Plot, Spectacle, and Experience

Contributions to the Design and Evaluation of Interactive Storytelling

Jarmo Laaksolahti

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In loving memory of my parents
Rauha and Matti

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1 Introduction

This thesis is concerned with new forms of storytelling in which users can influence the progression and outcome of a story. In such interactive stories the reader/spectator moves from being a receiver to an active co-creator of the story they are experiencing, thus promising a more profound experience (Voerderer 2000). More specifically this thesis concerns digital forms of interactive storytelling that use computers as the delivering technology.

The interest in interactive storytelling from both academia and the computer games industry has increased over the last years. A few years ago the computer game industry surpassed the box-office movie industry in terms of revenue in USA and still continues to grow (IDSA 2003). Developing games with more varied and engaging stories is often mentioned within the industry as an important prerequisite for broadening the market for computer games, in particular stories that are about human emotions and relationships rather than epic battles and heroic deeds.

Potentially such stories could lead to new types of games that attract other segments of the market to play computer games. In fact, computer games have often included stories in one way or another, but it has rarely been their major concern. The stories found in games are often quite simple and usually not part of the games core mechanics. That is, the story is not what the game is about. Instead the story's role is to provide context and atmosphere to the game. One sign of the increased interest in interactive storytelling is that Façade[1], an interactive drama created by Michael Mateas and Andrew Stern that was released in 2005, has received reviews describing it as "…one of the most important games ever created, possibly the most important game of the last ten years" and "…the future of video games".

Interactive storytelling is a phenomenon emerging in the crossroads of many scholarly, artistic, and industrial traditions, such as ludology, art, literature and the games industry. As a new realm it has attracted the interest of many stakeholders out to claim the territory as their own. Consequently there are many different perspectives on what interactive storytelling is, what it could be and even what it should be. Depending on which group of stakeholders you belong to different aspects are emphasized and other aspects are criticized. For instance, literary scholars wonder how you can achieve anything close to the carefully planned stories and character portraits found in literature, or even film, in a medium where the player is constantly meddling with the author's work. For ludologists and games designers on the other hand, the important thing is interactivity and game play, and the question is how a medium that is essentially linear and predetermined can possibly provide interesting choices to users or even how it can be called interactive in the first place. The scuffle for territory is also illustrated by the fact that interactive stories are called interactive narratives, interactive dramas or ergodic literature just to mention a few. A more reconciling term, sometimes used by the author, that recognises the dual nature of interactive storytelling, is Dramatic Gaming. It indicates how interactive stories inherit qualities from both stories and games, synthesising them. However, as interactive storytelling seems to be the simplest of these

[1] See http://www.interactivestory.net

terms as well as the most inclusive we shall use it to denote all of the mentioned types of stories as well as a name for the field of research.

The aforementioned perspectives also lead to questions about what kind of activity a consumer of interactive stories is actually engaged in. Consumers of media products such as films, books or computer games are called different things depending on the medium. Hence book consumers are called readers; film consumers are called viewers or spectators while game consumers are called players. Interactive storytelling borrows characteristics from all of these media: consumers are experiencing a story but not necessarily reading it, consumers are viewing an animated sequence of pictures but also experiencing a story, consumers are interacting with a game world but the motives for playing and the experience created may not fall into any established definition of what a game is. What then, should consumers of interactive stories be called? In our view, they are not mere spectators or readers as they make choices that directly and meaningfully affect the progression and outcome of a story. Instead they are participants in a drama which would not be the same without them. Throughout this thesis we have chosen to use the term player for two reasons: firstly because we wish to emphasize the participant aspect of interactive storytelling, and secondly because we wish to amalgamate terminology with games research.

In general, focusing on the player's experience seems a better idea than to get stuck on definitions of what interactive storytelling is and what it is not. Instead of focusing on the formal characteristics differentiating stories and games, we can focus on the experiential characteristics bringing them together. There does not seem to be anything intrinsic that prevents unity between game experiences and story experiences. It seems more likely that games can have qualities that are essentially game like and others that are essentially story like. Some theorists like Eric Zimmerman argue that we have been asking ourselves the wrong question. Instead of asking "Is this thing (such as a game) a narrative thing or not?" the question we should ask ourselves should be "In what ways might we consider this thing (such as a game) a narrative thing?" (Zimmerman 2004). Seen from this perspective, story and game are simply terms describing a certain kind of experience just like strawberry and vanilla are terms describing ice cream flavours. And like strawberry and vanilla are sometimes mixed in a cone of ice cream, so game and story are experiential flavours that are sometimes mixed in interactive stories. Sometimes they blend perfectly creating something altogether new where each original component is more or less indiscernible, other times they stay separated but contrast each other in a way that heightens the perception of each individual component. What is important is that the experience is a product of all the ingredients added to the mix. Hence it does not make sense to speak about interactive storytelling being about having a story experience or a game experience in isolation, as it can be both. One of the aims of this thesis is to investigate some of the ways in which gameness and storyness can combine into something new.

The road to Plot, Spectacle, and Experience

This thesis marks the endpoint of a long journey both in time, but also in way of thinking about interactive storytelling; what it is, how it works, and what is required from a system to make it work.

The journey started nearly a decade ago when I was involved as a coder in the development of the Agneta & Frida system (Höök *et al.* 2000). The system was an experiment in making a users web browsing experience more story like by having two characters, Agneta & Frida, watch and comment on the web pages that the user browsed as well as the user's browsing behaviour. The characters lived on the user's computer

desktop and watched the browser as they would a television set while the user browsed a collection of websites that had been Agneta & Frida enabled. The characters' comments were designed to be funny and often rather sarcastic. The main focus of the work was to explore the use of anthropomorphic interfaces, and in particular believable characters.

The Agneta & Frida project spurred a continued interest in believable characters, what made them believable, and their role in user interfaces. When the project was completed the people working in it started looking for other suitable application areas for such characters. At this time computer games presented themselves as an application area with a long standing tradition of including characters in the interface albeit they were sometimes lacking in believability. Hence games seemed like an ideal application area in which to continue exploring believable characters.

It was at this time that the Kaktus scenario described in chapter 5 was created as a platform for our efforts. Already from the start the scenario was intended to be story like, focusing on the personalities of, and relationships among, characters. However it was not until sometime into the project that storytelling developed into my main interest.

The first problem that captured my interest was what at the time seemed like the holy grail of interactive storytelling: exploring how to interactively sequence pieces of a story together into a coherent and engaging whole. For some time this became my primary research interest and eventually resulted in the idea of anticipatory plot guidance as reported in chapter 6. During the work on story sequencing mechanisms I had started to feel that an overly strong focus on those aspects provided a rather mechanistic view of storytelling; as if it was all about slapping events together into something resembling a plot, and that in doing so one would automatically have created a great storytelling experience.

Instead stories, especially as they are realised in film and theatre, provide us with a sensory display; a spectacle consisting of visual, auditory, emotional and social experiences to name a few. These experiences are not easily traced back to a mere story sequencing mechanism but instead depend on how story events are composed and presented. Hence I started questioning how important the underlying sequencing mechanism really is for the experience of an interactive story. As a result of these concerns my interest gradually shifted away from story sequencing mechanisms in two new directions.

The first new direction focused architecturally on the presentation system, exploring strategies for automatically presenting story events in a way that supports the storytelling process. Viewing this shift of interest in the light of Aristotle's theory of drama (further explained in chapter 3) which divides the experience of drama into several layers, it represents a shift of focus from plot, the topmost level, to spectacle, the lowest level. Whereas story sequencing mechanisms are mainly concerned with plot, sequencing a selection of events so as to form a coherent plot, presentation systems are concerned with spectacle, building a sensory display that makes story events salient and understandable to players. My work in this area was inspired by many things including film, comics, colour theory, and shape theory. The result of this work was a presentation system which is described in greater detail in chapter 7.

The second direction focused on evaluation of interactive storytelling experiences. The bulk of work performed within the field has focused on exploring methods and structures for manipulating plot. To date not very many interactive stories have actually been implemented although a fair amount of interactive storytelling systems have been implemented. Hence I wondered how developers of interactive stories might find out

something about what kind of experiences that their stories provided. In particular I was interested in providing developers with some feedback that could help them "debug" their stories and feed into the design process.

From technology-centric to experience-centric

During this journey my belief in what the "core" of interactive storytelling (systems) is has slowly shifted from a rather technology centric view to an experience centric one. The former was based on the belief that developing systems and algorithms for interactively stitching together pieces of a story is the most important problem of interactive storytelling. The latter is based on a belief that a storytelling system is no more (or less) important for a good storytelling experience, than a camera is for a good film experience, or a typewriter for a good reading experience. In this latter view, a storytelling system is a tool to be used by gifted developers to produce interactive stories. A player's experience of an interactive story will ultimately rely to a much larger extent on how the tools are used by developers, although certain tools may provide their own characteristic flavour.

Drawing an analogy to electronic music the "problem" of creating it was not solved when synthesizers were invented. Instead synthesizers simply provided musicians with a new instrument. Today there is a plethora of synthesizers available and which one to use depends on the music you wish to create combined with personal preferences. In the same way there is not an optimal storytelling system. Which system to use depends on the story you want to tell (purpose) and which system you like to work with (preferences). The point I am trying to make is that creating a storytelling system is not an optimisation problem with a known best solution. Instead there are many different approaches that are worth exploring.

As a consequence of this shift we have also adopted a more holistic notion regarding interactive storytelling systems themselves. From viewing the story sequencing mechanism as the core part of an IS system, we now consider the presentation system to be an equally important part. A player's experience of an interactive story will depend on both.

1.1 Research questions

The OZ project at Carnegie Mellon University envisioned a basic architecture for interactive storytelling systems that has its roots in ideas first presented by Brenda Laurel (Laurel 1993). A schematic overview of the architecture envisioned by the project is shown in Figure 1. The architecture consists of a story world containing characters able to express their personality in various ways. At the story level characters are guided by a drama manager that attempts to manoeuvre the progression of the story towards a dramatically fulfilling end by giving characters tasks to perform. The story world, including all characters, is presented to the user via a presentation system that can be anything from text to 3D graphics. The OZ project built several prototypes based on this architecture, some with textual interfaces and others with graphical ones (Loyall 1997). Looking at the architecture it is easy to get an impression that the functionality of each part is so independent from the others that they become interchangeable. For instance, one might believe that a text interface could simply be swapped to a graphic interface without requiring changes to other parts of the system. While in some cases such an exchange might be possible from a strictly technical perspective, it is less clear what it would mean for the player experience.

This thesis attempts to address several challenges related to interactive storytelling from a holistic point of view. Throughout our work we have had a focus on player experience. Our belief is that the experience of a story is a function of all constituent parts of the storytelling system. Hence the experience depends on the story material at hand, the characters present, how players interact with the story and how the story world including characters presents itself to the player. From this perspective it is not immediately clear that e.g. the separation of drama management from the presentation system in the OZ architecture is useful or even possible. What it is possible to present dictates what can be expressed, at least to some extent. For instance, written text is in general an excellent medium for expressing internal processes and emotions which are hard to convey in other ways; pictures on the other hand sometimes literally say more than a thousand words. Hence it seems as if the drama manager and the presentation system are bound to be, if not wholly joined, then at least tightly coupled. In our discussion below, we shall however stick to the architecture and situate our problem descriptions in relation to it for clarity.

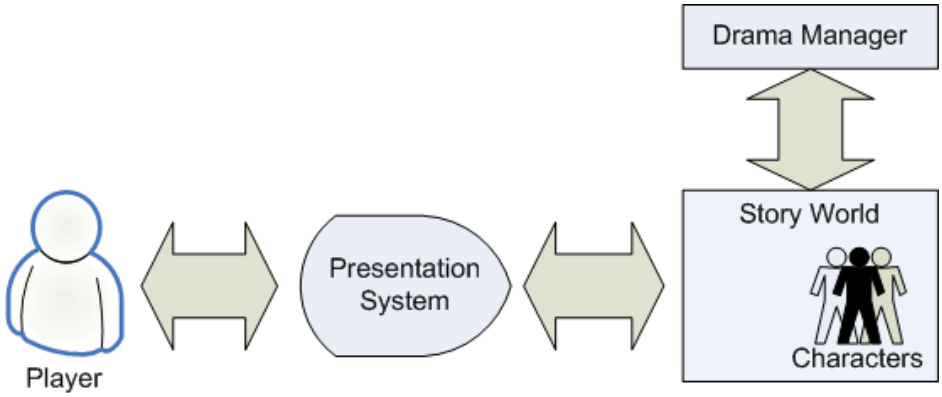


Figure 1 The OZ architecture for interactive drama

1.1.1 Story construction

One of the fundamental challenges of interactive storytelling is how to reconcile interaction with stories, or perhaps how to reconcile storyness with gameness. As stories are essentially linear structures with a predefined order of events, adding interaction, which threatens to break that order, is seemingly at odds with the whole concept of stories. In the movie The Matrix, the protagonist Neo is presented with a choice between two pills; a red pill and a blue pill. The red pill leads to greater knowledge about the true nature of the world and a chance to make it a better place, while the blue pill will make Neo forget the whole episode and go back to his old life. In the movie Neo chooses the red pill and goes on to eventually save the world. But what if The Matrix had been an interactive story instead and what if the player as Neo chooses the blue pill instead of the red one? What becomes of the story? These are the kinds of situations in which a choice made by the player may ruin a story painstakingly created by an author.

