don't have to see or hear airplanes.	'Interjection', Killer Phrase: 'Reproach Careless'
USER	Mister CON, would you please stay to the facts.	Moderation
Mrs PRO	But, we're not going to arrive at any solution this way. Let's work on a concept together. We don't mean you any harm.	Moderation, 'Promise'
Mister CON	Yes, but you have to say that. You only care about money! You make promises you have no intention of keeping … we've seen that often enough.	Killer Phrases: 'Reproach Unfair', 'Doomsaying'

Table 6.4. Excerpt from a preliminary script (translated from German ex post), created by moderation experts using video teaching material as a model. Then, draft dialogue act 'labels' were added, leading to the conclusion that longer turns needed to be subdivided in further revisions.

For the attainment of interactivity in the sense of a gaming simulation, it was necessary to think of possible user actions, and of the concrete influence of these user actions. According to fundamentals of narrative logic (see Sections 4.2.1 and 4.3.1), actions – in contrast to activities – form events that change 'states of affairs' in the world of the story. Therefore, the necessary next step was identifying actions and their conditions and effects within the spoken utterances. Thus, the goal was to achieve a 'model' of dependencies between utterances, to accomplish a more dynamic, open-ended conversation, managed by the Scenejo engine. This task was discussed within the team, applying the principle introduced in Section 4.4.2.2 (Fig. 4.10) of building a dynamic model (Holland, 1998) to obtain emergent behaviour. The transfer of the linear 'story' into a dynamic model by observing world states and transition functions is not a straightforward task, but requires design decisions by expert analysts. It results in the identification of 'critical incidents' that are immanent to difficult situations, such as motivations and reasons for certain behaviours as well as effects and influences. In the case of the moderation game, the identification of the phenomenon of 'killer phrases' already existed in the learning material, which was indeed an important 'critical incident' to start out with.

Dialogue Act Modelling

The first practical step was to analyse the initial scripts and categorise the single utterances, for example, into killer phrases and thematic groups of arguments, resulting in an abstraction of concrete dialogue lines towards 'dialogue acts' (see Table 6.4 above). Starting out from dialogue acts, it was later possible to gather and write more concrete alternative utterances that would realise the same dialogue act (examples see Table 6.5), for the purpose of realising variety in the rendered digital conversations, especially during possible repetitions or through randomisation.

ARGUMENT PRO 'NEW JOBS'	KILLER PHRASE 'REPROACH IGNORANCE'	KILLER PHRASE 'REPROACH NO CLUE'
New jobs will also be created!	No one has ever cared about us.	Just come to my house on any given afternoon!
The economy will improve, which can also mean a job for you!	We residents don't figure into your plans.	You're not even from here … who are you to judge?
Think of the effect on employment in our area!	That's no skin off your noses, because you live out in the countryside, where you don't have to see or hear airplanes.	You have no idea what daily life is like for us!
The airport will also create new jobs!	We're only asked our opinion after everything is already set in stone.	You have no idea how irritating that is ...

Table 6.5. Alternative concrete utterances to express three different abstract dialogue acts.

Dialogue act modelling has been considered a creative design task of interactive story authors, following a pragmatic goal. The purpose is finding equivalents for 'actions' in the conversational realm, which affect the progression of the narrative by leading to turning points, and serve as an aggregation or abstraction for several instances of utterances. At this stage, the modelling task is an informal endeavour. It is not necessarily comparable to formal dialogue segmentation as undertaken in automatic conversation analysis for digital dialogue management, for example by using standardised labelling systems, such as the domain-independent DAMSL description language (Core and Allen, 1997) or classification schemes of dialogue moves (Cooper et al., 1999). Instead, this choice of actions is highly interdependent with the whole game design and can be subordinate to a highhanded goal. The defining dimension of the 'dialogue act' can be anything from semantic descriptors to pragmatic discourse functions, depending on the purpose of the simulated narrative.

It is pivotal for this approach that although authors do not necessarily need to have a background in the details of discourse analysis – in case they develop knowledge of speech act theory or related frameworks, this serves as useful conceptual models leading to advantages in this abstraction process, as experienced practically during this project (see Section 6.3).

6.2.2.2 Finding a Model for Emergent Dialogues

Building a model for an experiential simulation required the connection of these groups of utterances to world states that can change over time, as well as their rules of change. Identifying significant world states of a dysfunctional (or ideal) moderation at 'the right level of detail' (Holland, 1998) required the knowledge of the domain experts. Further, the model had to follow pragmatic motivations of the game goal, also assuming that the model was supposed to be simple for the first implementation. According to simulation engineers Flynt and Vinson (2005), an event model for 'experiential mediation' had to be created, which has to be abstracted and filtered according to an intention to emphasise given themes. During brainstorming sessions, world states and possible transitions based on the dialogue acts were identified. The different objectives of the two parties of stakeholders in our team were sometimes contradictory. While the domain experts were in favour of describing realistic behaviour, which was difficult to simplify, the Scenejo team opted for abstraction to fulfil the goal of a simulation game. In the end, the emphasis was on identifying reasons for the occurrence of killer phrases, and their effects on participants in a meeting.

The resulting first draft of the virtual debate model was 'actor-centred' in the same sense as there is a character-centred approach to storytelling. Each individual agent was assigned separate internal states of a modelled 'mind' – and should then behave in accordance with those states. Fig. 6.16 shows an abstract sketch of the conceived structural elements of this first game model. The considerations leading to changing values of 'Involvement', 'Cooperativeness' and 'Time Pressure' were not only based on possible participant attributes as a source of killer phrases, but were also motivated by the search for possible parameters to address with moderation attempts.

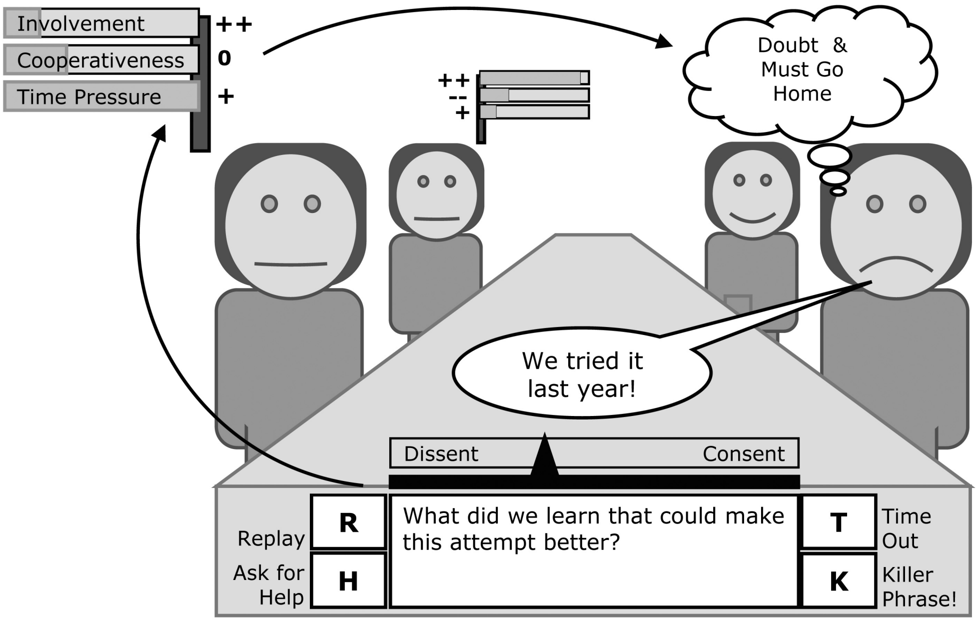

Fig. 6.16. Design sketch of the conceived structural elements of the 'Killer Phrase Game', such as the parameter states of each virtual actor.

Agent utterances (dialogue acts) can influence the internal parameter states (predicates) of other agents during their 'response' to the stimulus, while the actualisation of the act itself depends on a bot's own current state values. User utterances are compared with a prepared database of anticipated user acts covering possible verbal interventions. They influence the same set of character parameters. These influences had to be modelled as simple rules. For example, offending one character with a certain killer phrase would count down the value of that character's cooperativeness – the moderator may have to do something to raise this value again, since only with a high degree of cooperativeness would this character ever agree to a compromise.

Reducing the Complexity of the Model

This first attempt modelled a simple 'mind' for each virtual actor. It was not based on approved psychological models, but on analysed incidents derived from the expert experiences with real moderation situations. In order to achieve dramatic interactive storytelling, one could additionally model special personality traits for each actor. The traits would affect the transition rules for state changes in a way that lets different personalities react differently to the same actions and events. This kind of complexity would allow for emergent conversations providing novelty and surprises in the conversational turns, each and every time the game would be played. The project's scope, however, did not allow for technical developments of a complex emotional model, if anything comparable to research done for *"Façade"* (Mateas and Stern, 2005a) or *"FearNot!"* (Aylett et al., 2007). As a prerequisite for increased drama, this has been identified as being useful for future work.

Instead, for this prototype, the complexity had to be reduced to even less complex interactions. As a result, the initial model had been changed to a more abstract and simple game-like model. Fig. 6.17 shows the simplified model, which was then implemented. Instead of modelling each character's mind, a generalised view is taken by only modelling overall levels of stress or mood – here: the 'Killer Phrase Level' (working as a general 'stress level'). The utterance repertoire of each bot contains killer phrases, as well as valid arguments for its own position. As soon as an argument is played, it will lead one step towards a compromise. However, according to our design, valid arguments of each party can only be triggered by the system if the killer phrase level is low. Any occurrences of killer phrases raise this level, and it can only be kept low by the moderator's interaction.

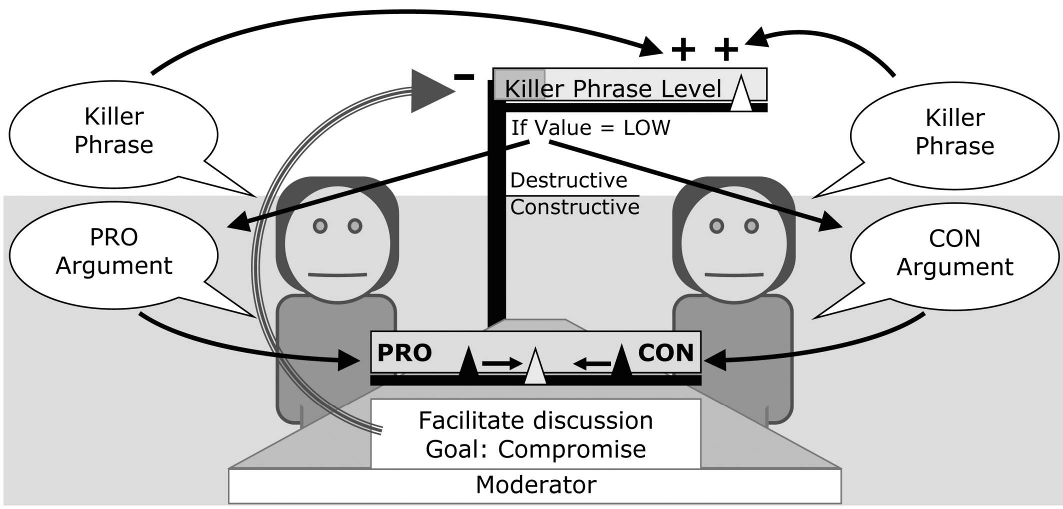

Fig. 6.17. Simplified model of states and transitions.

Design of Progress and Plot Points

For the purpose of adding a game goal as an objective for the player/user, threshold values have been introduced on two scales: The 'Killer Phrase Level' and the

'Agreement Level'. The game goal is to lead the conversation towards a compromise as a happy ending, which occurs when the 'Agreement Level' reaches a threshold of played arguments. The game is lost when the 'Killer Phrase Level' reaches a threshold first, resulting in an escalation of the scene. In this worst case, the bots leave the scene, affronting the moderator.

Initially, these threshold values have been defined arbitrarily and were then adjusted to appropriate values during the tuning phase. Further, it was experimented with dividing the whole game into scenes with stages of increasing occurrence of killer phrases, to achieve rising dramatic tension. However, this kind of tuning the flow by inserting fixed scene elements impinged upon the intended variability of events. During redesign, in favour of more 'perpetual novelty' in replaying, the order of events was mainly based on the changing states of affairs (predicates). Final design decisions were impossible to fix before starting with the implementation. It was necessary to redesign parameters and rules during iterations of running the interactive experience. This practical experience of necessary iteration for model design is well in line with methods of event model design (Flynt and Vinson, 2005) and reports of simulation-based storytelling (Swartjes and Theune, 2008).

A Note on 'Emergence'

Compared with other attempts at achieving programmed 'emergent narrative' in the sense of free improvisation of independent agents (Aylett et al., 2006), our realisation still followed a rather author-controlled method. Nevertheless, it was an instrumental goal to be able to slightly vary the order of utterances between different passes of game play. 'Emergent' features consisted of partial ordering with some randomisation and dependency on user behaviour. They are here understood rather as a means to achieve variations in an otherwise defined experience, than as a goal in itself. If understanding 'emergence' in the strict definition of the term of letting unexpected things happen, its notion is largely inappropriate, as apart from a bit of randomness, the system behaves deterministic within the predefined dialogue base.

6.2.2.3 Authoring as Implementation of the Dialogues

For the implementation of the first prototype in Scenejo, the initial best case / worst case scripts were taken as a starting point for concrete utterances. These utterances were assembled into dialogue acts of different argument themes and killer phrases. Further, each argument consisted of a leading dialogue act followed by an interchange of following acts with the opponent bot, which resulted in a chunk of several turns, representing a whole argument sequence (similar to connected dialogue chunk elements illustrated within the 'database' illustration of Fig. 6.13). The size of these conversational threads ranged from 2 to 10 single turns in a row (see example draft in Fig. 6.18). One thread could then be triggered by a keyword. [45]

JOBS					
MISTER CON Leader / Initiative			*MRS PRO Follower*		
			TRIGGER MISTER CON		
NEW JOBS WILL ALSO BE CREATED			**New jobs will also be created!**	used <2	
Not that old argument again! No one wants to hear that!	used =0	K+1	NOT THAT OLD ARGUMENT AGAIN *		
* ESTABLISHMENT OF NEW BRANCHES			**It's the airport itself that will promote the establishment of new branches!**		arg used
For instance?			*		
THINK OF ALL THE LOGISTICS FIRMS *			**Think of all the logistics firms and suppliers that our location will now draw!**		used +1
The logistics in particular are primarily dependent on the infrastructure of the roads. Bypasses have to be in place first!			* BYPASSES HAVE TO BE IN PLACE FIRST		
* TO OUR MUTUAL BENEFIT			**Surely, a speedy completion of the A73 Suhl-Bamberg is to our mutual benefit!**		
It's not in your hands! How do you expect to control it? You're just trying to fool us again.		K+1			

Fig. 6.18. Intermediate draft document for the dialogue thread 'Argument New Jobs 1'.

Only after some intermediate draft documents were created (such as Fig. 6.18), the Scenejo authoring tools (Fig. 6.19) were used to implement the structure in chunks, which were test-played in iterations. State changes invoked by utterances were implemented in the next step, as well as at chosen points, the conditions under which an utterance is likely. According to the model, the two global attributes of a 'killer phrase level' and an 'agreement level' have been created as 'counting' predicates of the bots. The effects of dialogue acts were defined as basic arithmetic operations on these predicates. Further, for the management of repetitions and dialogue advancement, auxiliary predicates were defined, for example for taking into account the number of used arguments for the selection of a next trigger.

Dialogue threads such as the one in Fig. 6.18 were composed grouping themes of different arguments. The first prototype consisted of two threads for 'new jobs', two for 'parking and traffic" and one for "noise". The idea was that grouping the whole conversation into argument threads would make it easier to handle, and can also easily be extended by simply adding more self-contained threads. Fig. 6.20 shows the advancement of the model in Fig. 6.17 towards its implementation. The (over-)

[45] Samples of draft documents have been collected in Appendix C, together with more authoring screens.

simplification of this model in comparison to reality was made not least due to the constraining conditions of implementation. In the model, utterances of valid arguments only take place if the ‘killer phrase level’ is low; however, the mere utterance of an argument is sufficient to raise the ‘agreement level’. Once a given value has been achieved either by killer phrases or by the agreement level, the game ends with either an escalation or a compromise (‘agreement’) of the parties.

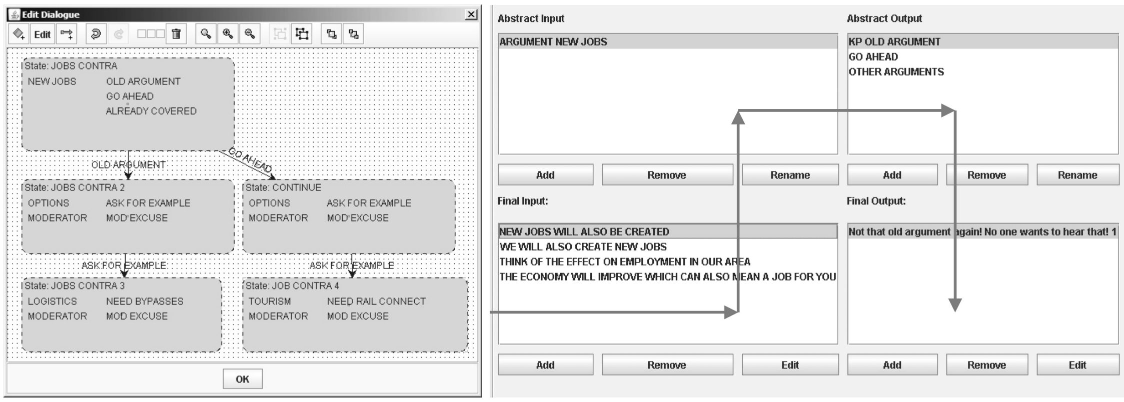

Fig. 6.19. Left: State chart of ‘Argument New Jobs 1’ for Mister CON. Right: Stimulus-Response authoring of dialogue acts (top) and utterances (bottom).

Another advantage of this simplification is that the game play is independent of the domain knowledge needed by players to participate in the discussion, because all arguments are brought up by the virtual characters. The role of the player is only to moderate the discussion style. The disadvantage is, naturally, that this model is oversimplified and different from the real world. It is only suited to create awareness of killer phrases.

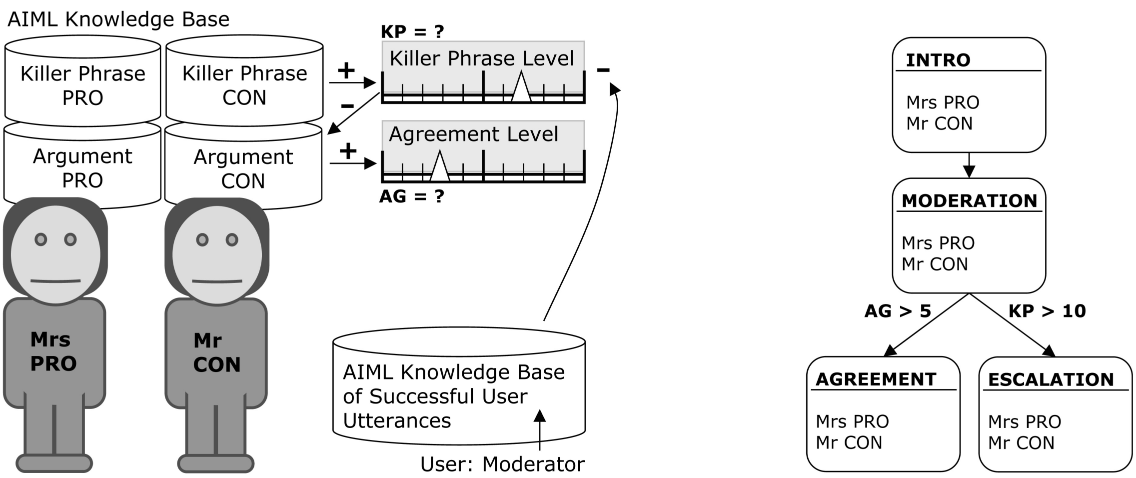

Fig. 6.20. Left: Implementation of utterances with state changes in AIML. Right: Implemented decision points (thresholds) for winning or losing the game.

For implementation, this means that the anticipation of user actions can be restrained to some narrow context of reactions to killer phrases, which is connected to the moderator role. Phrasing these possible user input patterns is the most challenging task in authoring, because there is no intelligent natural language understanding unit supporting the aggregation of input. Only with this narrowed context for interaction, there is a chance that a significant amount of potential user utterances can be addressed by perceivable effects.

Tuning and Testing

As is common practice in computer game design, at the stage of the first testing, flaws in the game play became obvious and had to be fixed iteratively by testing and tuning the game play. For example, phases of lengthy dialogues between the virtual actors, without a possibility for the moderator to take a turn, had to be cut into smaller segments. Resulting from the first linear scripts, single utterances suddenly appeared too long. Although in reality, one conversational turn of a participant is likely to cover several sentences, it turned out to be not suitable within the implemented game, in which all utterances were spoken by a speech synthesiser (TTS). Together with the difficulty involved in interrupting the conversation at any possible point 'within' a sentence, it shows that technical circumstances also have to lead to a redesign of the dialogues – mostly by shortening the single utterances of the virtual actors. The result is a game that has a specific (technical) pacing of conversational turns that is not the same as experienced in reality.

6.2.3 Lessons Learnt

6.2.3.1 Team Work, Design Preferences, Experience

The creation of the 'Killer Phrase Game' was more than a technical challenge. It afforded the cooperation in an interdisciplinary team with expertise in educational simulation and game design, as well as domain knowledge of moderation and technical implementation. The first game prototype was test-played with students within the project's scope. The lessons learnt from this first iteration of design and testing are reported here briefly.

Lessons from Modelling

The creation of a dynamic model of the situation is impossible without particular knowledge detail of the domain concerned. Additionally, it has to fulfil the goal of being educational, entertaining and implementable. In the beginning of this modelling process, it was hard to convince the domain experts that this modelling partially falls into their responsibility, because they saw it as a technical task. The elicitation of critical events and their effects on parameters is indeed an abstraction process, but it is connected with creative decisions about what is the most important content of the 'story' (in the sense of the 'fabula'). In the end, it was rather the Scenejo author who made these decisions after substantial briefing by the domain experts, than the domain experts directly. A similar kind of experience in team collaboration for the business simulation *"Virtual Leader"* has been reported by Aldrich (2004). He concluded that deciding on an abstract model requires negotiation with stakeholders. Also comparable, Marsella (2008) reported that agent modelling processes for pedagogical drama with the *"Thespian"* framework had to be completely accomplished by the system engineers after the story drafts were initially written by story creators and educators.

Beginning with the design of a real dialogue as a linear script was then the easiest start. It increased the imagination of the intended result and fostered discussions between the different team members in the following shared process of abstraction. This finding is in line with experiences reported by Szilas et al. (2003) in the collaboration with authors in story modelling for *"IDtension"*. Szilas called this process *"delinearisation"*. What follows is a cyclic process of alternating *"delinearisation"* and *"linearisation"*, going back and forth between the *"model"* and its *"mediation"* according to Flynt and Vinson (2005) (also compare Section 4.4.2.2).

The fact that the final model was oversimplified in comparison with reality was considered as a potential problem for the domain experts only in the beginning of the process, but later has been increasingly more appreciated. In the end, it gave the game a clear and simple objective, and it is imaginable that more small experiences of this sort can be built and debriefed separately.

Evaluation of the End-User Experience

The evaluation of the game was conducted in a classroom setting during a regular course slot of the seminar *"Moderation and Mediation"* at the FH Erfurt, University of Applied Sciences. 21 participants played with the game in parallel, which was installed on 10 computers. An observed play session of 30 minutes was followed by a focus group discussion of 20 minutes, finally concluding with a short individual questionnaire to be filled. Before the play session, in an introduction the overall scope of the game and a briefing for playing was given. 3 assistants were available to ad-hoc solve cases of technical contingency, further 3 assistants observed and recorded the sessions. [46]

The briefing of the players consisted in giving them the task of the moderator who has to especially take care of occurring killer phrases. Within the weekly seminar, this session was preceded by a theoretical introduction to the phenomena of killer phrases and moderator strategies to cope with them. These strategies were to be used. As a further means of facilitation, 'cheat-sheets' were placed face-down beside each computer, to alleviate potential problems of finding appropriate textual inputs. In general, the meaningful possibilities were rather limited and consisted of 1) any interruptions in the right places, 2) directly approaching the last killer phrase uttering bot with a question or remark, and 3) expressions to remind the bots at staying to the facts, staying objective and to ask for arguments.

Under these conditions, and with a certain cooperativeness of the students, the game play worked (surprisingly) well – it could be played from start to finish several times. Still, there were many issues recognised by the evaluation, complemented by own further formative evaluations:

- The game actually affords a mixture of agency and passive listening (according to the mission to 'only moderate in the case of killer phrases, don't engage in the discussion'). This is a bit counter-intuitive and leads to unclear expectations what can be done when, a similar experience as reported from *"Façade"* evaluations (Milam et al., 2008).
- Players expect direct feedback on their actions. Delayed or non-existent feedback has led to frustration (*"they do not react to what I say"*).
- The game was perceived as not yet technically mature (a matter of fact).
- The students found out that the game reacted mostly to the same keywords. Once these keywords were spotted, it was not necessary anymore to type full sentences.
- The duration of the dialogues was perceived in unequal ways. Some reported them as too fast to be able to interact properly, others found them too lengthy. We assumed that this has to do with the degree of active participation expected by different participants.

[46] The questionnaire results can be found in Appendix C.9.

- The overall experience was reported to be rather a technical game than having to do with humans. Still, the majority of students found that a game like that could be useful as an addition to real role play for the seminar in the future.
- The synthetic voices were considered as annoying.

Lessons for Structuring

The main lessons from the first prototype concerning future directions of redesigning the structure are summarised here:

- Design more visible/perceivable reactions and feedback on every user action – if possible also on every bot action.
- Shorten the length of single bot utterances for more opportunities to interact.
- Implement better management of user-specified turn-taking (it was difficult to directly address only one bot).

6.2.3.2 Implicit Creation and Explicit Authoring

The conceptual and technical authoring procedure partially profited from methods of implicit creation, together with aspects of explicit authoring. Working with the Scenejo platform showed both limitations and possibilities of explicit writing methods, as well as of implicit techniques. In terms of accessibility for newcomers to the modelling process, it was easiest to start with explicitly phrased text in a linear order on several task levels. For turning the dialogue script into something more procedural it was first necessary to abstract the linear text and then to define rule-based models.

Implicit Creation in the Killer Phrase Game

The following aspects of creation were part of the concept of 'implicit creation':

- The conception is based on a dynamic model, which can be conceptually consulted to define the logic of appropriate actions.
- Concrete utterances are subsumed in categories of dialogue acts, therefore abstracted to perform actions.
- Abstract dialogue acts can result in variations of concrete utterance templates.
- The order of these actions is partially made dependent on the state of storyworld parameters. Also, introducing some randomness is possible. In a sense, each action has a pre-condition and a post-condition or effect.

- Interruptions within the dialogue threads are possible at any given moment, since the utterances are modelled as conditional actions (stimulus-response).
- The game state varies based on user interaction or on randomisation in the bot's action selection, depending mostly on the development dynamics of the 'Killer Phrase' state and 'Agreement Level' state in the designed model.

Explicit Authoring in the Killer Phrase Game

The following aspects have still been authored explicitly:

- The utterances are hand-crafted. Therefore, it can not be excluded that exact repetitions in the spoken text occur. This can be diminished by creating a huge body of random variations explicitly. Turning to complete 'implicit creation', i.e., 'generating' the language, would have required modelling tasks likely outreaching current possibilities – having to model ontologies and corpora of the thematic domain (airport expansion), of discussion styles and register, emotional domains and more.
- The order of actions 'within' a dialogue thread is predefined, unless a user interrupts. However, the order of all available dialogue threads varies according to the game state model. More 'implicit creation' at this level would have to result in a conversational model of the argument (see Section 6.3).
- The game contains a small higher-level plot structure, providing a predefined branching point to win or lose the game (compromise or escalation). More sophisticated models could contain planning structures and goals for the actors to be tuned on a higher level.

Although technically, comparably few aspects of this application were model-based instead of explicitly scripted and linked, it showed some emergent performance, in the sense that it turned out to be difficult to anticipate the runtime behaviour completely during the authoring phase. From a perceptual point of view, there might be no difference between the appearance of a successfully emergent aspect and a failure in authoring. The consequences are that the phase of tuning and testing gets intricate, and that 'debugging' tools for dynamic content are needed, in the sense of inversely tracking down responsible rules for an occurring effect, in order to fine-tune them. Thus, the process of creation becomes similar to programming complex software, even if no programming language, but rather visual editors are used. The Scenejo tools have proven to be accessible and effective for the limited game. However, the technical authoring process at the utterance level, including the definitions of patterns, conditions and effects, is nonetheless a tedious task close to programming.

6.2.4 Conclusion for Conceptual Modelling

This section explained the initial design, implementation and testing of the 'Killer Phrase Game' application. The case study shows novelty mainly in its approach as a media design project, exploring new territory concerning structuring complex and unclear authoring tasks in order to find design principles. Further, the achievements were a playable prototype of an interactive storytelling artefact.

The findings have led to the enunciation of conceptual models explained in Section 5.2, which we consider – at the same time – as essential for interactive story creation: in IDS, 'storytelling' is in fact 'story modelling'. It has been discussed above how 'implicit creation' has led to structuring the storyworld in terms of a model, although many items during authoring needed to be implemented explicitly. For model thinking, it was most important to abstract the initial script (dialogue act modelling) and to find interdependencies in kind of a simulation model, expressed as a diagram.

The next section further explains the conception of more detailed acting situations in order to increase variability, while progressively thinking about the storyworld as a model.

6.3 Increasing the 'Implicit' in Implicit Creation

In Chapter 5, a conceptual model of 'implicit creation' has been proposed that claims advantages in approaching all interactive story events as conditional events (see Section 5.2.3.1), postulating a guiding principle: 'In interactive storytelling, there are no unconditional events.' This section analyses how the conceptual modelling of more 'conditional' events and of still more 'abstract' structures can contribute to a higher degree of interactivity and variability for the same application.

6.3.1 Conditional Events with Dialogue Acts

6.3.1.1 Alternative Approach to 'Stimulus-Response': 'Pre-Act-Post'

In the design process described in the previous section, the spoken actions were conceived in an experimental way by using and adopting concepts of the authoring tools and architecture of Scenejo, which based the fine-grained dialogue design on writing AIML-like stimulus/response pairs and the tool's graph modelling features. Graphs were originally introduced in Scenejo to address the common issue mentioned in Section 2.3.3, namely that authors found it more intuitive to think of a ramified flow of possible events, instead of programming rules. The method also reflects other approaches to dialogue modelling for IS based on Harel (1987) state charts for reactive systems (Iurgel, 2006; Gebhard et al., 2003). Due to the AIML principle of stimulus-response, any starting point in implementing a dialogue act with utterances in Scenejo has been a word pattern functioning as 'catchword' to cue the bot in – a 'reaction-based' philosophy. Thus, Scenejo's afforded conceptual model of designing an acting situation is 'reaction-centred' (as opposed to 'action-centred', compare Section 5.2.3.2).

Scenejo does not suggest to first describe a scope of actions with their pre-conditions and effects for a character, but the responses to stimuli can be translated to such a structure. In terms of 'pre-conditions' of a dialogic action, it can be said that 'hearing' certain keywords is a pre-condition for uttering a certain sentence. As a 'post-condition', it can be stated that the output of that sentence has the effect of at least providing another keyword to react upon. Additionally to these minimal elements required by the Scenejo authoring tools, more pre- and post-conditions are possible to implement, such as the further dependency on a predicate state, which is equivalent to a branching on output (see Fig. 6.14), and adding post-conditional effects by setting or calculating new predicate values.

As described above, the design started from a linear script. Not before the structure of a first dialogue was finally completed, Scenejo authors thought of the actual effects of these words as actions influencing the overall storyworld. Then in a design iteration, the incrementing parameter of the 'killer phrase level' (amongst others) was added. Also, the question came up late at which places interacting users can achieve meaningful and perceivable effects in the storyworld. So far, we actually ignored concepts from game design (compare Section 4.4.2.1) and interaction design (Section 4.4.1.1). Drawing from these novice-level experiences in IS authoring, the result had to be rethought. It became obvious that beyond only specifying reactions to utterances, action effects (of utterances) also needed to be a starting point for designing a more goal-based structure during conception. Therefore, the model of defining actions similar to a STRIPS-like planning method has theoretically been explored (see Fig. 6.21).

It is shown here that independently of the way of 'technical authoring', and rather as a strategy in 'conceptual authoring', the conceptual model of designing 'acting situations' in two different ways could be applied to the same storyworld. To create an overview of 'possible actions' for one bot, planned dialogue elements can be conceptually described with the minimal action triad (see Section 5.2.3.1): *"pre-condition – action – effect"*. Fig. 6.21 shows examples of such alternative action descriptions.

Pre-Condition	**Action/ Dialogue Act**	**Post-Condition/ Effect**
Hear Prompt Have Turn Stress Level < X Argument A Unused	**Argument A**	Uttered Argument Increase Consent Argument A Used
Hear Argument Have Turn Stress Level < X	**Killer Phrase**	Uttered Killer Phrase Increase Stress Level
Hear Moderator Have Turn Stress Level < X	**Excuse to Moderator**	Uttered Excuse Decrease Stress Level

Fig. 6.21. Three dialogue acts with pre-conditions and effects.

Fig. 6.21 also mentions some preconditions (e.g. 'have turn') that in the running example actually were hard-coded within the DA (the dialogue engine). They are mentioned here nonetheless, because in a thinkable future version of the system, they shall be made accessible for authors, to allow the definition of special turn-taking rules. Placing a text pattern ('hear X') is the mandatory AIML precondition (the pattern). Placing a wildcard within that precondition loosens the constraints of reacting to certain stimuli, while forcing it to follow a specific utterance may lead to linear dialogue. This choice enables different grades of linearity or variability.

Conceiving the same dialogue this way allows authors to first and more easily lay out dialogue acts according to their intended effects, and then think about the constraining pre-conditions in a way that makes them happen in certain situations only. For example, it made the following tasks easier to achieve:

- During the design, it facilitated the goal-directed distribution of dialogue act effects (such as level states of killer phrases and arguments) within the structure at certain potential situations. This designed distribution was more difficult with the reaction-based thinking approach.
- Combined with dialogue act abstraction, it was easier this way to think about the necessary keyword 'triggers' that invoke complete argument sequences.
- The effects of user actions could be planned by designing bot responses to user utterances with post-conditions. For example, under the assumption that

the user acts as an advising moderator, these are mostly excuses or justifications decreasing the stress level, or answers to direct questions.

- This way of conceptual thinking advocated increased inclusion of post-conditional effects of dialogue acts and made authors more aware of the case that each act should 'do something to the world', i.e. change the world state in some way.
- Finally, general pre-conditions for one dialogue act were considered more profoundly (beyond the heard pattern), which led to increased reusability of the act, in terms of possible rearrangements in the order of the conversation.

In short, this 'swapping of perspective' in designing the actions ('action-centred' or 'reaction-centred' – compare principles in Section 5.2.3.2) increased the consideration of possibilities for interaction and direct feedback, because the conditions of utterances were thought of more precisely. However, since the Scenejo tools still followed only the stimulus-response principle, the conception based on 'pre – act – post' has been carried out with offline low-fidelity prototypes. Examples were a paper prototype game (see Fig. 6.22) with small index cards for the dialogue acts and small stickers for the conditions, further dialogue-act collections in table-form and graph drawings. The index card game could be test-played to check for flaws, which was done in quick iterations alternating some redesign in the details. After conception, the paper layout and tables could then be re-translated to the stimulus-response structure in Scenejo for implementation.

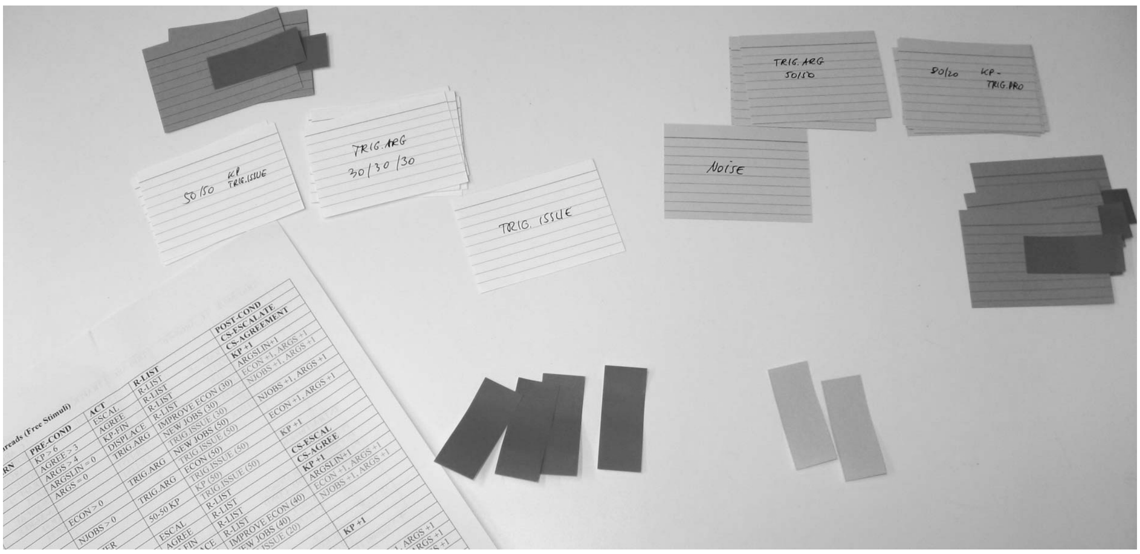

Fig. 6.22. Paper prototype 'game', suited to test the selection of dialogue acts outside argument chunks.

6.3.1.2 Increasing Abstraction of Dialogue Chunks

At first sight, specifying more pre- and post-conditions for every uttered sentence places a burden on the author, making the task of 'dialogue writing' quite tedious and close to programming. It was essential that further speech act abstraction than the initial arbitrarily found dialogue acts was performed at the same time. This is especially important as there are dialogue acts that not really require a long list of pre-conditions, because they happen within a dialogue chunk, in which they build a 'second part' of an 'adjacency pair'. In the theoretic conception experiment, it seemed inefficient to specify all preconditions for each utterance. Further, there are dialogue acts that are hard to associate with perceivable effects (as changing states), but which are nevertheless needed for the flow of the conversation, for example, to change the initiative between the bots or simply because it would feel unnatural otherwise.

Therefore, the next step was an attempt to further abstract the conversation, in order to find higher-level structures than just pairs. A dialogue chunk model similar to the one proposed by Longacre (1996), presented in Section 4.4.3.2, has been adopted. Longacre's concept of including 'countering moves' (or *"continuing moves"* in his original terminology) seemed to be suitable for the 'Killer Phrase Game', because it can model uncooperative / adversarial dialogue partners. The process of defining these structures included iterations of supposed abstractions and their test-playing with the paper prototype. The first trial consisted in leaving aside the concrete utterances designed so far, and starting with the extreme abstract model in Fig. 6.17, associating index cards with killer phrases and with arguments to be played out. It revealed that this model is incorrect inasmuch as it tries to model a 'whole' conversation beginning with a 'Killer Phrase Level' of "0" – the conversation would just not generate any killer phrases. More than that (as this could be solved by an intro phase), if the motivations (pre-conditions) for uttering killer phrases only depend on the value of an already high killer phrase level, this would lead to boring and almost self-solving games. If Scenejo would be equipped with a drama manager that can be tuned according to dramatic tension, it would be a general solution to think of top-level rules for dramatic arcs. In order to accomplish it with Scenejo, the solution is again a mixture of implicit and explicit authoring tasks. As a step towards 'model thinking', the dialogue has been abstracted. The model can be used conceptually to then manually author its structure according to the Scenejo philosophy, albeit with some work-arounds. Draft material (lists and conceptual graphs) of this translation has been included in Appendix C.10.

Within that modelling process, the following distinctions have been made with the existing material of the previously designed utterances:

- Dialogue acts 'within' an argument thread (or chunk) and dialogue acts 'outside' of threads are distinguished and treated differently.
- Threads are built by the chains of utterances following a trigger of a certain argument theme, each one initiated by one bot (PRO: 'new jobs', 'economy', CON: 'traffic', 'noise')
- Killer phrases (which were before grouped according to their 'meaning') are distinguished according to whether they form 'initiating moves' (they can start a thread) or are suited as 'resolving moves', which can be used as answers or appendices to answers.
- In order to better distribute killer phrases in the whole conversation based on conditions, some were identified as capable of being attached to any ordinary act on a case-by-case basis.
- Some alternative dialogue acts are categorised as 'anti' (antagonistic) or 'coop' (cooperative), the choice of which may depend on pre-conditions, deciding on the probability of a thread leading towards agreement. Mister CON has a low threshold for 'anti' remarks, Mrs PRO is more cooperative.
- Abstract structures of the argument threads are built, identifying 'closing' chunks according to Longacre (1996): "*question/answer", "proposal/ response", "remark/evaluation"*. This can lead to variations by inserting deviations (additional countermoves) or short cuts in the utterance material (Fig. 6.23), based on pre-conditions or random/probabilistic choice. In the given antagonistic discussion of opponents, the pairing 'remark/evaluation' was the most common (often with dispreferred 'second parts').

In summary, this result describes the abstraction of a given (pre-written) text according to models from discourse analysis, which then had to be re-implemented with the conventional tool (technical authoring). The result increases possibilities for variations and replayability, because more conditions are included by design, deciding on the next actions (by fine-grained authoring), where in the first instance, a straight connection had been the case. The conclusion of this exercise is that applying knowledge in abstraction of discourse structures can increase the interactivity in the sense of variations depending on user input, as it generalises from an instance to more abstract rules. However, finding the right rules is mainly a tuning process requiring iterations of test-playing and adapting the rules. It is essential that the 'surface realisation’, in other words, the concrete wording, is also regularly experienced and adapted during that play-testing, as the dialogue still has to feel natural.

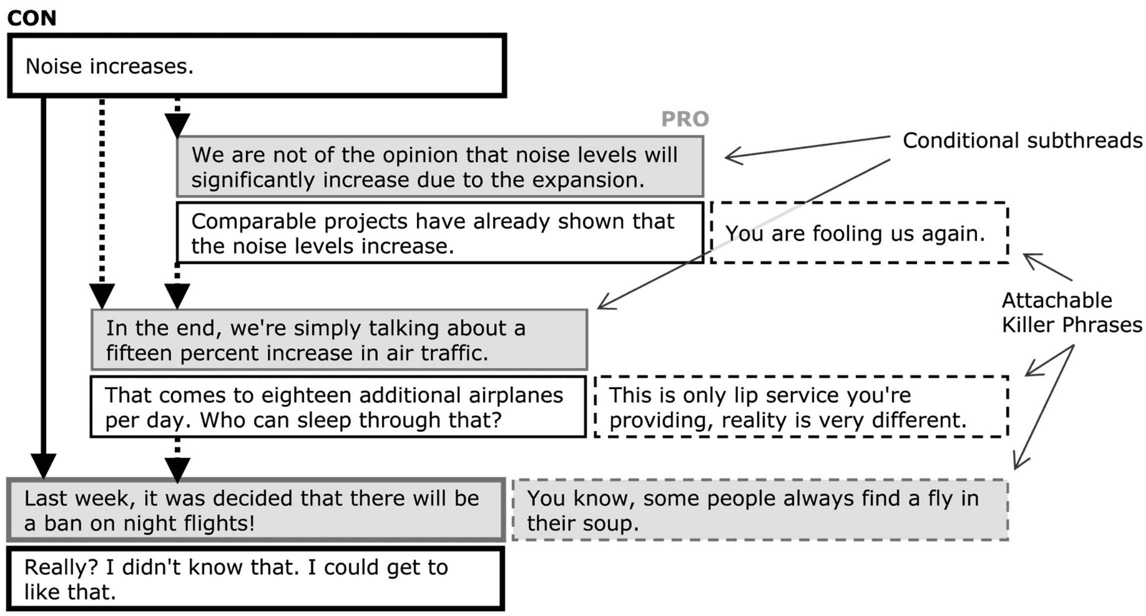

Fig. 6.23. Complex dialogue thread with options of sub-chunks and attachable elements. Only the three acts with bold outlines are mandatory.

The dialogue thread in Fig. 6.23 contains several options for variations, which are possible through grouped sub-chunks as countering move units. It is essential that no elements are taken out that would lead to an isolated remark. The full abstraction of the above dialogue thread can be read like the following (where IM = initiating move, RM = resolving move, CM = countering move, KP = killer phrase, black and grey colour denote different actors):

1. **(IM, Remark)**
2. **(RM, Evaluation + CounterRemark)**
3. **(CM/IM, Evaluation + CounterRemark)** (optional: **KP)**
4. **(RM, Evaluation + CounterRemark)**
5. **(RM, IM, Evaluation + CounterRemark)** (optional: **KP)**
6. **(CM/IM, Proposal)** (optional: **KP**)
7. **(RM, Response)**

Structures like this have the potential to be reused with variable utterance wordings and some conditional structural variance, leading to less repetitive content, although the final utterances are hand-crafted. The driving philosophy has been that it should be possible to design the ‘Killer Phrase Game’ without ‘programming’ knowledge. However, applying further steps of abstraction increases the potential for flexibility and thus perceived interactivity.

6.3.2 Conclusions and Generalisations

The structural redesign of the 'Killer Phrase Game' was an exercise exploring two different ways of conceiving conditional events. In Section 5.2.3, conditional events have been emphasised as a central technique to define situated actions of a storyworld's characters. Acting situations can be expressed as parts of a plan or as reactions to circumstances. Even without programming, there are theoretical differences to approach the conceptual thinking about these situations. The case study has shown that both ways have been relevant within one project, as the swapped perspectives emphasised thinking about different dialogue functions.

Further, this part of the study emphasises and illustrates the importance of intermediate 'abstract' representations between the most abstract formal structure required by an engine and a linear concept outline provided by initial authors (as explained in Section 5.1.1.3).

To sum up and compare with the first version, it can be said that the flow and order of some events have been defined more implicitly in a way that allows for more variations. This can be achieved by considering situated and abstract actions as opposed to explicit and unconditioned connections in a runtime flow graph.

6.3.2.1 Discussion of 'Pre-Act-Post' vs. 'Stimulus-Response'

Modelling actions in terms of *"pre-conditions – actions – post-conditions"* is common practice when configuring a planning domain for interactive storytelling (Pizzi and Cavazza, 2008). When adopting this modelling technique 'offline' for the Scenejo example, it increased thinking of utterances as actions in terms of character goals and situations. As seen in the last section, this point of view could not be maintained throughout the whole design – only concerning the parts outside dialogue chunks. The following two tables (draft documents after the paper prototyping) list for some actions how they were transformed back to the stimulus-response principle, also to meet implementation needs.[47]

[47] Additional draft material (listings and structure graph) is available in Appendix C.10. The new structure graph illustrates the differences between 'action-centred' design at 'plan level' and 'reaction-centred' design within dialogue chunks. The plan level contains almost no 'sequential' structures, in contrast to the dialogue chunk parts.

Pattern	Pre-Condition	ACT Mrs PRO	Post-Condition/Effect
(all patterns)	KP > threshold	**Escalation**	Change to escalation scene
(all patterns)	AGREE > threshold	**Agreement Conclusion**	Change to agreement scene
Killer Phrase	KP high	**Append KP**	KP +1
* Trigger for Args.	All arguments used KP high	**IM_KP**	KP +1
* Trigger for Args.	Own arguments used	**Trigger Mister Con**	(Con will start thread)
* Trigger for Args.	New Jobs unused Random order	**Trigger Arg. New Jobs**	(Jobs thread started)
* Trigger for Args.	Economy unused Random order	**Trigger Arg. Economy**	(Economy thread started)
Moderator input	Following own KP	**Excuse to Moderator**	KP -1

Table 6.6. Design question starting from the 'action' (of Mrs PRO): "In which situation do we want to play the act in question with this effect?"

PATTERN	PRE-COND	ACT	RANDOMS	POST-COND
*****	KP > 6	ESCAL		CS-ESCALATE
	AGREE > 3	AGREE		CS-AGREEMENT
	ARGS > 4	KP-FIN		KP +1
	ARGSLIN = 0	DISPLACE		ARGSLIN+1
	ARGS = 0	TRIG.ARG	IMPROVE ECON (30)	ECON +1, ARGS +1
			NEW JOBS (30)	NJOBS +1, ARGS +1
			TRIG.ISSUE (30)	
	ECON > 0	TRIG.ARG	NEW JOBS (50)	NJOBS +1, ARGS +1
			TRIG.ISSUE (50)	
	NJOBS > 0	TRIG.ARG	ECON (50)	ECON +1, ARGS +1
			TRIG.ISSUE (50)	
	OTHER	50-50 KP	KP (50)	KP +1
			TRIG.ISSUE (50)	
KP_IM	KP > 6	ESCAL		CS-ESCALATE
	AGREE > 3	AGREE		CS-AGREEMENT
	ARGS > 4	KP-FIN		KP +1
	ARGSLIN = 0	DISPLACE		ARGSLIN+1
	ARGS = 0	TRIG.ARG	IMPROVE ECON (40)	ECON +1, ARGS +1
			NEW JOBS (40)	NJOBS +1, ARGS +1
			TRIG.ISSUE (20)	
	OTHER	50-50	KP	
			TRIG.ISSUE	
KP (INIT)	KP > 3	KP		KP +1
	OTHER	PHATIC		
TRIG.PRO	ARGS = 0	TRIG.ARG	IMPROVE ECON (50)	ECON +1, ARGS +1
			NEW JOBS (50)	NJOBS +1, ARGS +1
	ECON > 0	TRIG.ARG	NEW JOBS	NJOBS +1, ARGS +1
	NJOBS > 0	TRIG.ARG	ECON	ECON +1, ARGS +1
	OTHER	50-50 KP	KP	KP +1
			TRIG.ISSUE	

Table 6.7. Alternative design question starting from the 'reaction' (input pattern): "What can be done when the pattern in question is 'heard'?" Included are further conditions and potential random distributions.

When designing from the point of view of 'actions', it is natural to keep in mind at the same time the goals and traits of the characters. For example, Mrs PRO is more cooperative than Mister CON, and would only utter killer phrases in two possible situations: 1) when the general stress level is already raised to a high value, 'and' in direct response to a killer phrase, and 2) when all arguments are played out without an agreement, then leading to a quick end. In cases when nothing specific is cued, Mrs PRO has a repertoire of displacement activities ("well, what more can I say"), where Mister CON would bring a killer phrase. However, goals like these mainly were taken into account in the dialogue acts 'outside' argument threads, which are the ones represented in the above tables. These acts are important for the management of the conversation between and towards the triggering of argument threads. 'Within' such a thread, it appeared more intuitive to think in the 'reactive' structure of stimulus-response again, with the exception to also include characters' behaviour rules by placing more additional conditions on the input.

This reminds (philosophically) at the distinction of plans and scripts by Schank and Abelson (1977), who noted that agents use goal-based planning for their actions unless they are acting according to a *"script"*, which is highly stereotyped. In our case, the so-called 'plan' consists in the simple rules outside dialogue chunks. The intra-chunk sequences show certain patterns. Adapted to the formal requirements of structuring in Scenejo (without planning software incorporated), some random/probabilistic spreading of responses has been included, in order to further increase possible variations in the occurrence and order of upcoming arguments.

6.3.2.2 Classification of the Approach

The general approach taken in the above example is author-centric, as such complementary to 'generative' approaches that from the outset rely on simulation, automatic plot planning or emotion planning, being based on fully implemented models. Herein, 'implicit creation' has been explored in steps and by authoring exercises. Starting from the linearly scripted content, models and rules were added, at first only at the conceptual level, then by finding some way of implementation with given tools. The process arrived at a stage of possible solutions that still falls within the 'combinatorial' category – however, with increased interactivity and variability due to additional rules working on reusable abstract structures.

This project is structurally comparable with the *"constructive and formal approach for finding interesting structures for interactive narratives"* (Szilas and Rety, 2004), undertaken by the designers of the *"IDtension"* model, and the *"IDtension"* authoring experiences reported by Szilas at al. (2003). Szilas et al. started out from *"minimal story structures"*, based on the simple set of a goal-directed task that is retarded by an obstacle (which can only be overcome by another similar set etc.). At an abstract level, the structure can be reduced to 'stimulus-response' thinking, where the obstacle is a starting point (stimulus) from which adequate goals are searched to overcome it (response). By constructing more abstract structural combinations of the simple principle, and by adding a probabilistic ('random') factor, more variations and better interactivity were the result, findings similar to the Scenejo authoring experiences.

Any more implicit creation can then be achieved by advancing the runtime engine to include a planner for dynamic sequencing of argument triggers. Assumably this would support the authoring process particularly in the task of managing the dialogue structure outside argument chunks, especially if the whole dialogue base and the number of arguments would be much bigger than the small example above. The combinatorial approach based on reusable conversation models is scalable for reaction rules within a dialogue chunk – but not for dynamic dialogue management outside of chunks. The effort of specifying conditions for variations explicitly would explode with the number of possible arguments. For the size of the 'Killer Phrase Game', however, it was manageable.

6.4 Conclusion

This chapter presented a case study of authoring tool conception and of an authoring process with that system. The initial tools, which were designed after conclusions from experiences in prior research, allow the definition of 'reaction-based' conditional actions that are abstracted from utterances. They let follow a character-centred approach of specifying 'bots' separately, allowing users to intervene between each utterance. This frequent interaction has been identified as one criteria of 'highly-interactive' storytelling. Although relatively simple, if compared to systems with more sophisticated natural language processing, it was possible to use the system in a media-design oriented creation project for a multi-party bot conversation. The character-centric approach is unique and different from other comparable systems (such as *"Cyranus"* or *"Scenemaker"*).

The case study explained a conception process of modelling the content in a real-world project, independent of implementation, and following that, the technical design and its re-design after an evaluation.

The endeavour was an 'artefact creation' part of a design research strategy. By practice, conceptual models of 'implicit creation' and its context could be enunciated.

The prospects of 'implicit creation' and related concepts could be illustrated in the project at several stages.

- We have explored conceptual authoring as well as technical authoring (see Section 5.1.1). For conceptual authoring, 'model thinking' has led to abstractions of the content in between the extremes of linear outline and formal engine model.
- The Scenejo philosophy of incorporating the user could be explained with the level model (see 5.1.2)
- Abstraction of dialogues into a simulation model relates to considerations that storyworld creation is a modelling task (see 5.2.2) and it has been discussed to explain 'explicit' vs. 'implicit' creation (concept in 5.2.1).
- Modelling conditional and dialogic actions has led to the conclusion that there are different approaches to think about interactive situations. 'Action-centred' and 'reaction-centred' design denote different starting points of thinking about these situations (see 5.2.3).

During the intertwined building and conceptual modelling process, several existing theories have been incorporated. These relationships are described in Chapter 5. In summary, the most practically influential theories came from simulation design and discourse analysis. Further, creation principles from the field of screenwriting were also relevant, such as the advice to always consider 'what dialogue acts do to the world'. In retrospect, theories helped to structure the formerly messy design challenge to formulate principles for a new field of media design.

The used technical authoring approach may appear as a way of 'programming' the content. First, an abstract model had to be built. Next, we needed a method of implementing conditions and rules, and finally, the code had to be tested and 'debugged'. The process indeed shows similarities with software development, similar to game production. What remains for non-programming conceptual authors is to join the iterative team-based process of refining the storymodel, and find creative ways of abstraction. In terms of applying the model of 'implicit creation', it can be stated that the concept was 'accessible' after a learning phase, and 'effective', as it has led to working content. As for accessibility, it would be over-enthusiastic to declare the concepts as 'intuitive'. It has to be expected that learning phases and education of authors is a necessity. However, there are prospects that this can be achieved without going to the absolute abstract level of first learning 'how to program'.

The case study as a content example and as a basic-level tool has served as educational example (together with the theoretical concepts in Chapter 5) to communicate with interested authors in IDS, mostly at workshops (Spierling and Iurgel, 2006; Spierling et al., 2009b) and tutorials on 'Interactive Story Creation' (Spierling et al., 2010), and as input to continuative authoring research in the IRIS project (IRIS, 2010).

6.4.1 Discussion on Generalisation

This design process can be considered as a learning process of approaching 'implicit creation' from an initial 'linear-thinking' attitude. It can be assumed – concluding also from other experiments with interactive story creation – that this learning process is prototypical, and that this need to learn is transferrable to others in the same situation.

We are not considering computing experts, such as knowledge engineers for voice interaction design, as the future story inventors in IDS – even though they can be members of the team. In predominantly technical domains, such as for a well-structured 'task-based' interactive system, it is feasible to begin 'top-down' at the most abstract discourse level. This is different from creative storytelling domains, where it is more realistic to assume that each new idea needs to be developed and fleshed out 'bottom-up' and uniquely, instead of using templates of existing ones. Hence, design principles are important, but like in screenwriting, these are probably not accepted as a prescription.

In our case study, in order to get a 'feeling' of the experienced conversation, it was necessary to first imagine concrete utterances in a linearised context. Again, this points to a general model of having to alternatively *"delineraise"* and *"linearise"* the content. While this has been experienced here, it has also been reported using these terms by Szilas et al. (2003).

6.4.1.1 Further Studies to Compare Authoring Experiences

Unfortunately, there are not many comparable and published case studies with authors from media design and storytelling yet that could offer to share and generalise experiences. In the context of this work, we can draw from more own practical exercises conducted mainly with students or at workshops (compare Section 2.3.3). It is a particular problem that these kinds of authoring studies have limitations: Most actual IDS systems' (research) prototypes have usability flaws and software bugs, which require the effort of working around them, which is also an accessibility problem. Also Scenejo had such issues, which hampered the exploration of general tool-independent concepts. Further, the mostly limited time of studies in workshops or university courses can only reveal insights about a beginner's learning curve and give a first impression. In spite of these known limitations, some experiments could lead to first findings about the process of abstraction in different systems, especially when certain effects reoccurred.

Authoring with Scenejo and "IDtension"

One joint exploration of *"Authoring Issues beyond Tools"* has been published about compared experiences with Scenejo and *"IDtension"* (Spierling and Szilas, 2009)[48]. We categorised the found issues into several problem groups, such as *"Story Ideas that Do Not Fit into the Engine's Approach"*, *"Painful Process of Storyworld Implementation"* and *"Deliberating the End-User Experience"*. A key similarity between the two case studies' findings is the authors' need for 'abstraction' of the storyworld, in which 'abstraction' can occur in different ways. It can concern the degree of abstraction in a technical formalism during technical authoring, or abstraction as a generalisation of actions and events, or generic vs. instantiated behaviour with the motivation to 'reuse' authored constructions. Further insights extend the conception experiences and also let reflect on general tool requirements. In both authoring studies (leading to completely playable results), mostly close team members of the system designers (and only few externals) have authored.

Authoring Studies in University Seminars

Several technical authoring studies have been included in media design university seminars. One bigger study concerned the comparison of eleven available systems (IDS research prototypes or peripheral tools) with one creation exercise.[49] The participants were students in media informatics and capable of programming. One main insight was that apparently, programming knowledge was not sufficient to grasp concepts of the more complex systems, such as *"Emo-Emma"* or *"Storytron"*. It requires special creative knowledge in abstraction of a narrative, which was unfamiliar for the students. Another common finding was that in order to understand the system, almost everyone tried to first create something 'linear'. Using Scenejo in other less structured student projects or authoring workshops showed similar results.

[48] Appendix D.2.

[49] Appendix D.1, Authoring Studies with IDS Systems at FH Erfurt.

Authoring Studies in Workshops and Tutorials

At several issues of the annual ICIDS[50] conferences and their predecessors, short-term authoring studies with several systems have been performed and/or discussed with participants. Ongoing work includes tutorial material and the collection of more case studies, which are presented online, such as in the multi-author blog[51] about authoring interactive *“Little-Red-Ridinghood”* stories, or in the authoring repository of the IRIS project[52] showing further case studies that partially built upon this work. Within the IRIS project, the conceptual models have been further successfully used for communication, for example, to introduce tutorial participants to the conceptual conditions of interactive story creation (IRIS, 2010). The conceptual principle of ‘conditional events’ has been discussed with workshop participants and project members. We compared principles of ‘reaction-centred’ conditions with ‘action-centred’ thinking approaches inherent in planning technology during the conception of a ‘planning card game’. The game’s goal is to explore and explain the authoring conditions for a planner using a STRIPS-like representation of actions. The IRIS web repository on authoring collects such workshop case studies and tutorial material, partly including the case study presented herein.

Conception Exercise in Story Adaptation and Story Modelling

We explored the apparent gap between a written representation of authored concepts and their formal implementation (compare Fig. 5.3) in a conception exercise of adapting a linear story to interactive storytelling (Spierling and Hoffmann, 2010)[53]. The chosen story was Hemingway’s short story *“The Short Happy Life of Francis Macomber”*, and we chose the *“Storytron”* engine as the prototypical example for formal implementation. We found that the task cannot be done ‘straightforward’ by simple ‘deductive’ engineering, but only by an ‘inductive’ process, affording many creative decisions for omitting existing and inventing new elements. The conclusion is that we need a step of tool-independent ‘story modelling’ in between thinking of a story outline and the actual technical authoring process.

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[50] International Conference on Interactive Digital Storytelling. Conference series website: http://icids.org

[51] http://redcap.interactive-storytelling.de/

[52] http://iris.interactive-storytelling.de/

[53] Appendix D.3.

7 Conclusions

This chapter summarises the presented research results, points out the objectives fulfilled and the novelty of the results. Limitations of the research are explained further. We conclude with the presentation of future work, which contains a suggestion of creation principles that can be derived from the experiences described herein.

The research reported herein has started out from a perceived gap between designers approaching the creation of 'highly-interactive' storytelling and the complex technologies that this endeavour involves. The general long-term vision has been stated as to close this gap, on the one hand by building accessible tools, and on the other hand, by enunciating novel creative principles that are to be adopted by creators in a learning process. The task of this thesis' research has been to lay the ground for this merging of disciplines, by suggesting and evaluating novel conceptual models for authoring processes, accessible to be adopted and/or learnt by non-programming authors and effective for approaching the usage of AI-based concepts to solve the creation problems of dynamic content. Non-programming authors shall have a more responsible role in defining future creation processes.

Two objectives have been in the centre of this work:

- Theoretical contribution: Conceptual models for non-programming authors shall be enunciated. They shall have the potential to bridge the gap between traditional story conception and programming engines at a technical level.
- Artefact development: A playable prototype in Interactive Storytelling shall be built, providing experiences and practical insights that are useful to find and evaluate these conceptual models. It shall approach more generative variability in steps, beginning with traditional media design concepts.

The research started from the point of view of creative conception – in that sense from one side of this gap – approaching the other side in steps. It has been based on

- a theoretical review of known structures and creative principles in storytelling and human-computer interaction (reported in Chapter 4),
- a suggestion of conceptual models of the authoring process as metaphors or guiding principles, spanning criteria for storytelling and for the development of complex systems (reported in Chapter 5), and

- a case study of an application development in ‘highly-interactive’ storytelling, especially conversational storytelling, including the conception of simple authoring tools and design steps towards increased interactivity (reported in Chapter 6).

These tasks have not been performed subsequently, but intertwined.

7.1 Fulfilled Objectives and Research Achievements

The main outcome of this research is summarised and concluded as follows.

First Objective: Theoretical Contribution

- ‘Conceptual models.’ Conceptual models for interactive story creation have been enunciated that 1) describe structures and borderlines within dynamic content including roles of authors and end-users, and 2) describe novel points of view for creators that reconcile design thinking in traditional storytelling or media design and dynamic model building.
- ‘Implicit creation.’ As an umbrella concept, ‘implicit creation’ has been suggested and described as a guiding metaphor for designers, as opposed to ‘explicit authoring’. Steps of increased implicit creation can be applied to projects by abstraction techniques, which has been demonstrated by artefact creation. The concept directly points to further detailed research into creative principles as future work.
- ‘Argument on model thinking.’ The theoretical contribution of this thesis is embedded in an argument on differences in conceptual thinking, between narrative thinking in sequences and logical thinking in models, which need to be reconciled for ‘highly-interactive’ storytelling. The conceptual gap, which is still there, can therefore be better described, which is a first step to work on correctives.

Novelty

- ‘AI-based IDS from the point of view of media design.’ Within the field of IDS, this work made a novel contribution to the discussion how to better integrate authors through a shared point of view. AI-based interactive storytelling creation concepts had not yet before been tackled from the point of view of media design, which has been unique.

- ‘Story modelling concepts for authors.’ From the point of view of AI or computer science, some concepts are not new, for example the insight to model a storyworld based on conditional events. However, the context for communicating these aspects so far was strongly associated with means of technical implementation. In our case instead, we employ the concept as a thinking model for story conception, at a stage far from formal implementation. This point of view is novel, and it has impact on future (better) communication between the disciplines.
- ‘Models as communication tools.’ The enunciated models of ‘implicit creation’ are new as communication tools targeting prospective authors, showing differences in conception between traditional and interactive storytelling, but also ‘points of contact’ in between. Existing models and concepts of other disciplines (such as AI, narrative theory or HCI) have been consulted as referenced, while the novelty lies in their combination.

Second Objective: Artefact Development

- ‘Playable prototype.’ The objective of artefact creation as part of the research design has been fulfilled by the playable prototype, its evaluation and redesign, and by reflection on the authoring process that fed back into conceptual models. Further, it consists of an example tool approach.
- ‘Experience report.’ One exemplary authoring process has been performed, and an artefact has been created. The experience report and the artefact can be used (and have been used) to explain and illustrate typical steps and problems of creation in education and discussions on interactive storytelling. It contributes to a future consolidation of generalised findings, especially as it shows overlapping results with reports from other efforts in the community.
- ‘Example of increased model thinking.’ The objective of increasing the variability step-by-step by introducing more abstract models of dialogue has been fulfilled. Increased model thinking and abstraction has led to more potential variations in the content structure.

Novelty

- ‘Playable unique prototype contribution.’ The achievements are novel as a design case study with a playable result. It is uniquely positioned within the community of IDS research, which is still currently suffering from a lack of playable prototypes, in comparison with many theoretical methods presented in papers. Using the case study as a learning vehicle can even be done with flaws or imperfection in the result.

- 'Simple, low-barrier authoring approach.' The technology developed in the case study does not contribute novelty in comparison with the 'technical' state of the art, for example in complex generative dialogue systems. However, the contribution of the simple authoring approach (including the tools and case study as example and tutorial) is novel, in that it can be used by almost anybody to step in.

In summary, the objectives circled around the research question what general abstract design models need to be adopted by 'non-programming' story creators to reach higher levels of content variability beyond branching. The question was raised due to the situation that at the outset, user-centred development and evaluation of tool concepts are unlikely to be successful, due to a lack of general authoring experience. As a result, the conceptual models help to structure the previously unknown design process. Together with the example material, they build a bridge for communication across the gap. Thus, the work lays the ground for more user-centred approaches in the future.

Further Achievements

Next to artefact-based research, the outcome has produced several findings that contribute to the community's discussion about the situation of authors. Beyond the common insight that better tools are needed, it points to the potential to educate authors. While several community members argue that it is first necessary to develop more mature engines before authoring access is worthwhile, the further conclusion can be that small systems (such as the 'Scenejo' experimental platform) are useful to serve authors' education, further evaluation and a greater body of prior experiences. The preliminary findings regarding the abilities of future authors are:

- Authors should be able to think in abstractions, generalisations, and conditional procedures. The performed study is an example to show that with increased abstraction of narrative statements to generalised constructs, and considering the conditions for actions, possible interactivity and variability can be increased.
- The research has not created any evidence (yet) that authors need to be able to program with a standard programming language. It is still not refuted that with adequate authoring tools, 'non-programmers' can one day create

'highly-interactive' storytelling with generative algorithms. On the other hand, it has been shown that being able to program alone was no sufficient precondition. Depending on the genre of IDS, knowledge of 'grammatical' structures (at sentence, discourse or story level) is useful.

- It is useful to divide the creation process up in roles, such as those of a conceptual author or technical author. The roles can then be distributed in a team or combined in one person. To facilitate the discussion, conceptual authors need intermediate abstracting tools before a complex engine is approached for implementation.
- Even though creative principles for screenwriting are widely dismissed in the community for their (often-called) 'linear' approaches, the literature review revealed useful concepts within these principles that are likely to be similarly useful in a storyworld 'modelling' process. Examples are the thinking in character-based goals and traits defining their actions, externalising the internal, and more. Research into RPG, which takes place in the community, shall complement this to establish creative narrative principles in the future.

Several conclusions can be drawn concerning the general state of the research field. First, the perceived gap (see hypotheses) has not been closed by this research. The field can be considered as not mature enough to expect this in the near future. However, the gap can be described better with the research performed, leading to a number of suggestions for future work. Second, this direction of research, starting out from conventional ways of creation, is only one possible approach, and complementary to other existing approaches in the research community from the point of view of AI systems.

7.2 Research Limitations

The main and general limitations of the research lie within general issues of how such a design problem can be approached, being a 'wicked problem', studied by means of artefact creation. General and specific limitations are:

- The involved learning process in one artefact creation cannot be undone to repeat the study, therefore such an endeavour has natural limitations in its generalisation as an experiment.
- The artefact creation has – naturally – been dependent on an arbitrary situation, for example determined by the available technology at the start of

the studies. Although the approach has been justified by researching the state of the art and prospects in the near future, novel technologies can potentially make (part of) the findings obsolete.

- A proper evaluation of the result claiming to lay the ground for a reduction of an interdisciplinary gap can only be done in a long-term endeavour, depending on many environmental factors. These include the advancement of the field and education of potential authors.

7.3 Future Work

This research has created several open questions and pointers to future work.

- ‘Long-term rigorous evaluation of conceptual models with expert authors.’ Only long-term evaluation, involving several complete productions of running prototypes including learning processes of authors, can reveal if the proposed conceptual models are persistent or have to be adapted. They have been adjusted and refined within the performed study, so with advancements of experiences and technology, it is natural that they will continue to evolve.
- ‘Consolidation of creation terminology.’ Not only is there contradictory terminology between disciplines, but also between IDS systems. Current tools and approaches are inconsistent in the way they offer structuring of interactive storyworlds. Often, they inherit their vocabulary from the technological base instead of from storytelling domains, for example, such as having to describe ‘actions’ as *“operators”* in a planning domain. The conceptual models proposed herein are meant to be independent of the different tools. For example, it was possible to conceptualise with a paper prototype what was later implemented in Scenejo in a different (incompatible) way. However, it can be seen as an advantage – especially for education of authors – if vocabulary and ontologies for creation get reconciled. Respectively, in the 3D animation industry, an adaptation process has led to systems with similar concepts. On the other hand, it may be that in IDS, systems will be more complex, differ more substantially and their vocabulary would ‘need’ to be different. These issues need further research, which will probably lead to several IDS genres.
- ‘Creative principles for interactive storytelling.’ This work has laid the ground for further development and enunciation of creative principles for

IDS, which are to be considered valid at a general level and independent of tools or systems to use. In Chapter 4, the reported creative principles of several storytelling disciplines rely on a substantial body of referenced work, finished artefacts that can be experienced and their creation process compared. For IDS, it may be too early to phrase definitive principles, and it may lead to first principles that are less motivated by artistic effects, but by technical production affordances of 'getting it done' (a similar effect as in video game writing). This is also a long-term process. Nevertheless, based on this research, first suggestions for creative principles are made below.