Chris Crawford (2005) and Janet Murray (1997) suggests that part of the solution is to view stories at a higher level of abstraction and exert control over them at those levels. Instead of trying to force the player to experience an exact plotline, we could construct a more abstract web of possibilities that communicates the same message albeit in different ways. Crawford illustrates his point by comparing the actual plotline of Star Wars episode 4, to a more abstract version of the story. The abstract version of the story reads "A young man ventures out into the world, makes new friends, and

experiences many adventures. He learns much and triumphs over adversity, winning the respect of a pretty girl". In this version of the story, *overcomes adversity* could be anything from going into space and blowing up the Death Star just like in the movie, to helping his uncle Owen overcome the draught and securing the harvest home at Tatooine. The message, at some level, stays the same although the story is quite different.

Another insight can be gained if we change our focus from the structure of stories to the process of telling stories. The conflict between story and interaction is most evident when viewing stories from a formal perspective, as linear structures consisting of predefined sequences of events. People however, seem to be able to tell each other stories while managing various kinds of interactions and interruptions quite successfully. The question is, how do they do it? What happens in a storytelling situation is that a story is constructed piece by piece on-the-fly. The storyteller listens to the reactions of her/his audience and creates, or selects ready-made, story events on the fly. Hence the structure of the story is gradually constructed instead of being presented as a ready-made, atomic entity to the player. This process of storytelling seems to lie much closer to what an interactive story should be. Instead of focusing on the finished product we can focus on the process of getting to it.

Shifting focus from stories to storytelling makes the challenge more graspable; the problem becomes one of Drama Management. The task of a drama manager is to monitor the progress of the story and dynamically choose suitable story elements according to some criterion. How to achieve drama management is, however, still an open question. It seems unlikely that there will ever be a single way of doing it. Rather there will be a number of methods to choose from and which one is chosen will depend on personal, artistic or perhaps even economic factors. This thesis attempts to fill in some of the blank spots on the map by suggesting new methods for automated drama management. Our work focuses on examining methods attempting to predict – or anticipate – story progression as a means to inform selection of story elements.

Our work takes a starting point in existing theories of dramatic writing and analysis. Our intention is not to contribute to these areas but rather to ground our own technical solutions in them. We are aware that from a human author's perspective our efforts may seem modest and incomplete. However, as the field of interactive storytelling is quite young, much groundwork remains to be done before more complex systems can be created. It is in this light that our own work should be viewed.

1.1.2 Story presentation

Some scholars believe that stories are media independent; that they retain an identity regardless of whether they are presented as, for instance, a book or a movie (Chatman 1978). While this may be true in the sense that some basic message (Crawford 2005) of a story survives between media it seems clear that the experience of a story does not. Anyone that has experienced the same story in different media knows that the experiences usually are very different. The way in which the story material is conveyed to the player – the medium of the story – seems important and hard to decouple from the underlying drama management. But even within a given medium there are variations in style and techniques that are used. For instance, Japanese manga comics differ radically in style of expression from their western counterparts. Interactive storytelling as a medium has yet to develop these styles, or genres, and consequently there is plenty of room for experimentation.

In interactive storytelling as envisioned by e.g Cris Crawford and Michael Mateas (Mateas and Stern 2000; Crawford 2005) characters are the main vehicle for presenting story material. The characters act in accordance with story goals and react to player input thus giving the story its momentum. Because of the importance of characters in a story a quality that is often cited as being crucial for the success of interactive storytelling is character believability. It is often – somewhat circularly – defined as a character's ability to suspend disbelief. Believability arises between a specific user and some symbolic representation of a character (image or text). A character is considered believable if it allows an audience to suspend its disbelief and if it provides a convincing portrayal of the personality they expect or come to expect (cf. Loyall 1997). That is, believability makes the user 'disregard' the physical circumstances of the cinema, theatre, book, reading situation or the technical features of the computer game, and instead 'enter' the story world, focusing on the events and becoming cognitively, emotionally and morally engaged in the lives of the characters. This is partly dependent on the features of the character, partly dependent on the attitude and ability 'to let go' in the user.

Most of what we normally define as believable arises from how the character behaves in relation to a socio-emotionally rich 'situation'. Such a situation or 'scene' involves other characters' goals, intentions, personalities, and social identities as well as objects and artefacts handled and manipulated by those characters. Whether a character is experienced as believable or not is thus a function of how well its behaviour fits with the reader's or user's expectations about characters and the situation in which the behaviour takes place. Hence believability is not something universal that cuts across domains or applications but rather something very specific. What is believable for one character or context may not be for other characters or contexts. For instance, a piano falling on a character's head without causing serious injuries is believable in a Donald Duck cartoon but maybe not in Hamlet. This level of believability has little to do with the medium of the presentation, and can emerge through written (literature) and spoken text (radio theatre) as well as through moving images and live acting.

In films, computer games or plays, a character may move, act and behave believably on a graphical level. In the games industry increased graphical realism has often been equated with increased believability. However, other media such as comics teach us that a less detailed representation often does a better job (McCloud 1995). By using an iconic representation users can more easily identify with a character and attribute traits to it that are not apparent in the graphical representation. Abstraction of this kind has less to do with leaving details out than focusing on certain fundamental details according to McCloud.

Consequently, instead of focusing on increased graphical realism as means of increasing believability, we could instead focus on making the important details more salient. We can focus on graphical expressivity instead of graphical believability (in the sense of realism). The interesting thing with this shift is that it allows us to take into consideration other believability/expressivity factors as well. Believability is not only affected by the internal state or appearance of characters. For instance, movies show us that there are several factors that are external to any character or even the world in which they exist. Examples of such factors include music, sound effects and visual effects. When watching a movie we can hear music reinforcing the dramatic tension in a scene, or view the character through different lenses for dramatic effect. By altering these factors different dramatic and emotional effects can be constructed, clarified or enhanced without changing the content or the appearance of the character (Mascelli 1965; Bordwell and Thompson 2001). In film studies, diegesis refers to the internal world created by the story and that characters themselves experience and encounter. Hence aspects of the story such as background music and lighting effects are not part of the

diegesis; they are non-diegetic, or rather extra-diegetic. In keeping with this terminology we have called believability factors not directly related to characters or the story world extra diegetic.

One of the challenges addressed by this thesis is automating the use of extra digetic expressivity factors. In contrast to film, where all effects can be carefully planned in advance a dynamic medium such as interactive storytelling requires effects to be composed in real time. In particular this thesis investigates the use of cinematography and visual effects as a means of increasing emotional and social expression within an interactive story. Most work in automated cinematography has so far focused on techniques for describing and solving the geometric constraints of a scene, such as where to place the camera given two characters talking to each other so that none of the characters are occluded (Hornung *et al.* 2003). In contrast fairly little work seems to be available on how automated cinematography can actually be used to make a scene more expressive, understandable or believable. Our work belongs to this second category in that we focus on exploring the expressiveness afforded by cinematographic techniques. Again, our purpose is not to contribute to the field of cinematography but rather to ground our own technical solution in existing theories and practices. From a professional film makers point of view our efforts are undoubtedly modest. For interactive storytelling however, it is part of the groundwork.

1.1.3 Story evaluation

What it means for a players experience to be compelling and engaging is one of the open questions of the digital storytelling medium, and a question worth exploring through experimentation and study. This effort is complicated by the lack of methods suitable for the task. The traditional HCI tools available to practitioners are often not suited for evaluating such aspects. Work in media studies and other disciplines has provided analytic tools for understanding experiences of traditional stories but those tools are not necessarily well equipped to handle the dynamic nature of interactive storytelling, its *dynamic gestalt* (Löwgren and Stolterman 2004). Thus in addition to exploring the medium itself there is also a need to explore methods that can capture some of the experiential aspects of playing interactive stories and other experience-focused applications.

Evaluation can be performed at many stages during a design cycle for different reasons. When a system is finished we may want to know something about the experience it creates. We may also wish to know if the system as a whole worked as indented and if the experience provided is the one we aimed for. However during our design cycle we also wish to know if and how the system parts contribute to that experience. If the experience is dramatic, where does the drama come from? Is it from the drama manager? Or perhaps it is the presentation system? Or even the story world and characters? An interactive storytelling system may have a good drama manager but still produce bad experiences because e.g. the mode of interaction is unsatisfying. Vice versa, the system may produce great experiences because the presentation system is fantastic although the story telling system is not. Performing early evaluations of a prototype can provide design feedback and correct such weak spots.

Using a multi-tiered evaluation model, in which parts of the system are evaluated separately to ensure that they work as intended, before the system as a whole is evaluated (Höök 2004), may be helpful in this respect. For instance, once we know that characters express emotions through facial expressions in an understandable way, it may be easier to trace aspects of the overall experience back to facial expressions rather than something else. However, even when using a multi-tiered evaluation model we are faced

with the problem of finding suitable evaluation methods for the evaluation tiers. One of the challenges addressed by our work is finding methods that can capture the dynamic experience of users' interaction with a storytelling system.

As a starting point for our efforts we can resort to classical dramatic theory in which stories (or plays) are often visualized as curves that describe the emotional tension created in the reader/spectator (Laurel 1993) (See Figure 2). Tension is caused by unresolved conflicts and unsettled emotions in the story. During the exposition phase tension rises slowly as the setting of the story and its main characters are introduced. An inciting incident then adds momentum to the story leading to a quick rise in tension. Eventually tension builds to a climax where conflicts and emotions are resolved after which tension quickly drops and the story eventually ends.

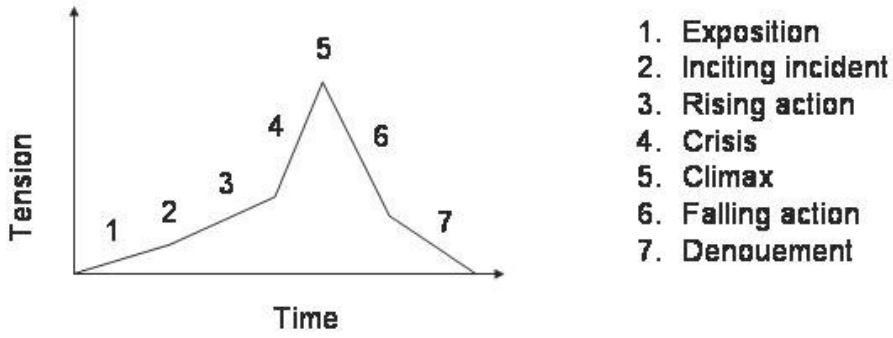


Figure 2 The dramatic curve according to Laurel

If an interactive story succeeds in producing a dramatic experience it should be possible to find traces of such a curve in the user experience.

1.1.4 What this thesis does not deal with

This thesis deals with technologies for interactive storytelling and to the extent needed for motivating the choices made in the work, with theory of interactive storytelling. The purpose has not been to construct new theories but rather to understand and apply existing theories to our problem.

To evaluate ideas related to interactive storytelling technology ideally one would do so using an implemented interactive story of significant length. Only then can you be truly sure that all aspects have been covered and all connections between parts come through as intended. However, creating interactive stories of significant size is a big undertaking (Mateas 2000; Crawford 2005). In our work we have focused on techniques for creating – and methods for evaluating – interactive stories and consequently we have not devoted time to creating any large scale interactive story world. That is to say we have not created an interactive story in the sense that e.g. Façade is one. Instead we have taken a scenario based approach where we have created an overall scenario for our intended story world, identifying the core mechanics and conflicts of that world, and then implemented small parts of the scenario to test certain features of our design- and technical solutions. Thus, the reader should not expect to find an intriguing interactive story in here.

1.2 Method

It is a challenge to find a methodological home for the whole of the work presented in this thesis: it spans over several academic and artistic areas, all with their own methodological basis. However, within the Human-Computer Interaction research community there has lately been an increased interest in exploring non-task related aspects of application usage (Blythe *et al.* 2004; McCarthy and Wright 2004). Instead of focusing on task-completion time, productivity etc the important questions instead include: What kind of experience does the application provide? What emotions does it evoke? Is it fun? In our daily life we are surrounded by applications, such as interactive stories, whose primary purpose is to provide experiences rather than make us more efficient at tasks. As a whole, our work belongs to this new direction within HCI, also known as "third-wave HCI", in that it focuses on user experiences rather than traditional HCI metrics such as efficiency or ease of use.