7.3.1 Creative Principles for Interactive Storytelling

This section summarises preliminary suggestions for genuine creative principles in IDS. They have not only been informed by the research described in this thesis, but find some parallel conclusions in the research of others, which suggests to see them as general issues. The evaluation of these creative principles is currently continued in the ongoing IRIS project[54].

Abstraction

Not only in this thesis, also in other works, for example by Szilas and Rety (2004) and Crawford (2004), 'abstraction' is explicitly mentioned as a necessary creative step. This is especially true for all generative methods, such as planning, emergent narrative and programmed storyworlds, but it has been shown that also for simple worlds, abstraction increases interactivity and variability.

Conditional Events and Acting Situations

Thinking in terms of the conditions for events is a prerequisite for interactive storytelling. On the one hand, it means creating interesting affordances as situations for the user to act, on the other hand, it makes behaviour of virtual characters situation-dependent.

Including the User from the Start of Modelling

Storyworld modelling has to include a role (or possible roles) of the 'user' ('player', 'performer', 'participant' etc.) from the start. Creating a model starting from a given

[54] To be published online as repository on authoring: http://iris.interactive-storytelling.de

story without a user role and objective makes it difficult to insert the user afterwards. The model needs to be balanced during iterations of redesign, taking into account all possible actions, and all possible states of characters including the ‘player-character’. In IDS, ‘story’ can be seen as a high-handed goal of a simulation. This story simulation model and user/player objectives have to be reconciled.

Externalising the Internal

This creative principle from screenwriting holds true for IDS as well, which has been experienced more when it was missing than when it has been done well. If inner thoughts of characters are important for the ‘gist’ of the story (for example a plan), then designers have to find ways to reveal details of that plan, or inner states of characters, to engage the audience (the participating user). This affords complex representation, one of the major research challenges if done automatically. Beyond mere representation, it also has to do with creating extra events that express the ‘internal’.

Interaction Design

The complementary principle to ‘Externalising the Internal’ is important for the experience of agency. It is essential to design action conditions for users (affordances) in a way that they are easily grasped, and give users immediate feedback on their actions. It is important to consider that in agent-based and story-based interactions, the results of one’s action are potentially delayed. This does not mean that immediate feedback is obsolete; it rather means that this feedback may include techniques of foreshadowing or flashback. The conception of a complete interactive storyworld includes the interaction design.

Debugging as Authoring (Iterating)

Proposed by several scholars in computer science (Pizzi and Cavazza, 2008; Swartjes and Theune, 2009) and confirmed by the experiences of this research, ‘debugging’ in the context of IDS creation is more than repairing software. It refers to the constant necessity to iterate changes in the model and test the result, due to the unlikeliness of guessing optimised rules before running a test. Swartjes referred to it as *“co-creation”*, in the sense that a ‘bug’ may turn out as a ‘feature’, contributing an unexpected idea to the storyworld. This principle also points to necessary tools to inspect the outcome without having to experience it over and over, which is a production issue.

8 List of Appendices

A List of Own Publications

B Literature Review on Authoring Tools

C Case Study

1. Responsibilities in Artefact Building
2. AIML Concepts in Scenejo
3. Initial Draft Killer Phrases Best Case / Worst Case (German)
4. Argument Collection Pro/Con (German)
5. Dialogue Spread Sheet In/Out (English Version)
6. Selection of Scenejo Authoring Screens
7. Killer Phrase Game, Testplay Good/Bad Ending
8. Questionnaire (Translated from German Original)
9. Questionnaire Results (Partially Translated from German Original)
10. Killer Phrase Game, Redesign Structure

D Further Authoring Studies with IDS Systems

1. Seminar Report: Authoring Studies with IDS Systems
2. Paper: Authoring Issues Beyond Tools (ICIDS 2009)
3. Paper: Exploring Narrative Interpretation and Adaptation for Interactive Story Creation (ICIDS 2010)

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Weiß, S.A., Berger, F., Marbach, A., Müller, W. (2009). CharanisML: a Flexible Virtual Actor Control Interface. In: Chang et al. (eds): Learning by Playing. Game-based Education System Design and Development, Proc. Edutainment 2009. LNCS, vol. 5670, Springer-Verlag Heidelberg, pp. 120-132.

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Yee, N. (2005). Motivations of Play in MMORPGs: Results from a Factor Analytic Approach. Proceedings of the DiGRA Conference 2005, Vancouver.

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Young, R. M. (1999) Notes on the use of plan structures in the creation of interactive plot. In Proc. AAAI Fall Symposium on Narrative Intelligence, AAAI Technical Report FS-99-01, AAAI (www.aaai.org).

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List of Appendices

App. #

A LIST OF OWN PUBLICATIONS

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3. (Spierling and Szilas, 2009)
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22. (Spierling and Iurgel, 2006)
Spierling, U., Iurgel, I. (2006). Pre-conference Demo Workshop “Little Red Cap”: The Authoring Process in Interactive Storytelling. In: Technologies for Interactive Digital Storytelling and Entertainment (TIDSE 2006), Darmstadt, Germany.

Online workshop publications, contributions to online repositories

23. IRIS project online repository on ‘Interactive Story Creation’. Result presentations of the work package ‘Authoring Tools and Creation Methods’.
http://iris.interactive-storytelling.de/

24. ICIDS 2010 Tutorial: Introduction to Interactive Story Creation. Announcements web pages for ‘Authoring Activities in Interactive Digital Storytelling’.
Contributions: Main editor and organiser.
http://edu.interactive-storytelling.de/tutorial.html

25. Little Red Riding Hood Workshop: The Authoring Process in Interactive Storytelling. Group Blog. Contributions: Main editor and organiser, pages for authoring tool “Scenejo”.
http://redcap.interactive-storytelling.de/

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B LITERATURE REVIEW ON AUTHORING TOOLS

Research Publications on Authoring: Authoring Tool Descriptions

The majority of research publications in the realm of authoring cover ‘solution presentations’ of designed systems with their authoring tools or authoring interfaces. This list is divided into categories made according to the degree of which authoring tools are available with an Interactive Storytelling system:

1. Complete IS systems with integrated or connected authoring tools or environments
2. IS systems without an authoring tool, but authorial access to the story content
3. Authoring tools without an associated story engine

1. IS Systems with Authoring Tools

BEcool

- Szilas, N. (2007). BEcool: Towards an Author Friendly Behaviour Engine. In International Conference on Virtual Storytelling (Saint-Malo, France). LNCS, vol. 4871, Springer, Berlin / Heidelberg, pp. 102–113.
- ***Authoring Possibilities / Editors:***
  Graph for animations (nodes are animations, arcs are transitions).

EmoEmma (Bovary Authoring Tool)

- Pizzi, D., Cavazza, M. (2008). From Debugging to Authoring: Adapting Productivity Tools to Narrative Content Description. In ICIDS (Erfurt, Germany). LNCS, vol. 5334, Springer, Berlin / Heidelberg, pp. 285–296.
- ***Authoring Possibilities / Editors:***
  Planning domain (GUI for textual input of propositions, operators, states and goals); tree-based visualisation.

Emohawk

- Brom, C., Bída, M., Gemrot, J., Kadlec, R., Poch, T. (2009). Emohawk: Searching for a "Good" Emergent Narrative. In ICIDS (Guimarães, Portugal). LNCS, vol. 5915, Springer, Berlin / Heidelberg, pp. 86–91.
- ***Authoring Possibilities / Editors:***
  Branching graphs for story; 3D editor for world (objects).

GEIST (Keating)

- Schneider, O., Braun, N. and Habiger, G. (2003). Storylining Suspense: An Authoring Environment for Structuring Non-Linear Interactive Narratives. In WSCG 2003: The 11th International Conference in Central Europe on Computer Graphics, Visualization and Computer Vision'2003, February 3-7, 2003 (Plzen, Czech Republic). UNION Agency - Science Press.
- ***Authoring Possibilities / Editors:***
  Media (picture, audio, text files); ideas and notes for story concept (GUI simple text); story scenes (GUI for text); different visualisations are available (tables, graphs).

INSCAPE

- Balet, O. (2007). INSCAPE: An Authoring Platform for Interactive Storytelling. In International Conference on Virtual Storytelling (Saint-Malo, France). LNCS, vol. 4871, Springer, Berlin / Heidelberg, pp. 176–177.
- Dade-Robertson, M. (2007). Visual Scenario Representation in the Context of a Tool for Interactive Storytelling. In International Conference on Virtual Storytelling (Saint-Malo, France). LNCS, vol. 4871, Springer, Berlin / Heidelberg, pp. 3–12.
- ***Authoring Possibilities / Editors:***
  Story units (stages, situation that contain objects); objects (properties), can have actions, events (scripting language; can have several tasks); storyboard (text, sketches, pictures, camera views); 2D- and 3D editors (to create stages, place objects); story flow by policies (strategies with conditions and actions).

NM2 (NSL Authoring Tool)

- Ursu, M.F., Cook, J.J., Zsombori, V., Kegel, I. (2007). A Genre-Independent Approach to Producing Interactive Screen Media Narratives. In Intelligent Narrative Technologies, Papers from the 2007 AAAI Fall Symposium. AAAI Technical Report, FS-07-05, AAAI Press, Menlo Park, California, pp. 174–180.
- ***Authoring Possibilities / Editors:***
  Tagging of different media (automatic or manual); graphs for story structure (based on Narrative Structure Language).

PaSSAGE

- Thue, D., Bulitko, V., Spetch, M. (2008). Making Stories Player-Specific: Delayed Authoring in Interactive Storytelling. In ICIDS (Erfurt, Germany). LNCS, vol. 5334, Springer, Berlin / Heidelberg, pp. 230–241.
- Thue, D., Bulitko, V., Spetch, M., Wasylishen, E. (2007). Learning Player Preferences to Inform Delayed Authoring. In Intelligent Narrative Technologies, Papers from the 2007 AAAI Fall Symposium. AAAI Technical Report, FS-07-05, AAAI Press, Menlo Park, California, pp. 159–162.
- ***Authoring Possibilities / Editors:***
  Editors for configuring player preferences.

PRISM

- Cheong, Y.-G., Kim, Y.-J., Min, W.-H., Shim, E.-S., Kim, J.-Y. (2008). PRISM: A Framework for Authoring Interactive Narratives. In ICIDS (Erfurt, Germany). LNCS, vol. 5334, Springer, Berlin / Heidelberg, pp. 297–308.
- ***Authoring Possibilities / Editors:***
  Story structure (by graphs, with situations, beats, scenes); 3D editor for stages and objects.

RENNAISSANCE

- Zancanaro, M., Cappelletti, A., Signorini, C., Strapparava, C. 2001. An Authoring Tool for Intelligent Educational Games. In International Conference on Virtual Storytelling (Avignon, France). LNCS, vol. 2197, Springer, Berlin / Heidelberg, pp. 61–68.
- ***Authoring Possibilities / Editors:***
  Graphical knowledge base editor (frame hierarchies, frames, slots, rules); knowledge base shell.

Scenejo

- Spierling, U., Weiß, S.A., Müller, W. (2006). Towards Accessible Authoring Tools for Interactive Storytelling. In TIDSE (Darmstadt, Germany). LNCS, vol. 4326, Springer, Berlin / Heidelberg, pp. 169–180.
- ***Authoring Possibilities / Editors:***
  Transition graphs for dialogue structure; dialogue editor (utterances, pre-conditions, effects).

SCHEHERAZADE

- Elson, D.K., McKeown, K.R. (2007). A Platform for Symbolically Encoding Human Narratives. In Intelligent Narrative Technologies, Papers from the 2007 AAAI Fall Symposium. AAAI Technical Report, FS-07-05, AAAI Press, Menlo Park, California, pp. 29–36.
- ***Authoring Possibilities / Editors:***
  Story graph (as timeline with states and transitions); characters, props, locations, actions and conditions (in natural language).

Scribe

- Medler, B., Magerko, B. (2006). Scribe: A Tool for Authoring Event Driven Interactive Drama. In TIDSE (Darmstadt, Germany). LNCS, vol. 4326, Springer, Berlin / Heidelberg, pp. 139–150.
- ***Authoring Possibilities / Editors:***
  2,5D editor for maps and objects; graph editor for story.

ScriptEase

- McNaughton, M., Cutumisu, M., Szafron, D., Schaeffer, J., Redford, D. (2004). ScriptEase: Generative Design Patterns for Computer Role-Playing Games. In ASE '04 (Linz, Austria). IEEE Computer Society, Los Alamitos, CA, pp. 88–99.
- Cutumisu, M., Onuczko, C., McNaughton, M., Roy, T., Schaeffer, J., Schumacher, A., Siegel, J., Szafron, D., Waugh, K., Carbonaro, M., Duff, H., Gillis, S. (2007). ScriptEase: A Generative/Adaptive Programming Paradigm for Game Scripting. Science of Computer Programming 67(1), pp. 32–58.
- ***Authoring Possibilities / Editors:***
  Encounters, behaviours, dialogues and quests (as scripts in a tree-based interface).

StoryTec

- Göbel, S., Salvatore, L., Konrad, R.A., Mehm, F. (2008). StoryTec: A Digital Storytelling Platform for the Authoring and Experiencing of Interactive and Non-linear Stories. In ICIDS (Erfurt, Germany). LNCS, vol. 5334, Springer, Berlin / Heidelberg, pp. 325–328.
- ***Authoring Possibilities / Editors:***
  Story editor (scenes, complex scenes – graph), stages (stages, props – by interface to off-the-shelf software), action sets (story logic, actions, conditions within a scene – graph based on UML Activity Diagram), assets (cameras, lights, props, etc. for the stages – file manager).

Textable Movie

- Vaucelle, C., Davenport, G. (2004). A System to Compose Movies for Cross-Cultural Storytelling: Textable Movie. In TIDSE (Darmstadt, Germany). LNCS, vol. 3105, Springer, Berlin / Heidelberg, pp. 126–131. ***Authoring Possibilities / Editors:***
  Tag editor for movie clips.

Thespian

- Si, M., Marsella, S.C., Riedl, M.O. (2008). Interactive Drama Authoring with Plot and Character: An Intelligent System that Fosters Creativity. In Creative Intelligent Systems. AAAI Technical Report, SS-08-03, AAAI Press, Menlo Park, California, pp. 75–81.
- ***Authoring Possibilities / Editors:***
  Configuration editors for plans and characters (goals, beliefs, policies, relationships).

VR Authoring Tool and VR Tuner

- Wages, R., Grützmacher, B., Conrad, S. (2004). Learning from the Movie Industry: Adapting Production Processes for Storytelling in VR. In TIDSE (Darmstadt, Germany). LNCS, vol. 3105, Springer, Berlin / Heidelberg, pp. 119–125.
- ***Authoring Possibilities / Editors:***
  Parallel hierarchical graph structures (one graph for story, multiple parallel graphs for objects); event scripts.

Wide Ruled / Wide Ruled 2

- Skorupski, J., Jayapalan, L., Marquez, S., Mateas, M. (2007). Wide Ruled: A Friendly Interface to Author-Goal Based Story Generation. In International Conference on Virtual Storytelling (Saint-Malo, France). LNCS, vol. 4871, Springer, Berlin / Heidelberg, pp. 26–37.
- Skorupski, J., Mateas, M. (2009). Lessons Learned from the Wide Ruled Authoring Tool. In Proceedings of DAC09 (University of California Irvine). eScholarship, California Digital Library.
- ***Authoring Possibilities / Editors:***
  Text-based editors for objects (characters & environments – with traits and relationships), story objects (plot points), author goals (plot fragments, parameters).

WordsAnime

- Sumi, K. (2009). Interactive Storytelling System Using Recycle-Based Story Knowledge. In ICIDS (Guimarães, Portugal). LNCS, vol. 5915, Springer, Berlin / Heidelberg, pp. 74–85.
- ***Authoring Possibilities / Editors:***
  Rules (by simple scripts).

2. IS Systems without Authoring Tools, but Author Accessibility to Content

IDtension

- Szilas, N., Marty, O., Réty, J.-H. (2003). Authoring Highly Generative Interactive Drama. In International Conference on Virtual Storytelling (Toulouse, France). LNCS, vol. 2897, Springer, Berlin / Heidelberg, pp. 37–46.
- ***Authoring Possibilities / Editors:***
  XML files for configurations and descriptions for characters, objects, values, goals, obstacles, tasks.

FearNot!

- Sobral, D., Machado, I., Paiva, A. (2003). Managing Authorship in Plot Conduction. In International Conference on Virtual Storytelling (Toulouse, France). LNCS, vol. 2897, Springer, Berlin / Heidelberg, pp. 57–64.

- Kriegel, M., Aylett, R., Dias, J., Paiva, A. (2007). An Authoring Tool for an Emergent Narrative Storytelling System. In Intelligent Narrative Technologies, Papers from the 2007 AAAI Fall Symposium. AAAI Technical Report, FS-07-05, AAAI Press, Menlo Park, California, pp. 55–62.
- ***Authoring Possibilities / Editors:***
  XML files for configuration of agents through goals (by states) and actions (by pre-conditions and effects), appraisal rules (emotional reactions); action tendencies.

3. Authoring Tools without associated Story Engines

AESOP

- Silverman, B.G., Johns, M., Weaver, R., Mosley, J. (2003). Authoring Edutainment Stories for Online Players (AESOP): Introducing Gameplay into Interactive Dramas. In International Conference on Virtual Storytelling (Toulouse, France). LNCS, vol. 2897, Springer, Berlin / Heidelberg, pp. 65–73.
- ***Authoring Possibilities / Editors:***
  Plot and dialogue editing (graph, markup language), storyworld templates, pallets of reusable parts, digital cast members, autonomous behaviour modules, art/animation assets.

Bowman

- Thomas, J.M., Young, M.R. (2006). Author in the Loop: Using Mixed-Initiative Planning to Improve Interactive Narrative. In AI Planning for Synthetic Characters and Computer Games, ICAPS 2006 Workshop, June 7, 2006 (Ambleside, English Lake District, UK). Heriot-Watt University, Edinburgh, Scotland, Paper 3.
- Thomas, J.M. (2006). Collaborative authoring of plan-based interactive narrative. In ICAPS (Cumbria, UK). Planning and Learning Group, Universidad Carlos III de Madrid, Madrid, Spain, pp. 127–130.
- ***Authoring Possibilities / Editors:***
  Plan graph editor.

DraMachina

- Donikian, S., Portugal, J.-N. (2004). Writing Interactive Fiction Scenarii with DraMachina. In TIDSE (Darmstadt, Germany). LNCS, vol. 3105, Springer, Berlin / Heidelberg, pp. 101–112.
- ***Authoring Possibilities / Editors:***
  Graphical text editor for protostory, actors (personality, behaviour, traits), objects, areas, dramatic actions, protodialog, dialog (graph)

U-CREATE

- Sauer, S., Osswald, K., Wielemans, X., Stifter, M. (2006). U-Create: Creative Authoring Tools for Edutainment Applications. In TIDSE (Darmstadt, Germany). LNCS, vol. 4326, Springer, Berlin / Heidelberg, pp. 163–168.
- ***Authoring Possibilities / Editors:***
  Hierarchical stage graph, scene editor, action editor (transition conditions), 2D & 3D editor; input editor (for external devices)

C CASE STUDY

RESPONSIBILITIES IN ARTEFACT BUILDING

Unless otherwise noted and referenced, has all work reported herein carried out by Ulrike Spierling.

Scenejo and the Killer Phrase Game

The development of ‘Scenejo’ and the ‘Killer Phrase Game’ has been performed in team work. The system is currently in a redesign phase. Responsibilities are distributed as follows:

Scenejo Runtime Engine

- Initial concept (2004): Sebastian Weiß, Wolfgang Müller, Ulrike Spierling
- Programming: Sebastian Weiß
- Redesigned architecture and programming (2009): Sebastian Weiß

Scenejo Authoring Tool

- Concept (2006): Ulrike Spierling, Florian Steimle
- Programming (2006): Florian Steimle, Sebastian Weiß
- Redesigned concept (2009-10): Ulrike Spierling, Steve Hoffmann, Sebastian Weiß
- Programming (2010): Steve Hoffmann, Christoph Knauf, Marcel Wildt.

Killer Phrase Game

- Concept (2006-2008): Ulrike Spierling, input by Rebecca Eizenhöfer
- Implementation with authoring tools (2006): Ulrike Spierling
- Programming (2006): Dennis Linke, Sebastian Weiß
- Redesigned concept and prototypes (2009-10): Ulrike Spierling

AIML CONCEPTS IN SCENEJO

Scenejo and AIML (Artificial Intelligence Markup Language)

AIML is an XML-compliant language allowing the definition of bot answers to anticipated word patterns as a human user's input. According to its inventor and many real life exercises with students, it *is* easy to learn, at least at its basic concepts, which allow getting a quick start and creating first dialogic exchanges within a short time. This high accessibility was another reason to use it in *Scenejo*.

The most important 'tags' of AIML are:

- **<category>** marks a "unit of knowledge" in a bot's knowledge base
- **<pattern>** contains a simple pattern that matches what a user may type
- **<template>** contains the response to a user input

AN AIML category contains one pattern (the anticipated input) and a template (the output). A template can contain a simple utterance, or complex constructs defined by other AIML tags. A complete account of AIML tags and their functions can be obtained from the inventor's Online database (http://www.alicebot.org/aiml.html). Apart from their use by authors as specified there, several tags of AIML have been used internally by the first Scenejo authoring system to restructure dialogue, without letting users of the tools be aware of it:

- **<srai>** used by Scenejo to redirect an input pattern (or several patterns) to another internal pattern, represented as an 'abstract act'. Abstraction of dialogue acts is a central concept of the proposed authoring principle of an 'SRE' (stimulus-response-element).
- **<topic>** used by Scenejo to narrow the context to a given turn (SRE) in the dialogue, enabling direct answers. In the graph visualisation, this can be represented as a direct link of subsequent utterances of one bot in the transition network.
- **<condition>** used by Scenejo to implement the test of pre-conditions on predicates
- **<set>** used by Scenejo to implement post-conditional effects on predicates**,** such as <set name="predicate">VALUE</set>
- **<random>** used by Scenejo in the same way as in AIML, within a <template>, to provide several ways of phrasing concrete

utterances for a single abstract act on the output side, also as a part of the SRE-concept.

AIML 'predicates' are freely-definable attributes that usually can be 'declared' at any point in an AIML object and whose value can be manipulated by the AIML object within <template> elements. With the Scenejo extension 'SCAIML', the concept has been extended to include arithmetic calculations on these predicates, introducing the possibility of including counters. AIML was originally developed for single chatbots, having one conversation with a human user. It is important for authors to consider that this concept has been maintained in Scenejo and is the base for the character-centred approach. Predicates belong to one actor only. However, 'global' predicates can be declared by a special prefix, and Scenejo passes these values through to the single bots. In the process of restructuring new versions of Scenejo, its dependency on AIML tags has been given up gradually, without changing the basic principles.

AIML Pattern Expressions Syntax

An AIML pattern is the 'stimulus' or 'input' part of an AIML category. In original AIML, it can only occur once within a <category> tag. Scenejo has extended its use to also occur within the novel constructs of abstract acts. However, AIML <pattern> elements still require a restricted syntax as an expression of mixed character data and optional restricted element content that is called an 'AIML Pattern Expression'. This expression is a formal description that consists of

- Words of natural language in UPPER CASE,
- the symbol * which matches any sequence of one or more words,
- the symbol _ which is the same as * except that the latter comes after Z in lexicographic order.

AIML patterns must not contain punctuation marks or special characters, such as German Umlauts (ä, ö, ü, ß), or apostrophes and quote signs. The Scenejo editors constrict the input of mistakes at this point, but still the 'design' of a pattern requires a basic knowledge of the syntax and the search priorities of the bot. The wildcards * and _ are treated differently according to their place in the alphabet. There is further a lookup table to replace special characters, for example, "ä" is replaced with "ae", or "I'm" is replaced by "I am".

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KILLERPHRASENSPIEL, Entwurf Beispielkonversation

(Text: Rebecca Eizenhöfer)

Situationsbeschreibung:

Der Flughafen der Stadt Erfurt soll erweitert werden. Die Bewohner im Umfeld des Flughafens sind aufgebracht. Schon jetzt fühlen sie sich durch Lärm und Verkehr sehr belästigt. Heute findet eine Bürgerversammlung statt, auf der Sie als Moderator durch die Veranstaltung führen sollen.

Übungsinhalt: Die Übung zielt darauf ab, Killerphrasen zu erkennen und durch eine gekonnte Reaktion, die Gesprächsbereitschaft Ihrer beiden Gesprächspartner (wieder-)herzustellen.

Teilnehmer:

Bot 1 (Frau PRO) – Sprecherin der Flughafen AG

Bot 2 (Herr KONTRA) – Anwohner

Sie selbst als Moderator (User)

BEST CASE SCENARIO

USER: Guten Tag zusammen, ich freue mich sehr, Sie zur heutigen Veranstaltung zu begrüßen. Mein Name ist XXX und ich führe Sie heute als Moderator durch die Diskussion. Das Thema des heutigen Zusammentreffens sind die Ausbaupläne zum Flughafen. Das Ziel der heutigen Veranstaltung ist es, die Meinungen und Anregungen der Bürgerinnen und Bürger aufzunehmen. Zunächst einmal möchte ich Sie bitten, sich kurz vorzustellen und ihr Anliegen in einem Satz vorzutragen.

FRAU PRO: Guten Tag, mein Name ist Frau PRO. Ich bin Sprecherin der Flughafen AG. Unser Anliegen ist es, den Ausbau des Flughafens schnellstmöglich voranzutreiben.

HERR KONTRA: Guten Tag, mein Name ist Herr KONTRA. Ich bin Anwohner des Flughafens. Ich möchte meine Bedenken und Anregungen zu den Ausbauplänen äußern denn es ist mir wichtig, dass ein Flughafenausbau nur dann stattfindet, wenn auch unsere Belange ausreichend berücksichtigt werden.

USER: Vielen Dank, ich möchte direkt auf die Anliegen der Anwohner eingehen. Herr KONTRA, könnten Sie bitte Ihre Bedenken vortragen?

HERR KONTRA: Mit dem Flughafenausbau ist verbunden, dass der Flugverkehr stark zunimmt. Sowohl für den Güter- als auch für den Personenverkehr sind ja enorme Steigerungen angekündigt worden. Das mag ja wirtschaftlich alles sehr schön sein, aber für uns Anwohner ist das doch nicht zumutbar! Schon jetzt ist die Situation um den Flughafen eine einzige Zumutung. Die Fluggäste und auch Angestellten parken kreuz und quer in unseren Wohngebieten. Ja, kommen Sie mal nachmittags nach Hause, Sie finden dann kaum einen Parkplatz.

FRAU PRO (Zwischenruf): … aber das lässt sich doch regeln…!

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HERR KONTRA: ….und damit ist ja erst der ruhende Verkehr angesprochen, die parkenden Autos müssen da ja auch hin und wieder weg bewegt werden. Was glauben Sie, was für ein Verkehr bei uns in der Straße ist. Wir wohnen ja nun in einer Spielstraße, aber spielen können unsere Kinder nicht auf der Straße, da ist viel zu viel los und zu schnell wird auch gefahren. Das ist doch ein Risiko! Aber dafür hat sich ja noch niemand interessiert! Vom Lärm ganz zu schweigen. Jetzt sind es ja nur die Personenflüge, aber zukünftig die Güterflüge, da entsteht doch erst richtig Lärm wenn die schweren Dinger da runterkommen. Das ist doch nicht zumutbar!

FRAU PRO: Ich möchte da erstmal klarstellen: dass in Ihrer Spielstraße keine Schrittgeschwindigkeit gefahren wird, hat ja mit dem Flughafenausbau nichts zu tun, das ist ja wohl ein Phänomen, das Sie überall beobachten können, Flughafen hin oder her. Und denken Sie doch einmal an die vielen neuen Arbeitsplätze, die mit dem Ausbau entstehen.

HERR KONTRA: Nun kommen Sie mir doch nicht so! Die Autos kommen doch erst wegen dem Flughafen! Na Euch ist das egal, ihr wohnt ja schön im Grünen draußen, wo man keine Flieger hören und sehen muss.

USER: Herr KONTRA, bitte bleiben Sie doch sachlich.

FRAU PRO: Aber so kommen wir doch zu keiner Lösung, lassen Sie uns doch gemeinsam ein Konzept erarbeiten, wir wollen Ihnen ja nichts Böses.

HERR KONTRA: Ja das mussten Sie ja jetzt wohl sagen! Profit, Profit, erst machen Sie hier Versprechungen, die halten Sie ja dann eh wieder nicht, das kennen wir doch schon zu genüge!

USER: Frau PRO hat den Vorschlag gemacht, die Bedenken der Anwohner aufzugreifen, was meinen Sie Herr KONTRA – Sehen Sie Möglichkeiten, dass Ihre Bedenken durch geeignete Maßnahmen abgebaut werden können?

HERR KONTRA: Naja, wir können ja mal die einzelnen Punkte diskutieren, aber ich möchte dabei schon ernst genommen werden!

USER: Ja, das ist doch ein schöner Anfang. Ich würde vorschlagen, wir sammeln die Bedenken der Anwohner zunächst einmal auf Moderationskarten. Bitte schreiben sie doch Ihre Bedenken auf die Karten, jeweils ein Karte für einen Aspekt.

USER: Herr KONTRA, würden Sie bitte beginnen und ihre Bedenken vortragen und die Kärtchen an die Wand pinnen?

HERR KONTRA: Ja gerne, also ich sehe ein großes Problem bei der Parkplatzsituation, …….

USER: Frau PRO, erläutern Sie doch bitte einmal, was die Flughafen AG bisher an Bedenken aufgegriffen hat, welche Aspekte also bereits in der Planung berücksichtigt wurden.

FRAU PRO: Ja, also was die Parkplätze angeht, da haben wir ein Parkhaus geplant. Damit das Zuparken der Wohngebiete eingedämmt wird, haben wir vorgesehen, sehr niedrige Parkgebühren zu erheben, dann nutzen die Fluggäste das Parkhaus nämlich auch.

HERR KONTRA: Das klingt doch nach einem guten Konzept. Ich freue mich, dass endlich an die Anwohner gedacht wurde.

USER: Meine Damen und Herren, ich möchte mich bei Ihnen für die konstruktive Diskussion bedanken. Das Ziel des heutigen Zusammentreffens war es, die Bedenken der Anwohner zusammenzutragen und eine Diskussionsbasis herzustellen. Wir haben bereits heute eine ganze Reihe von Bedenken offen diskutieren können. Leider sind wir in der Zeit bereits soweit fortgeschritten, dass wir die restlichen an der Stellwand aufgeführten Belange bei unserem nächsten Zusammentreffen aufgreifen werden. Ich wünsche Ihnen bis dahin eine gute Zeit und verabschiede mich.

WORST CASE SCENARIO

USER: Guten Tag zusammen, ich freue mich sehr, Sie zur heutigen Veranstaltung begrüßen zu dürfen. Mein Name ist XXX und ich führe Sie heute als Moderator durch die Diskussion. Das Thema des heutigen Zusammentreffens sind die Ausbaupläne zum Flughafen. Das Ziel der heutigen Veranstaltung ist es, die Meinungen und Anregungen der Bürgerinnen und Bürger aufzunehmen. Zunächst einmal möchte ich Sie bitten, sich kurz vorzustellen und ihr Anliegen in einem Satz vorzutragen.

FRAU PRO: Guten Tag, mein Name ist Frau PRO. Ich bin Sprecherin der Flughafen AG. Unser Anliegen ist es, den Ausbau des Flughafens schnellstmöglich voranzutreiben.

HERR KONTRA: Guten Tag, mein Name ist Herr KONTRA. Ich bin Anwohner des Flughafens. Ich möchte meine Bedenken und Anregungen zu den Ausbauplänen äußern denn es ist mir wichtig, dass ein Flughafenausbau nur dann stattfindet, wenn auch unsere Belange ausreichend berücksichtigt werden.

USER: Vielen Dank für die kurze Vorstellung. Frau PRO, das ist ja wirklich ein tolles Projekt, das Sie da vorhaben. Nun müssen wir uns aber mal um die Bedenken der Anwohner kümmern. Herr KONTRA, wo sehen Sie Schwierigkeiten beim Flughafenausbau?

HERR KONTRA: Den Flughafen als tolles Projekt zu bezeichnen finde ich schon gewagt. Es sind doch noch jede Menge Fragen offen, die erst einmal geklärt sein sollten, bevor es hier um eine konkrete Umsetzung geht. Das betrifft Aspekte des Lärmschutzes, der Parkplatzsituation und schließlich darf ja auch die Natur und der Naturhaushalt nicht vergessen werden!

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FRAU PRO: Wir haben sehr viele Aspekte bereits bedacht und natürlich ist beim Flughafenausbau mit einer Beeinträchtigung der Anwohner zu rechnen, da will ich auch gar nichts schön reden. Aber Sie müssen doch auch einmal betrachten, was der Flughafenausbau für die Stadt bedeutet, das fängt beim Image an und endet bei einer Vielzahl neuer Arbeitsplätze die direkt und indirekt mit dem Ausbau zusammenhängen. Sehen Sie doch einmal die vielen Vorteile! Aber um die alle auszuführen fehlt uns die Zeit.

HERR KONTRA: Na das sagen Sie ja immer alle…. „die vielen Vorteile“! Aber die Folgen, deshalb sind wir doch heute hier! Aber das hat ja noch nie geklappt, dass die Anwohner mal Ernst genommen wurden, das läuft doch hier wieder in genau derselben Weise ab wie immer!

FRAU PRO: Was erwarten Sie denn? Eingriff ohne Folgen – Sie leben ja in einer Traumwelt! Wie doch jeder weiß muss man bei jeder Planung und Veränderung mit Folgen rechnen. Kommen Sie doch mal in die Realität zurück!

USER: Frau PRO, mäßigen Sie sich! Herr KONTRA, versuchen Sie doch auch einmal die Position der Flughafen AG zu verstehen.

HERR KONTRA: Verstehen, verstehen! So langsam versteh ich hier gar nichts mehr. Auf wessen Seite stehen Sie eigentlich? Solche Veranstaltungen haben doch noch nie was gebracht!

USER: Ich stehe auf gar keiner Seite. Als Moderator habe ich die Rolle, neutral im Gespräch zu vermitteln.

FRAU PRO: Haben Sie dafür überhaupt eine Ausbildung? Sie scheinen mir nicht sonderlich qualifiziert dafür zu sein und außerdem – von hier sind Sie ja wohl nicht, wie wollen Sie denn da die Situation der Anwohner beurteilen können?

USER: Herr KONTRA, das muss ich mir ja wohl nicht anhören. Ich habe das Gefühl, die Anwohner sind gar nicht bereit dazu, ein konstruktives Gespräch zu führen und einen Konsens zu finden.

HERR KONTRA: Unter diesen Umständen nicht! Machen Sie Ihre Planungen doch alleine, ich stimme einem Ausbau niemals zu! Das Bürgerbegehren ist schon in Gang gesetzt, wir werden den Flughafenausbau schon zu verhindern wissen. Sie werden schon sehen, was Sie davon haben. Ich gehe!