While the target of our research, interactive storytelling, is undoubtedly in the end best described as a form of art, our own efforts have not had any artistic ambitions. Rather, we have attempted to create some of the tools that are required for interactive storytelling to become possible. Drawing an analogy to painting, we have tried to create some of the brushes or paints that artists use to create paintings, rather than the paintings themselves. By tools, we refer both to software tools that authors of interactive stories can use, but also to methods that authors and evaluators of implemented systems can used to steer the development process.

As a starting point and focus object for our efforts a scenario was created early on in the process. Without a particular scenario to work on the end result will never reach its final shape. It is not until one starts working with the particular materials and circumstances that are at hand that many questions that need to be addressed and decisions that need to be made present themselves. Is it to be a heroic war story or a tender love story? Will it be presented on a computer screen standing on a desk or projected on the wall of a museum? The final shape of a storytelling system depends on how such questions are answered.

In our technical work described in part 2 of this thesis we have used a prototype driven approach, iterating design, implementation and evaluation. Theoretical investigations, mainly in literary theory, film theory, and psychology have been conducted in parallel and used to inspire our work. Our work may seem like a continuous evolution of a single prototype towards a final system. In reality it is much more fitting to view it as a series of experiments in interactive storytelling using a common scenario as a starting point. The four different implementations of the scenario have all focused on certain challenges while disregarding others. For instance only the first version of the scenario explored use of emotion models. At the same time the system as a whole has been iterated several times and parts of it has survived, and been improved, between implementations.

Our work on evaluation methods for interactive storytelling systems described in part 3 of this thesis is based on both an existing method that has previously been used in HCI albeit for different purposes, as well as a wholly new one. The list of criteria underlying the choice of methods evolved in time with our own understanding of interactive storytelling. Some criteria originated in our own experiences of working on the technical aspects of the system, others had previously been suggested by literature. Of particular importance to us was that the methods should allow players to express their experiences without being limited to predefined descriptive categories (cf. Thick Descriptions Geertz 1973). Another key aspect was that we wanted methods that could tell us

something about the *dynamic gestalt* of player experiences, i.e. how experiences evolve over time (Löwgren, 2000).

The Sensual Evaluation Instrument (SEI), one of the methods that were eventually evaluated, was developed as a tool for non-verbal self report of affect (Isbister *et al.* 2006; Isbister *et al.* 2007). The tool uses organically shaped objects that are purposely ambiguous thus allowing users to assign their own meaning to them. The Repertory Grid Technique is a method developed within psychology to investigating interpersonal relationships, but which has later also been used to capture subjective experiential aspects of interaction with technology (cf. Fällman 2003 for an overview). Our use of RGT involved altering its deployment slightly to allow for capturing dynamic qualities of a player's experience.

The two methods were evaluated along with three different interactive stories in a laboratory experiment. The number of subjects was small and the study aimed to produce "thick descriptions" of a few player experiences rather than spreading our resources thinly across a larger field. The methods we were evaluating allowed us to explore the player experiences for both relevant phenomena as well as descriptive categories.

Project homes

The work included in this thesis has been conducted within the HUMLE and Interaction labs at the Swedish Institute of Computer Science. Both labs has/has a focus on HCI. Furthermore the research has been performed in a variety of projects over many years. It started off as an interest in virtual characters and possible uses of them. More specifically we were interested in believable characters and which factors are necessary for believability (Persson *et al.* 2001). As a tool for experimenting with characters we created a small story scenario in which our characters lived and from this an interest in interactive storytelling eventually grew. The initial story world that we created was a textual world in which players interacted with characters through a scripted dialogue. Our main interest at this time was believability and how it is affected by the use of emotion models (Laaksolahti *et al.* 2001). Later a graphical (2D) version of the scenario was created to explore how visual presentation of characters and settings would affect believability as well as how to design a graphical story world. During this time our interest broadened to include cinematography as a means for clarifying, and enhancing emotions and social relations in a scenario. In the MagiCster project we implemented a 3D version of the scenario including a cinematographic component that used various techniques to enhance expressivity of characters and scenarios (Laaksolahti *et al.*; Laaksolahti *et al.* 2004). During this time we also developed our ideas regarding anticipatory planning as a means of controlling story progression.

The final version of the scenario, implemented in the SOURCE engine which also powers games such as Half-Life2, continued to work mainly on the presentation aspects of interactive storytelling and was conducted within the HUMAINE project. While working on the later versions we also took an interest in how to evaluate interactive stories (Laaksolahti 2006). None of the projects in which our work was carried out was specifically dealing with interactive storytelling; instead the storytelling aspect was included as a setting for believable characters (MagiCster[2]) or as an example of affective interaction (HUMAINE[3]).

[2] http://www.ltg.ed.ac.uk/magicster/
[3] http://emotion-research.net/

1.3 Contributions

This thesis makes several contributions to the field of interactive storytelling attempting to fill in some of the white spots on the map.

One of the contributions is to explore the use of anticipatory planning as a means of controlling dynamic plot construction. By simulating the progression of the plot undesired developments can be detected and avoided. As far as we know, ours was one of the first publications on the subject (Laaksolahti and Boman 2003). This work was done together with Magnus Boman. He inspired to the use o anticipatory planning and provided the expertise on the algorithm, while the author of this thesis did most of the implementation, analysis and write-up of the results.

A second contribution is that we have investigated techniques for dynamically supporting the storytelling process at the level of spectacle, the sights and sounds that ultimately are the material cause of a player's experience. As interactive storytelling is a dynamic process authors cannot always rely on scripted material but must create techniques that are capable of adjusting the presentation on the fly. We have created techniques for making emotions and social relations salient in a player's experience of a drama, that are inspired by cinematography, comics, colour theory and shape theory. While the techniques have not been evaluated with real players yet, plans for how to study their impact on the story telling process have been laid out. The system we created, see chapter 7, was designed and implemented by the author and Thomas Bäckström jointly. We do not regard this tool as a ready-made product with a nice artistic rendering. Instead, the main contribution is a computer science result as it helps an author to automate mapping from emotional shifts of the story into graphical elements. Exactly which those graphical elements should be, is something that the author (or a designer) needs to create to make sure that the aesthetics of the graphical expressions match the interactive story being created.

A third contribution is that we have looked at how interactive stories can be evaluated with respect to their dramatic qualities. A particular concern in our work has been to find methods that make the players' subjective experiences salient, rather than forcing the experience into some pre-existing framework. We evaluated two methods: one existing method, Repertory Grid Technique (RGT), which we modified to allow us to look at the development over time of an interactive storytelling experience, its dynamic gestalt, and one novel method named Sensual Evaluation Instrument (SEI). While the development of SEI is not reported as part of this thesis its usage for evaluating interactive storytelling experiences is. The methods are intended to be used during the development process of an interactive story to help the author to find problems and get at the experience of their story. The development of SEI was done together with Katherine Isbister and Kristina Höök (Isbister *et al.* 2006; Isbister *et al.* 2007), while the modifications of the RGT method were done by the author alone (Laaksolahti 2006).

A final contribution is that we have explored the notion of believability and extended it to include factors that lie outside the character itself. Usually believability has been equated with realism and has been based on models of real human appearance, behaviour, and thought. However believability is also affected by extra-diegetic factors that influence how we perceive characters such as what angle they are filmed from. Our work in this area is tightly coupled with our work on supporting storytelling at the level of spectacle. This contribution is done by the author alone.

1.4 Outline

The thesis is divided into 13 chapters divided into three parts. The first part covers background material and previous work. The second part covers the design and implementation work that we have performed describing the software tools we have developed. The third part covers the work on evaluation methods for interactive storytelling systems that we have performed, describing SEI and the modified RGT methods. The following outline sketches the purpose of chapters 2 and onwards.

Chapter two gives an overview of what stories are, their structure and form in different media.

Chapter three goes into how stories are experienced according to different theories and also explains qualities that have been claimed to be characteristic for interactive stories.

Chapter four looks at what has been done previously within the field of interactive storytelling providing a set of examples of interactive stories that have been developed.

Chapter five gives an overview of the scenario that has been the basis for our work. The chapter explains the vision underlying the scenario and how the scenario evolved over time.

Chapter six goes into our work on anticipatory plot guidance – on the software tools we have created.

Chapter seven relates our work on supporting storytelling on the level of spectacle as explained above. We describe our tool for generating graphical, emotion-expressive, elements and camera-angles on the fly while a story is being told.

Chapter eight gives an overview of evaluation of dramatic experiences and provides a list of criteria that we set up for the design and evaluation methods that were selected. An introduction to the empirical user study is also provided.

Chapter nine explains how the RGT-method works and how we adapted it to be able to handle dynamic experiences.

Chapter ten describes the background to, and evolution of, SEI, and how it can contribute to design and evaluation of interactive storytelling.

Chapter eleven presents a user study that we performed where SEI and RGT were used to evaluate three storytelling games: Façade, Full Throttle and Fahrenheit.

Chapter twelve summarises our higher-level experiences from the user study reviewing how the selected methods lived up to the criteria we had set up for design and evaluation methods for interactive storytelling, and taking a look at how the experiences from the different games differed.

Chapter thirteen revisits our research questions and discusses how they have been answered.

Part I
Interactive Storytelling

Part one of this thesis covers background knowledge and previous work that has been inspirational to the work presented in part two and three. It will provide the reader with the necessary concepts to approach stories, experiences of stories, and interactive stories. First, in chapter two, we provide an introduction to stories, what they are and how they are structured. Stories are seemingly simple structures that exist all around us. But beneath the surface they are amazingly complex and multifaceted. The main purpose of the introduction to stories is to give an understanding of the challenges that creators of interactive storytelling systems face. Knowing how a story is structured is however not enough for creating a storytelling system; we also need to know something about how stories are experienced. Chapter three goes deeper into how stories are experienced according to prior research in the area and in particular how interactive stories are experienced. Finally chapter four will review a portion of the previous work that has been done on computer mediated interactive storytelling and position our own work in relation to it.

2 Stories

The narrative form of discourse is fundamental to humans and can be found in all aspects of life from science to superstition. Brannigan observes that

> […] it seems to be everywhere: sometimes active and obvious, at other times fragmentary, dormant and tacit. We encounter it not just in novels and conversation but also as we look around a room, wonder about an event, or think about what to do next week. (Brannigan 1992 p.1)

Stories are present in the protocols written down in a court of law, they can be found in medical journals, and even our income tax returns may be read as stories of what has happened to us financially during the year.

Stories are accounts of events that have happened either in the real world or in a fictional one. But there are many event sequences that do not qualify as stories. Stories are about meaningful events, and what makes them meaningful is that they have some degree of significance for someone. For instance, that it rains is not really a meaningful event unless the rain pours down on someone who is affected by the rain, a character in the story (McKee 1997; Lemon 2001). Hence stories are about human affairs, about important changes to the life situation of some real or fictional character (Ochs 1997). In fact, stories can be about almost anything and still remain interesting as long as they manage to convey how the particular sequence of events that they are telling is important to someone. A character does not need to be human in order to appear in a story. For instance, there are numerous examples of stories including animal characters. However, characters are not even required to be things that we normally would think of as living e.g. magic mirrors and robots. What is important is that we can attribute human-like qualities to the characters and understand their behaviour in terms of human behaviour.

Not only are stories present in all aspects of life, but they are also told using all kinds of media. Throughout history, whenever a new medium has appeared, it has soon been appropriated by storytellers and incorporated into their palette of storytelling tools. Beginning with the oral storytelling tradition of prehistoric times, via cave paintings; stories written down on different kinds of tablets, scrolls, and pages; printed stories, film, comics, and the latest addition computer mediated stories, new media have offered new possibilities for storytellers to work with. Usually the addition of a new medium has not spelt the death of an older medium, but instead they have continued to happily coexist and complement each other as each medium has its own characteristic qualities that make for different kinds of experiences.

For instance, in literature all events in a story are related through words. In movies on the other hand some aspects of a story are related visually by sequencing and composing moving images in various ways. We can for instance come to understand what a character is looking at by following its gaze through a point-of-view perspective, or understand that it is frightened if it is filmed from a high angle thus making it seem small and vulnerable (Bordwell and Thompson 2001). In comics, pictures and words are used in combination to convey the story and its emotional qualities. In addition, what happens in the gaps between the comic panels, and must be inferred by the reader, is often as important as what happens in them. The shape of the panel in which comics are

drawn is often used to convey information as well. For instance, a long panel may indicate that it represents a longer period of time; a spiky panel resembling an explosion can sometimes be used to indicate that something violent or drastic happened. The shape of the panel can also be used to indicate the mood or emotions of characters such as when a frosty comment from a character is illustrated by a speech bubble with icicles hanging from it.

The choice of media for a story affects how it is experienced. While most stories can be told using any medium, certain combinations of story and media may be more successful than others. For instance, stories where most of the action revolves around the inner life of a character, without external events to convey, may be easier to tell using written words rather than moving pictures, whereas a highly action packed story may be easier to tell on film.

2.1 Story structure

When authors create stories they usually start with some idea about what it is that they wish to convey and proceed to select a sequence of events from their story world to accomplish that. Stories are structured so as to make a

> … selection of events from characters' life stories that is composed into a strategic sequence to arouse specific emotions and to express a specific view of life. (McKee 1997 p.33)

What characterises a story event is that it expresses a change of value that is meaningful to one or more characters in the story. Such values can for instance be love/hate, joy/sadness, or wealth/poverty. In general, story values are able to take on values ranging from positive to negative to the involved characters in the story. For instance, an event can make a character more or less happy or more or less wealthy. If an activity does not turn any value it is not a story event. It becomes meaningless, void of any dramatic potential.

Some events may turn values more than others or even turn more than one value at the same time. Using the terminology of Robert McKee (McKee 1997) the smallest value changing event is the *beat*. It consists of an action/reaction pair that causes minor but significant changes to at least one story value. Let us take an example from the movie Star Wars: The Empire Strikes Back. In one scene, Darth Vader urges Luke Skywalker to come over to the dark side of the force while they are fighting with light sabres in the central air shaft of Cloud City, but Luke refuses to give in. This interchange might constitute a beat. The length of a beat can vary. It may be as short as a single exchange of lines between characters, but can also cover a longer period such as Darth's invitation and Luke's refusal.

A scene consists of several beats and causes moderate changes to at least one value. Scenes are in a sense the most fundamental building blocks of stories forming the arc of the story. According to McKee a full-length movie or novel typically contains somewhere between 40-60+ scenes while a play rarely reaches as many as 40. A scene might cover the whole situation in which Luke Skywalker confronts Darth Vader, fights him in a light sabre duel, and eventually learns that Darth Vader is actually his father. The scene ends with Darth Vader chopping of Luke's hand and begging him to join him on the dark side of the force. Luke refuses and let's himself fall down a deep shaft to what seems like a certain death rather than joining Vader. Miraculously he is rescued by his companions and can make his escape from Cloud City. The scene causes a significant

turn of values as Luke learns that his beloved father, whom he only knows from stories, turns out to be the man he hates the most.

Sequences are strings of scenes that culminate with a more powerful turn of values than a single scene can accomplish and acts are strings of sequences that cause a major reversal of values. Love can turn to hate, despair to hope, and in Mary Shelley's Frankenstein even death is cheated as the inanimate corpse of the monster comes alive and starts breathing. The scene from The Empire Strikes Back described above might well be the ending scene of a sequence or even an act. Finally, there is the story itself which is a long irreversible change of values.

A fundamental property of stories is that they order events along a temporal dimension (Bordwell and Thompson 2001). An event *a* can happen before, after or simultaneously as another event *b*. Stories also link events together causally (Lemon 2001). An event *a* happens because of another event *b*. Narrative causality should not be interpreted in the classical sense, but should rather be seen as a probability distribution among possible succeeding events. That *a* happened because of *b*, should be interpreted as: given the circumstances it makes sense for *b* to follow *a* in an account of events, i.e. there is a larger than zero probability that *b* caused *a*. Figure 3 illustrates the temporal and causal order that stories impose on events. As we shall see later, structuring a story so that the relations between story events make sense is crucial for an experience of narrative coherence and a tough challenge for interactive storytelling. Without it a story will simply collapse to a random string of events.

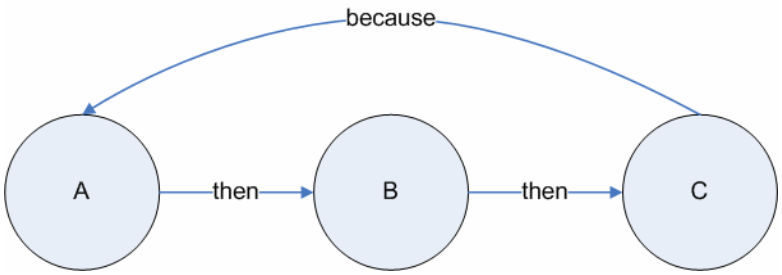


Figure 3 Temporal and causal ordering of story events

2.2 Plot

The distinction between story and plot is common in narrative media. Story refers to what has actually happened in a story world. For instance, a jealous husband, suspecting that his wife is cheating on him, has left her. Plot refers to the sequence of events as it is actually told (Chatman, 1978). The story can for instance be told in reverse: the man leaves his wife, and only later do we come to know why. In short, the plot functions as a view port into the story world. It is the way in which the reader comes to know what has happened although a part of the story is usually inferred by the player. For instance, if a detective is investigating a scene we can infer that a crime has happened although the plot has not revealed it to us. The plot is the only connection that the reader has to the story world.

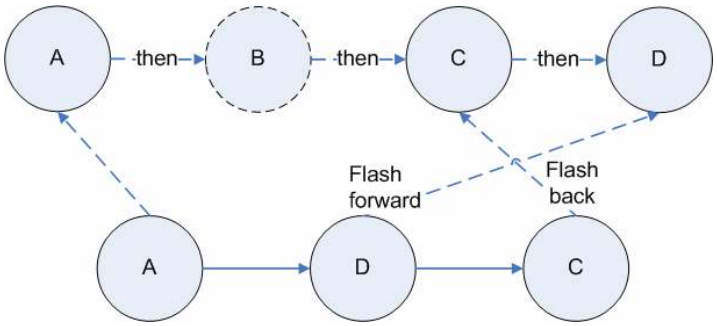


Figure 4 The plot selects and orders events from the story

The events of a story can be arranged in various ways to produce different plots. According to Chatman the function of plot is

> … to emphasize or de-emphasize certain story-events, to interpret some and to leave others to inference, to show or to tell, to comment or to remain silent, to focus on this or that aspect of an event or character. (Chatman 1978 p.43)

Figure 4 illustrates the relationship between story and plot. At the top are the events in the story world as they actually happened. At the bottom are the events as selected and ordered by the plot. Some events have been left out, others have been rearranged. By experiencing the plot the reader comes to understand the sequence of events as it took place in the story.

Chatman also notes that some events in a story are more central than others. Kernels or story-functional events are crossroads where the plot of a story is forced to branch off in one direction or the other. By contrast satellites or descriptive events do not affect the plot in the same way, but instead serve as instruments for creating atmosphere, elaborating on kernels or fleshing out the story.

One of the most important attributes of a story, that can be altered to achieve different plots, is time. Genette (1980) describes how a plot can manipulate time by changing the order, duration or frequency of events in a story. For instance, the normal order of story events can be altered by flashbacks, recollections of earlier events, or flash forwards, leaps ahead to subsequent events.

Duration concerns the relation between how long events last in the story and the time the plot spends on retelling them. For instance, Conan the barbarian spent many years leashed to a treadmill, but the plot summarizes those years in a few moments. In other cases, such as in The Matrix when Neo discovers that his reactions are so fast that bullets seem to move in slow motion making it possible for him to dodge them, the plot actually spends longer time on retelling the events than the story does.

Finally the plot can retell story events with a different frequency than the story does. For instance, the plot can tell the same event several times but from different perspectives as in Pulp Fiction. Genette also discusses other factors influencing the plot, such as who is telling the story (who is the narrator), or whether we are restricted to objective information about what is happening in the story or if we are allowed to see things from a characters point of view and perhaps even have a look inside its' mind.

2.3 Setting and genre

Setting refers to the situation or world in which a story takes place. For instance, it can take place in the fictional world and time of King Arthur or in the war plagued Vietnam of Deer Hunter. To a large extent a story's setting stipulates what is likely to happen in it and what is not. For instance, we would not expect a mounted assault by knights in shining armour to take place in Deer Hunter, although a fight with swords or rather machetes would be possible. Likewise, we would not expect King Arthur to call in an air strike to soften up Mordred, although he could conceivably fly as he had the help of the great wizard Merlin.

Throughout the history of man myriads of stories have been told and retold. At first they were told orally and later through increasingly complex media such as cave paintings, books, and recently computer games. Over the years *genres* of stories have emerged that share certain elements such as setting, values that are at stake in the story, or plot progression.

Recognizing the genre of a story makes the audience form expectations as to what will happen in it. For instance, a western movie is often a struggle between law and order with the good sheriff on one side and a gang of outlaws on the other. The conflict, between the two camps is often resolved in a climactic gunfight where the sheriff is heavily outnumbered but through cunning prevails against impossible odds.

Note that the genre expectations of an audience do not necessarily correspond to any formal genre categorisations, although there are a number of them to choose from. Instead they reflect a complex set of anticipations learned through a lifetime of experiencing stories (McKee 1997).

Together setting and genre creates a host of expectations regarding what is likely to happen in a story and what is not. Each story world creates its own internal logic which dictates what is possible and what is not. For instance, pianos falling on someone's head without causing fatal injuries are to be expected in a Donald Duck cartoon but not in Hamlet.

That is not to say that there are no exceptions to the rule. A striking example is Roberto Rodriguez's film From Dusk Till Dawn which starts out as a hardboiled crime story following two criminal brothers and their hostages as they are attempting to escape from the police after a bank robbery. The brothers make their escape across the border to Mexico where they eventually arrive at a strip joint where they are to rendezvous with the local kingpin. At this point the whole movie changes character. The strip joint turns out to be a nest of vampires and the only chance for the brothers to get out of the mess is to survive from dusk till dawn. In the crime story setting encountering vampires is a highly unlikely event, but here the writers have used it for effect.

2.4 Interactive Stories

The notion of interactive stories has been around for a sometime and has been explored within many arts and disciplines. Borges' novel "The garden of forking paths" from 1941 introduces the idea of a story world where all possible outcomes of an event occur simultaneously, each one itself leading to further possibilities, instead of one where choosing one alternative at each decision point eliminates all the others. The most utopian vision of interactive storytelling so far was introduced by the television series Star Trek: The Next Generation and has inspired researchers in many different fields. Janet Murray even titled her popular book on interactive stories, Hamlet on the

Holodeck (Murray 1997), after the technology that in the TV series was used to enact the stories. Stories on the holodeck are experienced from a first person perspective as a participant. Players are immersed in an illusion of a world including visual, aural, sensual and olfactory sensations that is indistinguishable from the real world. When eating an imaginary apple it feels like eating a real apple, when touching a characters face it feels like touching a real face, when punching a character in the face, your hand hurts. Fictional characters appear as real as real persons in that they can think, feel, speak, and act. Players on the holodeck can do all the things that they would, or would not, do in real life: discuss with a friend, shout at the boss, steal a fortune, kill an enemy, kiss a loved one, valiantly stay in the heat of battle or cowardly run away. On the holodeck there is no difference between how players interact with fictional characters and events while immersed in the story world, and how they would go about interacting with real persons in real life. Many of the efforts to create computational interactive storytelling systems within research have assumed a first person perspective in which the player takes part as a character in the story. However, other forms of interactive storytelling are also being investigated.

Electronic literature refers to various forms of textual interactive stories with the hypertext story perhaps being the most prototypical form that has been explored. In a hypertext story pieces of the story are linked together in a network structure. Each piece of the story contains links to other pieces of the story, and by clicking these links the story unfolds as the network is traversed. The links in a hypertext story can be dynamic, changing in time with the user's interaction, but typically there is at least a static core of nodes and links. Not all hypertext stories need to be experienced on a computer. Adventure books where the reader can choose which path to take through the book are also examples of hypertext stories albeit in printed form.

Interactive fiction is another form of mostly text-based interactive story that is played on a computer. The player types commands to the computer, such as *go north*, and the computer responds by describing the effect of the commands on the world. During the 80's interactive fiction was highly popular with many commercial works produced by above all Infocom. Many of the works produced under the era, such as Planetfall, have become classics. Today, there remains a sizeable community involved in exploring and producing interactive fiction although to our knowledge no commercial titles are produced.

Live Action Role Playing (LARP) is a type of role playing in which participants take on the role of a character and dresses up and acts as that character in a live situation. A person playing a knight may be required to wear armour and heavy swords, a person playing an elf may be expected to speak elfish. Often LARP's are performed in areas that have been staged to look like the setting of the story for instance a castle. In a LARP there are game masters that monitor how the experience unfolds and attempts to influence its trajectory by e.g. setting scripted events in motion or, either in character or out of character, suggesting to players what to do. Recently there has been research on how to create technologically enhanced LARP's that further strengthens the experience of being in a story world (Jonsson *et al.* 2006). Live Action Role Playing is probably the interactive storytelling experience that comes closest to the holodeck vision described above in that players act in a fully immersive world as they would in the real world.