PRO	KONTRA
Arbeitsplätze • Neue Arbeitsplätze direkt und indirekt mit dem Ausbau • Ansiedelung neuer Branchen (z.B. Logistik, Zuliefererfirmen) und damit Schaffung neuer Arbeitsplätze und Steigerung der Attraktivität als Wirtschaftsstandort	Arbeitsplätze • Neue Arbeitsplätze direkt und indirekt mit dem Ausbau • Ansiedelung neuer Branchen, gerade Logistik, auch mit guter Straßenverkehrsinfrastruktur verbunden => schnelle Fertigstellung der Autobahn A 73 Suhl-Bamberg von großer Bedeutung, um Ansiedelung für Logistikunternehmen wirklich attraktiv zu gestalten • Ansiedelung von Unternehmen ist auch stark von Flächenpolitik der Stadt abhängig -> gibt es überhaupt noch attraktive Gewerbeflächen?
Bedeutung für die Stadt • Image • Attraktiver Standort für Tagungen • Attraktiver Standort für Tourismus • Wichtiger Aspekt zur verkehrlichen Anbindung • Hebt Bedeutung der Stadt als Messestandort • Erhöhung der Standortgunst • Positiv für wirtschaftliche Gesamtentwicklung	Bedeutung für die Stadt • Image • Erfurt als Knotenpunkt und Tagungsort: ICE-Anbindung nach Nürnberg viel bedeutender als Ausbau des Flughafens • Stärkung des Tourismusstandort: bisher nicht DIE tragende Rolle im internationalen Tourismus, daran ändert Flughafenausbau nichts, nationaler Tourismus wird nicht durch Ausbau gestärkt Der Flugverkehr nimmt stark zu • Personenflüge und Güterflüge
Parkplatzsituation • Parkhaus geplant mit günstigen Gebühren • Veränderte Verkehrsführung hält Verkehr aus Wohngebieten raus -> direkte Leitung zum Flughafen • Gute Anbindung an den öffentlichen Verkehr bietet Alternative zum Auto -> Zusammenarbeit mit Verkehrsbetrieben vorgesehen für attraktives „Flughafenticket"	Parkplatz-Situation um den Flughafen • Kinder nicht in Spielstraße spielen, zu viel Verkehr • Sie finden keinen Parkplatz • Reisende mit viel Gepäck nutzen lieber Pkw statt ÖPNV, gerade wenn die Parkgebühren günstig sind
Lärm • Lärmschutzfenster • Eingeschränkte Flugzeiten für den Güterverkehr • Nachtflugverbot • Ausbau ermöglicht den Einsatz von größeren Flugzeugen mit moderner Technik, welche leiser sind als die bisher eingesetzten	Lärm-Situation • Schwere Güterflugzeuge • Unerträglich • Wohnen in der Einflugschneise • Größerer Flughafen führt zur mehr Pkw- und Güterverkehr
Natur • Eingriff wird gemäß den gesetzlichen Regelungen ausgeglichen • Keine derart großen baulichen Maßnahmen mit Versiegelung vorgesehen, dass von Verdrängung der Tier-/Pflanzenarten die Rede sein kann. • Naturschutzrechtliche Belange werden eingehend geprüft	Natur und Naturhaushalt • Verdrängung heimischer Tier- und Pflanzenarten • Baulicher Eingriff in die Natur durch Verlängerung der Start-/Landebahn, Bau des Parkhauses etc. • Zerschneidung der Landschaft nimmt durch Ausbaumaßnahmen weiter zu
Argumente-Reaktion auf Argumente KONTRA • Parkplatzsituation: Parkhaus geplant mit günstigen Gebühren, Steigerung der Attraktivität der Anbindung durch öffentlichen Verkehr	Einlenkungen, Lösungsmöglichkeiten, Forderungen • Konstruktive Vorschläge zum Treffen in der Mitte • Parkhaus • Lärmschutzfenster • Bedeutung für gesamtstädtische Entwicklung -> Wohl der Allgemeinheit • Ausgleichsmaßnahmen nahe dem Eingriffsort -> auch Naherholung für Bewohner

KILLER PHRASE COLLECTION

KONTRA Leader-Initiative	KONTRA Leader-Initiative	KONTRA Leader-Initiative	PRO Follower
Vorwurf Nichtinteresse / Reproach Ignorance	Schwarzreden mit Vorwurf	Vorwurf Keine Ahnung	Verniedlichung & Angriff Moderator
Finally, we get to speak!	That's never worked.	You have no idea how irritating that is ...	You can see/find that phenomenon everywhere, airport or no airport.
No one has ever cared about us.	We've never been taken seriously.	Just come to my house on any given afternoon	What do you expect? Let's be realistic here!
Nobody here cares about that.	I see that everything is going like it always has!	Can you imagine what kind of traffic we have?	You live in a dream world!
We're only asked our opinion after everything is already set in stone.	That's simply intolerable!	You're not even from here … who are you to judge?	You don't seem especially qualified to me.
We residents don't figure into your plans.	You make promises you have no intention of keeping … we've seen that often enough.	That doesn't bring anything to the table.	
You don't care - you live out in the countryside.	These kinds of meetings have never amounted to anything!	gemeine AIML-Killerphrasen	gemeine AIML-Killerphrasen
Ablehnung Mitverantwortung / Ausstieg	I get the feeling you are not willing to come to a consensus.	We're only asked our opinion after everything is already decided.	It's always the same ones making trouble.
So, I have to handle the planning myself?	And how is that going to help?	You don't care what we think!	You just want to cause trouble - I know people like you.
Just do it all yourself ...	Angriff auf Moderator und Gegner/ Angriff auf Einlenkungen	No one has ever cared about us residents!	Are you even qualified to judge the criteria for the expansion?
That's pointless.	From you, we just get lip service, but the reality is completely different!	What is this charade all about? As residents, we don't figure into your plans.	You're only here to make a stink … you don't know anything about spatial planning.
That may all be well and good, but ...	I would have said the same thing in your position.	WE ARE ONLY ASKED *	
Hey, don't come at me like that!	That's what you all always say	YOU DO NOT CARE WHAT WE THINK	
The longer this goes on, the less I understand.	Whose side are you on anyway?	FUER UNS ANWOHNER HAT SICH DOCH NOCH NIE *	DER FLUGHAFENAUSBAU IST NOTWENDIG DA FUEHRT KEIN WEG DRAN VORBEI
I don't have to listen to that!	Are you even qualified to do that?	WAS SOLL DENN DAS HIER *	
Go ahead, do your planning by yourself! I'll never agree!	You're not even from here … who are you to judge?	You only care about money!	Airport expansion is a necessity. There is no way around it!
You'll see soon enough what comes from it!	You're only interested in making money.	You have no idea what daily life is like for us!	You can't stop the expansion now anyway - why upset yourself?
	Oh, you just have to say that.	This whole airport plan must be stopped!	You have no clue!

INTRODUCTION	cond	calc		cond	calc		cond	calc	
Killer Phrase Collection, Triggers									
KONTRA Leader-Initiative			PRO Follower			PRO S2 TRIGGERSCHALTER			HERR KONTRA
OK LASSEN SIE UNS ANFANGEN *						Triggers ohne KP hochzähler			Yeah, yeah.
Hello (everyone), I'm Mr. CON.									But it's true!
						So, you're still worried about the parking situation?			
						Do you still have concerns about increased noise?			KONTRA S2 TRIGGERTHEMEN
						You know, some people always find a fly in their soup.			
AIML			AIML			What do you expect? You must live in a dream world.			There's still going to be increased traffic due to heavy airplanes.
Killertest-KONTRA_S1.aiml.xml			Killertest-PRO_S1.aiml.xml			Well, what else can I say?			Besides, we are all going to have increased noise
TRIGGER IM AIML (Killerphrasen: Vorwurf Nichtinteresse)			TRIGGER IM AIML (Killerphrasen: Vorwurf Nichtwissen und Stunk)			See, everything will be taken care of, just as I said.			Our streets will also become increasingly congested.
We're only asked our opinion after everything is already set in stone.			You only came here to make a stink. You don't know anything about logistics.						
You don't care what we think!			It's always the same ones stirring up trouble!						
No one has ever cared about us residents!			You just want to make trouble, I know people like you			PRO S2 KILLERPRO			
What kind of charade is this? As residents, we've never figured into your plans!			Are you even qualified to judge the criteria for the expansion?			More Killerphrases to match in Scene2			
Endlich kann man sich mal aeussern, das wird aber mal Zeit!									
TRIGGER IM AIML (Killerphrasen: Übertreibung)			TRIGGER IM AIML (Killerphrasen: Übertreibung)			Oh, come on! You've only come here to make a stink. You know nothing about logistics.			
The entire airport expansion plan must be stopped!			Airport expansion is a necessity. There's no way around it!			Well, I've also had enough. Are you even qualified to judge the criteria for the expansion?			
The airport expansion brings with it a great increase in airplane traffic. Enormous increases in both commercial and passenger traffic have been announced. Economically, that may all be well and good, but for us residents, it's simply intolerable!			You can't stop it now anyway -why upset yourself?			Look, who are you to judge? This type of planning is somewhat more complex than your residential street at home!			

JOBS	cond	calc		cond	calc		cond	calc	OTHER
Starting Thread, Theme Introduction									
KONTRA Leader-Initiative			PRO Follower			MODERATOR OPTIONEN und Antwort KONTRA			OPTIONEN
			TRIGGER KONTRA						
NEW JOBS WILL ALSO BE CREATED			New jobs will also be created!	used <2					
Not that old argument again! No one wants to hear that!	used =0	K+1	NICHT SCHON WIEDER *						KONTRA used: Can't you come up with any other arguments?
GERADE DIE ANSIEDLUNG NEUER BRANCHEN *			It's the airport itself that will promote the establishment of new branches!		arg used +1	/// WAS * // WIESO * // WARUM * // KOENNEN SIE * // HERR KONTRA * ///			
For instance?			*			Well, the argument for "job creation" is often made to justify all kinds of nonsense, and at the same time, Opel is letting 1000 employees go!		K-1	NUN DAS ARGUMENT ARBEITSPLAETZE *
DENKEN SIE AN DIE LOGISTIK UND ZULIEFERFIRMEN *			Think of all the logistics firms and suppliers that our location will now draw!		used =1				That is indeed tragic, but it is nevertheless not a good reason for not creating new jobs, quite the opposite is the case.
The logistics in particular are primarily dependent on the infrastructure of the roads. Bypasses have to be in place first!			* UMGEHUNGSSTRASSEN GEBRAUCHT						
* IST DA GANZ IN UNSEREM SINNE			Surely, a speedy completion of the A73 Suhl-Bamberg is to our mutual benefit!						
It's not in your hands! How do you expect to control it? You're just trying to fool us again.		K+1				/// HERR KONTRA * ///		K-1	
						OK, OK … but it's true!			USER TRIGGER
									NENNEN SIE * ARGUMENTE
									SAGEN SIE * ARGUMENTE
						Alright, I am trying.			WAS FUER ARGUMENTE *
Then go ahead and say why, even if I can't stand to hear it anymore.			DANN SAGEN SIE SCHON WIESO *			OK, but I just want to be taken seriously, too.			WELCHE ARGUMENTE *
						Yes, alright, I'll try.			NENNEN SIE * ARGUMENT
						I only want us to be taken seriously			SAGEN SIE * ARGUMENT
						Hey, no offense, but that is true!			
						OK, but I just want to be taken seriously, too.			
Alternativen Jobansage			If we finally want to agree, we have to come up with arguments.						
			Think of the effect on employment in our area						
			We will also create new jobs!						
			The economy will improve, which can also mean a job for you!						

JOBS	cond	calc		cond	calc	
Starting Thread, Theme Introduction						
KONTRA Leader-Initiative			PRO Follower			
			TRIGGER			
NEW JOBS WILL ALSO BE CREATED			New jobs will also be created!	used <2		
Yes, we covered that subject already. However, not everyone works in the logistics branch!	used =1		* NOT EVERYONE WORKS IN THE LOGISTICS BRANCH			
* TOURISMUS *			Exactly. But with the airport, Erfurt will become an attractive location, both for tourism and conferences.			
If the ICE connector to Nuernberg was finally expanded, we'd be much better off!			* ICE ANBINDUNG *			
* VERKEHRS KNOTENPUNKT		E +1	The ICE connector, together with the airport, will finally give Erfurt its old status back, namely, that of important transportation hub.		used =2	
Speaking of tourism: Erfurt does not play a fundamental role in international tourism and the airport expansion is not going to change that.						

PARKING	cond	calc		cond	calc	
Starting Thread, Theme Introduction						
KONTRA Leader-Initiative			PRO Follower			MODERATOR OPTIONEN und Antwort KONTRA
			TRIGGER KONTRA			
HERR KONTRA KOENNTEN SIE DANN BITTE IHRE BEDENKEN *			Mister CON, would you then please present your concerns?	used <2		
The situation at the airport is already unbearable. The cars park all over our residential streets. You should try coming home in the afternoons, you'd be hard pressed to find a parking space.	used =0	K+1	SCHON JETZT IST DIE SITUATION UM DEN FLUGHAFEN *			
ABER DAS LAESST SICH DOCH REGELN			But that can be taken care of!		arg used +1	/// WAS * // WIESO * // WARUM * // KOENNEN SIE * // HERR KONTRA * ///
And we've only discussed the idle traffic - those parked cars have to be moved occasionally. Can you imagine what kind of traffic we have on our streets?		K+1	UND DAMIT IST JA ERST DER RUHENDE VERKEHR ANGESPROCHEN *			OK, OK, I'll try.
*			What I imagine is not the issue here.		used = 1	/// WAS * // WIESO * // WARUM * // KOENNEN SIE * // HERR KONTRA * ///
We live on a residential street where children normally play, but our children can't play, there is much too much going on and the cars also speed. That constitutes a great risk! But no one has ever cared about that!		K+1	WIR WOHNEN JA NUN IN EINER SPIELSTRASSE *			OK, OK, I'll try.
ICH MOECHTE DA ERSTMAL KLARSTELLEN *			I want to clarify something first: the fact that cars don't travel at walking speed on your street has nothing to do with the airport expansion. That is a phenomenon that you can find anywhere, airport or no airport.			/// WAS * // WIESO * // WARUM * // KOENNEN SIE * // HERR KONTRA * ///
Now, don't give me that! The cars come, because of the airport! But that's no skin off your noses, because you live out in the countryside, where you don't have to see or hear airplanes.		K+1	NUN KOMMEN SIE MIR DOCH NICHT SO *			OK, OK, I'll try.
ABER SO KOMMEN WIR DOCH ZU KEINER LOESUNG *			But, we're not going to arrive at any solution this way. Let's work on a concept together. We don't mean you any harm.			/// WAS * // WIESO * // WARUM * // KOENNEN SIE * // HERR KONTRA * ///
Yes, but you have to say that.		K+1	JA DAS MUSSTEN SIE JA JETZT WOHL SAGEN			OK, OK, I'll try.
						/// WAS * // WIESO * // WARUM * // KOENNEN SIE * // HERR KONTRA * ///
MODERATOR						OK, OK, I'll try.
			Well, we can discuss the individual points, but I want to be taken seriously.			

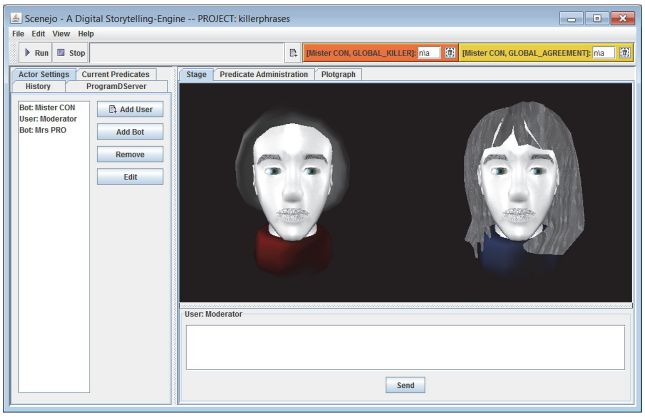
Moderation Scene	cond	calc		cond	calc		cond	calc	OTHER
DIV. THREADS SIEHE EINZELBLAETTER									
PRO Leader-Initiative			KONTRA Follower						
OK LASSEN SIE UNS ANFANGEN *									
Guten Tag, ich bin Frau PRO									
AIML									
Killertest-PRO_S2.aiml.xml			AIML						
TRIGGER IM AIML			Killertest-KONTRA_S2.aiml.xml						
			TRIGGER IM SRE			Innen Trigger KONTRA			Innen TRIGGER PRO
Well, what else can I say?									
I am certain these concerns can be handled to everyone's satisfaction.			It's a good thing for us residents to be listened to for a change!			There's still going to be increased traffic due to heavy airplanes.			Do you still have concerns about increased noise?
It's good that we can address your concerns with solutions.			If everything occurs as you've said, then it's all good.			Besides, we are all going to have increased noise.			Are you still worried about the parking situation?
See, everything will be taken care of, just as I said.			These plans should have been explained to us much earlier.			Our streets will also become increasingly congested.			What do you expect? You must live in a dream world.
			Something like this has to be explained!						You know, some people always find a fly in their soup.
			Nevertheless, to tell the truth, I still have my doubts!						
						Innen Killer ??????			Well, I've also had enough. Are you even qualified to judge the criteria for the expansion?
									Look, who are you to judge? This type of planning is somewhat more complex than your residential street at home!
						Oh, come on! You're only interested in your profits.			Oh, come on! You've only come here to make a stink. You know nothing about logistics.
						This is only lip service you're providing, reality is very different.			Look, who are you to judge? This type of planning is somewhat more complex than your residential street at home!

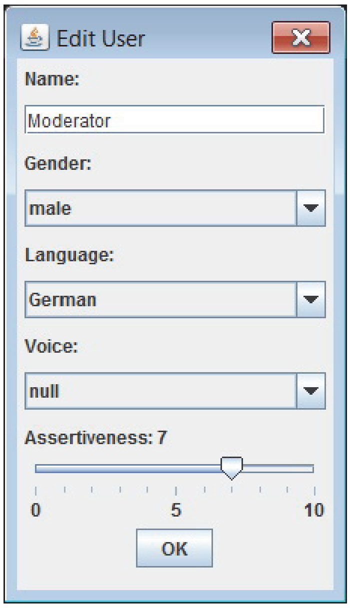
PARKING	cond	calc		cond	calc	OTHER
Moderation Scene						
PRO TRIGGER			KONTRA			OPTIONEN
			THEMENAUFGRIFF KONTRA			
So, you're still worried about the parking situation?	used <=1		* SORGEN WEGEN DER PARKPLATZSITUATION			The situation with the parking spaces will be handled. However, even without a new airport, the streets are going to get more congested!
* WIE SOLL DAS ERST NACH DEM AUSBAU WERDEN			Yeah, that's right. Already, we residents often can't find a parking space in the vicinity of our homes. How tough is that going to be after the expansion?			
Well, there are various ideas on that subject. Right now, we are favoring the idea of building a multilevel parking garage.		used +1	* MOEGLICHKEIT EIN PARKHAUS ZU ERRICHTEN			
* MIETE ZAHLEN ODER WIE			And for a parking space in this parking garage, we'll have to also pay rent, or what?		K+1	
No, no. As residents, you would be able to use the facility for free.		E+1	NEIN *			
KOENNEN SIE MIR DAS SCHRIFTLICH GEBEN			Can you give me that in writing?			
As soon as a final decision is made in this matter, you will receive a confirmation. Until then, you'll just have to take my word for it.			* BIS DAHIN MUESSEN SIE * GLAUBEN SCHENKEN			
			OK, I'm satisfied. But a promise is a promise.		E +1	
NOISE	cond	calc		cond	calc	OTHER
Moderation Scene						
PRO Leader-Initiative			KONTRA Follower			OPTIONEN
TRIGGER			Noise increases.			Talk about noise! Now, it's just the passenger flights, but soon there will be the supply planes overhead ... there's going to be some real noise when those heavy things go to land. That's just too much to bear!
We are not of the opinion that noise levels will significantly increase due to the expansion.	used <2		WIR SIND NICHT DER MEINUNG DASS * LAERMBELAESTIGUNG *			
VERGLEICHBARE PROJEKTE * LAERMBELASTUNG ZUNIMMT			Comparable projects have already shown that the noise levels increase.	used = 0		
In the end, we're simply talking about a fifteen percent increase in air traffic.			ES GEHT DOCH * UM FUENFZEHN PROZENT		K+1	
* WER KOMMT DA NOCH ZUM SCHLAFEN			Yes, exactly. That comes to eighteen additional airplanes per day. Who can sleep through that?			
Have you heard the newest planes? Last week, it was decided that there will be a ban on night flights between the hours of 10:00 p.m. and 6:00 a.m.		used =2	* NACHTFLUGVERBOT *		E +1	
* DAMIT KANN ICH MICH ANFREUNDEN			Really? I didn't know that. I could get to like that			

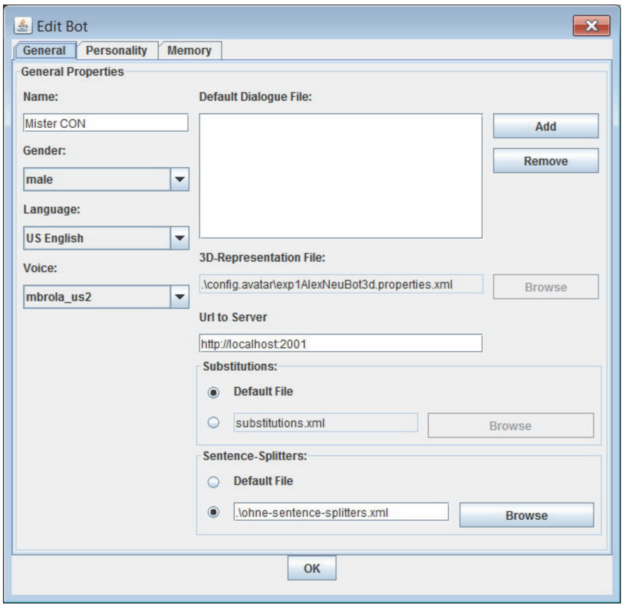
End Scene AGREEMENT	cond	calc		cond	calc	
EINIGUNG (nur noch Kontra)						
KONTRA Leader-Initiative			PRO Follower TRIGGER			KONTRA Leader-Initiative TRIGGER
*			Also, ich hoffe wir sind uns dann wohl bald einig, dass es Loesungen fuer alle gibt. Gut dass Sie doch kompromissbereit sind!			Nun, wenn Sie Ihre Versprechen einhalten, denke ich dass wir mit den Kompromissen leben koennen. Aber darauf bestehe ich!
Well, dear Moderator, I congratulate you on your efforts and thank you for your assistance. You really helped us. Goodbye.	used =0	used =1				
*						
Was denn jetzt noch? Jetzt ist Schluss! Das Spiel ist aus! Oder soll ich Ihnen etwa noch was singen?	used =1					
JA *						

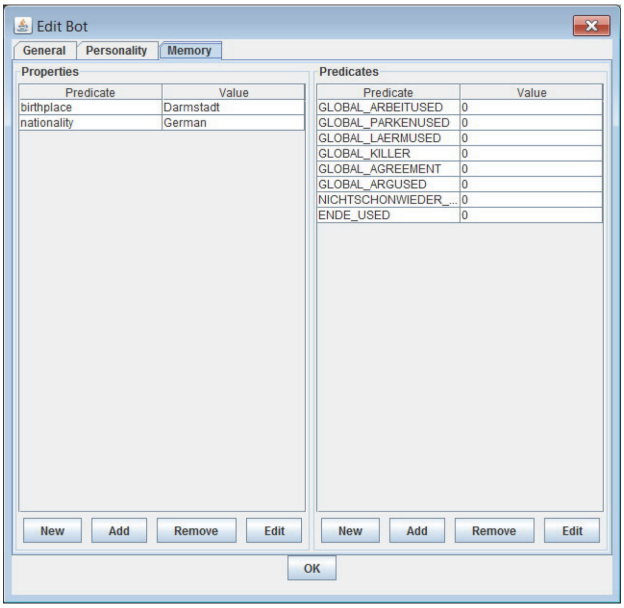
End Scene ESCALATION	cond	calc		cond	calc	
EINIGUNG (nur noch Kontra)						
KONTRA Leader-Initiative			PRO Follower TRIGGER			KONTRA Leader-Initiative TRIGGER
*			Ich weiss nicht was diese Diskussion noch fuer einen Zweck haben soll. Wir drehen uns ja im Kreis.			Sie wollen mich wohl hochnehmen. Jetzt reichts mir aber. Ich habe die Nase voll. Ich gehe gleich!
I can see that this is pointless. I'm going home. Why do we even have a moderator? Hey You! What are your qualifications anyway?	used =0	used =1	I'm going, too. I've got other things to do. Why do we even have a moderator? Hey, what are your qualifications anyway?			
* QUALIFIKATION HABEN SIE EIGENTLICH			* QUALIFIKATION HABEN SIE EIGENTLICH			
So, the game is now over. I suggest that the session be adjourned and you try it once more.	used =1		So, the game is now over. I suggest that the session be adjourned and you can try it once more.			
JA *						
{SetSingingTempo:180} {SetOctave:C}		used =2				

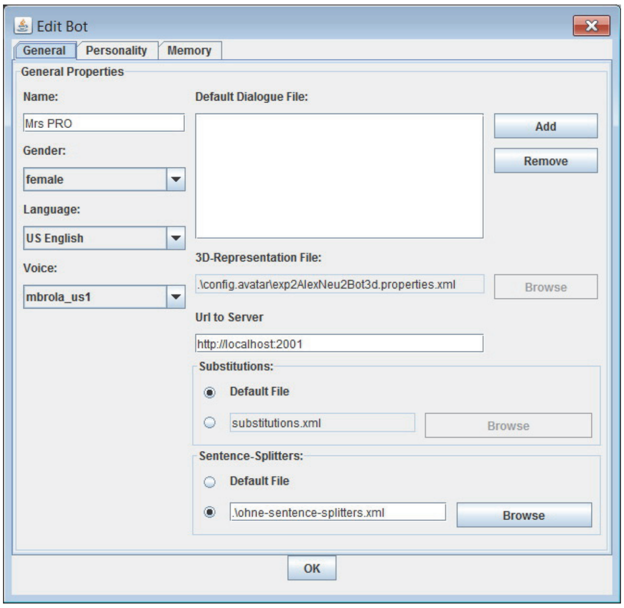
Actors Configuration

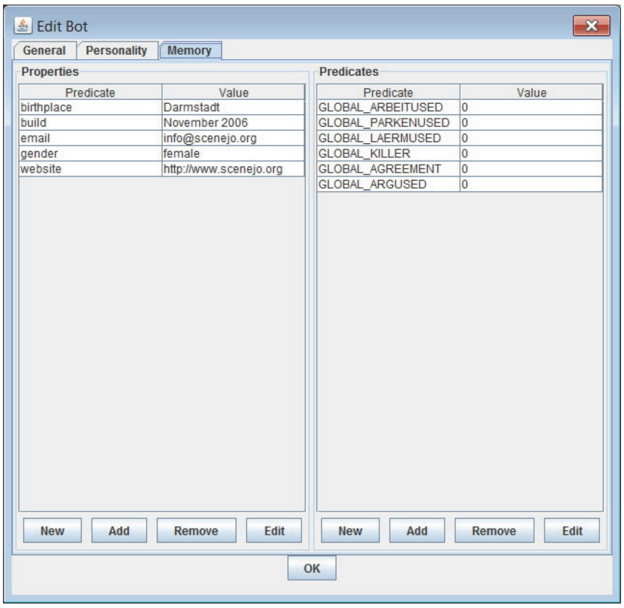




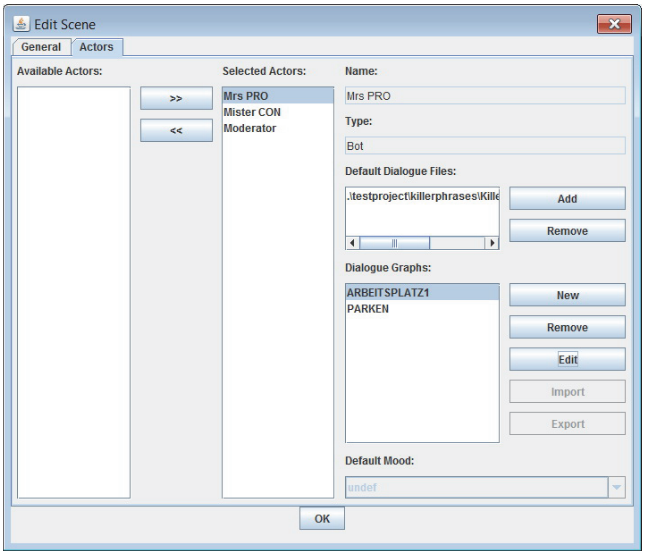


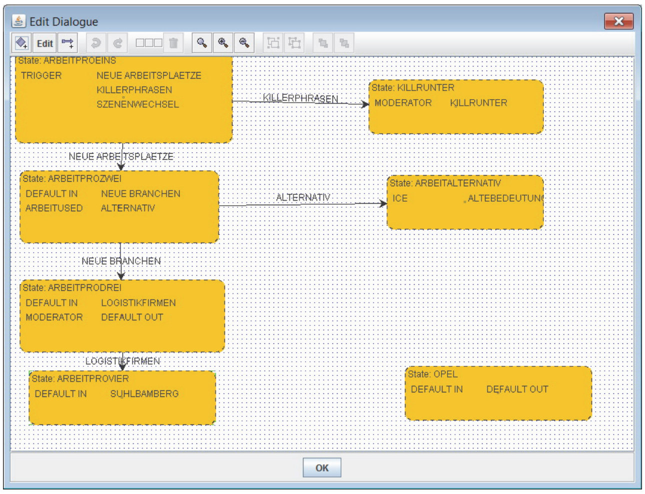


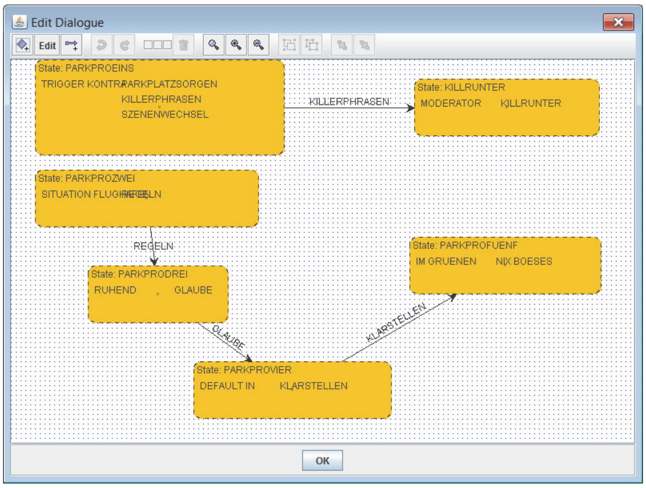




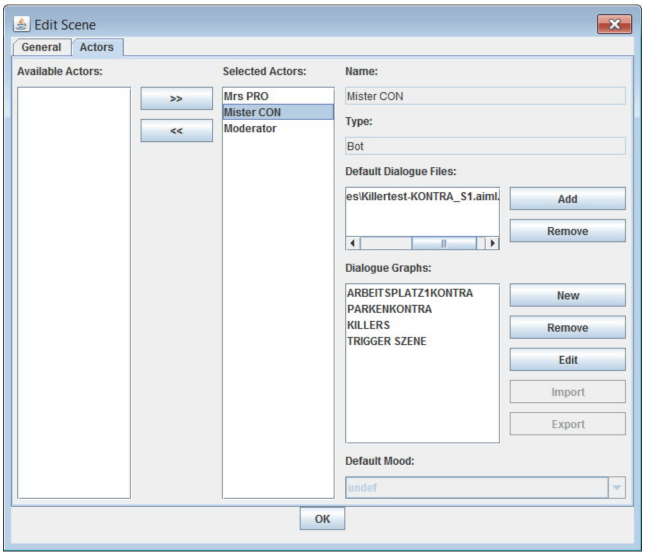
Scene 1 Mrs PRO

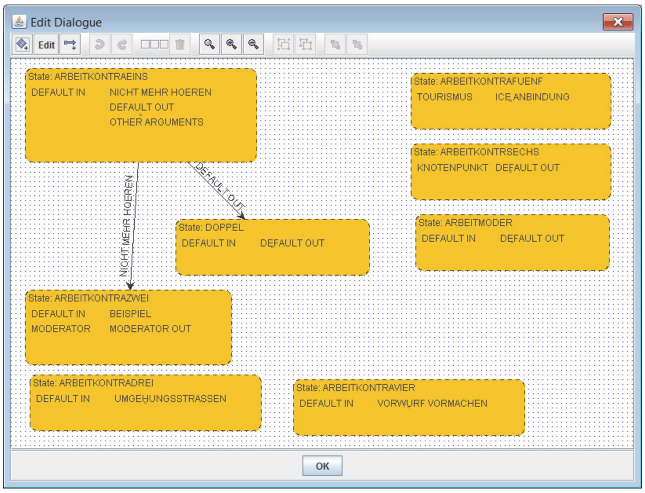


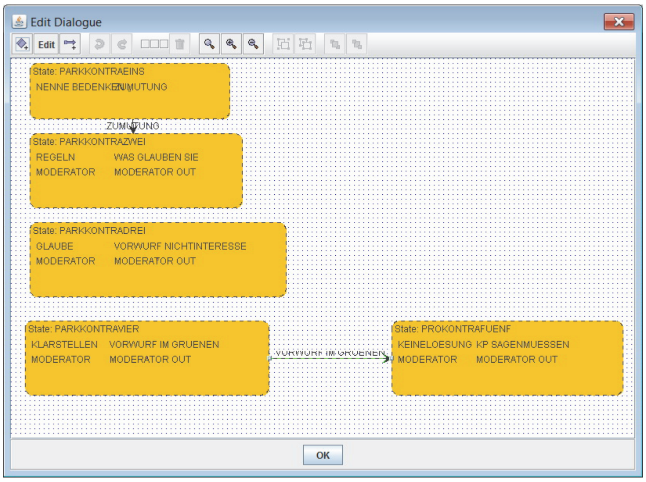


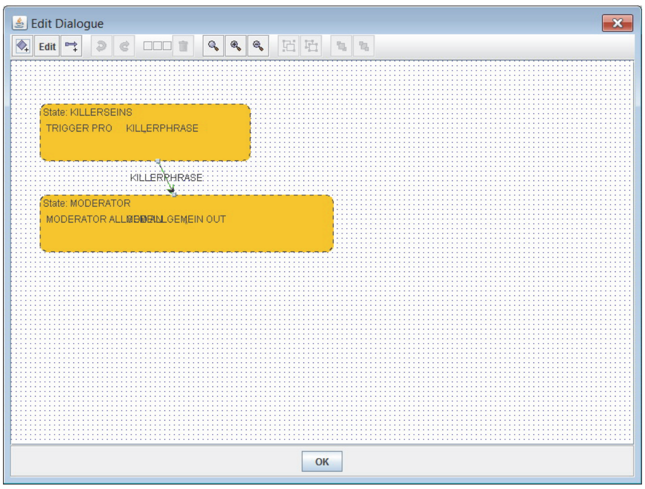


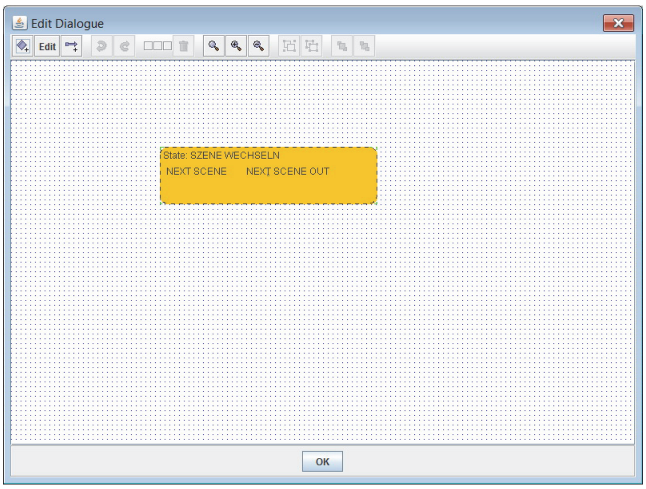
Scene 1 Mister CON



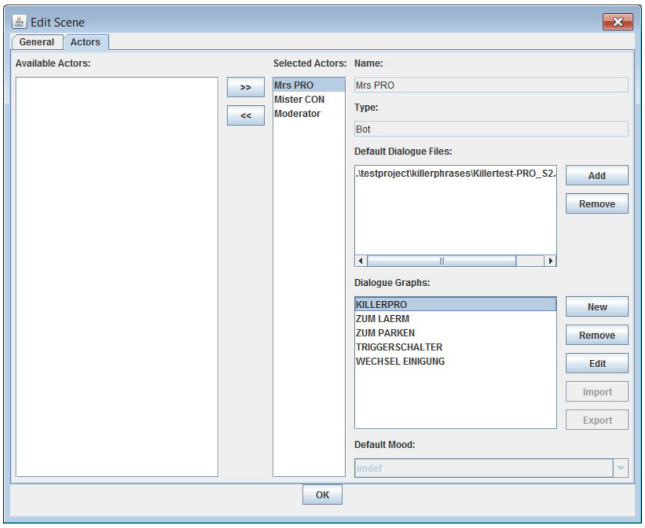


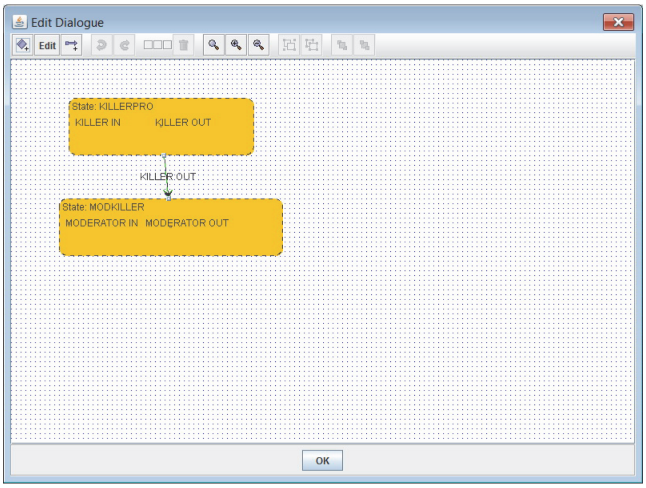


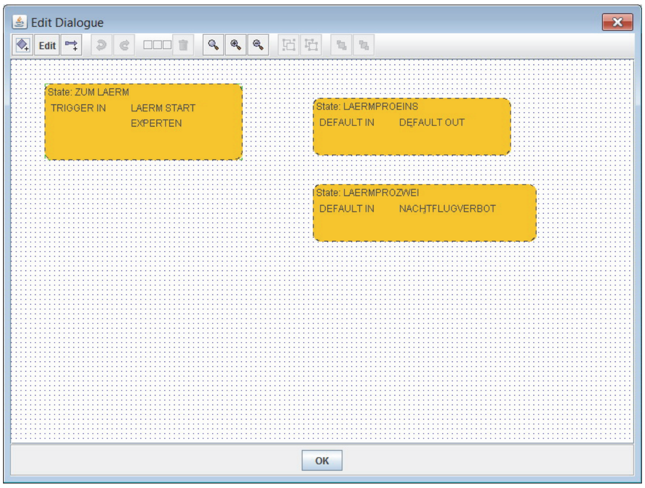


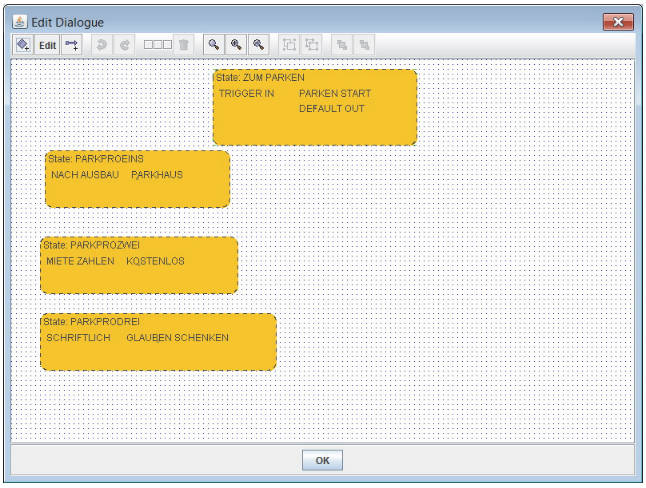


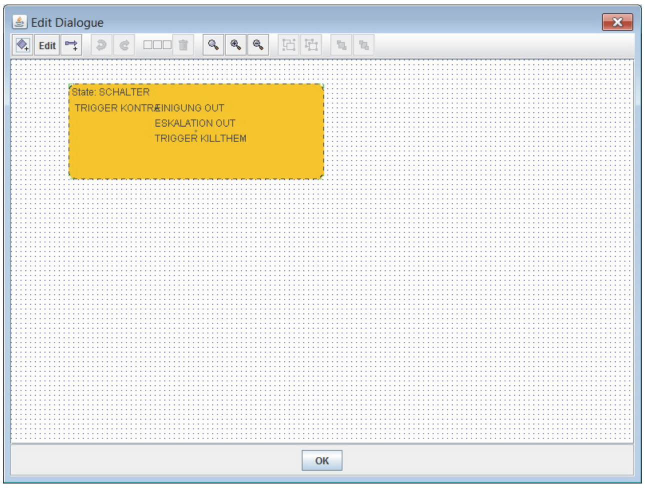
Scene 2 Mrs PRO

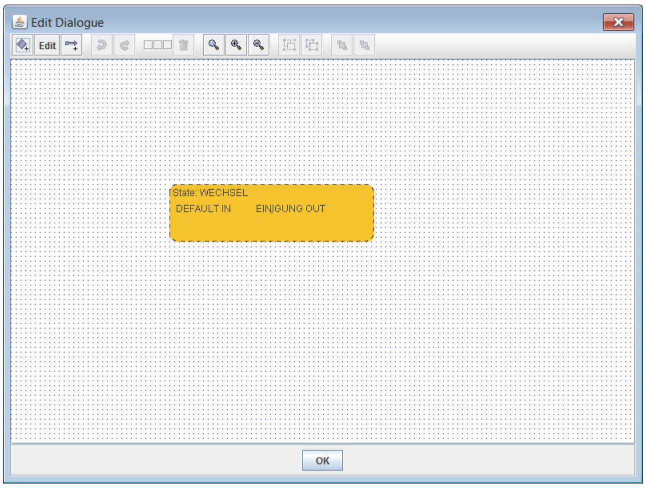




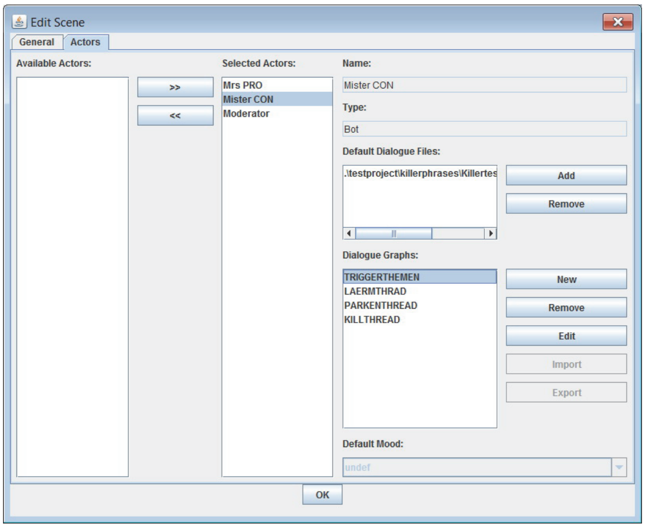


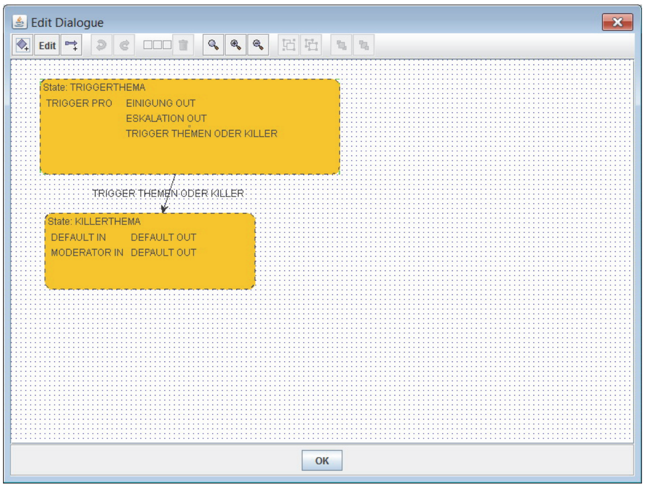


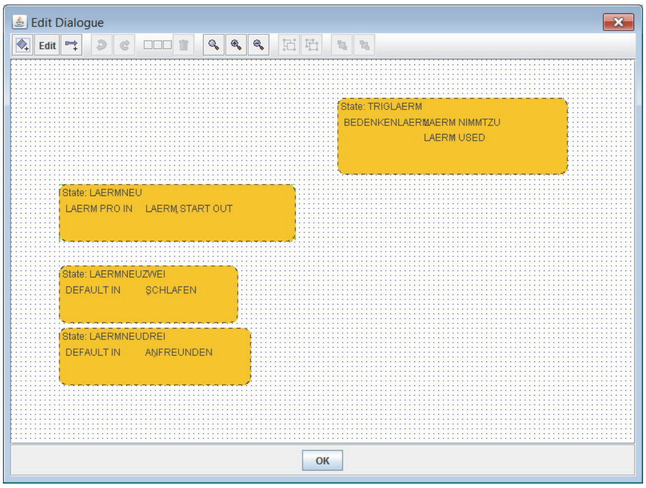


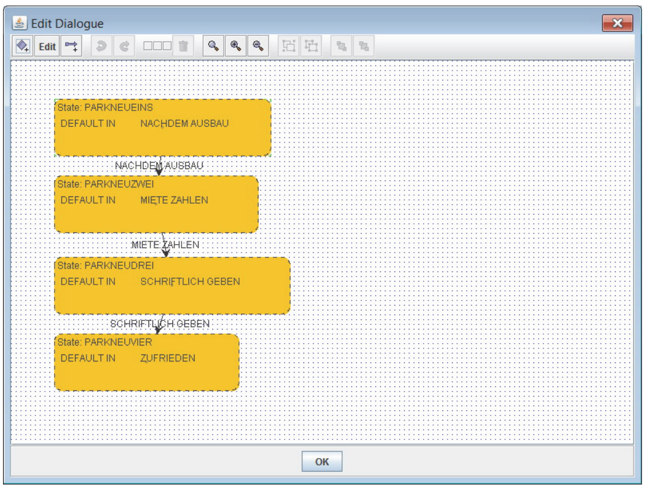


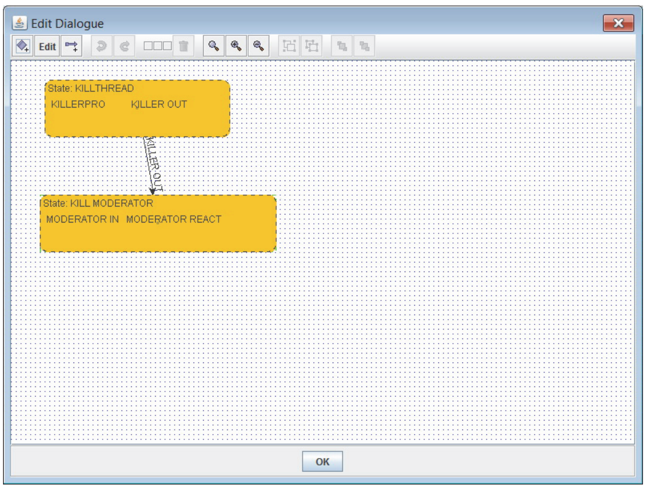
Scene 2 Mister CON



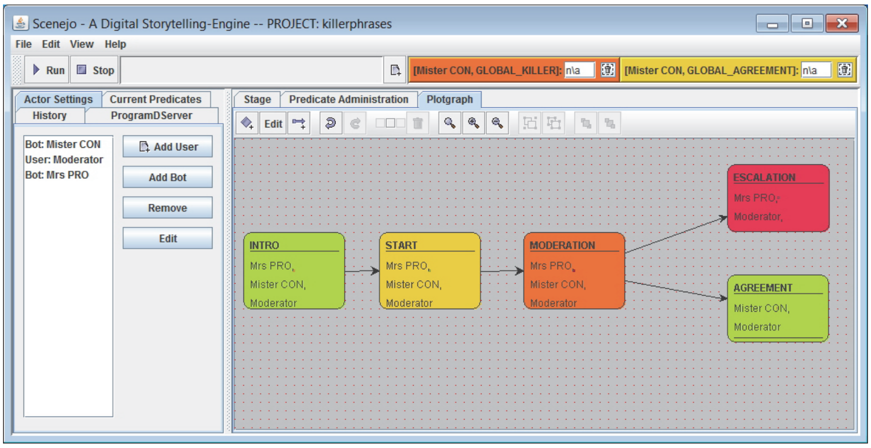


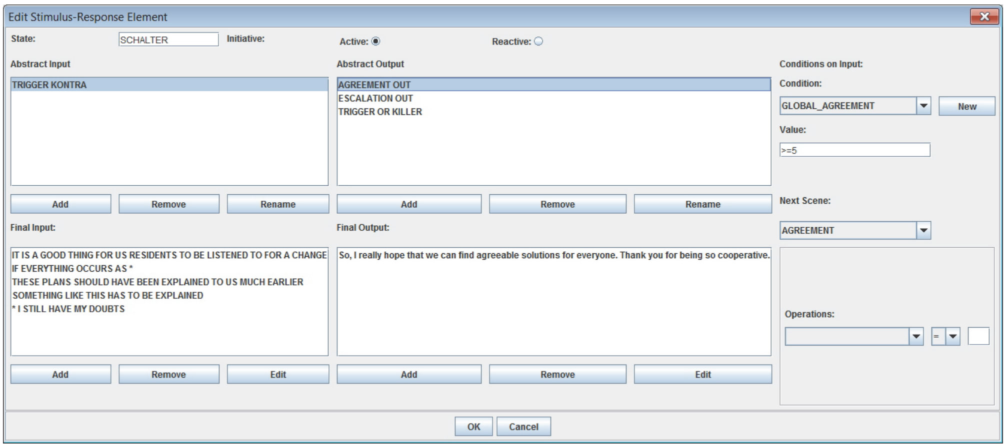


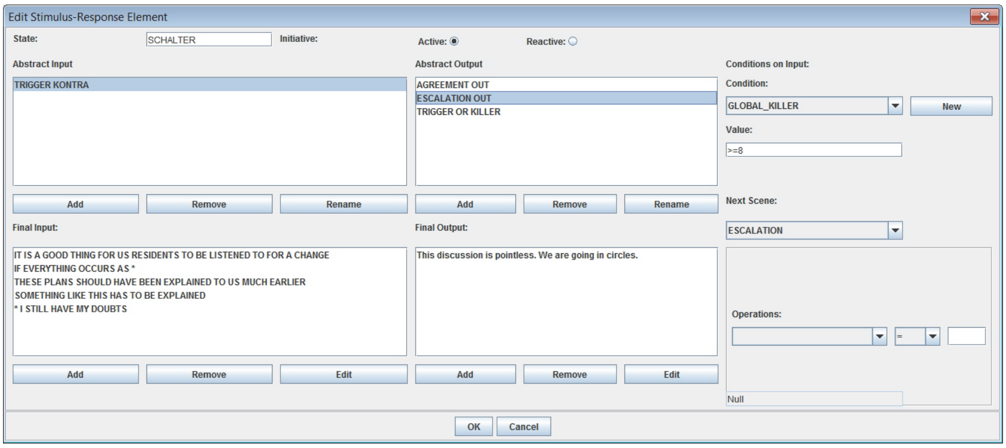


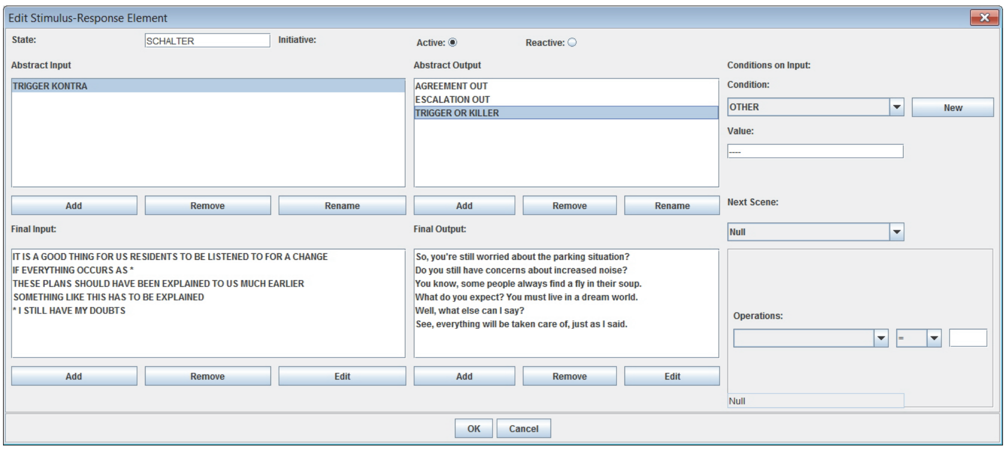


Scene 2 Mrs PRO Switch

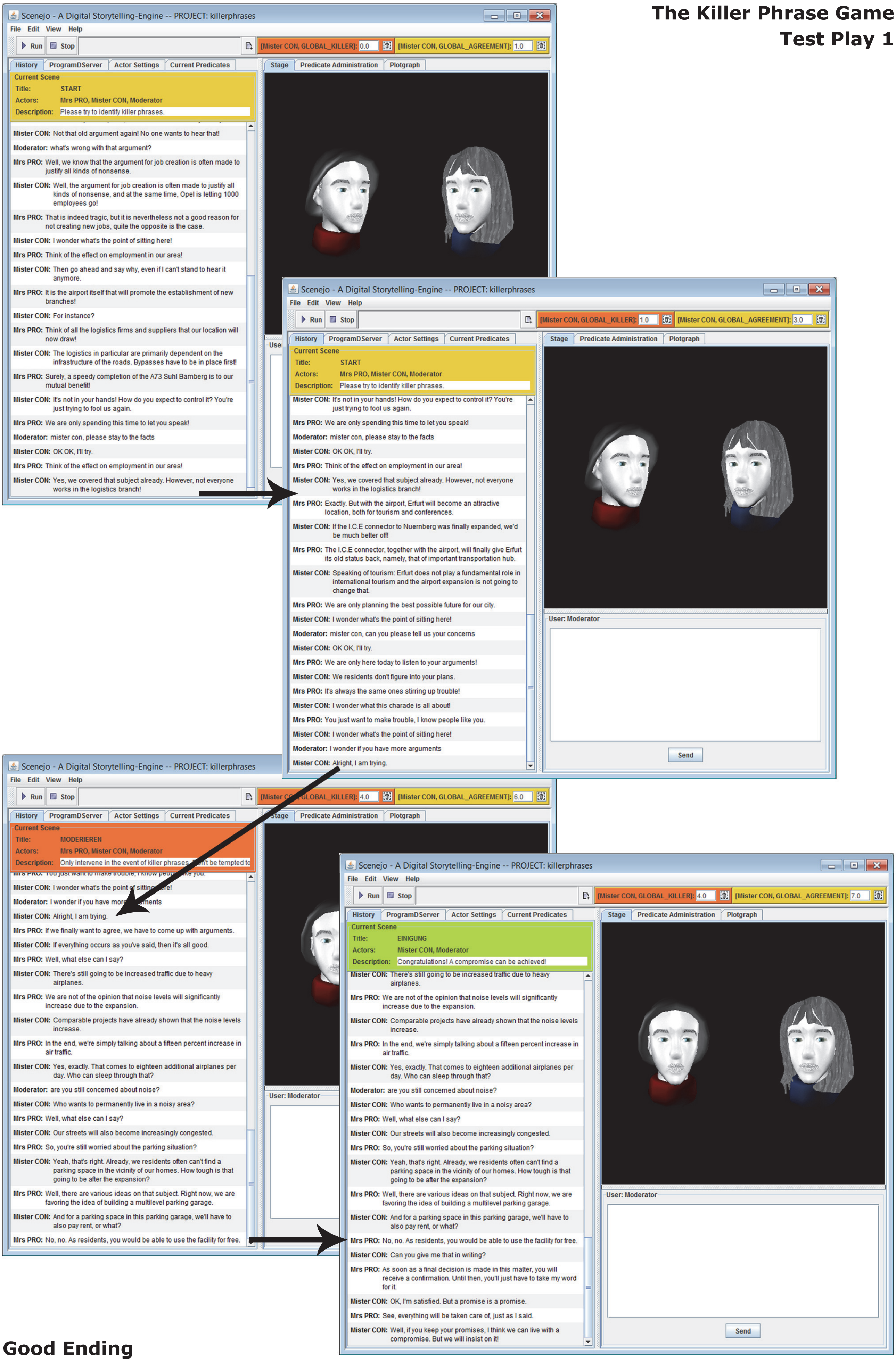






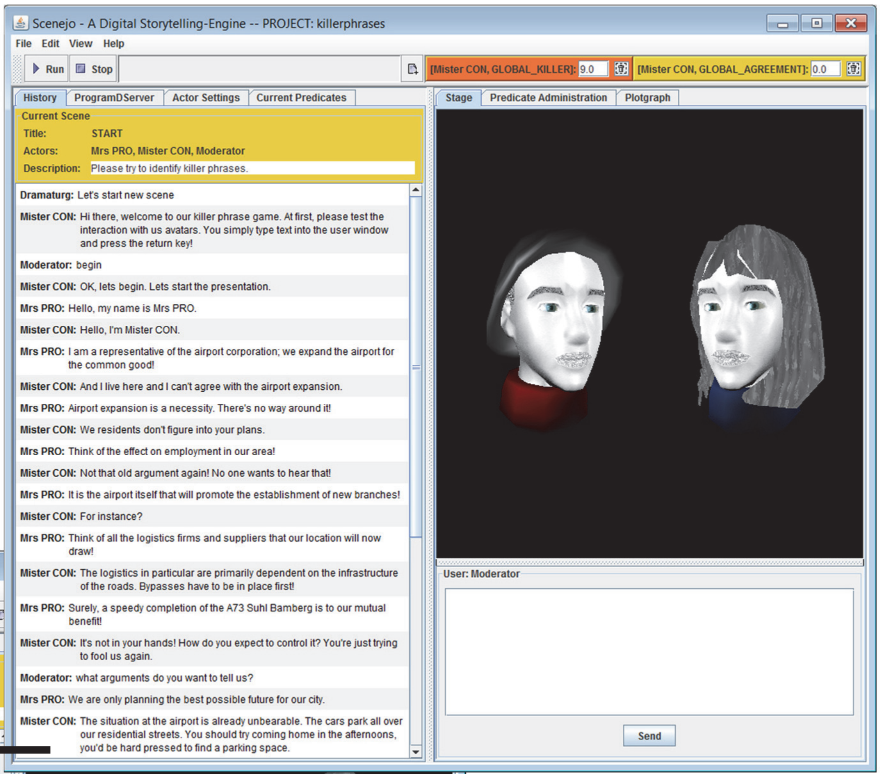


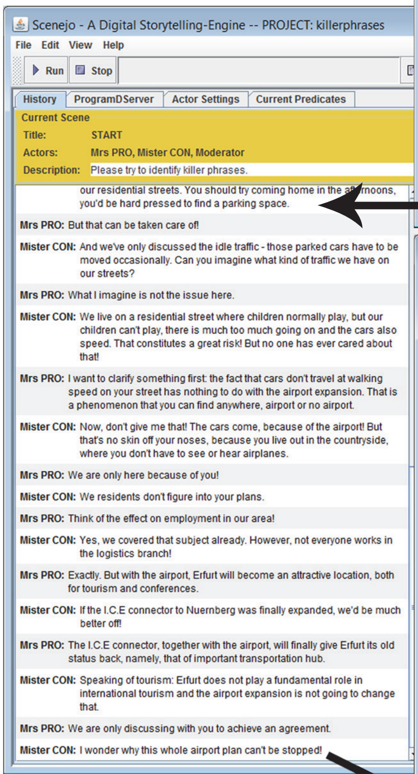
The Killer Phrase Game
Test Play 1

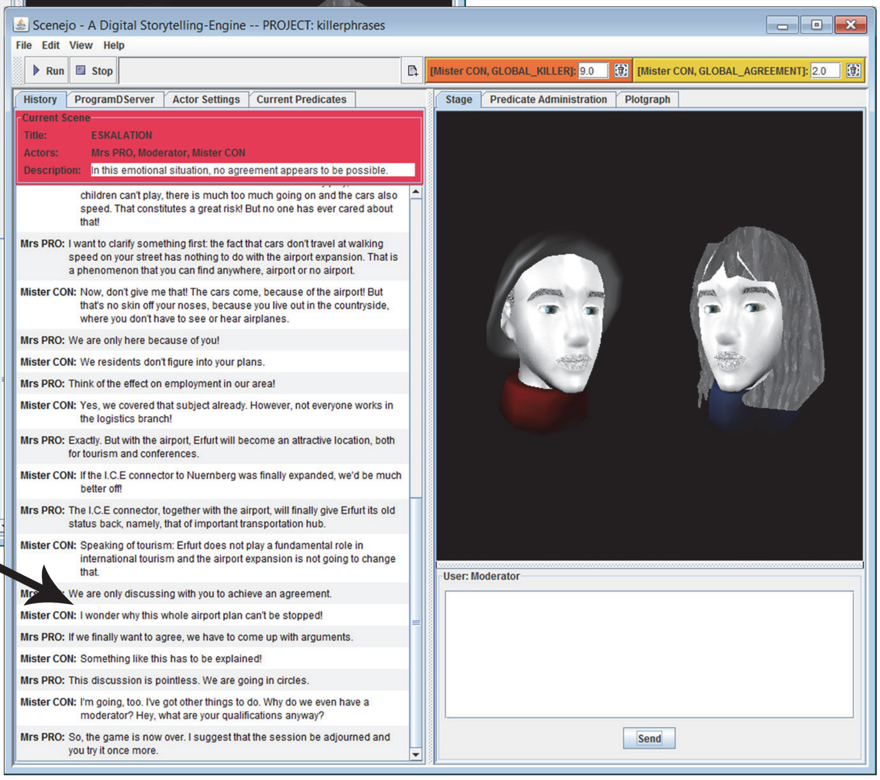


Good Ending

The Killer Phrase Game
Test Play 2







Bad Ending

Interparolo Focus Group Notes and Questionnaire	**The Killer Phrase Game**

DISCUSSION(S)

"Focus Group" Sessions / Focused Interviews

Preliminary remark to moderators and minute takers:
In the beginning, test persons should be granted the possibility to express themselves spontaneously – to articulate own perceptions, opinions, suggestions and ideas. Further in the course of the discussion, focusing of questions will increase.
The questions below are to be understood as a flexible guideline: In case of doubt, the exact order and phrasing of the aspects are of secondary importance. Preferably the conversation unfolds naturally …

The moderator should neither approve nor contradict with test persons' remarks and refrain from answering (especially with justifications) or disclosing opinions – even if this is sometimes difficult.

Contributions	Behaviour (if applicable)
How did you experience the interaction / the game?	
Which strategies did you develop?	
Do you remember specific dialogues or moments?	

Interparolo Focus Group Notes and Questionnaire	**The Killer Phrase Game**

What did you like?	
What didn't you like?	
For whom would this game be suited best, and for whom would it be suited least?	
Can this game be taken seriously?	

DETAILED QUESTIONS (~ 10 minutes)

Please try to associate your first impressions to the following oppositional statements!
Help: **„1“** indicates that your impression applies to the statement on the left; „**5**“ indicates your compliance with the statement on the right; „**3**“ is a neutral position between them. Please choose **„n/a“** in case you feel that nothing applies, even not the middle position.

The game was enjoyable.	**1**	**2**	**3**	**4**	**5**	**n / a**	The game was annoying.
I am interested in the theme of the game.	**1**	**2**	**3**	**4**	**5**	**n / a**	I am not interested in the theme of the game.
The game is exciting.	**1**	**2**	**3**	**4**	**5**	**n / a**	The game is boring.
Such a game can be instructive and makes sense.	**1**	**2**	**3**	**4**	**5**	**n / a**	Such a game is just a gimmick and not suited for learning.
I engaged in the mission of the game.	**1**	**2**	**3**	**4**	**5**	**n / a**	I tried to shortcut the mission of the game.
The game appears humanoid and real.	**1**	**2**	**3**	**4**	**5**	**n / a**	The game appears technical and nonhuman.
The game lasted too long.	**1**	**2**	**3**	**4**	**5**	**n / a**	The game was finished too quickly.
The dialogues and interaction proceed too slowly.	**1**	**2**	**3**	**4**	**5**	**n / a**	The dialogues and interaction run too fast.
Graphics and sound come across well.	**1**	**2**	**3**	**4**	**5**	**n / a**	Graphics and sound are unconvincing.
The usability was good.	**1**	**2**	**3**	**4**	**5**	**n / a**	The usability was bad.
The virtual characters always reacted to my input.	**1**	**2**	**3**	**4**	**5**	**n / a**	The virtual characters never reacted to my input.
For learning, it is useful as a supplementary computer game.	**1**	**2**	**3**	**4**	**5**	**n / a**	For learning, the roleplay should rather only be played in real life.
This game version intrigues me to see the final version.	**1**	**2**	**3**	**4**	**5**	**n / a**	I am not interested in the final game version.
The game appears innovative.	**1**	**2**	**3**	**4**	**5**	**n / a**	The game does not appear innovative, rather traditional.

Which term do you consider accurate to describe the game? Please distribute 5 points (accumulations are possible, such as 3-2, 2-2-1, 5 once, or different)

☐ **Simulation of virtual humans** ☐ **Doll play** ☐ **Interactive story**
☐ **Learning software** ☐ **Reaction game** ☐ **Virtual theatre play**
☐ **Other**____________________________

Interparolo Focus Group Notes and Questionnaire	**The Killer Phrase Game**

What else would you like to tell us?

Personal QUESTIONS

As we want to address different target groups, you would help us by (voluntarily) adding your personal data!

How old are you?
Are you male or female?
How often do you play games (without computer)? (daily, 1/week, 1/month, more rarely, never)
How often do you play computer games? (daily, 1/week, 1/month, more rarely, never)
How often do you use a computer in your professional life? (daily, 1/week, 1/month, more rarely, never)
In which industrial sector are you active (predominantly)?

Many thanks for your collaboration!

You made an important contribution to the success of our project!

Your Project Team INTERPAROLO

Interparolo Focus Group Notes and Questionnaire **The Killer Phrase Game**

RESULTS / **DISCUSSION(S)**
"Focus Group" Sessions / Focused Interviews

Preliminary remark for moderators and minute takers:
In the beginning, test persons should be granted the possibility to express themselves spontaneously – to articulate own perceptions, opinions, suggestions and ideas. Further in the course of the discussion, focusing of questions will increase.
The questions below are to be understood as a flexible guideline: In case of doubt, the exact order and phrasing of the aspects are of secondary importance. Preferably the conversation unfolds naturally …

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Contributions *(translated transcription of fill-in by 2 minute takers, A: and B:)*

How did you experience the interaction / the game?

A:

First impressions:
- *One has to guess the keywords, then the goal can be reached*
- *It was fun*
- *No answering to arguments*
- *Annoyed about 'hanging-up' of the game*

B:
- *No reaction to input*
- *Too many repetitions*
- *Amazed that agreement can be achieved without influence*
- *Generally funny but not enough functionality*

Which strategies did you develop?

A:
- *Why ...?*
- *Keywords are easy to figure out*
- *Offer sentences for choice (?)*

B:
- *After finding keywords, several attempts to steer in different directions*
- *Finding keywords is important, then input keywords without sentence structure*
- *Some found finding the keywords difficult, some found it easy (different opinions)*

Do you remember specific dialogues or moments?

A:
- *Mister Con does not react (or illogically) to interaction*
- *"This airport expansion must be stopped." There should be more variations.*

B:
- *Interaction with Mister Con is difficult, he does not respond to users*
- *Inputs were not understood correctly*
- *Opinion raised that only punctuation marks are recognized and no content*

Interparolo Focus Group Notes and Questionnaire **The Killer Phrase Game**

What did you like?

A:

- *To try, to play*
- *Characters*

B:

- *Mess around, but interest decreases quickly after understanding*

What didn't you like?

A:

- *Visualisation could be better*
- *Procedure before start is not self-explanatory*
- *Timing/synchronization between inputs could be better*

B:

- *Loading time too long*
- *Too difficult to find first step to input*
- *Not enough diversity of sentences*
- *Amazed (not necessarily negative) that game took other directions than expected*
- *Operation of input delayed, reaction not correct any more*

For whom would this game be suited best, and for whom would it be suited least?

A:

- *For people who need to do moderation "on a small scale"*
- *Nice as a variety for students*
- *For people who prefer play over theoretical education, as a stimulation to deal with a subject*

B:

- *No real imagination where to apply it*
- *Currently not applicable yet, imagination is difficult whether adoption is possible after improvement*
- *Only funny exercise, a gimmick*
- *Too playful for free market*

Can this game be taken seriously?

A:

- *Yes, as a learning game*
- *Taken seriously the first time, then explored boundaries of the game*
- *"I cannot advance, because there is no reaction to my arguments"*

B:

- *Different opinions, first yes/partly, then no longer*
- *Positive and negative aspects are questioned*
- *Biggest problem is ignorance against moderator*
- *Students would actually not yet consider it as serious exercise method*
- *Different opinions whether a playful handling wouldn't yet be a possibility as introduction to the topic of moderation*

Interparolo Focus Group Notes and Questionnaire **The Killer Phrase Game**

RESULTS / DETAILED QUESTIONS (~ 10 minutes)

Please try to associate your first impressions to the following oppositional statements!