Interactivity

As we can see there are attempts to create interactive storytelling experiences within many fields, all of them creating different kinds of experiences. But what exactly is it that makes a story interactive? What is it that interactivity does to the story structure?

As we have seen, a story is a fixed set of story events that are connected by temporal and causal links. For a story to become interactive either the events themselves or the links between them must become dynamic. Interactive plot means that the links between events become virtual (see Figure 5). Instead of being composed into a pre-defined story, events are pooled and dynamically inserted into the story based on what has happened before, what events are available, and an event selection policy that chooses among events. To cater for different plot unfoldings there will typically be a larger number of events available in the pool than can be experienced in a single session. Most work on computer mediated interactive stories has focused on interactive plot. In chapter 4 we will go through some of the systems that have been produced.

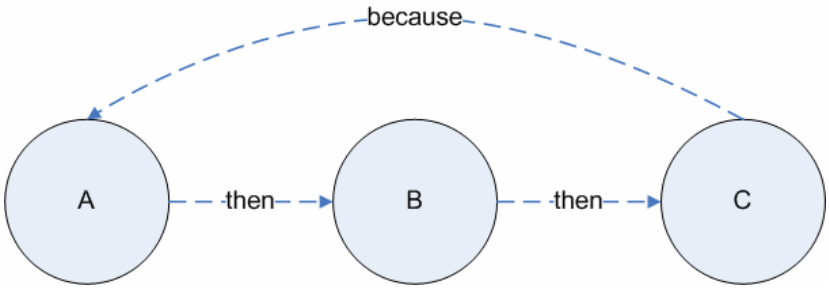


Figure 5 Interactive plot makes links between events virtual

Interactive story means that the story events themselves become virtual (see Figure 6). Instead of relying on a pool of pre-authored events to choose from, they are created on the fly and integrated into the story. Creating story events dynamically is an even harder problem than sequencing pre-fabricated events, but may eventually provide experiences that are more adapted to each player and situation. How to automatically create story events is an open topic of research. However, story generation systems and the techniques used by them may be a starting point. Szilas work on an interactive storytelling system based on narrative principles is a step in this direction (Szilas 2003).

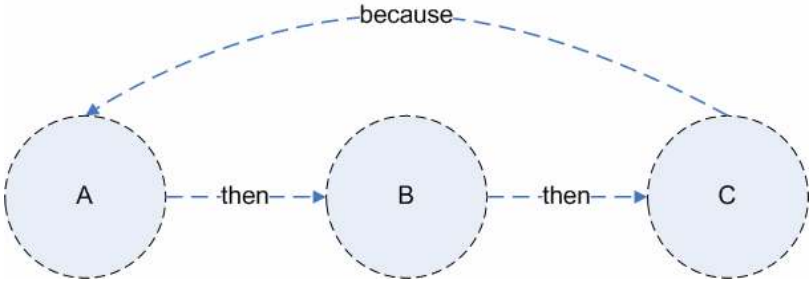


Figure 6 Interactive story makes the story events themselves virtual

2.5 Believable Characters

In the arts as well as in computer science *believability* is often – somewhat circularly – defined as a character's ability to suspend disbelief (Loyall 1997). It refers to the set of expectations regarding appearance, movement, personality and many other dimensions that a character must fulfil in order to project an image of life. McKee states that a character's credibility depends on how well a character's mix of qualities motivates its actions:

> … a character must be credible: young enough or old enough, strong or weak, worldly or naive, educated or ignorant, generous or selfish, witty or dull, in the right proportions. Each must bring to the story the combination of qualities that allows an audience to believe that the character could and would do what he does. (McKee 1997 p.106)

Thus it is important for characters to have the right characteristics to plausibly move the story forward. Creating believable characters for interactive storytelling is complicated by the fact that characters must act and react appropriately in real-time. Characters must act autonomously as there is no author there to make up responses to unforeseen events on the fly. As so much of storytelling revolves around believable characters, creating their computational counterparts, believable agents, is another one of the main challenges for interactive storytelling.

Agent technology refers to a set of software approaches that are shifting users' view of information technology from tools to actors. Tools react only when interacted with, while agents act autonomously and proactively, sometimes outside the user's awareness. In combination with the fact that many systems now also have a humanoid surface appearance (known as interface agents) the tool metaphor is being replaced – or at least complemented – by the agency metaphor.

As agents become more complex they will land in the twilight zone between mechanistic and living, between dead objects and live beings. In their understanding of the system, users will be tempted to employ an intentional stance, rather than a mechanistic one. Computer scientists may choose system designs that encourage or discourage such anthropomorphism for various reasons (Höök 2004). Irrespective of which, we need to understand how and under what conditions it works.

Agent research – like Artificial Intelligence (AI) research before it – can be pursued with different goals in mind. A deep AI approach seeks to simulate real intelligence and processes. By studying actual socio-psychological processes in related research fields, the deep AI approach seeks to model these theories in code and then run simulations. A shallow AI approach aims to create artefacts that are not socially intelligent *per se*, but rather appears socially intelligent to a given user. The ultimate reason to construct agent technology is, according to this approach, to generate certain effects and experiences in the user. The shallow approach does not seek to create social intelligence unless it is meaningful social intelligence vis-à-vis some user situation. In order to develop believable agents we do not have to know how beliefs, desires and intentions actually relate to each other in the real minds of real people. If we want to create the impression of an artificial social agent driven by beliefs and desires, it is enough to draw on investigations on how people in different cultures develop and use theories of mind to understand the behaviours of others. Agents need to model the folk-theory reasoning, not the real thing. To a shallow AI approach, a model of mind based on folk psychology is as valid as one based on cognitive theory (Persson *et al.* 2001).

If we can describe the mechanisms by which people in everyday life understand socially intelligent creatures, then other, perhaps more scientific, frameworks may not have to modelled in the agent technology. For instance, in everyday life, people seldom explain other's behaviour in terms of neural configurations and how neurons fire in the brain (although this is ultimately and perhaps objectively the material basis for all mental life). Instead, sensations, beliefs, emotions, intentions, traits or situational factors are referred to. In this way, engineers can in their modelling scale away levels of 'real' intelligence and still achieve believability.

The levels of reasoning that humans employ when experiencing believability include expectations on visual appearance and behaviour, primitive and folk psychology, personality, and affect.

The number of levels is not important. The multi-layered structure of people's understanding of social intelligence, however, is. In trying to create impressions of social intelligence one level is not more important or central than the others. If one level poorly meets the expectations users may have on that level, other levels may fill in and compensate.

In Heider & Simmel's (Heider and Simmel 1944) experiment, subjects were exposed to a silent cartoon animation in which two triangles and a circle move against and around each other and a diagram of a house. These triangles and circles did not look anything like believable agents on the graphical/appearance level. However, their movement and counter movement across the white abstract background allowed spectators to attribute mental states and folk psychology to them in a coherent fashion. For instance, the large triangle was described as chasing and then fighting the smaller one, while the small triangle was trying to get away. This observation also shows that it does not require sophisticated or photo-realistic cues in order to get users to start constructing some level of social intelligence to objects (cf. Reeves and Nass 1996).

Neither is it necessary for low-level processes to be in place before starting on the high-level processes. Levels surely influence each other, bottom-up as well as top-down.

An area of special interest for interactive storytelling is emotional believability; a characters ability to display emotions grounded in goals, plans, personality factors and context (Bates 1994). Without such grounding characters run the risk of appearing schizophrenic and ruin the experience of believability (c.f. Sengers 1999). In addition, emotions are important for creating atmosphere and interesting interchanges between players and characters of a story.

2.6 Dramatic Stories

Having created characters, a setting, looked at genre expectations, and all the other bits and pieces needed to create a story the author has to start structuring the story into beats, scenes, and acts. But the question of what that structure should look like remains. Should all scenes turn values equally much, should all the most "exciting" scenes come first, in the end, or should they perhaps be evenly distributed?

In classical dramatic theory the anatomy of stories (or plays) is often visualized as a curve that describes the emotional tension that the story creates in the reader/spectator as it unfolds (Laurel 1993). Tension is caused by unresolved conflicts and unsettled emotions experienced as changes in the values that the story revolves around. A typical dramatic experience is thought of as consisting of several phases or steps, see Figure 7. During the exposition phase tension rises slowly as the setting of the story and its main characters are introduced. An inciting incident then adds momentum to the story leading to a quick rise in tension. For instance, the attack on Luke Skywalker's home on Tattooine makes him realize the evil nature of the empire and sets him on the path towards becoming a Jedi Knight. Eventually tension builds to a climax where conflicts and emotions are resolved one way or the other after which tension quickly drops and the story eventually ends. The climax of Star Wars is reached as the final attack on the Death Star begins. Until the very moment when Luke turns off his targeting computer trusting the force to guide his aim, and successfully hits the tiny exhaust port leading to the reactor powering the Death Star with a proton torpedo, and thereby destroying it, the outcome is uncertain. But in that climactic instant, all the possible ways in which the story could unfold collapses into one single thread, and the major complication of the story is resolved.

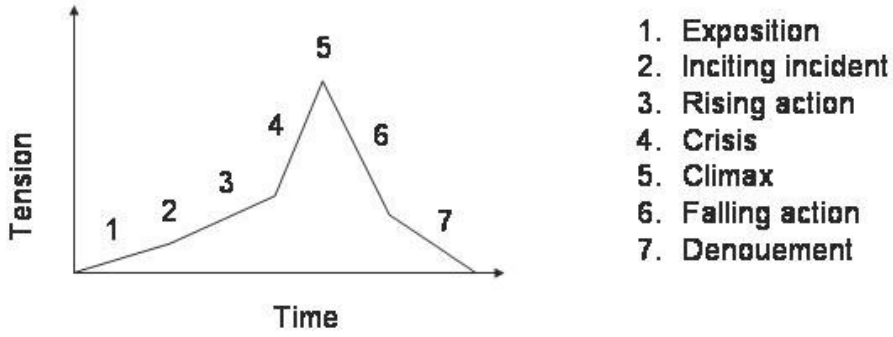


Figure 7 Phases of a dramatic story

By sequencing events so as to create a similar curve authors can create an experience that is dramatic but also familiar to the audience, as it follows patterns that they have learnt through a lifetime of experiencing stories.

2.7 Challenges to interactive stories

We have now introduced the basic concepts needed to understand both stories in general and interactive stories in particular: beats, scenes, acts and value changes are the basic building blocks. These can be put together in many different ways but to make a good story, the concept of a dramatic story and dramatic curve needs to be regarded. A story where no emotional values are changed and where these is no drama, will be uninteresting to the player.

But we have also discussed how a design also needs to consider the believability of the interactive characters, and the choice of setting and genre and its influence on players' expectations.

The challenges to interactive stories so far included:

- Allowing the player to interact with the story and change the progression of events without losing the dramatic curve development.
- Creating believable, computer-controlled, characters that can behave in ways that make sense to even when the player is acting in ways that are not anticipated by the author of the story. Here folk psychology might provide a useful stance to the design of characters.
- Making story events virtual so that they can be ordered in many different ways and still produce an interesting, dramatic, story progression.

3 Experiencing Stories

We have now learnt something about the complexities of stories and interactive story construction. But knowing how a story is structured is not enough for creating a valuable, enjoyable, interactive story or storytelling system; we also need to know something about how stories are experienced by its players. As a reader, you might think that you know a good story when you see one, but in order to create tools, design and evaluation methods for creating interactive storytelling systems, we need to drill a bit deeper than so in order to figure out what those tools need to be.

What does it mean to experience a story? In what way is the experience of an interactive story different from the experience of, say reading a book? Can we really design for a certain kind of experience or is it always constructed in the players mind, uniquely subjective to each person? And how do those experiences differ from other kinds of experiences we might have such as playing football or listening to music? In fact, what does it mean to have an experience in the first place?

Dewey can act as a starting point to understand experiences in general and experiences of interactive stories in particular. Dewey states that:

> "…we have an experience when the material experienced runs its course to fulfilment. Then and then only is it integrated within and demarcated in the general stream of experience from other experiences. A piece of work is finished in a way that is satisfactory; a problem receives its solution; a game is played through; a situation, whether that of eating a meal, playing a game of chess, carrying on a conversation, writing a book, or taking part in a political campaign, is so rounded out that its close is a consummation and not a cessation." (Dewey 1934 p.36-37)

According to this definition an experience has a temporal dimension; it has an extension in time. In the same way Aristotle described stories as having a temporal dimension; something which has a beginning, middle, and an end. That stories have an end can be interpreted as achieving the consummation that Dewey speaks about. Without consummation stories can feel incomplete. We can feel that the story completely lacks an end (a morale) or that the ending is bad in that it does not tie together all pieces of the puzzle in a satisfactory way, it has not exhausted its material. In contrast to paintings, sculptures and many other art forms that do not have an explicit temporal dimension stories seem to lie quite close to Dewey's description of what an experience is. In a good story, it is often very important that we end up in a state where all the threads come together, the experience is completed, the dramatic curve comes to its final state, and in some cases even that we come to an experience of catharsis. If all materials come together, it can be immensely satisfying to person experiencing the story.

In the same way, interactive stories are quite close to Dewey's description. However, in contrast to static stories such as books or films that tell a predefined story, an interactive story can unfold in many different ways. Depending on how players interact within the story world sometimes the story may run its course to fulfilment and other times it may not. One of the fundamental challenges to designing interactive narratives is finding methods for making the former happen more often than the latter.

Interactive stories are a new form of art which means that Dewey's treatment of art and aesthetics becomes relevant even if none existed when did his work. Having an extension in time cannot fully account for the experience of a story. There has to be something else, a sense of drama, a conflict, a problem that the story revolves around. And maybe it is in the drama that the aesthetics of a story is to be found, not in its formal properties.

Dewey makes a distinction between forms of art that have the human mind-body of the artist as their medium, such as dance, song or theatre, and those that require external materials such as painting or sculpting. Dewey (1934) refers to these two categories of art as automatic and shaping arts. Interactive storytelling as an art form seems to be an interesting hybrid of automatic and shaping arts. The core material of an interactive story ought to be the story, or story world, itself; the dramatic events or possibilities for dramatic events, contained within the world that will eventually unfold into a particular plot forming a player's experience. In contrast to e.g. literature (most literature anyway) interactive stories contain loads of external material in the shape of graphical elements, music, special effects and possibilities for interaction that are important for the final experience. In a sense interactive stories represent a multiform style of art, at least when computers act as the delivering medium. However it is the combination of all components, the unity of expression that meets the eyes and ears of an audience that determines what the experience will be like.

How the story world is designed including the interaction possibilities that are available affects both the story and the experience of it in the same way that cinematography – how something is filmed in contrast to what is filmed – affects it in movies.

The interaction possibilities afforded by interactive stories also lead to a blurred boundary between artist and audience. Because players influence the unfolding of the story they are actively taking part in the creation of their own story and experience. Just like an artist, players can interact with the material at hand, review the result and then choose the next step based on it. But in contrast to the creator of the story world, players do not have access to the same raw material. While authors of interactive story worlds busy themselves with creating a set of story elements that can be combined in various ways, in addition to all the other materials that are part of the world, players are limited to choosing and combining them in various ways. In that sense playing a story world is more accurately thought of as building something from blocks of Lego rather than building a sand castle from nothing but the sand on the beach.

There is another important difference between players and authors. Murray states that: "Authorship in electronic media is procedural. Procedural authorship means writing the rules by which the texts appear as well as writing the texts themselves" (Murray p.152). Depending on how these rules are realised a player can have more or less control over the progression of the story, but will typically not have full control, as they have when combining Lego pieces. Rather players will interact with the rule system and influence how the story progresses.

3.1 Characteristic pleasures of interactive stories

Murray's treatment of interactive stories in "Hamlet on the holodeck" names three experiential qualities, or in her own terms "characteristic pleasures" of interactive stories (Murray 1997):

- Agency
- Immersion
- Transformation

As the ability to influence the progression and outcome of a story lies at the heart of interactive stories, many consider *agency* to be the most important of these characteristics and it is also the most widely used. Agency is usually taken to denote a player's sense of being able to influence the story, its progression and ending in a directed manner. Murray describes it as "Agency is the satisfying power to make meaningful actions and see the results of our decisions and choices" (Murray p.126). This does not mean that the mere possibility to perform actions means that agency is involved. In fact Murray claims that the term is often misused:

> When users are merely asked to respond to for example a menu with a begin/quit choice, they are merely performing a kind of response to the "call" of the machine (Murray p.127).
>
> In a tabletop game of chance the players may be kept very busy with activities, spinning dials, moving game pieces, and exchanging money, but they may still not have any true agency. The player's actions have effect, but the actions are not chosen and the effects are not related to the player's intentions. (Murray p.128)

Actions of the type described by Murray do not involve any significant degree of agency on the player's behalf. Although actions are performed they are not related to player goals, and the choices available are not necessarily the ones that players would pick if they could choose freely. Even if there are lots of actions to choose from, the number of available actions in itself is no guarantee for agency. Unless actions are meaningful, directly related to a player's short and long term goals, and have a noticeable impact on the story world, they do not provide food for agency. Hence, the quality of the actions is more important than the quantity. A game that offers few actions to the player may still create a strong feeling of agency, if the quality of the actions is right.

Immersion refers to a player's perception of a story world in a way that makes them feel that they are actually there and that they screen out the real world. Murray metaphorically explains immersion as being submerged into water, being surrounded by an alternate reality that completely captures our attention. Children are usually very good at immersing themselves in their play, completely forgetting the real world, and actually being in the fantasy world. In literature similar descriptions of immersion have been suggested. For instance, Gerrig (1993) speaks about being transported into narrative worlds, a process through which the reader comes to accept the rules, qualities and attitudes of the story world (or stop reading the book) and in the process distances herself from the world of origin, making some aspects of it inaccessible. In everyday terms we refer to this as "getting lost in a book". However the experience of a narrative world is optional: a text cannot force a reader to experience a narrative world. Not all readers will like a particular book and will therefore decline the invitation to be "transported".

Ryan describes the experience of immersion in relation to textual worlds in the following way:

> In the phenomenology of reading, immersion is the experience through which a fictional world acquires the presence of an autonomous, language-independent reality populated with live human beings. (Ryan p.14)

Ryan also suggests that there are different types of immersion – spatial, temporal and emotional. Spatial immersion refers to the proven ability of literature to promote an acute sense of presence of a spatial setting including a clear vision of its topography. By reading a text the reader can be transported to the world and make it her home. While spatial immersion provides staying power, a pleasant landscape that incites the reader to stay on, temporal immersion incites readers to rush along to the end of the story. Ryan describes it as: "temporal immersion is the reader's desire for the knowledge that awaits her at the end of narrative time"(Ryan p.140). The end state is described as a state of blissful omniscience, where the reader has experienced all that the story world has to offer and can look back at it. A more common term for temporal immersion is suspense. Finally, emotional immersion refers to the emotional responses for often non-existing characters and situations that a story can induce. Sometimes these emotional reactions can be strong enough to lead to actual physical symptoms. For instance, we cry when the protagonist of the story dies or shout in joy when the underdog turns from a frog to a prince; we become emotionally entangled in the lives and doings of the characters in the story and empathize with them. When we are emotionally immersed we, willingly, oversee the fact that the characters we are feeling empathy towards are not real.

The last of Murray's characteristic qualities, and the most difficult one to define, is *transformation*. It refers to the computer's ability to easily let players slip into different roles that may be very different from the real person. In some cases this seductive transformative power that the computer possesses makes us long for our alternate personalities:

> It makes us eager for masquerade, eager to pick up the joystick and become a cowboy or a space fighter, eager to log on to the MUD and become ElfGirl or BlackDagger. […] they call forth our delight in variety itself. (Murray p.154)

But transformation does not need to be limited to characters or roles. The transformative power of the computer can also change the story world or the story itself. The result is what Murray calls kaleidoscopic stories which like fractals are composed of tiny pieces and that can be arranged in a myriad of ways. The ability to present simultaneous actions in multiple ways is one of the most compelling possibilities presented by the kaleidoscopic structure.

3.2 Aristotelian drama

Aristotle thought of dramas as organic wholes, where the whole is more than the sum of its parts (Aristoteles), much like Dewey's notion of unity. In the Poetics, Aristotle describes a theory of drama based on six characteristic qualities that all dramas share. In her treatment of Aristotle's theory Laurel, describes the qualities as connected by formal and material cause, see Figure 8. The material cause of an object is the substance from which it is built. For example, the material cause of a building is the bricks and concrete used to construct it. The formal cause of an object is the form, plan, goal or idea of what an object aims to be once it is finished. For instance, the formal cause of a building is the blueprints that were used when creating it.

In drama the formal cause corresponds to the plot that an author has created to tell a certain story, while the material cause corresponds to the stuff that the drama is made of. The material cause includes all sights and sounds that are presented to the audience during the drama.

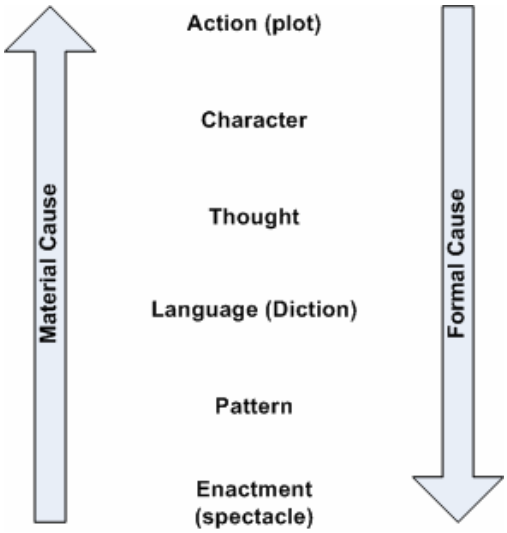


Figure 8 The Aristotelian model of drama according to Laurel

Following the chain of formal causation from top to bottom, the model represents an authorial view of a drama. It starts with the plot telling a certain story, that an author has constructed. As it is the topmost layer it is not formally caused by anything but is itself the formal cause of the underlying level, character. The characters of the drama, including their personality and traits, are determined by the plot as they are there to perform whatever actions that the plot requires. A character's thought processes lead to its choices and actions, and are determined (formally caused) by the type of character they are. For instance, Uncle Scrooge will not spend money because he is a stingy character. Characters express their thoughts through language which can include both verbal and non-verbal signs and sounds. More generally language can be thought of as referring to a character's actions. The language expressed by characters is arranged into patterns that are perceived as pleasurable by an audience. Finally the patterns are the cause of the sensory display that an audience meets when experiencing the drama.

If we instead follow the chain of material causation from bottom to top the model represents an audience centric view of drama. Instead of telling us how the author intended the drama to evolve, we get to know how the audience comes to understand the plot. The audience experiences an enactment of the drama; a spectacle composed of all the sensory phenomena that are part of the representation. In the spectacle the audience detects patterns that are caused by characters expressing themselves in language and action. From the language and actions the audience infers the characters' thought processes, and gradually develops an understanding of what kind of characters they are dealing with. Based on the knowledge about what kind of characters they are dealing with the audience can make sense of the actions that characters make and understand the plot. By working their way up the chain of material causation the audience is able to experience and understand the chain of formal causation.

Mateas (Sengers and Mateas 1999) expands on Laurel's work by incorporating the player into the model. The expanded model adds a chain of formal causation from the level of character corresponding to the player's intentions. By interacting with the story world the player's actions become the formal cause of events on the levels below character. Events on the levels below character in turn provide the player with material resources for action, adding a chain of material causation. Mateas argues that by balancing the formal constrains of the player from the level of plot, with the material resources for action provided from the lower levels, a sense of agency emerges (Mateas and Stern 2000). If formal and material causes are unbalanced, such as when the player

has many options (material affordances) but no clear way of choosing between them (lack of formal cause), the sense of agency diminishes.

A more recent model based on Aristotle's work created by (Tomaszewski and Binsted 2006) attempts to eliminate some of the strains of Laurel's model and make it suited for different media. In the new model a distinction is made between the object of drama which is "characters-in-action" and the medium through which the drama is conveyed. A drama can be instantiated in different media which influences how it is constructed. For instance, a story's dialog is written in quotes in a novel and spoken by actors in a play. Tomaszewski states that: "We materially construct a sense of the object from our experience of its instantiation in a particular medium" (Tomaszewski and Binsted p.3).