Statement	Ø	1	2	3	4	5	n/a	Statement
The game was enjoyable.	**2,82**	0	9	9	3	1	0	The game was annoying.
I am interested in the theme of the game.	**2,68**	1	**11**	5	4	1	0	I am not interested in the theme of the game.
The game is exciting.	**3,64**	0	0	**11**	8	3	0	The game is boring.
Such a game can be instructive and makes sense.	**2,19**	4	**10**	6	1	0	1	Such a game is just a gimmick and not suited for learning.
I engaged in the mission of the game.	**2,14**	2	**15**	5	0	0	0	I tried to shortcut the mission of the game.
The game appears humanoid and real.	**3,64**	0	0	**10**	**10**	2	0	The game appears technical and nonhuman.
The game lasted too long.	**3,05**	1	4	**10**	3	2	2	The game was finished too quickly.
The dialogues and interaction proceed too slowly.	**3,05**	3	4	6	7	2	0	The dialogues and interaction run too fast.
Graphics and sound come across well.	**2,95**	0	8	9	3	2	0	Graphics and sound are unconvincing.
The usability was good.	**3,32**	0	5	6	**10**	1	0	The usability was bad.
The virtual characters always reacted to my input.	**4,32**	0	1	0	**12**	9	0	The virtual characters never reacted to my input.
For learning, it is useful as a supplementary computer game.	**3,00**	1	7	5	7	1	1	For learning, the role play should only run in real life.
This version intrigues me to see the final game version.	**2,27**	4	**12**	3	2	1	0	I am not interested in the final game version.
The game appears innovative.	**2,41**	3	**10**	6	3	0	0	The game does not appear innovative, rather traditional.

	Classification points (of 5 pP, n=21):		
Which term do you consider accurate to describe the game?	**Ø pP**	**Sum**	**%**
Learning software	**2,33**	49	47%
Reaction game	**0,76**	16	15%
Simulation of virtual humans	**0,71**	15	14%
Doll play	**0,43**	9	9%
Interactive story	**0,43**	9	9%
Virtual theatre play	**0,33**	7	7%
5 Points pP. (check sum)	**5,00**	105	100%

Participants **22**
Age Average (of n=18) **24,5**

What else would you like to tell us? *(Transcription)*

E:

Das Spiel war leider durch mehrmaliges Aufhängen nicht möglich, richtig durchzuführen. Es kam vermehrt zu Zeitunterschieden in Bezug auf die Eingabe u. den tatsächlichen Text, der dann mit eingebunden wurde.

F:

- *Zeituhr einbringen um zu erkennen wann d. Programm lädt*
- *Spiel sollte sofort stoppen wenn man Kommentar eingeben will*

G:

- *Ladebalken bzw. Zeituhr einbringen!*
- *Spiel sollte bei Eingabe des Moderators sofort stoppen!*

I:

- *Zielgedanke der Software ist gut, jedoch müsste besser auf die Einwürfe des Moderators eingegangen werden, da sehr oft kein Zusammenhang im Dialog herrschte*
- *Gute Übung ist wahrscheinlich nur im persönlichen Dialog möglich*

J:

- *Häufig abgestürzt, besonders in Endphase ärgerlich*
- *Keine richtige Reaktion auf unsere Vorschläge von PRO/KONTRA*

K:

Das Programm sollte weiterentwickelt werden. Insbesondere ist darauf zu achten das die "Personen" auf den Moderator eingehen u. sich damit realer verhalten. Wenn eine größere Vielfalt an Lösungen gegeben wird u. die Reaktionen untereinander abgestimmt werden, kann es eine gute Lernmethode werden.

L:

Finde die Idee zum Killerphrasenspiel gut, aber die Realisierung sehr schwer und denke es wird noch ein paar Jahre dauern bis diese Art von Spiel in der Wirklichkeit Fuß fassen wird.

M:

Gut zur Gestaltung d. Veranstaltung Mod/Med

N:

Guter Ansatz, mit Sicherheit ausbaufähig

P:

- *Generell gute Idee*
- *Zu leicht zu durchschauen, wie es funktioniert → nur noch eingabe der Schlüsselwörter, ohne tiefgründig nachzudenken*

Q:

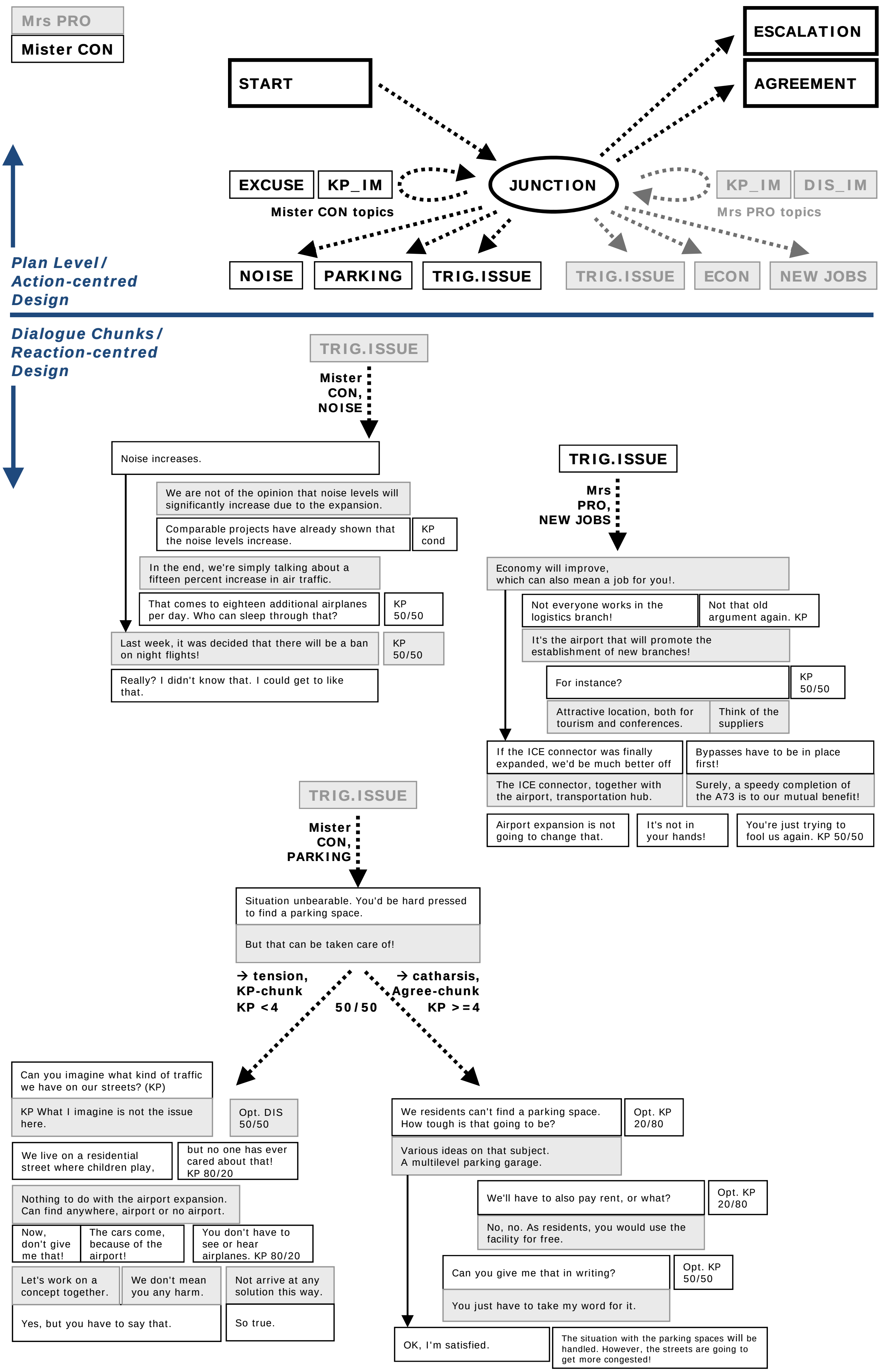
- *Geben Sie mögliche Antworten vor! Das wird dadurch nicht zu leicht! Das ist Unsinn*

S:

- *Es tut mir leid, aber es hat mich gelangweilt. Mehr als 5 Minuten Interesse konnte ich nicht aufbringen. Es hat das „gewisse etwas" gefehlt.*

U:

- *Phrasen wiederholen sich zu oft*
- *Reaktionen erfolgen ungenügend*


Mrs PRO
Mister CON
START
ESCALATION
AGREEMENT
EXCUSE
KP_IM
JUNCTION
KP_IM
DIS_IM
Mister CON topics
Mrs PRO topics
NOISE
PARKING
TRIG.ISSUE
TRIG.ISSUE
ECON
NEW JOBS
Plan Level/ Action-centred Design
Dialogue Chunks/ Reaction-centred Design
TRIG.ISSUE
Mister CON, NOISE
Noise increases.
We are not of the opinion that noise levels will significantly increase due to the expansion.
Comparable projects have already shown that the noise levels increase.
KP cond
In the end, we're simply talking about a fifteen percent increase in air traffic.
That comes to eighteen additional airplanes per day. Who can sleep through that?
KP 50/50
Last week, it was decided that there will be a ban on night flights!
KP 50/50
Really? I didn't know that. I could get to like that.
TRIG.ISSUE
Mrs PRO, NEW JOBS
Economy will improve, which can also mean a job for you!.
Not everyone works in the logistics branch!
Not that old argument again. KP
It's the airport that will promote the establishment of new branches!
For instance?
KP 50/50
Attractive location, both for tourism and conferences.
Think of the suppliers
If the ICE connector was finally expanded, we'd be much better off
Bypasses have to be in place first!
The ICE connector, together with the airport, transportation hub.
Surely, a speedy completion of the A73 is to our mutual benefit!
Airport expansion is not going to change that.
It's not in your hands!
You're just trying to fool us again. KP 50/50
TRIG.ISSUE
Mister CON, PARKING
Situation unbearable. You'd be hard pressed to find a parking space.
But that can be taken care of!
→ tension, KP-chunk KP <4
50/50
→ catharsis, Agree-chunk KP >=4
Can you imagine what kind of traffic we have on our streets? (KP)
KP What I imagine is not the issue here.
Opt. DIS 50/50
We live on a residential street where children play,
but no one has ever cared about that! KP 80/20
Nothing to do with the airport expansion. Can find anywhere, airport or no airport.
Now, don't give me that!
The cars come, because of the airport!
You don't have to see or hear airplanes. KP 80/20
Let's work on a concept together.
We don't mean you any harm.
Not arrive at any solution this way.
Yes, but you have to say that.
So true.
We residents can't find a parking space. How tough is that going to be?
Opt. KP 20/80
Various ideas on that subject. A multilevel parking garage.
We'll have to also pay rent, or what?
Opt. KP 20/80
No, no. As residents, you would use the facility for free.
Can you give me that in writing?
Opt. KP 50/50
You just have to take my word for it.
OK, I'm satisfied.
The situation with the parking spaces will be handled. However, the streets are going to get more congested!

Rules for plan-level conditional dialogue acts

For Scenejo authoring to be placed into structure (see following tables for listings)

Turn/initiative Mrs PRO

1. Check thresholds for switching to Escalation or Agreement
2. Check if all arguments in the storyworld have been raised → end towards escalation (raise KP)
3. Beginning: Displacement remarks
4. Start own argument topics (random order):
   Economy, New Jobs, or give turn to Mister CON to start
5. If own arguments are covered, randomly bring KP or trigger Mister CON

Global conditions (in Scenejo authored explicitly) for Mrs PRO

1. First react to recognised patterns (intra-thread)
2. Only bring KP in direct reaction to Mister CON's KP, or if all arguments are exhausted
3. Use displacement or phatic to pass turn

Turn Mister CON + initiative

1. Check thresholds for switching to Escalation or Agreement
2. Check if all arguments have been raised → end towards escalation (bring KP)
3. Beginning: Killer phrases
4. Start own argument topics: Parking, Noise, or give turn to Mrs PRO to start
5. If own arguments are covered, randomly bring KP or trigger Mrs PRO

Global conditions (in Scenejo authored explicitly) for Mister CON

1. First react to recognised patterns (intra-thread)
2. Add random KPs to utterances in the beginning, later based on state
3. Utter KP if all arguments are exhausted
4. Answer to Moderator on recognised moderation patterns

INTER-Threads (plan-level)

PRO

PATTERN	PRE-COND	ACT	R-LIST	POST-COND
*	KP > 6	ESCAL	R-LIST	**CS-ESCALATE**
	AGREE > 3	AGREE	R-LIST	**CS-AGREEMENT**
	ARGS > 4	KP-FIN	R-LIST	**KP +1**
	ARGSLIN = 0	DISPLACE	R-LIST	ARGSLIN+1
	ARGS = 0	TRIG.ARG	IMPROVE ECON (30)	ECON +1, ARGS +1
			NEW JOBS (30)	NJOBS +1, ARGS +1
			TRIG.ISSUE (30)	
	ECON > 0	TRIG.ARG	NEW JOBS (50)	NJOBS +1, ARGS +1
			TRIG.ISSUE (50)	
	NJOBS > 0	TRIG.ARG	ECON (50)	ECON +1, ARGS +1
			TRIG.ISSUE (50)	
	OTHER	50-50 KP	KP (50)	**KP +1**
			TRIG.ISSUE (50)	
KP_IM	KP > 6	ESCAL	R-LIST	**CS-ESCAL**
	AGREE > 3	AGREE	R-LIST	**CS-AGREE**
	ARGS > 4	KP-FIN	R-LIST	**KP +1**
	ARGSLIN = 0	DISPLACE	R-LIST	ARGSLIN+1
	ARGS = 0	TRIG.ARG	IMPROVE ECON (40)	ECON +1, ARGS +1
			NEW JOBS (40)	NJOBS +1, ARGS +1
			TRIG.ISSUE (20)	
	OTHER	50-50	KP	
			TRIG.ISSUE	
KP (INIT)	KP > 3	KP	R-LIST	**KP +1**
	OTHER	PHATIC	R-LIST	
TRIG.PRO	ARGS = 0	TRIG.ARG	IMPROVE ECON (50)	ECON +1, ARGS +1
			NEW JOBS (50)	NJOBS +1, ARGS +1
	ECON > 0	TRIG.ARG	NEW JOBS	NJOBS +1, ARGS +1
	NJOBS > 0	TRIG.ARG	ECON	ECON +1, ARGS +1
	OTHER	50-50 KP	KP	**KP +1**
			TRIG.ISSUE	

CONTRA

PATTERN	PRE-COND	ACT	R-LIST	POST-COND
*	KP > 6	ESCAL	R-LIST	**CS-ESCAL**
	AGREE > 3	AGREE	R-LIST	**CS-AGREE**
INIT	KP > 3	KP	R-LIST	**KP +1**
INIT	OTHER	PHATIC	R-LIST	
*	ARGS > 4	KP-FIN	R-LIST	**KP +1**
	ARGSLIN = 0	KP_IM	R-LIST	KP+1
	OTHER	80-20 KP	KP_IM (80)	**KP +1**
			TRIG.PRO (20)	
TRIG.ISSUE	C_ARGS = 0	TRIG.ARG	TRAFFIC (50)	TRAFF +1, ARGS +1, C_ARGS+1
			NOISE (50)	NOISE +1, ARGS +1, C_ARGS+1
	TRAFF > 0	TRIG.ARG	NOISE	NOISE +1, ARGS +1
	NOISE > 0	TRIG.ARG	TRAFFIC	TRAFF +1, ARGS +1
	OTHER	KP	KP	**KP +1**
DISPLACE	KP > 6	ESCAL	R-LIST	**CS-ESCAL**
	AGREE > 3	AGREE	R-LIST	**CS-AGREE**
	ARGS > 4	KP-FIN	R-LIST	**KP +1**
	OTHER	KP_RM	R-LIST	**KP +1**

INTRA-Threads (dialogue chunk level)

PRO
Free Stimuli (Begin Thread)

PATTERN	PRE-COND	ACT	R-LIST	POST
NOISE	KP > 6	ESCAL	R-LIST	**CS-ESCAL**
	AGREE > 3	AGREE	R-LIST	**CS-AGREE**
	OTHER	C-NOISE-1	R-LIST	
TRAFFIC	KP > 6	ESCAL	R-LIST	**CS-ESCAL**
	AGREE > 3	AGREE	R-LIST	**CS-AGREE**
	OTHER	C-TRAFF-1	R-LIST	

→ Argument Threads

CONTRA
Free Stimuli (Begin Thread)

PATTERN	PRE-COND	ACT	R-LIST	POST
NEW JOBS	KP > 6	ESCAL	R-LIST	**CS-ESCAL**
	AGREE > 3	AGREE	R-LIST	**CS-AGREE**
	C_JobsEcon > 0	REPEAT	NJOBS-ANTI	
	ARGS < 2	ANTI	NJOBS-ANTI	
	KP < 2	COOP	NJOBS-COOP	
	KP > 4	ANTI	NJOBS-ANTI	
	OTHER	ANTI	NJOBS-ANTI	
ECON	KP > 6	ESCAL	R-LIST	**CS-ESCAL**
	AGREE > 3	AGREE	R-LIST	**CS-AGREE**
	C_JobsEcon > 0	REPEAT	NJOBS-ANTI	
	ARGS < 2	ANTI	NJOBS-ANTI	
	KP < 2	COOP		
	OTHER	ANTI	ECON-ANTI	

→ Argument Threads

Reaction variants to Arguments:

- cooperative (coop) → interjections with forwarding questions
- antagonistic (anti) → interjections as counterquestions, remarks, critique
- resolving move → give in (argument counter)
- kill argument move → killer phrase (no argument counter)

Model of argument thread:
Pro=Initiative

ARG (IM) [New jobs will also be created]
  ANTI (CM, KP) [Not that old argument again]
    ANTI (RM, Mod) → Moderator!
    RESOLVE (RM, Exc)
  ARG-2 (IM) [It's the airport itself that will promote new branches!] Opt. KP
    FW Q (IM, Q) [For instance?] Opt. KP
    Promise (RM, A) [Think of all the logistics firms and suppliers]
      ANTI (CM) [Bypasses have to be in place first!] Opt. KP
      (RM) [Surely] … Op. KP
RESOLVE (RM) Positive evaluation

Con=Initiative
ARG (IM) [Noise increases.]
    ANTI (RM) [We are not of the opinion.]
    ARG-2 (IM) [Comparable projects]
  ANTI (CM/IM) [We are talking about 15 percent]
  ARG-3 (RM) (Evaluation) [Who can sleep through that!]
  PRO (IM) Ban on night flights
  RES (RM) I could get to like that.

D FURTHER AUTHORING STUDIES WITH IDS SYSTEMS

Seminar Report: Authoring Studies with IDS Systems

Summary of studies carried out in a university seminar with eleven tools (IDS systems, Interactive Fiction systems, game editors and interactive video and animation tools. The summary has also been contributed to an IRIS Deliverable.

> Spierling, U., Hoffmann, S., Szilas, N. (2009). Report on Prescriptive Narrative Principles and Creation Methods in Interactive Storytelling (Non-Digital and Digital). Deliverable 3.1, IRIS NoE FP7-ICT-231824, http://iris.scm.tees.ac.uk/publications.

Paper: "Authoring Issues Beyond Tools"

In-depth exploration of two concrete (technical) authoring processes, providing feedback from the practical steps. The result is a presentation of general issues in authoring Interactive Storytelling.

> Spierling, U., Szilas, N. (2009). Authoring Issues Beyond Tools. In: Zagalo, N., Iurgel, I. Petta, P. (Eds.): Interactive Storytelling, Proceedings of ICIDS 2009, LNCS, vol. 5915, Springer Verlag Berlin-Heidelberg, pp. 50–61.

Paper: "Exploring Narrative Interpretation and Adaptation for Interactive Story Creation"

Discussion of a concrete case study of transforming and abstracting a Hemingway short story into a model suitable for an interactive version (prototyped with *"Storytron"*).

> Spierling, U., Hoffmann, S. (2010). Exploring Narrative Interpretation and Adaptation for Interactive Story Creation. In: R. Aylett et al. (Eds.): Interactive Storytelling, Proceedings of ICIDS 2010, LNCS, vol. 6432, Springer Verlag Berlin-Heidelberg, pp. 50-61.

Online Presentations

> **SCENEJO** Information.
> http://scenejo.interactive-storytelling.de/
>
> **IRIS Repository**: Authoring Tools and Creation Methods.
> http://iris.interactive-storytelling.de/
>
> **Little Red Riding Hood Workshop**: The Authoring Process in Interactive Storytelling. http://redcap.interactive-storytelling.de/

Interactive Digital Storytelling

Authoring Studies with IDS Systems

Seminar in Media Informatics

Fachhochschule Erfurt (FH Erfurt)
Erfurt, Germany
2009

Supervisors:
Prof. Ulrike Spierling
Steve Hoffmann

Authoring Studies with IDS Systems

IDS systems
- **ActAffAct**
- **Emo-Emma, Bovary authoring tool**
- **IDtension**
- **Storytron**
- **The Virtual Storyteller**

Interactive Fiction
- **Adrift**
- **Inform-7**

Game Editors
- **Aurora Toolset/Scriptease for Neverwinter Nights**
- **Morrowind – The Elder Scrolls Construction Set**

Interactive Video and 3D Animation
- **Korsakow System**
- **Storytelling Alice**

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FH Erfurt, IDS Authoring Seminar

The study has been conducted within a seminar during summer term 2009 at FHE with students of Applied Computer Science (Media Informatics). In a first task, short descriptions of systems or tools were created by the students, including information about the availability of tools, of a runtime system, and about tutorial information or system descriptions. Based on that, a selection of tools for the practical study was made.

The final selection is a mixture of tools or systems available from IRIS partners, other interesting tools from the IS community that were available, and for comparison reasons, some examples of older available authoring tools in the periphery of IS, such as for adventure games (interactive fiction), or game editors.

The task for the students was the development of a mini scenario of an interactive story of their choice. Additionally, they should take notes of their process and report their working steps and finally also give a brief feedback or judgement how they liked the tool or system.

This report summarises the main statements from the students' reports. The original text of the students' studies is written in German and available on request. For the purpose of this report, system descriptions are kept brief and the focus is on comparability of the studies. More detailed descriptions of the actual authoring tools can be found at several sources from the original providers of the tool. For each study, the descriptions include a statement on the results the students have achieved, what main steps and judgements they reported and the supervisors' observations and conclusions.

1 ActAffAct

Origin: OFAI, Österreichisches Forschungsinstitut für Künstliche Intelligenz, Austria

Information: http://www.ofai.at/research/agents/projects/actaffact.html

Description

- "ActAffAct" (AAA) is based on the appraisal theory of emotion from Ortony, Clore and Collins (OCC)
- the core is a belief-desire-intention architecture for software agents which is extended by an appraisal component following a psychological model of the appraisal process
- autonomous agents with goals, standards and preferences as well as emotional expressions and coping activities are deployed in a scene and interact with each other and the environment (objects), the influence from outside is very limited, so no direct interaction with the story is possible
- four characters (agents) do exist: hero, villain, victim and mentor
- the target user is not an audience, but a researcher who can test results generated with different initial conditions and parameters and inspect the state of the simulated world at different times

Result

- the original story consists of four characters with different goals, for example to solve a puzzle or to place a bomb
- the students were not able to create a new story, because that is not the purpose of the system
- to create a new story from the scratch, deep changes of the code would have been necessary
- instead they made some experiments with changing parameters and conditions and watched how they influence the outcome of the story

Authoring experience reported by the students

General working steps:
- the students tried to change the code, but this was not possible
- instead they decided to edit the setup files, so that this could influence the story, but they were not successful in achieving a major impact
- they changed parameters, deleted characters and watched the results
- they found out, that same setups lead to similar actions of the characters, behaviour patterns could be recognised
- changing character properties or removing characters lead to great impact on the before noticed patterns, but they said that the behaviour of the characters was still plausible
- changes in the environment (removing one object or adding two of the same kind) influence the behaviour, too

Judgements:

Advantages:
- the agents perform autonomously simple dramatic actions
- repeating the story leads to different situations, that way replays are still interesting
- the students mentioned that AAA is an excellent tool to create suspenseful short stories without deep plot, so it could find good use in roleplay games or simulations to control the non player characters and make the game world more diversified

Disadvantages:
- it is not possible to create a story with an overall plot arc, because of the autonomy of the characters
- the user has no real interaction possibilities
- the induction in the plan scripting language JAM is elaborate

Observations on their experiment

- the students were motivated to understand the principles of the system, but it was too complex for them to master it
- interesting was their idea to use the tool in the current or a more advanced state for games

Conclusions

- the system is interesting for authors who may experiment with it and understand better the limitations and capabilities of generative storytelling systems
- the system is an interesting test case for autonomous agents, but without authoring tools it is not usable for authors that have no programming skills, the scripting language would be too complicated

2 Emo-Emma (Bovary Authoring Tool)

Origin: TEES, University of Teesside, England

Information: http://ive.scm.tees.ac.uk

Description

- important: for the study the "HSP authoring tool" was used, not the whole Bovary IS system
- only one character (actor) could be created
- the story has to be defined as a planning domain consisting of propositions and operators
- propositions describe the world and/or characters and operators are actions that can be performed
- each operator can have several propositions as preconditions and can add or delete others from the world state after the action was performed, here called effects
- goals can be added or deleted in the same way

Result

- the students created an alternative version of "Little Red Riding Hood", where the user plays the wolf and tries to get the information where the grandmother lives from the girl and

– if he is successful – visits her and tries to convince her to open the door, so he can eat her
- the story consisted of 25 propositions representing emotions like fear (RC_afraid) or important events of the story, like the wolf eating the grandmother (wolf_eat_GM)
- there are 22 operators (actions) like knocking on the grandmothers door (knock_hard_at_the_door) or asking where she lives (ask_where_GM_lives)
- the story can be run in the "HSP authoring tool" by choosing the possible actions (operators) in the planning tree (plan evolution)

Authoring experience reported by the students

General working steps:
- the students started with preliminary considerations, like the goals for the actor (wolf), important actions and emotions of the actor; in this phase of creation they differentiated between friendly and unfriendly actions
- next they structured them into propositions and operators and entered them into the tool
- then they started to connect the propositions and operators by setting up the preconditions for the operators
- to make use of the created emotions (for example propositions with the name "RC_afraid_1", "RC_afraid_2" and "RC_afraid_3", which means that 3 different levels of "fear" for the girl exist) they determined that an unfriendly actions increases the afraid level; the highest level for this emotion is the precondition for the action (operator) that will let the girl run away in fear; other propositions are used in a similar way (e.g. convincement)
- if otherwise the girl trusts the wolf, an action (operator) can be performed, that lets her say where the grandmother lives, this action removes the old goal (finding out where grandmother lives) and adds a new one (let grandmother open the door)
- the next step is analogous to the one before (different actions change the emotional state of grandmother, e.g. her convincement level to believe the wolf)

Judgements:
- for the students it was difficult to use only one character, they wanted to make the story more interesting by adding more (mother, little red riding hood, grandmother, hunter); because this was not possible they abstracted other characters by describing them in the actions (operators)
- another problem was the strict action-based approach; they wanted to make some descriptions of the things that were happening or tell things that are not actions performed by the wolf; this was not possible
- they wanted to create situation in which only one operation can be performed, the one with the most met preconditions, but the system allows all other actions too, that have a subset of these preconditions
- for the students it was difficult to abstract the story as a sequence of actions, they missed structures like states and events
- the authoring interface was described as uncomfortable, but they didn't point out why
- summarising they found the tool for very open and free structured stories very useful

Observations on their experiment

- the students needed relatively long to understand the principles of the tool and even though they were able to finish their story, it sometimes seemed that the concept was not fully understood

Conclusions

- problems occur if parts of the story have to be more linear to create narrative context
- it is easy to create unwanted loops in the story that can only be recognised after a few cycles; the tree view makes it difficult to see them, another kind of view could be helpful
- because of the loop problem and the quickly raising number of possible directions the story can take with every added operator (action), it is very difficult to keep an overview after a certain number of operators is exceeded
- because of the same reason the outcome of a story (story branch) is more and more unforeseeable, if the content increases

3 IDtension

Origin: UNIGE, TECFA Lab at the University of Geneva, Switzerland

Information: http://www.idtension.com

Description

- interactive drama engine where the narrative unfolds as the user decides what actions the main character will perform in relation to other characters in story
- story is not described as pre-authored story parts such as scenes but as an structure of goals, tasks, obstacles and values; structure resembles a classical goal driven architecture for agents, but is described in narrative terms (obstacles, ethical values) and not attached to a character but centralised in a "state of the world"
- no authoring tool is available for IDtension, a story has to be created in an XML- and CSV-file; due to the prototype status some important mechanisms are only hardcoded and can not be influenced by the author; because of that the study of the tool was done in a theoretical and conceptual way

Results

- the students created an alternative version of "Little Red Riding Hood", where the user plays the wolf and tries to get the information what the girl is doing (taking basket to grandmother) and – if he is successful – tries to convince her to leave the paths and pick up some flowers
- this was done in a conceptual way, no playable version exists, but charts of the needed information and values

Authoring experience reported by the students

General working steps:
- the students started with the suggested creation of a "goal/task structure"
- after that the existing example "The Mutiny" was analysed and the structure and declarations from the XML-file are adapted for the "Little Red Riding Hood" story
- four characters are created (girl and wolf, mother and grandmother) and tasks, goals and obstacles are declared
- then the character features and relations among them are declared

Judgements:
- the students had big problems with the use of the french language in the configuration files and the ambiguity of translations
- they gave up when they realised that it was not possible to play the result without programming access to the engine

Observations on their experiment

- the understanding of the complex concept of IDtension was a big obstacle for the students
- because of the not existing authoring tool and the conceptual approach of creating a story they had a big challenge and were only able to provide results after a lot of enthusiastic work

Conclusions

- IDtension is a tool with lots of possibilities for authors to create a story world, but in the available stage of development it was not possible for them to use it without the help of a software engineer

4 Storytron

Origin: Storytron, Inc.

Information: http://www.storytron.com

Description of the tool

The Storytron system contains the following components:

- *Storyteller* - plays the story worlds
- *Deikto* - a simplified version of the english language used by the player
- *SWAT* - the Storyworld Authoring Tool to create and edit story worlds, it contains editors for Verbs, Actors, Stages, Props, Relationships and Operators
- *Sappho* - a scripting language used by the author

Results

- the students used SWAT to create their own story world, an alternative version of “Little Red Riding Hood”
- the user plays the wolf and tries to lure the girl to a flowery meadow for diversion
- therefore he can give her different objects, like wine or flatteries (they are abstracted as an object, too) to influence her mood
- the story can be played with the Storyteller but was not finished, so that the outcome of interactions seems to be random and illogical

Authoring experience reported by the students

General working steps:
- started with creation of four stages, like forest and meadow
- because of the character based approach they continued with the actors (wolf, little red riding hood) and configured their traits
- next they created props (basket, wine)

Judgements:
- creation of stages, actors and props was simple, although they could not find out how to let the actors carry the props
- the three editors are easy to use and understand, the complexity reduced to a useful minimum
- the opposite applied to the verbs (actions - the core element of Storytron) and the roles; they found them very difficult, even with the help of the provided tutorials
- Sappho (a treelike scripting language, that has to be used) seemed intuitive to them, but during use they found it unusual and too complex
- biggest problem was that the available tutorials pointed to the important option “inclination”, that was renamed and rearranged (now “Acceptable/Desirable Option”) in the version they used, because of that it was not possible to use different options/reactions (verbs) for the roles
- the included debugging tools (lizards) were not used or understood, they did not find them helpful
- bugs prevented them from fully testing Storytron and their story world and so the intended story could not be finished
- the manuals/tutorials were found insufficient

Observations on their experiment

- the order of creation (editors) is not determined, they could have started with actors instead of stages, but this procedure seems to derive from the use of common game editors
- to let the actors carry an object, only a simple box has to be checked, maybe the students got confused by the interface although they said it was easy to understand
- verbs/roles/Sappho: they understood the principles but were not able to use them properly, because of the high complexity and the needed “backward thinking”, that is mentioned in the manual/tutorial

- the students had in the beginning some problems to understand the concept of the role, in the words of Chris Crawford himself “… one of the most difficult concepts in SWAT. Instead of asking ‘Who should assume the Role?’ we ask ‘What conditions specify whether an Actor should assume the Role?’”, he mentions that as “backward thinking”
- the bugs/changes in the software made it impossible for the students to finish their story

Conclusions

- Storytron offers a lot of possibilities for authors to define dramatic acting situations, in which complex contextual information can be taken into account
- actions of end-users and actors are defined in the same way, so that they are interchangeable; the Deikto interface is symmetric in terms of input and output
- a rich environment and experience can only be created with a huge number of verbs, roles and reaction options; this is very difficult, because there’s no abstract way of planning/creation, everything has to be done on a very low level, similar to programming with a common programming language
- getting an overview of all created content is also difficult, because of the same reasons
- the high complexity and the counterintuitive “backward thinking” makes learning and mastering of the tool difficult
- finally, it is not possible to use German language for storytelling, which was a barrier for some German students

5 The Virtual Storyteller

Origin: HMI, part of the Department of EEMCS at the University of Twente, Netherlands

Information: http://wwwhome.cs.utwente.nl/~theune/VS/index.html

Description of the tool

“The Virtual Storyteller” (TVS) contains the following components:

- Virtual Environment – world agent
- Simulation – character and plot agent
- Presentation – narrator and presenter

- TVS is a multi-agent framework for automatic story generation
- creates stories based on actions of autonomous agents living in a simulated story world
- formal story representation is constructed on basis of the "adventures" of these agents and then expressed in natural language (text and speech)
- 3 kinds of agents: Character Agents with emotions, beliefs, plans and goals, that inhabit the world and perform actions; World Agent keeps track of the story world state, processes the character agents actions and updates the world; Plot Agent intermediates between the other two and creates the fabula, a formal representation of the story content
- the Narrator converts the fabula to natural language text and then to speech
- the author has to use a domain specific Web Ontology Language (OWL) for the fabula and story world and Prolog to create schemas (actions, events, goals, …)

Result

- not available

Authoring experience reported by the students

General working steps:
- at first the semantics of the objects have to be described by using OWL
- for OWL they used the recommended Protégé Ontology Editor
- there are two basic ontologies, the Fabula Ontology (concepts like goal, event, action, emotion, belief, perception, outcome, character) and the Story World Core Ontology (describes objects and relationships, like paths, locations) where for example characters and actions (verbs) with preconditions and effects can be added

- after that the schemas (like action, event, goal, belief, framing schemas …) have to be created in Prolog

Judgements:

- the students failed in creating a working story
- the external Protégé Ontology Editor was found very helpful because of its structure
- the reasons for the unsuccessful work was the high degree of complexity of the system
- the students were distracted by the inscrutable number of menus and windows where the information are scattered
- another point is the high technical level of the software, that makes it very difficult to get an intuitive access to TVS
- an author has to understand the basic principles of OWL and Prolog to be successfully able to create a story world, what means that he needs programming abilities

Observations on their experiment

- the students were overchallenged with the system
- for them was the system too complex and complicated, even with the help of the tutorials
- the lack of knowledge about Prolog was another reason for the failure

Conclusions

- learning and understanding the principles of OWL and Prolog is mandatory
- without preknowledge from the field of programming it is very difficult to understand the underlying principles
- non-technical skilled author would be overchallenged by the very technical based approach
- the tool itself offers no possibilities for interaction, because of it's pure generative approach, it generates stories only from the presets of the author and the behaviour of the autonomous agents
- the agent-based approach makes it interesting for further research

6 Adrift

Origin: Campbell Wild

Information: http://www.adrift.org.uk

Description of the tool

Adrift (Adventure Development & Runner – Interactive Fiction Toolkit) contains the following components:

- Adrift Generator – the authoring tool to create stories
- Adrift Runner – to play the created stories
- completely menu-based, minimal scripting abilities needed
- principal elements are characters, rooms (a graphical map is automatically created), objects, tasks and events (everything which relies on time)
- tasks are actions that the player has to perform to advance in the story, this has to be done by entering a certain word or sentence
- tasks have preconditions (called restrictions) and post conditions/effects (called actions), which have a defined structure and can be set via drop down menus
- events can trigger tasks
- with characters can be interacted by simple dialogs, where the user has to talk about a subject and the character says a predefined sentence; they can change depending on the completion of a task

Result

- the students created a story in which the user plays a baby that wants to leave the house
- he is not able to communicate with other characters (mother, father, sister), but with his pet, a dog, that can give hints how to solve different problems

- two basic storylines can be followed to leave the house; in the first he has to trick the family members to make his way out by using different drugs; in the second the dog helps him to use the pet door if he gives him some food, that he has to acquire by distracting the mother
- the story can be played with the free Adrift Runner

Authoring experience reported by the students

General working steps:

- the students created the rooms (9, e.g. bedroom, street) and their connections at first
- after that the characters and objects (12, e.g. a magazine, dog food, sleeping pills) were created and placed inside the rooms, some of the objects are locked inside rooms or other objects
- the most important part was the creation of the tasks, where they connected the before defined elements to create the actual story; therefore they used for example a variable that represents the stress level of the sister and has to be raised before another task can be completed

Judgements:

- the students found out, that only two different character descriptions and dialog alternatives can be used, depending on a certain task; they said that this is unfavourable for more complex stories, where you want to change information about the characters multiple times or want to have more interesting dialogs depending on the progress of the story
- they found out, that a problem is the naming and invoking of the tasks; if someone knows the name of a task, for example the final task to finish the game, he can type it at the beginning and has not to play; this problem can be solved by connecting all tasks with restrictions (preconditions)
- a task overview is included (a dependency tree), that they did not find helpful during the authoring process, but after completion
- the students said, that it is possible to create interesting interactive stories with Adrift, but the more complex the stories become, the easier the author looses the overview over the project
- they liked the simple and user-friendly interface and found the basic principles easy to understand, even without tutorials
- they said, that the basic elements for interactive storytelling are available (characters, actions, events, preconditions, …), but because it was not intended to use it for complex character relationships, moods and emotions, it becomes very difficult to create them only with the given task structure and possibly created variables
- by trying to enrich the story with these features the insufficient visualisation capabilities of Adrift become obvious, it is too difficult to keep an overview; they suggested to use diagrams or sketches

Observations on their experiment

- the students made fast progress in understanding the functions of the tool and were motivated and creative during the authoring of their story

Conclusions

- the tool allows the easy creation of simple text adventures, therefore it is even possible to determine complex preconditions for certain actions by the use of simple structured menus
- because of the use of menus for all configurations in the structured GUI, it is easy for the author to learn the base functionality of the tool - no scripting language is needed
- emotional states can by simulated by using variables
- with growing scale and complexity the overview quickly get's lost, because there are no ways for an abstract structuring of the story and the visualisation modes to show the links of conditioned actions are insufficient
- no drama manager or story logic exists

7 Inform7

Origin: Graham A. Nelson

Information: http://inform7.com

Description of the tool

"Inform7" consists of the following primary parts:

- *Inform7 IDE* – includes development tools specialised for testing interactive fiction
- *Inform7 Compiler* – for the Inform7 language
- *Standard Rules* – the core library for Inform7

- "Inform" is a programming language and design system for interactive fiction
- the current version "Inform7" is a highly domain-specific language based on natural language, so the source code looks like natural language and is easy readable
- "Inform7" has a strong bias towards declarative rule-based (logic) programming
- direct support for relations which track associates between objects, including automatically provided relations
- the language is based on assertions and rules
- assertions represent the configuration of the story world
- the story world consist of objects and their relations between each other
- each object has attributes and abilities under certain circumstances
- rules represent how the world reacts, for example if the user interacts with it
- ability to infer types and properties of objects from the way they are used

Example:
The statement "John wears a hat." creates a "person" called "John" (since only people are capable of wearing things), creates a "thing" with the "wearable" property (since only objects marked "wearable" are capable of being worn), and sets John as wearing the hat.