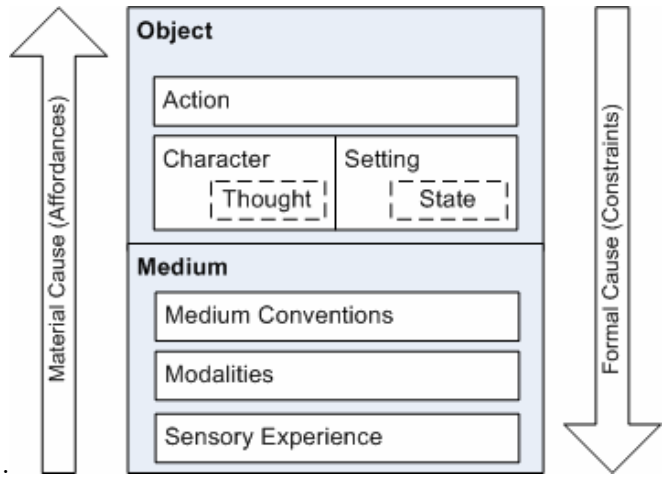


Figure 9 A reconstructed version of the Aristotelian model

Figure 9 shows the reconstructed Aristotelian version of the model. At the lowest level the medium can utilize different sensory channels such as auditory and visual channels. In the display of sensory experiences provided by the medium we can discern patterns such as music, speech, text, diagrams, animations etc. These patterns are the modalities of the medium. Over time conventions for the use of modalities in a certain way have emerged. For instance comic books use the shape of speech bubbles to convey whether a character is e.g. speaking, whispering, thinking, is angry. Each medium provides its own set of sensations, modalities, and conventions. Hence the same story instantiated in different media provides a different experience. This agrees with our own view on the relation between story, media, and experience (which will be discussed in detail later, see chapters 3 and 8).

At the object level the action of the drama is materially caused by characters. These in turn are formally constrained by the action; the action determines what kinds of characters are needed to produce it. Thought is important to understand characters, but it is not the only thing. For instance, expressions, gestures, appearance and even factors such as theme music can also contribute to an understanding of the character. In our treatment of believability in chapters 3 and 8 we give a similar argument for character believability.

Setting refers to the place where the story takes place and includes objects that the player can manipulate. Together setting and character constitute the story world in which the drama takes place. In an interactive drama the player will spend time interacting with objects and moving their character about the world. These activities on the player's behalf will partly cause the action of the drama. At the same time the story

as it has evolved so far places some constraints on the user. This corresponds to agency as described by Mateas (2000) although here the influence of a user manipulating objects and interacting with the world is placed in the same narrative context as characters.

For interactive storytelling the chains of causation in the model suggest that there are two ways of constructing a story: top-down and bottom-up. In the former a story has a strong authorial view where story construction proceeds from formal cause to material cause, from plot to spectacle. Pieces of the plot are delivered to the audience in suitable chunks as dictated by the sequencing mechanism and the underlying representation of the plot. In contrast a bottom-up approach has a strong focus on the player and story construction proceeds in the reverse order, from spectacle to plot. The plot is constructed from the player's interaction with the story world and the characters living in it. In its purest form there is no plot defined by an author to discover, instead the plot is wholly created by the player. All that an author does is provide the raw materials for the process. Aylett refers to these stories as "emergent" (Aylett 2000).

3.3 Experiencing stories

In summary, to come to a fulfilling, aesthetic, experience of a story is not something we can design for entirely, but will be construed by the individual players in their minds. But we can lay the groundwork for such an experience by making sure that the author empties all the materials, connecting all the threads, and making all the aspects of the story harmonize. The Aristotelian view entailed not only plot progression but also all the other aspects involved in telling a story – the spectacle. This is something we will come back to, and make use of, later in this thesis as we construct tools that the author can use to realize interactive storytelling systems.

4 Computational Storytelling

Authoring an interactive story world is by necessity a major undertaking. In addition to the massive amount of content (graphics, sound etc) that has to be created for any game, a plotline with multiple (equally?) interesting plot progressions has to be constructed. Even for skilled artists, such as authors and playwrighters, constructing such a plotline is a new and harder than usual task as it requires taking into consideration not only your own wants but also the players. The fact that an interactive story is non-linear complicates the situation as it can branch off in different directions depending on players' actions. Hence authors have to cater for several different possible story progressions. Taken together this makes authoring interactive story worlds more suitable for development teams consisting of individuals with complementary skills rather than a single author.

Computer scientists have so far produced a fair amount of interactive storytelling systems while there is a still a lack of implemented interactive stories. At some point most researchers working on interactive storytelling seem to have realized that it is easier to build a storytelling system, than to build a compelling storyworld (Crawford 2005). Simply stitching events together, even if they follow narrative rules (temporal and causal linking), does not automatically create for a good story. Instead there are other factors that depend more on artistic considerations and artistic talent that determine how a story turns out. Among other things, a compelling story has to turn interesting values, it has to have interesting characters and gripping and sometimes unexpected plot twists, as discussed in the previous chapters.

Below we will go through a selection of systems that have been developed to illustrate some of the approaches that have been explored. The list is not complete but reflects the major systems and approaches that have inspired our own work. Our focus here is on computational storytelling, i.e. interactive storytelling that uses the computer as delivering medium. Specifically, we will look at systems that have been developed in academia. In addition to the work presented here computational storytelling also encompasses works produced in other fields such as computer games and Live Action Role Playing (LARP). Computer games that have incorporated storytelling as part of the gaming experience include Infocom's highly successful interactive fiction games such as Planetfall, but also later works such as Fahrenheit (see section 11.5) which is described by its author as an interactive drama. LARP designers on their part have recently started to create technologically enhanced LARPs intended to accentuate player experiences. Such LARPs include techno-magical artefacts such as elf ears with built in sound amplifiers to mimic the heightened senses of elves, as well as sophisticated support for game masters to monitor gaming sessions as well as plant information in the game (Jonsson *et al.* 2006). While the delivering medium of such role plays is not a computer *per se*, computational power plays an important role in creating the player experience.

4.1 Basic approaches

Interesting events and characters are two cornerstones of interactive storytelling experiences. Thus any system attempting to create such experiences must provide them. The approaches to interactive storytelling that have been explored so far differ with respect to which of these aspects that have been in focus. In broad terms the approaches that have been explored can be divided into those that incorporate a central planning mechanism – a drama manager – that is responsible for guiding story progression and those that rely on autonomous character interactions to produce a story.

In essence, drama managed approaches represent an author-centric top-down way of thinking about stories that fit well with the classic Aristotelian view of drama. A plot, or a series of possible plots, are constructed by an author and presented to players in different order depending on how they interact. By contrast, character-based approaches follow the principle of emergence: "the creation of complexity bottom-up via interaction between essentially simple components" (Aylett 2000 p.3). Instead of an author creating a story top-down that is transferred to players the story emerges bottom-up from interactions within the story world.

The basic idea underlying the first approach is that authors create a representation of the story along with a model of how the story is supposed to progress. The drama manager continually monitors story progression and from time to time intervenes to ensure that the story evolves according to the model. The model can be as specific as a (partially) defined plot structure that the system aims to unfold, but it can also be more generic such as a dramatic arc that the system aims to achieve. In the latter case the system can choose among a number of plot events that has the required characteristics rather than being limited to one specified in advance.

In character-based approaches, there is not necessarily any explicit representation of a story. Instead it is implicitly encoded in the possible actions and reactions that the characters have. The basic idea is that given a suite of properly rigged agents they will enact a story through their autonomous interactions with each other and the player. For instance, imagine a story world containing two agents having an antagonistic relationship to each other with the player acting as a neutral part. The enmity of the agents will lead them to seek confrontation with each other while the player is left to choose sides, argue, and negotiate with the characters thereby influencing how the story evolves. The drama arises from the interactions among the characters not from an explicitly encoded story. As such, the character-based approach to interactive storytelling bears a greater resemblance to simulation and simulation games than the drama manager approach.

The two approaches can be combined. The name "drama manager" implies that it is a component that actively guides how a story unfolds by intervening in the storytelling process. If, however, the management is restricted to a shared view of how the story should evolve, it should be perfectly possible to decentralize drama management. In such a scenario the decision making process of the drama manager is distributed to the involved characters, who in turn are guided by the shared view of the story. In essence this means that characters are performing as actors that are guided by a script. However, distributing the drama management process does lead to other difficulties such as deciding which of the characters should act.

Hence the notion of a central drama manager is usually tightly coupled with the notion of semi-autonomous, or even non-autonomous, agents. Such agents have limited freedom to pursue their own goals or perform unsupervised actions. Typically this includes goals and behaviours that can add to a character's believability or make its personality salient, but that are not directly story-functional. For instance, an agent may

have autonomous behaviours related to its' own body movements and behaviours for going about its daily life, such as chatting with friends and eating. By contrast, story-functional behaviours are tightly controlled by the drama manager and portioned out in suitable chunks at appropriate times.

It has been argued that combining strongly autonomous agents with a centralized drama manager is counterproductive as the directives portioned out by the drama manager would conflict with an agent's existing goals. The brain surgery performed by the drama manager leads to constant re-planning by agents ultimately leading to fragmented and unbelievable behaviour (Mateas and Stern 2000). The more power over the story is centralized to the drama manager the less autonomous it makes sense for characters to be.

A problem associated with purely character-based approaches is that sometimes characters will not act in a way that is conducive of a narrative experience. There is no guarantee that the experience provided has a recognizable structure or a coherent meaningful outcome (Aylett 2000). However as noted by Aylett et al. (Aylett and Louchart 2007) for instance table-top and live-action role-playing stand as examples of emergent narrative that does work.

4.2 TALE-SPIN

Automatic story generation has been studied in computer science research. One of the earliest examples is Meehan's tale-spin system that automatically generates animal fables (Meehan 1976). TALE-SPIN generated stories by simulating a world and its inhabitants and telling us what happens in it. A world in TALE-SPIN was built from places, props, and inhabitants with, possibly conflicting, goals. From an initial set of character goals and relationships provided by a user the system would create a story through the interaction of characters.

TALE-SPIN could generate stories in three modes: verbose, not-so-verbose, and pre-packaged plot. The modes differed with respect to what was included in the printout of a story and how much user interaction that was required to generate it. A session with TALE-SPIN started by choosing one of the modes and then continued through a question-answer dialogue with the system in which all information required to generate a story was acquired. In verbose mode this process proceeded in a stepwise fashion; whenever the system did not have enough information to proceed it stopped to ask the user for input. In between stops the story, along with all activities that the system undertook in generating it such as asserting facts to the world model, were printed out for the user to read. As a result the generated stories had the character of system traces rather than thoughtfully laid out stories.

In the not-so-verbose mode the user engaged in the same type of question-answer dialogue as in the verbose mode, but the story was delivered in one piece once all the necessary information had been gathered. In contrast to stories generated in verbose mode, stories generated in not-so-verbose mode did not contain a full trace of the systems operation. Hence actions such as asserting facts to the world model were not included. In addition only events and actions that were relevant for the story being generated were included. Meehan compares the difference between the modes to "thinking your way through a story first, then telling it" in not-so-verbose mode vs. "telling the story as it is made up" in verbose mode. Stories are about important events in a character's life, and having a complete story to work with made it possible to omit the unimportant ones from stories generated in not-so-verbose mode.

In pre-packaged plot mode some of the choices made by the user in the two other modes were automated by using a predefined set of "morals" or scenarios, such as "never trust a flatterer", to bootstrap the story generation process.

In TALE-SPIN stories players do not have a first-person presence. They do not act as or control a character in the story. Rather they act as observers that from time to time are asked to provide information to the system that may change the course of the story. In that sense interaction with TALE-SPIN resembles prodding an anthill with a stick to see what happens.

While the level of interactivity in TALE-SPIN is rather low compared to what one would expect in an interactive storytelling system, it is one of the first examples of research addressing storytelling in the computer medium and has therefore been highly influential.

4.3 ID-Tension

ID-Tension is a system developed by Nicolas Szilas that attempts to create a storytelling system based on formal narrative properties (Szilas 2003). At the heart of the system lies an action calculus that can produce a set of narratively coherent actions given a world model and a set of values that are at stake. Values are defined by story world authors and describe the dimensions along which conflict and thereby drama can arise in the story. For instance, Szilas gives an example of a story world in which "lawfulness" and "non-violence" are important conflict dimensions. The system also contains a user-model that attempts to estimate what impact performed actions will have on the user experience from a narrative perspective. The model is used to inform the system as to which actions it should select.

Like TALE-SPIN, ID-Tension can run in several modes. In the automatic generation mode the system creates stories by "playing with itself" without human intervention. The story is created in a stepwise fashion. At each step the action calculus is applied to the story world to generate a list of possible actions. The list is ordered by the degree of (narrative) satisfaction that performing the action will cause in the player according to the systems beliefs. From this list a top ranking action is randomly selected to provide some degree of variability to generated stories. The role of the player in this mode is very similar to the one in TALE-SPIN: to provide some starting conditions for the story and then see what happens.

In interactive mode ID-Tension and the player take turns choosing which action should be taken next. When the player's turn arrives she is presented with a list of possible actions that characters under her control can perform based on the action calculus. After choosing an action it is performed and the turn returns to the system. The interaction pattern in this mode resembles that of a dialogue where participants take turns speaking. In interactive mode players get to choose actions rather than tweaking conditions for action as in TALE-SPIN. Hence the perspective is an in-game one where the player takes on the role of one or more characters. Although we have not experienced the system first hand it seems to provide an experience similar to classic adventure games. In such games players are also presented with a set of predefined options to choose from, which in turn lead to new options being available and so forth. However, unlike most adventure games where you sooner or later inevitably end up in an interaction loop, returning to previously visited points in the story, ID-Tension seems to provide a forward momentum to the story thus ensuring it progress.