Result

- the created story is a classical detective story in which a man has been murdered and the user has to find the killer
- therefore he can visit different locations, investigate evidences and interact with people
- if he chooses the right way in the progress of the story, he is able to convict the victims wife of murder
- the story can be experienced with the free version of "Inform7"

Authoring experience reported by the students

General working steps:
- not available

Judgements:
- not available

Observations on their experiment

- the students did not use the extensive possibilities the language offered for their story
- the story is considerable big, but does not go into the depth of the language
- the reason for this seems to bet the scale of "Inform7"

Conclusions

- the use of natural language is an interesting and promising approach to interactive fiction
- this approach - the similarity of the author input, user input and the system output - could help in developing new interactive storytelling tools for authors, that can be understood more easy from people who are not studied programmers
- the language is so intuitive, that simple stories can be authored without deep knowledge of the language itself

- nevertheless leads growing complexity and interactivity in the story to the necessity to use more complex "commands" or "command structures", which come close to the complexity of common programming languages
- because of that it is necessary, that an author has basic understanding of the principles of programming
- if that basic knowledge is available, an author has easy access to the system
- it is not clear, if the creation of a drama manager or a story logic from scratch is possible with "Inform7"

8 Aurora and ScriptEase for Neverwinter Nights

Aurora

Origin: BioWare, Subsidiary of Electronic Arts, Canada

Information: http://nwn.bioware.com/builders/

ScriptEase

Origin: Department of CS, University of Alberta, Canada

Information: http://webdocs.cs.ualberta.ca/~script/

Description of the tool

- "Neverwinter Nights" is a 3D computer roleplay game in a fantasy setting
- the authoring tool "Aurora Toolset" is provided with the game
- "ScriptEase" was developed by the University of Alberta to make authoring easier
- like TESCS, the tools were not explicitly developed for use in the field of interactive digital storytelling, but by usage of the scripting language it becomes possible
- like in most game editors, "Aurora" provides a map-based interface, where you place and edit characters (player and non-player characters) and props to create the game world, after that it is possible to write scripts for these objects to manipulate and link them
- the used scripting language is similar to C or Java, but much more simple, nonetheless it has all needed elements to create very complex instructions
- "ScriptEase" replaces the script writing process by a more simple and tree-like way of expressions, where the nodes are encounters, situations, events, actions and definitions
- the user has to choose a few parameters and will get appropriate suggestions from a list of predefined scripts; after that "ScriptEase" generates the final scripts and they can be integrated into "Aurora"

Results

- he students created a story in which the player was poisoned and has to find an antidote, therefore he has to speak to different people and visit different locations, the options chosen in the dialogs change the course of the story
- the students tried three ways to enrich their story world with scripts:
  1. without help of the integrated "Aurora" scripting assistant
  2. with help of the integrated "Aurora" scripting assistant
  3. with help of the external "ScriptEase"

Authoring experience reported by the students

General working steps:
- the students started with rough sketches of their stories, thinking about possible branches and how the choice of dialog options can change them
- after that they created the world with all props
- the next step was the creation of the characters
- then the dialogs were created
- at last all the above was connected with the scripts they created in the described three ways

Judgements:

- the creation of the world itself, the characters and objects was very simple and intuitive

1. Without "Aurora" or "ScriptEase"

- without help of the tools and directly writing the scripts it was difficult for the students to reach their goal, but they did
- getting familiar with the scripting language was time-consuming and difficult, because of the abstract names of the predefined scripts and their unknown connections among each other
- they found the documentation insufficient
- they created the needed variables for the objects and connected them with predefined and partially self-written scripts ("Aurora" has hundreds of predefined scripts included, from simple instructions like "open door" to complex fighting actions with multiple characters)

2. With "Aurora"

- the use of the "Aurora" assistant was much easier for them, the documentation was helpful and provided a lot of information

3. With "ScriptEase"

- "ScriptEase" offered the most useful and simplest way to create the scripts
- the tutorials were well written and only a short time (compared to writing the scripts from scratch) was needed to get familiar with the tool
- the biggest advantage was for them, that "ScriptEase" shows only the appropriate pre-defined scripts for the chosen object or situation, unlike the "Aurora" assistant, that created confusion by showing all scripts every time
- the biggest disadvantage was that "ScriptEase" is an external tool, so they had to switch between "ScriptEase" and "Aurora" every time they wanted to change or edit objects or the world itself

Observations on their experiment

- the students were very motivated to work with these tools, the reason for that seemed to be the game itself, the rich graphical environment and the huge number of possibilities the script-based system offered
- they worked independently and successful on their ideas even if they had to face problems, which could mainly be solved by the use of available tutorials and documentations

Conclusions

- with "Aurora" and "ScriptEase" it is possible to create interactive stories on a low but still emergent and suspenseful level, it is easy to create branched story structures
- no abstract level for authoring or planning exists, everything has to be done on the low level of scripting
- for more complexity and freedom in the course of the story, a lot of work has to be done by writing powerful scripts and "storytelling mechanisms"
- the graphical rich 3D environment of "Neverwinter Nights" is easier accepted and provides more motivation for students than text-based tools
- beside the script compiler and the error messages it gives, no other debugging tools are included so it is difficult to keep the overview of bigger and more complex stories

9 Morrowind – The Elder Scrolls Construction Set

Origin: Bethesda Game Studios, published by Bethesda Softworks and Ubisoft

Information: http://morrowind.de.ubi.com

Description of the tool

- "The Elder Scrolls Construction Set" (TESCS) is a free game editor for the game "The Elder Scrolls III: Morrowind", a 3D computer roleplay game in a fantasy setting, the game itself is played from first-person view
- allows the user to make modifications to the existing game or create new games

- as a classical game editor - like "Aurora" and "ScriptEase" for "Neverwinter Nights" - the tool was not explicitly developed for use in the field of interactive digital storytelling, but by usage of the included script language it becomes possible
- like in most game editors, TESCS provides a map-based interface, where you place and edit characters (player and non-player characters) and props to create the game world, after that it is possible to write scripts for these objects to manipulate and link them together
- the scripting language is similar to C or Java and offers more then 500 predefined functions and commands
- 3D models can be imported from 3ds Max to create individual objects and characters

Result

- a new NPC (non-player character) was created and placed at the starting point of the original game
- the player and the NPC are pupils and when the player starts a conversation with the NPC, a dialog begins in which they talk about watching a movie in cinema
- the NPC asks the player some questions and the player chooses the answers
- they range from accepting to different excuses why the player can not come
- the dialog has nine possible endings, depending on the answers

Authoring experience reported by the students

General working steps:

- the students started with preliminary considerations about the story and decided after some experimenting to only create a dialog
- the first step with the Construction Set was the creation of a map, they decided to use the original game map of "Morrowind" and added some props
- next they created two characters on the base of predefined ones
- the main part was the creation of the dialog and different alternative options for the user to choose from
- in the last step they connected the endings of the dialog with scripts, for example to begin a fight after a negative progress in the conversation

Judgements:

- becoming acquainted with the tool the students found extensive and tedious
- a big help were the numerous and detailed tutorials from the internet

Observations on their experiment

- the students always said, that everything can be programmed, they were sure, that many interactive storytelling challenges can be solved with the scripting language
- the tool offered a wide range of possibilities to enrich the dialog options with preconditions and other interactions by the use of scripts, but the students failed in a first attempt and created the (described) simple version of their dialog
- the students were really enthusiastic to work with the tool, but not to create something that would show the full range of possibilities the tool offered, one reason could be that they were too much distracted by the abilities of the 3d world editor

Conclusions

- the tool offers good possibilities for experimentation, mainly for branching-based stories
- the authoring interface is very much influenced by the original developers of the game, and therefore partially unnecessarily complex, a revised version could make the creation of interactive stories much easier
- because of the fixation of the scripts to objects or characters, it seems nearly impossible to create a story logic layer or drama manager inside the tool only by use of the scripting language
-

10 Korsakow

Origin: Florian Thalhofer

Information: http://korsakow.org

Description of the tool

The "Korsakow" system contains the following components:
- *Engine* – running, visualising and linking of the final project
- *Editor* – to create and edit a project (the films)
- *Analyser* – for visualisation of the links
- *Subtitler* – to create subtitles for the clips
- *Interfacer* – to edit the user interface
- the "Korsakow" system is a tool for the creation of database films, the target is "database storytelling"
- watching films in the system is interactive, the user can choose which film (scene) is shown next
- watchable alternative scenes presented to the user are defined by the author by using rules, the author decides which scene relates to each other, but does not create fixed links
- the resulting films are generative, the order is calculated while viewing
- a projects consists of SNU's (smallest narrative units), keywords and previews

Results

- their story was about a man, who is robbed on the street, depending on sooner decisions he is able to win or loose the fight if he tries to attack the robber
- the story can be experienced with the free version of the "Korsakow" system

Authoring experience reported by the students

General working steps:
- the students had no film material, so they decided to make pictures with a short written description about what should happen in the scene
- at first they made a simple tree sketch with the story and the alternative branches
- then they decided about the suiting keywords and combined them with the pictures in the editor

Judgements:
- the students had problems with the positioning of the keywords, they started to put them at the end of the clips but found out later, that this never works, because the end of a clip is not processed by the system; the last keyword has to be placed 1 second before the clips ends
- they wanted to create different probabilities for the occurrence of a clip, for example by placing clip A two times and clip B one time in the interface menu, so that A is chosen with a probability of 2/3; but they found out, that each clip can only be used once for the menu; the students made a workaround and copied that certain clip, so the system recognised it as two different clips
- similar problems occurred with the naming of the clips and preview pictures
- the students opinion was, that the system is more intended to be used for films without context, opposing the idea of interactive storytelling
- the idea of the "Korsakow" system is not to present traditional narratives
- they found that the creation of a dramatically rich interactive narrative needs a lot of effort and the low level of interaction (only one click on a preview clip) is insufficient, because of that the system is not useful for interactive storytelling

Observations on their experiment

- even if the system itself is very simple, the students had some problems in the beginning, the reasons were insufficient tutorials, a missing data base for experimentation and unexpected peculiarities, like the impossibility to place keywords on the end of a clip
- the idea of different probabilities for choosing a clip is interesting, but it is open if a user would really chose one clip with higher probability only because it is shown more often
- the workaround for that problem works in the experiment, but practically it is not useful to have the same clip twice or more often in the database

Conclusions

- the tools follows the interesting approach of linking existing movie clips by the use of tags - the result is cinematic hypertext artefact
- because of the lack of superior structures, like a drama manager or a story logic, only branching-based stories are possible, with a high degree of unpredictability regarding the final result
- a dramatic structure is not controllable and depends on chance
- the interactivity is limited to the sole clicking of a clip menu, created on the base of the tags
- it could be interesting to use the tool on very big data bases with a lot of keywords (tags) to recognise if the mere amount of data leads to an interesting story flow

11 Storytelling Alice

Origin: Carnegie Mellon University, USA

Information: http://www.alice.org/kelleher/storytelling/index.html

Description of the tool

- "Storytelling Alice" is a programming environment designed to motivate middle school students to learn to program computers through creating short 3D animated movies
- it is an further development of "Alice", with more animations for social interactions between characters and the possibility to use scenes
- it uses a simple structured graphical programming language to make interactions with pre- and self-defined objects possible
- a great number of objects (like characters and props) are available and already have methods with them, for example, animations can be performed
- even if it was not intended to be used for interactive storytelling, this can be done with the provided interaction possibilities (user can click on objects, type keys to trigger methods or move characters)

Results

- in the beginning the user has to choose which kind of story he wants to experience, fantasy or science fiction, therefore he has to click on a knight or a robot
- if he chooses the robot he is only asked to go back to the start-up screen, the real story is in the fantasy part
- a medieval battle scenario is presented and the user can interact by choosing different options that influence the fighting
- depending on the choices the good or the bad side wins
- the story can be played with the free version of "Storytelling Alice"

Authoring experience reported by the students

General working steps:
- the students started with the tutorials and some experimentation of the features Storytelling Alice has to offer
- they created the scenes with the characters and objects and assigned appropriate methods for the animations

- to make interaction with the user possible, they decided to use simple objects and written text that is clickable and triggers methods that start complex animations

Judgements:

- the students mentioned positive, that „Storytelling Alice“ offers a lot of predefined methods and animations, the live preview of the story/scene, the possibility to integrate sound effects and to download new (partially community made) objects from the internet
- they found negative, that it is difficult to delete methods (maybe a bug), the author has always to choose the right scene in the editor and the world view (otherwise errors occur, maybe a bug), the difficult placing of objects in the 3d world and that downloaded objects most times only have a few predefined methods
- the students found „Storytelling Alice“ only useful for simple interactive stories, because they found that the ways of interaction are too simple

Observations on their experiment

- the students used a lot of time to create the environment and the characters to visualise an interesting and rich story
- but they did not focus on the possibilities to enrich their story with different interaction types or more complex story events
- for example it would have been possible to create methods with preconditions, depending on traits or moods of the characters
- it is not clear if they did not understand how to do this or just failed to make it in the given time

Conclusions

- „Storytelling Alice“ is useful for simple branching-based stories
- could be used for more complex and interactive stories, but only with extensive effort, one reason for that is the missing of more powerful visualisation tools inside “Storytelling Alice”
- because everything has to be “programmed” in the tool, even if it is done with a graphical interface, it addresses more a programmer, than an author who is not from this field
- but the simple programming interface and language can be used to teach authors basic principles of programming (Boolean expressions and loops to realise preconditions), what is the main purpose of this tool
- no story logic or drama manager exists, but could be programmed inside “Storytelling Alice”, but the effort would be as big as to do this in a common programming language
- the 3d visualisation of the story world is an advantage, because the user is more attracted by visually rich environments then by simple text

12 Conclusion on the Practical Study

The study gave first insight into practical issues when using current state-of-the-art authoring tool prototypes. Not all systems were equipped with authoring tools, but were selected for other interesting insights they could offer, such as conceptual models of planning and agents. Some groups of students managed to create interactive story prototypes that were playable with a certain mini-scene. Others struggled with the software and could not come up with a playable result, however with some insights and a conceptual overview.

Different systems were involved in the study, and a side-effect of the study was to gain a better overview than from reading papers, including in-depth terminology used by the systems.

The following systems/tools started and finished the studies:

- IDS systems
    - ActAffAct
    - Emo-Emma, Bovary authoring tool
    - IDtension
    - Storytron
    - The Virtual Storyteller

- Interactive Fiction
    - Adrift
    - Inform-7
- Game Editors
    - Aurora Toolset/Scriptease for Neverwinter Nights
    - Morrowind – The Elder Scrolls Construction Set
- Interactive Video and 3D Animation
    - Korsakow System
    - Storytelling Alice

More systems were considered from the start, but were not selected for the final study. Scenejo was dismissed because we already had much experience with it. The Inscape authoring tool was selected but then turned out to be unavailable. FearNot! was considered too complex and not supported by enough information. Dramachina was not used because it does not include a runtime system.

On a very general level, and not surprisingly, it could be seen that the more immediate and playable results could be achieved with a system, the more motivated were the students in the first place. This concerned the game editors, interactive fiction tools and Storytelling Alice. The “core” IDS systems with story engines caused the most problems. Besides technical problems and missing information, one reason was that these systems (for example Storytron) require a certain complexity before they make sense, and for building complex worlds the allocated seminar time (which included the long learning phase) was actually too short. The seminar could only touch upon the surface of the complexer systems.

Authoring Issues beyond Tools

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Abstract. Authoring is still considered a bottleneck in successful Interactive Storytelling and Drama. The claim for intuitive authoring tools is high, especially for tools that allow storytellers and artists to define dynamic content that can be run with an AI-based story engine. We explored two concrete authoring processes in depth, using various Interactive Storytelling prototypes, and have provided feedback from the practical steps. The result is a presentation of general issues in authoring Interactive Storytelling, rather than of particular problems with a specific system that could be overcome by 'simply' designing the right interface. Priorities for future developments are also outlined.

Keywords: interactive storytelling, interactive drama, authoring, creation process.

1 Introduction

Creating an Interactive Storytelling experience is considered a difficult endeavour. It is aimed at an experience of an artifact that requires the execution of software constituting a dynamic story engine, which controls the unfolding of drama. This rather technical perspective is one of the main challenges that have recently been discussed at Interactive Storytelling conferences [14]. Dynamic story engines are complex software, equipped with Artificial Intelligence algorithms capable of reacting meaningfully to an interacting user, while maintaining a storyline model incorporated within the system.

Recent discussions about the issue of authoring suggest that it is hard to clearly define what steps of creation fall within the scope of authoring, and where the boundaries of so-called authoring tools are located. This is because on one hand we assign a co-creation role to the user regarding the resulting story experience, and on the other hand we cannot precisely distinguish between authoring a dynamic storyworld and programming the engine. There are also differences inherent to several approaches, resulting in genre-like interpretations of what Interactive Storytelling actually is.

Therefore, it is necessary that we first define the subject of this paper: "Authoring". After defining the term and discussing where its boundaries lie, we will explore the state of the art of authoring for current story engines, from a practical point of view. We focus our search on general issues that are most likely "here to stay", because of their independence from the (potential) lack of usability of some graphical user interface.

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1.1 The Case of the Authoring Problem within Interactive Storytelling

We are discussing types of Interactive Storytelling (IS), in which a user (or users) experiences a narrative by interacting with a digital system of agents during the unfolding of said narrative[1]. Such a system of digital agents is considered to be the created Interactive Storytelling (IS) artifact. It consists of

a) an IS storyworld, running on
b) an IS runtime engine.

The IS runtime engine enables the performance of agents' autonomous or semi-autonomous behaviour, which means that agents act independently of the author after the actual authoring phase is finished. This engine is a software architecture including specific IS platform components (e.g., story structure manager, planning, interaction/dialogue manager, representation managers, other agents ...).

The IS storyworld constitutes the actual “content”. It is created by a creator or author (or a team of creators / authors), and uses the agent functionality of the IS engine. For example, authors need to define the storyworld’s specific characters as instances of the engine’s generic agents. As a special difficulty, the user is as well an active agent (maybe a character) of the storyworld; the creator has to consider this when making up the storyworld. As well as containing components and assets, the content is also made up of rules and conditions that determine the occurrence and actions involving those entities, as well as their effects on the storyworld. As such, the created content ends up being code running on the IS engine.

Examples for such IS artifacts are Façade [15] and FearNot! [1], which are IS projects with integrated storyworlds and agent engines. Other IS research projects have built story engines that allow for various storyworlds to be authored. Examples are: ‘Storytron’ [16] which can run several storyworlds such as *Balance of Power*, or the two examples that will be discussed in the next section, IDtension (running the story *The Mutiny*) and Scenejo (with the *Killer Phrase Game*). In each case, there is an end-user who interactively experiences the storyworld by playing a role in it.

Authoring means delivering content for somebody else’s (an end-user) experience. It is different from the potential kind of co-creation that can take place when end-users interact with a storyworld. However, there is a blurry borderline between authoring a storyworld as a delivered artifact, and the end-user’s co-creation during the “runtime” experience. In Fig. 1, this blurry line is symbolized between the “Interaction” level and the “Storyworld” level as part of the IS artifact. Another blurry line is drawn between the runtime engine and the storyworld. This refers to the circumstance that an IS storyworld can only work in co-existence with a runtime engine, which (historically) was developed by a team of computer scientists.

We assume that the developers in this model are computer scientists and that authors are from creative media fields, for example writers, designers etc. Recent discussions about authoring addressed developing authoring tools that allow creative media experts to create a dynamic storyworld without programming know-how. The goal of this paper is to present an overview of general problems that currently exist in the authoring process between the two levels: development and authoring.

[1] We are aware that this is a rather technical definition. It is necessary to distinguish from other (“branching”) phenomena that might be grouped under the term “Interactive Storytelling”.

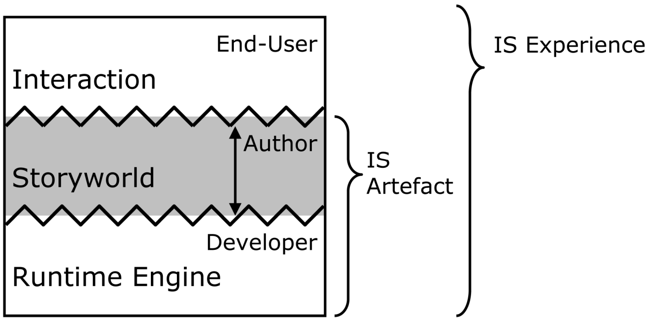

Fig. 1. Definition of the boundaries of authoring. There are blurry lines on the border of developing a runtime engine, as well as on the border of interacting with the content.

1.2 Related Work

Recent discussions on authoring have been followed up in workshops [14], and publications at conferences on that topic, e.g. [13]. However, there was less work on dealing with general authoring problems than with the suggestion of new authoring tools, which often provide GUI representations for specific engine functionalities. There have been few attempts to propose general authoring principles or tool classifications and outlines. For example, Pizzi [8] divided authoring tools according to the generative abilities of the underlying engine and the visibility of the engines' storyworld structure, while focusing on the aspect of visualizing and debugging plan structures. Louchart et al. [4] proposed a metaphorical landscape as a visualisation for emerging plotlines. Medler and Magerko [6] defined rather general requirements such as usability, debugging, control of pacing/timing and generality. A similar problem to the one presented here was the basis for Mateas and Stern's article on procedural authorship [5], with the conclusion that "authors must programme". While we agree that authors must have some level of procedural literacy, we think it's important to develop better tools that educate authors in what they need to do. Further, we believe that programming skills and authoring tools alone do not solve the problem, and that there are a number of general issues that have to be considered.

The goal of this paper is to give an illustration of "real" problems that are present in current content development for IS. It is the first step of an effort to bridge a perceived gap between creative authors and obscure technology by analyzing the affordances of current tools for creation.

2 Feedback from Real Authoring Exercises

In the following, *general* authoring problems are outlined that were observed during the practical creation of storyworlds, which run on interactive narrative engines. We take examples of our own systems and authoring tools to illustrate these problems: IDtension [17, 18], an interactive drama system that generates actions based on narrative principles, Scenejo [12], a character-centric conversational storytelling system based on conversing chatbots, and Rencontre [10], a fragment-based writing / reading system with dynamically generated hyperlinks. To complement the data, we also present feedback found in literature, since the goal is not to blame one specific tool but to generalize the issues.

The most significant interactive storyworlds we created with IDtension [19] and Scenejo [13] are (for online descriptions of the architectures and stories see idtension.com, scenejo.org, and redcap.interactive-storytelling.de):

- "The Mutiny"; synopsis: *As a sailor jailed in a 17th century galleon, your goal is to take the leadership by preparing a small riot.* IDtension grants the player diversified and combinable action possibilities by a text interface.
- "The Killer Phrase Game"; synopsis: *As the moderator of a public debate on an airport extension, you must control the fairness level, otherwise the dispute escalates.* Scenejo allows users to text-chat along with 2 virtual characters.

2.1 Story Ideas That Do Not Fit into the Engine's Approach

2.1.1 Finding Authors

The initial phase in starting a project in IS is to find authors. This initial phase was skipped in many recent research projects, where the author and system designer were the same person, the best example being Façade [5]. But in the general case, and for the sake of disseminating interactive narrative, a specific author must be found to create new stories that run on a system. This initial phase often turned out to be less easy than expected. Of course, because the IS systems we are working with are research-based prototypes, we did not expect to find authors who 'a priori' understand the authoring framework. However, approaching authors always implied having to explain operational principles of the system in detail. The outcome of such explanations appeared to be unpredictable.

With IDtension, we went through the experience of spending two hours explaining the system in detail to a potential author, who later produced a first document completely out of scope with the engine. In another case, the author produced a document that was not incompatible with the system, but she preferred to remain at a general level of a synopsis, leaving the fine detail of content specification to the system designer. This was the same experience as in the design of the *Killer Phrase Game* for the conversational platform Scenejo. There, we assumed the underlying chatbot principle to pose technical challenges of implementation of the dialogues. But more than that, it also constituted a mental model of questions and answers that was hard to grasp for developing story structures at all, even if at first just "on paper".

A typical situation we encountered in these early stages of looking for authors was that authors were simply reluctant to the idea of reducing human affairs into logical models.

2.1.2 Abstraction

Given their generative nature, IS systems require authors to write at the level of story-related abstract structures. For example, many systems represent stories in terms of characters' or stories' goals [2, 18, 21], using the notion of generic/instantiated data. Such abstract concepts, with which Artificial Intelligence practitioners are well accustomed, remain distinct from usual creative ways of thinking. The author who wrote

The Mutiny, the scenario used to demo the IDtension system, reported that this way of writing was quite remote from his usual writing activity [17].

When working with Rencontre [10], a system that could be considered less abstract, since narrative fragments are not generated (only their sequencing is), authors also reported difficulties in grasping the abstract concept of hypersections. More remarkably, the designer and programmer of the previous system "IDtension" also found it difficult to write at the particular level of required abstraction. This observation shows that this authoring difficulty cannot be reduced to a general lack of programming skills or procedural literacy of the author.

As with Rencontre, Scenejo's 'generative' features do not go far beyond slightly restructuring ordering for predefined utterances, and offering to get interrupted by user's actions and respond accordingly. However, dialogue states can be tracked by the system, such as an increased stress level. Therefore it was necessary for authors to not only write utterances in direct speech, but to model a dynamic system of influences and meanings of abstract speech acts. Experiences showed that computer science students, capable of programming in general, but not with AI, had no advantage in modeling the dialogues. Specific creative knowledge of dialogue abstraction and design was necessary.

2.1.3 Formatted and Constrained Writing

Current IS systems require filling in several precise data structures. For creative authors, this may be perceived as "filling a form", a typical non-creative activity close to using templates that abridge creativity.

With IDtension, surface text had to be written in a spreadsheet file that was then processed by the runtime engine. The author did not comply with this constraint, and spontaneously chose a word processor, to be able to freely phrase sentences. As a consequence, the produced sentences were partly incompatible with the engine's text generator, and some rewriting by the system designer was required. In this case, the creativity of the author was limited by the interactive narrative formalism used within the engine.

For Scenejo, an authoring tool was provided that enabled – and forced – authors to directly write in the chatbot's terms of patterns and templates [12], where a pattern is a precondition that has to become true before an utterance is made, or in other words, the pattern provides the stimulus for each uttered response of a character. The whole dialogue between two characters had to be written separately for each actor, in order to work according to the character-centric approach taken in Scenejo.

Although these are issues that could be partially enhanced with better GUI support through a better authoring tool, the GUI often only replaces typing by clicking, and does not avoid the formality of the implementation that is simply necessary with given formalisms in story engines.

2.1.4 Algorithm-Centered Story Design

Given the constraints just mentioned, a strategy often adopted consists in first looking closely at the computational model and its limitations, in order to then find a story that best suits the model.

For the engine IDtension for example, we deliberately chose a story (*The Mutiny*) with 8 characters, because it fully expresses the richness of the model [19]. But when applying IDtension to an existing training context with fewer characters and less inter-character interaction, the resulting global story was less interesting [11]. The pedagogical content, extracted from linear cases, consisted mainly in procedures to be applied by the main character. This context did not leave much room for possibilities such as influencing other characters to perform actions or getting helped by another character of your choice.

All the same, the idea for the *Killer Phrase Game* that runs on Scenejo was highly dependent on the potential that Scenejo offers to an end-user: Joining in a discussion between two or more chatbots (quite similar to the interaction paradigm in Façade). Starting out with the bot platform in mind, the creative task was to develop situations with real reasons to interrupt an ongoing dialogue between two or more characters, and the objective of moderating a debate suited that paradigm of the platform.

According to Marie-Laure Ryan [9], Façade's story [15] is chosen according to the limitations of the engine itself: *"As the conversation turns into a domestic fight, it is not too surprising that Grace and Trip increasingly ignore the visitor. With its theme of marital feud, Façade is very successful at minimizing the limitations of its AI module."* It is difficult to judge if algorithm-centered story design is a good or bad thing. It certainly characterizes the emerging field of Interactive Storytelling from the authoring point of view. For Laura Mixon, who has authored stories for the Erasmatron [7], one should not look too closely at the algorithm when designing: *"The first and among the biggest of my mistakes was to try to use every single, pea-pickin' one of the Erasmatron's wide array of features. If there was a button or menu item, I wanted to bring it into play."*

2.1.5 Potential of Engines Underused

Since it appears difficult to grasp the specifics of an engine, and therefore to ground any story design around the underlying computational models, some authors tended to use only a subpart of the engine's features. As a typical experience in first authoring attempts with each of our engines, an author would naturally try to reduce the functionality to a linear or branching structure, which is more intuitive.

For example, the first story that was written with Rencontre by an author external to the project did not use fuzzy hypersections, which constitute one of the distinctive features of this engine. Similarly, IDtension implements a system of ethical values which, has not yet been exploited enough in existing stories. Authoring seminars with students have shown that with Scenejo, first attempts to come up with story adaptations resulted in ideas for quiz game-like, question-answer structures. First, these are more akin to the well-known classical chatbot interactions than to the potential of having more characters debating with each other, and second, a quiz comes with a built-in branching structure of right and wrong answers. In other words, the result was far from conversational storytelling. It rather resembled well-known structures of casual or adventure games.

This simply told us that because the field of Interactive Storytelling still lacks inspiring examples, the effort for imagining novel ideas beyond known structures from known domains is high. This was the case for example with students of media informatics who found it easy to use the abstract tools, but on the other hand had few ideas. At the same time, it was hard for creative authors to arrive at conceptual models for creation that fit the engine’s underlying drama or interaction models.

2.1.6 When Authoring and Programming Intersect

Theoretically, an often assumed modus operandi has been that runtime engines should be built first, after which storyworlds can be written based on the runtime engines. Practically, things tended to happen differently. It has not been uncommon that while writing content for IS, the engine designer modifies the engine with new a functionality to accommodate a specific story with new features. In such cases, authoring and programming were performed simultaneously, blurring the line between the storyworld and the engine (see Fig. 1).

For example, when adapting *The Little Riding Hood* to IDtension, we significantly improved the management of locations that *The Mutiny* did not use. Motivated through the development of the *Killer Phrase Game*, Scenejo has been equipped with better functionalities for managing the turn taking between the digital bots and the user.

This kind of intersection between writing and programming can definitely be associated to a certain immaturity of the medium of Interactive Storytelling (compared to cinema for example). However, we also presume that there are some aspects of it that are here to stay, because they are inherent to the digital nature of the medium. Given the flexibility of the computer, it must be accepted that such instability is not only unavoidable, but certainly desirable, because it allows to constantly improve the technology instead of freezing it.

2.2 Painful Process of Storyworld Implementation

In this section, we grouped the feedback from authors related to the process of story making. It concerns the day to day work with runtime engines and authoring tools while creating an interactive storyworld.

2.2.1 The Time-Consuming Task of Entering Content

Generally speaking, we still lack usable enough authoring tools to enter content, despite the previous work tackling this issue [6, 12, 16]. Currently, entering content – at first sight – closely resembles programming activities, because at least partially, data structures must be directly entered in text files (such as XML structures). Even with graphical templates that help create the correct syntax, entering data takes time and prevents from quickly seeing the result of the created content.

Typical problems that slowed down the processes in our examples include the lack of usable graphical interfaces supporting different perspectives on the content, the lack of control mechanism preventing authors from entering erroneous content, and the existence of several distinct files that are needed for running one storyworld, such as configuration files for various modularized elements, characters, dialogues etc.

With IDtension, we ended up writing narrative structures twice: an initial schema is established in a simple graphical software, which provides a clean overview of the narrative structure but is not connected to the XML effectively needed by the engine. The author has to write the schemas and then enter them into the system. These two files are hard to maintain and keep synchronized.

As already mentioned in section 2.1.3, what made entering content in Scenejo a tedious task was that dialogue parts and rules had to be written for each character separately, following a character-centric approach. There was a lack of visualizing potential inter-character conversation results of these rules, so that authors of the *Killer Phrase Game* kept separate Excel files and external drawings to maintain an overview of the planned dialogue sub-lines.

At this point, future work in graphical authoring tools is worthwhile to speed up these processes. More than just providing templates for data input, different perspectives, on the same data, are necessary, as well as possibilities for simulating the outcome.

2.2.2 Understanding What Is Going on under the Hood

In our examples, after data for a conceived storyworld was entered, the first attempt was rarely conform to the author's expectations. A process of play-back, testing and tuning took place, as is quite common for linear media as well. But in the case of Interactive Storytelling, modifying the content is much harder, due to both the complexity of the models and the unfinished nature of runtime engines (see 2.1.6). Typically, in our own experience, when perceiving unwanted behaviour of the storyworld during its tested experience, three hypotheses were repeatedly made:

1. The storyworld was not implemented properly by the author. The content including its elements and rules must be tuned accordingly.
2. The runtime engine has a “bug”, in other words, according to the logics of the model, it should behave differently from the way it actually does. The engine must be repaired (debugged) by the developer.
3. The underlying model does not allow performing what the author expected. In this case, either the runtime engine must be extended and enhanced accordingly, or authors need to develop a better conceptual model of the engine’s potential and underlying dramatic model.

During our own experience with IDtension, we found that it was not easy to establish which of the three cases occurred. Finally, only the engine designer was able to tell. The adding of debugging/monitoring interfaces, allowing the visualisation of internal structures during execution (such as a list of all possible actions and their multifactor rating by the system) helped to better understand what was happening during execution.

In the implementation phase of the *Killer Phrase Game* on Scenejo, discussions were regularly needed between the designers/authors of the conversations and the engine programmers, to find out which of the above three possible interpretations of an error applied. This communication process slowed down the implementation significantly.

The conclusion to this aspect is that although there is great potential for improvements through better debugging tools, we believe that this issue is something inherent in Interactive Storytelling production in the near future, because engines constantly under development denote moving targets for authors. Similar experiences were had in the beginnings of the 3D animation production area, when graphic designers started using complex shaders and renderers that require many parameters to be tuned. Experienced designers usually get a good grip on intuitively finding “work-arounds” with given technical constraints. In the case of Interactive Storytelling, however, we have to deal with an even larger complexity.

2.3 Deliberating the End-User Experience

As motivated in section 1.1, the authoring process in IS aims at creating a storyworld that together with a runtime engine forms an artifact to be delivered to end-users. Not until end-users interact with this artifact does Interactive Storytelling occur as an activity and experience. Depending on the design of the engine model as well as the particular storyworld, the end-user plays a certain role within the storyworld, which is associated with particular possible actions and influences on the outcome.

This experience, which has often been discussed in relation to the notion of "the interactive narrative paradox" is actually something that the author has to conceive. In our view, it is an important – if not the most important – part of the authoring responsibility to care about the whole IS end-user's experience.

Within recent conferences and published literature, IS research has focused more on algorithms for interactive narrative management than on end-user experience, which has consequences in terms of authoring.

2.3.1 Foreseeing the End Result of the Storyworld Possibilities

While entering data for the storyworld, authors might have difficulties getting an idea of the final result of the interactive narrative. With IDtension for example, the author needs to enter a significant amount of data before getting an idea of the interestingness of the resulting interactive narrative. While testing the story, if no specific surface text is entered, the sentences appear in a crude form, which prevents a proper vision of the final product.

In Scenejo, dialogue pieces could be entered piece by piece and changes could be directly experienced after starting the play mode. This resulted in hearable and readable utterances, spoken by talking heads through a text-to-speech (TTS) converter. Preparations for this realistic playback included that the scene with modeled characters was built in advance and that TTS was connected and set up. Unfortunately it was not possible to change content "on-the-fly". This meant that there was a long design cycle, because it was necessary to stop the engine, go back to the authoring tool, make changes, and restart the engine from the beginning. With the prototype of Scenejo used in the authoring project, it was hard to focus on a specific situation that occurred late after some playback time, because it was only possible to initiate at the start, but not at a later plot point with given init values at this advanced state.

Through the feedback of the authors who really wanted to achieve a usable storyworld, more suggestions for changes in the authoring tools have been gathered. They concerned the possibility of on-the-fly changes as well as the possibility to scale down parts of the engine, because it also was perceived as a burden of always having to start the 3D world, even when only text occurrences within a dialogue had to be tuned.

2.3.2 Interaction Design

Only after a significant period of authoring effort, first real "play" tests were possible, which here means that end-users other than the authors themselves were called in to interact with the content. At this point, the next problem occurred in the experience that end-users would not know what to do and how to interact with the storyworld.

For example, in the conversational story of Scenejo, the interaction paradigm and style is quite obvious: End-users can type any text to phrase utterances directed at the two bots of the *Killer Phrase Game*. However, similar to Façade (but rather worse, since we only developed a fractional amount of content in comparison), only a few of the users' utterances could potentially lead to perceivable changes in the dialogic turns of the bots. In the limited prototype built, this was addressed by reducing the game to a narrow task assignment for the user of moderating by reacting to killer phrases. We also built in visualizations of the state changes, to give end-users the possibility to perceive effects of their actions if they influence state values.

We were aware that with these adaptations, we moved the original plan of having a free dialogue towards more narrow task assignment-like game features. On the other hand, this raised the issue that interaction design has to be an immanent job part for authors of a storyworld.

In IDtension, after temporarily using a basic end-user interface, the interaction mode eventually used – the history-based interface [20] – came late into the project, two years after writing *The Mutiny* began. Preliminary end-user feedback informed us that this interface has a huge impact on the experience. As with the *Killer Phrase Game*, end-users interacting with *The Mutiny* did not necessarily know what to do, and their behaviour sometimes consisted in clicking everywhere rather than trying to interact with characters in a meaningful way, as expected by the author. Adding a help section within the interface helped in the first instance.

As a consequence, we conclude that an important task in authoring an interactive storyworld is the design of possibilities for interaction and role-adoption for end-users, as well as of interfaces with suitable perspectives on the action and the storyworld state. These are actual parts of the artifact, which are to be provided with a designed shape by creators who aim at offering an integrated, 'holistic' experience to end-users. Ironically, the affordances of the fragmented and abstract creation processes seem to be contrary to this goal. In recent discussions on authoring, this issue of integration has been mostly ignored.

3 Conclusion for Overcoming Authoring Issues

In this article, we presented feedback coming from the collaboration of authors and developers in real Interactive Storytelling projects. Not all of the reported issues are to be overcome by simply building the next generation of usable GUI for the immature tools (although a substantial number of proposals for this immediately filled the to-do lists). We argue that the current state of the art in creation is far from what is needed to fully embrace the procedural potential offered by future IS engines.

Quite naturally, there are two general ways to overcome the gap between current complex systems and more sustainable access for authors:

- Listen to authors: Make tools that better match the concepts and practices of media designers and content creators
- Educate potential authors: Make procedural principles of Interactive Storytelling understandable

We believe it is necessary that both lines develop in co-evolution. There is a vicious circle at the beginning of this co-evolution, as there are mutual dependencies between the two actions. As was revealed between the lines of some sections (2.1.1, 2.1.5, 2.2.2), we cannot expect that newcomers as authors in Interactive Storytelling provide us with proper specifications of their needs, when they still cannot grasp the potential offered by engines and by the medium. Authors need prior design experience with the medium. However, designers and other non-AI-practitioners will require tools to get this first design experience, since they will not be able to program the engines directly.

In order to educate authors, procedural principles of Interactive Storytelling – grounded in Artificial Intelligence – have to be generalized to understandable conceptual models and metaphors. Further, design cycles need to be shortened, i.e. authoring tools need a direct connection to runtime engines in order to support these conceptual models, by letting authors experience the interactive quality of their decisions.

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Exploring Narrative Interpretation and Adaptation for Interactive Story Creation

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Abstract. Adaptation of stories – as a translation between media, such as literature and film – is explored for genres of interactive storytelling that make use of highly-interactive and user-adaptive technology. A concrete case study of transforming and abstracting a Hemingway short story is discussed in detail. The conclusion is that even though Interactive Storytelling content has to follow formal models, these cannot be derived from a written narrative alone and need story creators' input in order to work for interactivity.

Keywords: interactive storytelling, adaptation, authoring, creation process.

1 Introduction

In recent years, the research community in Interactive Digital Storytelling (IDS) has been investigating methods and technologies for semi-automatically controlling the flow of a dramatic plot. On behalf of an author – or substituting an author, story events can be 'generated' by a story engine or a drama manager. There is a variety of approaches claiming several degrees of generativity. While some engineers argue that their product creates 'new' events [21, 6], others delimit the generative functionality to adapting the order of predefined events [14, 15] in the process of coping with user interactions that otherwise would break the originally designed story. Especially in the latter case, Interactive Storytelling heavily relies on previously authoring a storyworld as an initial base for possible events.

The current state of the art shows that there is still a gap between intuitively understandable methods for the authoring of interactive storyworlds and the currently accessible database of existing examples running with story engines as demonstrators [18]. Many demonstrators have been authored by engineers, using pre-existing story material that was initially meant for linear forms of presentation in other media, such as literature or film. Examples for these kinds of adaptations are the Emo-Emma demonstrator [3] based on Flaubert's novel "Madame Bovary", or various demonstrations using the "Little Red Riding Hood" tale as a basis [11, 16]. These exercises illustrate how stories have to be formalized in such a way that they can be processed by the engines. Porteous et al. [13] modeled the "Merchant of Venice" and "Goldfinger" [14] as a planning domain with STRIPS-like propositions with operators, after extracting actions, initial/goal states and predicates directly from the original artwork.

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Bosser et al. [2] have modeled "Madame Bovary" as a network of linear logic operators in order to prove causal integrity.

Automation in future interactive story engines requires the technical formalization of stories at a high abstraction level, which is currently perceived as a burden for non-programming authors [6, 17]. There seems to be a gap between a written representation of authored concepts and their formal implementation. Investigations undertaken in the IRIS network of excellence [18] have suggested several creative principles for the creation of interactive storytelling experiences with generative engines, one of which is the requirement for 'abstraction' also at the creative conceptual level [19], even before 'mathematical' abstraction [6, p. 101] for the purpose of implementation occurs.

In projects like those mentioned above, there seems to be an underlying assumption that the extraction of logical operators from written stories can be a straightforward process done by knowledge engineers, making creative authors obsolete apart from delivering the initial story. We claim that this is unlikely to be successful, and that the extraction of suitable logical operators is a creative process similar to the undoubtedly creative process of a film adaptation of such literature works. The formalization of existing stories, undertaken to meet needs of story logic, causal models or plans, imposes the necessity of a-priori interpreting the narrative from its representation level – all the same as it is experienced and interpreted by an audience – except in rare cases when original authors unveil planning material [2]. The result is an essence of possible and required actions and world states that make up the 'gist' of the story experience. The result of this interpretation then needs to be translated into a completely different medium – here, an interactive medium, which requires the inclusion of a human participant, situations for interaction, as well as the definition of different forms of representation of all participants' actions. We claim that this process of adaptation is not a deductive engineering-like task but an inductive process, affording many creative decisions for omitting existing and inventing new elements. The remainder of this paper illustrates this hypothesis by means of an extreme example: the exercise of using Hemingway's short story "The Short Happy Life of Francis Macomber" as a base for Interactive Storytelling, starting by a formalization of the written story.

2 Related Work

Narrative theory – especially in the area of structuralism – has been consulted extensively by Interactive Storytelling researchers in order to either ground the development of story engine formalisms or to understand story structure [4]. These formal descriptions have been used to prove story models as causal chains that can logically operate. Several examples have been contributed (see above), but there have been few attempts to discuss this process of abstraction as an individual or even arbitrary interpretation of a given story being perceived solely from its representational level, and to view the use of literature examples in Interactive Storytelling as an act of adaptation across media.

2.1 Interpretation of Narrative

H. Porter Abbott [1] has pointed out that we are as much 'vulnerable' to narrative texts as they are to us as an audience. The narration can manipulate us in our judgment, but as readers, *"we exercise a power over narrative texts that is arguably as great as their power over us. After all, without our willing collaboration, the narrative does not come to life. […] we overlook things that are there and put in things that are not there. We underread and we overread."* [1, p. 86] As an example of a text likely to get 'underread', Abbott mentions the 400-page novel "Madame Bovary" with Flaubert's rich descriptions e.g. of Emma's sophisticated contemplations, some of which readers potentially compress to find 'closure' by asserting an overall meaning. According to Abbott, the issue of 'closure' is as well the motivation for the opposite: overreading. *"If a narrative won't close by itself, one often tries to close it, even if it means shutting one's eyes to some of the details and imagining others that aren't there, underreading and overreading."* [1, p. 91]

Another reason for overreading is the existence of gaps in all narratives. Ernest Hemingway was a master of using gaps, some getting closed less easily than others or even staying wide open throughout the narrative. Wolfgang Iser [10] has pointed out that several individuals necessarily end up with different individual interpretations as they fill these gaps with the help of their own life experiences and attitudes, while no reading can ever exhaust the full story potential lying in a text. Abbott calls unresolvable gaps as some are placed in Hemingway's short stories 'cruxes', leaving interpretation completely open. He also points out that there are at least three different kinds of interpretation. In our paper, we are not concerned with 'intentional' or 'symptomatic' ('deconstructive') readings searching for psychological/ideological/ cultural attitudes of the author or his/her social environment, but instead with the 'adaptive' reading as a kind of interpretation that is immanent to all creative adaptations. A simple example is yet the production of a play from a written script, which is always *"an occasion for enormous creative investment"* [1, p. 109]. More complex examples occur when adaptation across media is involved – as is the case in our example, the attempt of making a written story interactive.

2.2 Types of Adaptation across Media

A. E. Hotchner [9], who has dramatized 16 of Hemingway's works for the screen, figures that there are five different possible kinds of adaptations: 'Scissors Adaptation' is a more or less cut-and-paste of a theatre play (e.g., offered by Shakespeare) for a screenplay. Others demand more effort in conversion of a work not written for the intended movie presentation purpose, such as 'Distilled'-, 'Expanded'- and 'Straight Adaptation', the choice of which depends on the source material, in particular its length, scope and characters. Similar to underreading and overreading during interpretation of a work, short works need to be expanded and long works *"boiled down to a manageable length"* [9, p. 2]. Finally, there is 'Wild Adaptation', which means converting a basic work beyond its *"apparent resiliency"*, for example by changing the ending of a story to its opposite, which raises most of the critics as it is often perceived as destructive.

We look at these experiences with the motivation to extract principles for kinds of adaptation to interactive storytelling. We assume that although there are many existing cases of games designed after original written or filmed stories, these mostly have not even tried to use the existing story logic of the source material's actions, events and states for direct interaction, but often separate pieces of linear storytelling and gaming into distinct parts.

On the other hand, it appears obvious that a formalization sticking completely to original written literature must be too short-sighted for Interactive Storytelling; and we assume that there is rather the need for 'Expanded -' or even 'Wild Adaptation' than sufficing with 'Scissors' or 'Straight' methods.

2.3 State of the Art in the Interactive Storytelling Community

The experiment presented here has started out from two hypotheses that 1.) during an adaptation process for IDS, it is inevitable to formalize a written story into an abstract form that story engines can causally operate on the material, and 2.) this abstraction is not a merely deductive, straight-forward process, but requires creative interpretation and adaptation for the medium, and therefore has to involve story creators.

Concerning the first hypothesis, there have been examples presented by engine providers (see introduction) to prove and show engine formalisms [2, 13, 14, 16]. However, these works omit to present any decision process involved through interpretation and adaptation, and the field has not yet progressed much beyond an assumption that engineers have to simply derive a formal structure from story outlines created by writers. In practice, the field partly draws from story comprehension research, e.g., [20] by using causal networks to model representations underlying simulations within generation engines. However, in support of the arguments of different 'readings' in narrative interpretation, causal networks have also been used to research differences in individual resulting model representations, assuming that in many cases there is not one 'correct' so-called 'situation model' to achieve [22]. This also supports the conclusion that transfer of an author's linearly written story to a processable model is not only a deductive process. An exemplary illustration of parts of such a process with its limitations is the intention of the remainder of this paper. The work is based on a theoretical abstraction experiment and the analysis of different creative principles in story creation (screen, game, RPG and improv) researched in the IRIS project [18]. It further takes into account considerations by Crawford in formalizing interactive storytelling for the engine Storytron [6].

3 Interpretation: Formalization and Abstraction

We chose a Hemingway short story ("The Short Happy Life of Francis Macomber") for our exercise, as it leaves much space for interpretation, and provokes 'overreading' through many gaps and therefore may well illustrate our considerations.

As a start for deriving a causal model, it is first necessary to distinguish between the story and the discourse [5], or the narrated events vs. the referenced events of the reported (diegetic) story or diegesis, which is a general aspect in the adaptation. On the one hand, this refers to the narrated order of events vs. chronological order, the relation of which can be easily mapped out in a table (see Fig. 1). On the other hand, the discourse is made up of the representational level including the choice of the medium. In our case it is Hemingway's characteristic prose with its diction, points of view, tone/voice [8], and for example the existing underlying irony of the implied author. We assume that this representational level is difficult to maintain and has to be sacrificed during adaptation.

At first, we only look at the actions and events. Fig. 1 presents the sequence of narrated events (top to bottom) with indications of their chronological occurrence in the diegetic storyworld. The main characters are: Francis Macomber (FM), his wife Margaret Macomber (MM), and the hunter Robert Wilson (RW).

3.1 Summary of the Story

Synopsis (diegesis): 0. (Timeless exposition:) Francis and Margaret Macomber are a rich, unhappily married American couple. Robert Wilson (RW) leads African safaris. 1. RW takes Mr. and Mrs. Macomber out to hunt lion. Francis Macomber (FM) proves to be a coward in the lion hunt. 2. Margaret (MM) reacts obnoxiously, putting him down and flirting with RW. 3. After FM has enough of it, with anger he overcomes his fear and succeeds at shooting buffalo, which makes him happy. He gains RW's appreciation and independence of his apparently long suffering from his wife's behavior. 4. Suddenly he gets shot by his wife, and the story leaves open if that happened by accident or on purpose.

The written narrative begins 'in medias res' (at 2.) after the first lion hunt, when MM picks on FM. The reader is left alone with unclear insinuations about things that might have happened (at 1.), before they are told as a report of the past events triggered by FM's thoughts in the night. When the story continues in the 'present time' (at 2. and 3.) leading to its climax, many gaps are left open, which can later only partly be filled by the reader's interpretations of the author's hints and ironic overtones. The most important examples are the event of adultery that is never explicitly reported but implied, and the exact conditions of the killing event in the end. It is notable that events get told from different points of view including private thoughts of RW, FM and even the hunted lion, but not of MM (the woman).

Our creation of the table in Fig. 1 could not be done in a straight-forward way and without long discussions, as we achieved no instant consensus about the ideal selection of those events most important to the story, revealing slightly differing interpretations of the action. In order to give an overview, the list leaves out events that we chose to be secondary for maintaining the 'gist' of the story. This is to conclude that already with the attempt of neutrally describing the reported events in the written text with the need to summarize, interpretation is at work. Most remarkably, the wide open gap at the end presents a 'crux' of which we cannot precisely tell the conditions. Further, only at the end, the story's title can be fully 'understood' by implications: As soon as FM's disdainful life turns into a 'happy' state, it is getting 'short' (the *"short happy life"* lasts from event 13-15 in Fig. 1). This reading of the story influenced the choice of relevant events as those leading to turns in FM's emotional states and relationships.

3.2 Extracting Relevant Variable States and Attributes

Our interpretation and event selection was influenced by attributes of the characters that are either explicitly mentioned in the narration, or that we associated with their actions and thoughts described or implied. Looking for 'relevant' events means looking for meaningful changes in the storyworld's states. Although there are action-related storyworld states, such as "lion being alive or dead", "being in or out of the

Hemingway: "The Short Happy Life of Francis Macomber"

1	**Day 1 - lunch time conversation with analepses** RW, FM and MM have drinks, *„pretending that nothing had happened"*. Insinuations about *„that lion business"*: FM had been carried to his tent, he seems to be ashamed of something and in RW's debt, he wants to *"fix it up"*. Character expositions: RW's thoughts, FM's coping, MM's taunt, all through RW's PoV.
2	**That afternoon, impala hunt** FM succeeds with a good shot, again announces to *„clear away that lion business"* with the buffalo hunt planned for tomorrow
3	**Night, after dinner, trigger of long flashback** FM lies on cot thinking of lion, feeling shame and fear
4	**Back to night before and breakfast: That same fear of lion** Lion roars (at night and at breakfast), preparations for lion hunt, wild guesses about lion and increasing fear of FM
5	**Morning – go out, meet lion and shoot lion** FM shoots at the lion (told from: lion's PoV, FM's PoV), hits twice, lion is wounded but trots away and hides
6	**Talk about need to search lion – Sitting under tree smoking** RW leads, FM makes ‚unfair'/windy suggestions of leaving the lion, RW expresses his ethics of hunting, FM is scared but pride
7	**Search and find lion (in group)** Lion is found and charges, FM runs away, RW kills lion and saves everybody, embarrassment FM, *„this was the story of the lion"*
8	**Timeless exposition concluding "the lion story"** Information about personality and life of main characters
9	**Back to: that night after day 1 - 3 o'clock** FM wakes up, discovers MM is gone, stays sleepless for 2 hours, then MM returns, resulting argument: FM accuses her to cheat, with insinuations *„you promised there wouldn't be any of that"*
10	**Day 2 - breakfast, argument** FM starts open accusation, argument between all three, indications of an affair between MM and RW, FM is angry
11	**Morning, going out for planned buffalo hunt** RW's thoughts, more hints at possible adultery the night before
12	**Hunting of buffalo, action scene and turning point** FM is fearless, shoots buffalos, teams up with RW on same level
13	**Dialogue after successful hunt** MM picks on RW (hunting laws) and RW now appreciates FM
14	**Discover buffalo escape, déja vu situation of lion hunt** FM has no fear this time, feels happiness, eager to go after escaped bull, and RW is moved to see FM *"come of age"*
15	**Culminating scene, murder/accident** Buffalo attacks again, all of them have rifles, FM shoots bull, MM kills FM surprisingly – by shooting him from the back
16	**End scene, dialogue** Preparations for aftermath. Ironic dialogue: accident or murder? RW: *„Why didn't you poison him? That's what they do in England."*

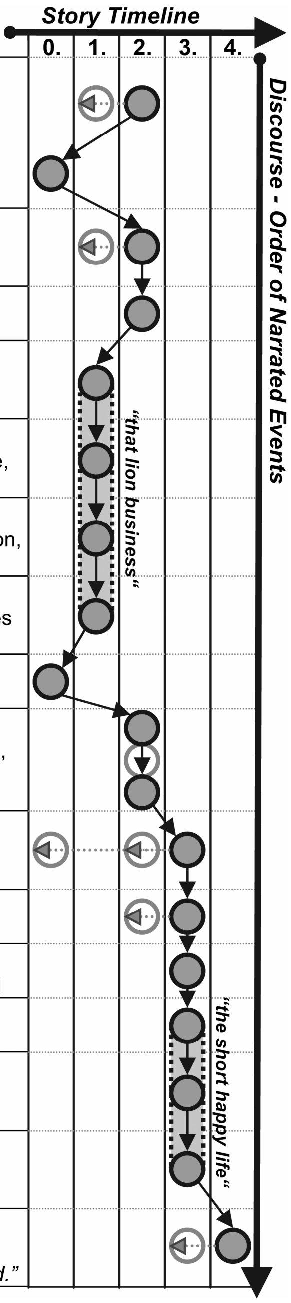

Fig. 1. Overview of narrated events (discourse, top to bottom) and timeline of corresponding diegetic events (story, left to right). Filled/dark circles denote explicitly described events; empty/white circles indicate parenthetical hints at something undefined that may have happened in the past. The 'Story Timeline' numbers refer to the description in section 3.1. Timeless exposition descriptions are in the first column (marked '0.').

car", or "having the rifle loaded", we found that these are only of satellite character. The important states (as kernels) that drive the story, for example by representing goals, are character attributes, such as traits, attitudes or emotions. We list the changes in the characters' attributes we observed as being introduced by important events.

- **FM: "Shame"** is the first explicitly mentioned emotion of FM, connected to the incident with the fear of the lion. He wants to be a hero but he is not. He has been repeatedly publicly humiliated by his wife. The situation seems to be even more complex in further interpretation by the reader. FM is aware that he makes a fool out of himself, but cannot do anything about it. His pride makes him go hunting.
- **FM: "Fear"** is the second explicitly mentioned emotion, and as we see by its occurrence in the analepse, it is one of the reasons for the shame. Fear is also complex, as it is being scared of the lion, further the fear to fail and gain disrespect (telling RW he shall finish it up alone because of his fear), and fear of being left by his wife.
- **FM: "Anger"** occurs after MM has obviously been dishonest with him, at the same time he is angry at RW. It is related to a feeling of hate towards RW and partly at his wife. Anger makes him forget his fear.
- **FM: "Happiness"** explicitly appears suddenly as an obvious result of shooting the buffalo fearlessly and successfully. In our interpretation, it is even more complex, as it seems that he realizes that he has lost MM and suddenly feels independent of her, as he lost the fear of being left. It is the state that he missed longer before than he knew about lions. This happiness has to do with his coming of age.
- **MM: "Disrespect"** is shown very often by MM's capricious behavior and is also mentioned in expositional text passages or attributions of cruelty in RW's thoughts. It is at times open contempt towards FM, with one exception as she cries because of his failure. In contrast, she respects RW for his manfulness.
- **MM: "Fear"** of FM's bravery and happiness occurs late in the story and only briefly described. We interpreted that the reason for this fear is that with FM's coming of age, she is not anymore in control, maybe afraid of being left by him.
- **RW: "Contempt"** (implicit) of both FM and MM as a type of rich American clientele he is experienced with, and especially for FM's willful ignorance of hunting ethics. He loses his disrespect of FM at FM's coming of age experience and starts *"to like him"*. We interpret that he keeps the contempt of MM even after their romance. RW has strong ethics and principles, but only his own, disregarding formal laws. RW is the character who undergoes almost no changes, and many scenes are narrated through his PoV and with his appraisal.

The goal of this exercise cannot be to obtain a complete and correct psychological model of a human being, but to extract attributes that we considered as driving the story. Not all of these attributes are explicitly mentioned in the narrative, some have developed implicitly in our understanding of the story.

3.3 Abstraction of Events and Actions Existing in the Discourse

In many situations, it is not easy to decide which verbs of Hemingway's delivered prose – representing the narrative discourse – are to be extracted as actions relevant to the story. With the intended adaptation to a different medium in mind, it is important to first abstract these verbs to the level of the situation model, in order to then find suitable new representations in the interactive medium. In comparison, the characteristics of the film medium demand that inner thoughts and states – such as emotions – of characters cannot just be 'reported' by language, but have to be represented in the visual 'mimetic' medium. Critical design principles (such as: 'show, don't tell!') have been developed over the years [12], for example the claim to have to 'externalize the internal' by introducing media-specific events or actions instead of states verbally narrated (e.g., by too much dialogue).

Remarkably, Hemingway uses a mixture of state descriptions, inner monologue of several characters, and at times a style of narration that externalizes the inner states similar to a visual description. For example, after describing the point of view of the lion in the situation in which it was shot, the story continues: *"Macomber had not thought how the lion felt as he got out of the car. He only knew his hands were shaking and as he walked away from the car it was almost impossible for him to make his legs move. They were stiff in the thighs, but he could feel the muscles fluttering."* In this scene, actions/verbs are used to circumscribe and emphasize a state description of how scared Macomber really was. The words also added to the interpretation of his character, being arrogant and willful ignorant of jungle animals and situations, in contrast to Wilson *("He's a hell of a fine lion").* Another example: *"Macomber shot again and everyone saw the bullet throw a spout of dirt beyond the trotting lion."* Making a connection to the previously constructed impression of Macomber suffering from shame and fear to fail, the hint that *"everyone saw"* rather emphasizes interpretations of these states than being important actions of the other characters.

4 Adaptation: Adding Interactivity

"Adding interactivity" is not simply providing alternative branches to the discourse's flow. There have been many discussions and contributions about this topic, ranging from claims that it is not possible to make a linear story interactive by just placing decision points at crucial plot points [6] up to insights that one way of letting users participate in the story is by giving them the same possibilities for action as available for defined characters [21]. The latter means generalizing actions to not be bound to a position in the linear flow, but to be universally usable, and to include situational information, such as conditions for their occurrence and descriptions of their effects. Some engines can process plans based on information of goals, subgoals, operating tasks and other engine-specific elements, for example 'obstacles' and 'values' in IDtension [21], situational 'roles' in Storytron [7], and planning operators in Emo-Emma [3]. Authoring exercises have shown [11] that the way these abstract descriptions have to be conceptualized differ a lot due to the kind of underlying engine, whereas all methods include some way of defining conditions for actions.

Therefore, a crucial step in translation of the described actions into interactive acting potentialities – if at this point, we do not want to specify the engine we use – would be to explicitly tell what conditions were at work in each acting situation. If one works through the presented story from action to action, not only local situations are important, but also global ones (e.g., goals and traits), which the reader is only aware of after having finished the story, possibly after several readings. One crucial consideration e.g. is defining the cause for FM's sudden happiness, that is, the actions or state changes that must have happened in order to let this state turn to 'happy'.

4.1 Possible Changes through Interaction

Interactive Storytelling implies that there is the possibility for human participants ('users') to influence aspects of the discourse and/or of the story, for example by deciding between different options for action. In the thought experiment, we brainstormed alternative endings for the story. This is in any case a creative decision. Fig. 2 shows first ideas how players can possibly influence the ending, by permuting the attributes of a 'short' and 'happy' life.

	short	**long**
happy	FM comes of age and is happy → MM now hates FM, because she cannot dominate him, and fears losing her standard of living → MM kills FM in the heat of the moment (by accident or on purpose?)	FM comes of age and is happy → MM fails to further dominate FM and fails to kill him in hate → FM leaves MM and breaks with his previous life → FM becomes a hunter like RW
unhappy	FM continuously fails → MM and RW lose all respect for him and he is desperate → FM commits suicide, OR he is killed by an animal in a hunting accident	FM continuously fails → MM and RW lose all respect for him, but he survives because they repeatedly rescue him → FM lives on in coward hell

Fig. 2. Four different endings of the story, permuting the 'short/happy' life attributes (the upper left quadrant is the original ending)

From a mere operational perspective, in order to achieve different story trajectories or even endings, it is necessary to add material, especially definitions of alternative actions and their effects, which then alter conditions for other potential acting situations. At this point, creators must leave the initial story aside and actually put in novel content, which is needed to create enough interesting situations [6]. An example for a boring decision would be to have to decide between "shoot" and "not shoot" – for the absence of alternative 'affirmative' options for action. In order to explore the invention of new actions, a model and its implementation has been tested with the Storytron system [7], where the player plays Francis Macomber (FM).

4.2 Model of Relevant Attributes and Possible States

In a conceptual model suitable for interactive changes, more possibilities have to be planted than in the original story. Fig. 3 shows character attributes including their interpreted goals, significant emotional values or attitudes (derived from the list in section 3.2 and by further interpretation). Ideally, such a model enables the outcomes of the original storyline plus alternative trajectories and endings.

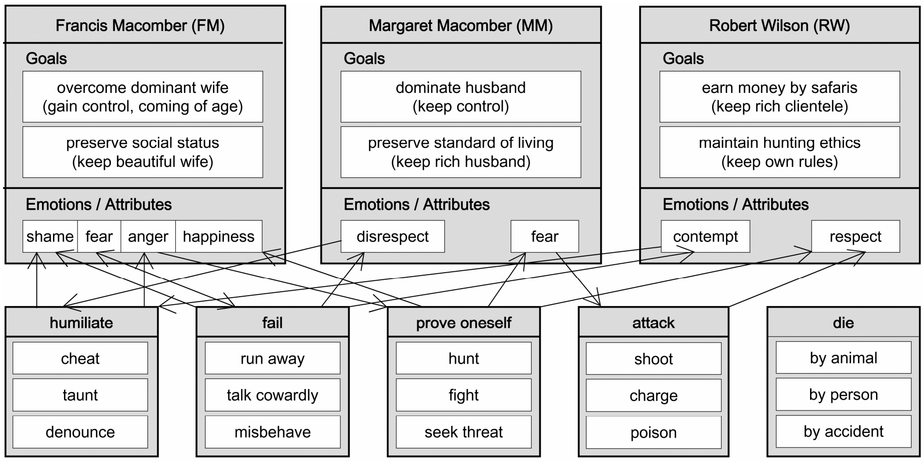

Fig. 3. Partial model of the most relevant states of the storyworld, including main goals of the characters (top) and a subset of generalized actions (bottom). The arrows indicate the possible elicitation of relations from the original story (mostly about FM); further details have to be invented, if needed for a balanced and more open-ended storyworld.

As one strategy to introduce variations, events have been categorized according to their effects and pre-conditions, possibly grouping alternative detail actions (see Fig. 3). For example, concrete doings such as ‘cheat’ or ‘taunt’ fall under an abstract action of ‘humiliate’. This simplifies the model, while still providing alternatives and room for newly invented actions, such as several ways of being killed, which by their scope do not violate the philosophy of Hemingway’s storyworld. For example, dying through an animal attack was always a probable event and one reason for FM’s fear, although it did not happen in the narrative.

Another crucial finding was that the character trait descriptions in the original only suffice to explain the existing ending of the short story – even not completely. We interpreted the actual ending of the story – FM suddenly being shot by his wife – as very surprising and a bit irrational (which is a widely shared and discussed experience). A probable reason is that Mrs. Macomber (MM) is not as profoundly described as the two male characters. She appears capricious, which is not a convincing motivation for her doings in an interactive model, because then everything could appear randomly. In an interactive process model, we need attributes of characters that convincingly drive their actions, also for alternative endings. As the player shall choose FM’s actions, the other two characters need a more profound trait description than Hemingway provided us with.

Interestingly, the film adaptation “The Macomber Affair” (of 1947) avoids the surprise effect of MM’s deadly shot by framing the jungle events in RW’s flashback, beginning with FM’s death and pursuing the mystery of its circumstances. The film presents a new, graspable point of view of MM, which is only possible by also slightly changing FM’s character, showing him not only cowardly but also a bit mean.

4.3 Additional Requirements

As with adaptations in general, the possibilities for changes and additions are great and a matter of creative work. The invention of more possible actions and therefore also of more character attributes is required. Whether the result is still a ‘Hemingway’ storyworld is questionable and discussed by Hotchner for film adaptation when faced with a plot only partially developed by the source writer. *“When I carry forward a Hemingway situation, I must consider whether the movement and the people are in keeping with what Hemingway himself would have done… I try to determine this from everything I know about all Hemingway has written”* [9]. A risk may be shown by the incident that the natural absence of the writer’s characteristic prose in the film adaptation has led to criticizing the rather blunt core content of that story. In the linear story, FM only comes of age when his anger overgrows his fear and shame. In an interactive version, this is difficult to achieve, as the outcome depends on the player’s failures in the beginning. It is rather a case for role-players than for addressing players with a ‘gamer’ motivation, which has to be represented in the piece accordingly.

5 Conclusion

The paper illustrated a process of adaptation of a so-called linear story to abstract models that can further be operated by story engines. In contrast to existing work with a similar motivation and the achievement of a formal logic model, we focused on discussing the fact that individual interpretation is always at work in an adaptation, completed by creative addition of content necessary for the storyworld being processed. The conclusion is that we suggest the impossibility of an authoring process for Interactive Storytelling, in which writers as story creators hand a written story outline to engineers to let them implement it, a consideration still present in the IDS community. The alternative point of view is that responsible interactive story creators have to first model on a less technical but still abstract level, and further participate in the whole process of storyworld implementation in a team, including the tuning phase left out in this paper. There is a necessity for tools supporting that teamwork.

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