ID-Tension takes steps towards automatically creating story events and thus providing interactivity at the story level. Instead of unfolding a pre-defined plot arc the system generates events that make sense from a narrative point of view using the action calculus. As such it stands out as a system that is neither distinctly author-centric nor character-centric.

4.4 MOE

The OZ project at CMU has produced several interesting results related to interactive storytelling. A basic research philosophy of the OZ project was that both character and story are equally important ingredients in a dramatic experience and consequently explored both.

The MOE drama management system was one of the first results related to top-down drama management from the Oz project. MOE implements the Oz architecture described earlier and is inspired by Brenda Laurel's work sharing among other things the same notion of drama. The goal of MOE is to maximize a player's dramatic experience of a story by guiding the player through a plotline. Weyhrauch used a simple murder mystery, tea for three, in which the player acts as a detective solving a murder case, to illustrate the ideas underlying MOE.

Stories in MOE are represented as partially ordered sequences of USER MOVES. These are actions having dramatic consequences that the user can take in the story world. An example of a USER MOVE can for instance be finding a new clue to the mystery. The system influences how the story unfolds by executing MOE MOVES which are actions that attempt to influence players to act in certain ways. An interesting aspect of MOE is the classification of MOE MOVES according to their function. Weyhrauch differentiates between five types of MOE MOVES:

- Causers
- Deniers
- Delayers
- Substitutions
- Hints

Their respective function is to: cause an event regardless of whether the user took action or not; stop an event from happening, i.e. stop the user from taking a certain action; push an event that would have taken place in the present to a later time; substitute an event with another one; and finally give players hints about actions they can take or paths they can explore.

MOE implements a search-based approach to story direction in which the system continually evaluates all possible unfoldings of the story searching for the best one. The search is guided by an evaluation function that quantitatively and qualitatively encodes an author's aesthetic preferences (Weyhrauch 1997). These preferences include features such as "intensity", "momentum" and "thought flow". Once the system has found the best possible unfolding given the heuristics provided by the author, it chooses a MOE MOVE that is likely to make it happen.

In contrast to story generation systems such as TALE-SPIN, MOE provides an in-story experience. Players act as one of the characters in the story and experience the

story world from a "first-person" perspective. In addition, MOE provides players with a more fine grained control over how the story evolves. Instead of supplying a set of parameters before the system is started, players continually make choices that affect the progression of the story. The system in turn responds by temporally re-ordering events so that they will give players the best possible experience. Note that while MOE can reorder events it can not change the content of them; all scenes are fully specified in advance by the author.

One of the problems encountered by Weyhrauch while working on MOE was the scalability of search algorithms. The tea for three scenario used to illustrate and experiment with MOE's operation consists of 16 USER MOVES and 18 MOE MOVES adding up to a total of 34 moves. Performing a full depth search over all combinations of the moves becomes intractable as there are literally billions of combinations. The partial ordering of USER MOVES reduces the number of possible combinations significantly but still leaves too many combinations to explore. As a result Weyhrauch explored variations of full depth search that could reduce the number of combinations that would have to be explored. Although MOE was successful regarding the tea for three scenario in this respect the problem remains for stories with a larger number of moves to choose from.

4.5 Façade

The last system to come out of the Oz project was Façade by Mateas and Stern (Mateas and Stern 2000; Mateas and Stern 2003), see also section 11.4. Façade is actually the name of the scenario used by Mateas and Stern and not the underlying system *per se* but they are usually referred to by the same name. Façade is a very ambitious undertaking taking a broad perspective on interactive storytelling. The project has not only produced technologies for creating/guiding dramatic experiences such as the ABL reactive planning language (Mateas and Stern 2004) and Façade Drama Manager, but has also contributed to theories underlying interactive drama and interactive storytelling architectures (Mateas 2000), as well as what is generally considered to be the world's first fully implemented interactive drama (Mateas and Stern 2003).

Façade aims to provide a fully realized one-act interactive drama in which the player plays one of the characters. The story of Façade revolves around Trip and Grace, a married couple that are having some problems in their relationship. The player as an old friend to both Trip and Grace is invited over to their apartment for dinner and steps right into the middle of the evolving drama. As the experience evolves the player witnesses the problems the couple is having first hand and is drawn into the conflict as both Trip and Grace are trying to get the player to side with them. When the evening is over the player's actions will have had an influence on the progression of the drama as well as its outcome.

Façade is a fully realized cartoon style 3D environment in which the player can move around, pick up and use objects and interact with the characters, e.g. kissing them or giving them a hug. The main mode of interaction is however natural language as the player can have a conversation with Trip and Grace by writing text messages to them like in a chat. The system implements a broad but shallow approach to natural language understanding, meaning that characters are able to respond to a large repertoire of sentences that the player might enter but has no deep understanding of the semantics of what the player is saying. Instead the system applies a straightforward but effective mapping of surface text to meaning representation that is adequate for the purposes of the drama.

The story of Façade is organized as a sequence of beats that specify both story content and character behaviour (for a discussion on beats, see section 2.1 above). As most of the story content revolves around – and is delivered by – characters, content and behaviours are usually one and the same. The beats are inspired by dramatic beats, the smallest unit of dramatic action such as a single action-reaction pair, but are generally larger consisting of up to a 100 behaviours (Mateas and Stern 2005). In addition to single character behaviours, beats can also specify joint behaviours that include two or more characters. A joint beat tells each character that is affected by it how to behave in a coordinated fashion as a team to deliver certain content. For instance, a quarrel between two characters where characters take opposing views on topics or a good cop – bad cop scenario where characters take on different roles for dramatic effect.

While beats specify what can happen in the story world, the drama manager of Façade is responsible for what actually does happen. In contrast to many other approaches Façade does not specify an explicit ordering of story events. Instead the drama manager sequences beats in response to user actions and the evolving plot during runtime. Each beat has a set of preconditions that must be fulfilled before the beat can become eligible for execution. Hence while there is not an explicit ordering of story content there is an implicit ordering, or at least a preferred ordering, encoded in the preconditions. Beats are also annotated with information about how their successful completion alters the dramatic values that the story revolves around. This information is used by the drama manager to rank all beats that are eligible for execution according to how well they fit the desired story arc, and randomly select one from the highest ranking tier. Note that the desired story arc that the drama manager aims for does not stipulate a desired sequence of beats, but a desired evolution of dramatic tension. Hence it is perfectly possible for several different beats to achieve the desired changes to the arc.

The effort required to author a story for the Façade architecture is significant as each beat must be authored so that it always moves the story forward while at the same time allowing players to traverse the set as a whole in different ways.

4.6 MIMESIS

The Liquid Narrative Group at the North Caroline State University has worked on interactive storytelling for a number of years. A large portion of their work has revolved around the storytelling architecture MIMESIS which has been developed within the group (Young 1999; Riedl *et al.* 2003; Young *et al.* 2004). MIMESIS implements several components of the OZ architecture discussed earlier. In addition to a story planning system it includes a presentation system based on cinematographic concepts that attempts to convey actions in a scenario.

In MIMESIS stories are represented as plans composed from actions that have preconditions and effects. The plan represents a sequence of player, character, and system actions that will unfold the story in a particular way. MIMESIS represents a top-down approach with a strongly author-centric view of stories. Plans are generated from three sources of information: the current game state, a predefined library of available actions, and a set of goals that should be fulfilled by the plan's execution.

The main feature of MIMESIS is its ability to create an alternate plan if the original one is about to fail. As the plan is executed the system monitors its progress. If the player performs an action that interferes with the plan, the system attempts to generate a new plan that will fulfil the goals. For instance, imagine that a player attempts to shoot a character that is needed to complete the plan; an action that clearly interferes with the

plan as it threatens one of its resources. To deal with such situations the system attempts to formulate a new plan that fulfils the same goals using one of two strategies: intervention or accommodation.

Intervention is a strategy which simply causes an action to fail, or rather its consequences to be disregarded. For instance, players attempting to shoot the important character may discover that their aim is bad (the bullets miss regardless of what they do) or their gun might jam. At a first glance intervention seems like a simple and effective strategy. However disregarding player actions may lead to a lesser sense of agency and also runs the risk of introducing strange twists to the story. Devising effective interventions that avoid such problems is likely to be a non-trivial task.

The second strategy involves accommodating player actions into the new plan. For instance, the system might let a player shoot the important character and instead assign its role to another character. Accommodation is generally more expensive in terms of computational power than intervention as a player action might require substantial amounts of re-planning to accommodate. At the same time accommodation is a strategy that potentially leads to a higher sense of user agency by not ignoring user actions.

Each action in a MIMESIS plan is causally linked to previous and subsequent actions through preconditions and effects respectively. Preconditions state under which circumstances that an action can be executed, while effects state all changes to the world that will be made if the action succeeds. In this way effects may in turn fulfil the preconditions of other actions in the plan, thus causally linking them together. The fact that actions are causally linked makes it possible to infer an order of events by tracing the chain of causality backwards and forwards, thus (re)creating a plan when necessary.

The MIMESIS architecture is one of the systems that we know of that addresses issues other than plot. An interesting aspect of the architecture is that it also contains a component that generates a presentation plan (discourse plan) which describes how the actions in the story plan should be presented to the player. Presentation options include generation of shot sequences, voiceovers, or background music. The camera component of the presentation system uses cinematographic knowledge to plan and sequence its shots and is in that sense similar to our own system.

4.7 Interactive Drama Architecture

Another system that uses a planning approach to drama management has been under development at the university of Michigan by Brian Magerko and John Laird (Magerko and Laird 2003). The Interactive Drama Architecture (IDA) is a drama management system with a strong focus on top-down storytelling. Unlike systems like Façade that do not specify any specific ordering of story elements, IDA attempts to rather tightly follow a pre-defined plot progression. IDA has been used to implement a simple scenario, Haunt2, where the player takes on the role of a ghost haunting a small inn. The player character has been murdered and it is up to the player to make sure that her/his body is discovered by one of the other characters in the story and bring the murderer to justice.

The goal of IDA is to present a story "as the author intended it to be told" while at the same time giving players leeway to explore the world on their own. Like in MIMESIS stories in IDA are represented as partially ordered plans specifying where and when story events should take place.

Unlike MIMESIS plan steps in IDA are not causally linked making re-planning in the face of plan failure hard. This is a deliberate design decision. Instead IDA attempts to make sure that the story (plan) never gets into trouble by pre-emptively steering players

away from actions that might threaten it. For instance if the system predicts that the player is going to explore a room instead of finding the murderer, the system takes action to prevent it. IDA uses a simple model of player activities to deduce what activity the player is likely to engage in and runs a simulation of the event. If the event turns out to break any requirements for the intended story the system attempts to intervene. Currently the user model consists of actions such as *appear*, *chase*, *light-fire*, *explore* and *hide*.

Magerko introduces the term *boundary problem* to describe situations in which player actions cause a dramatic experience to move out of scope of authored content. Such boundary incursions may occur for several reasons. For instance, players may take dramatically viable paths that the author did not think of or act out of character or setting, such as asking a medieval knight about his views on laser swords.

Magerko claims that the boundary problem is less of an issue in systems where the primary mode of interaction is dialogue, such as Façade. The example he gives is that if a player would say something non-sequitur, incomprehensible or even contrary to the authored plot content the situation would become obviously implausible, but the story would be able to go on. In systems that rely heavily on physical interaction on the other hand, the boundary problem is more pronounced. For instance, imagine the player shooting an important character; an action that would bring the story to a grinding halt.

However, imagine a scenario where a player is depending on another character to perform an important task, and further imagine that the player has verbally offended the character rendering him completely uncooperative. The result is the same as if the character had been shot; the story would come to a grinding halt. Offending the character is in this case analogous to pulling the trigger of the gun, while saying non-sequitur or incomprehensible things is analogous to clicking the mouse in meaningless places on the game interface. It may be true that action speaks louder than words, but on the other hand words can be action.

To us many cases of boundary problems seem to be design problems. For instance, if shooting a character is incompatible with the plot, why should the player be able to do it? If we choose to allow players to do it, as a dramatic alternative, we have to expect it to happen sooner or later and design our story world accordingly. However, many less obvious situations may benefit from a systems ability to steer clear of, or adapt to, situations that threaten do diminish a player's experience. This applies to both conversational and more "physical" stories.

System interventions are accomplished by actions akin to Weyhrauch's MOE MOVES that the system can use to nudge players in the right direction. For instance, if the player lingers in a room for too long, and needs to be in an adjoining room for the story to make progress, IDA can make a crashing noise in that room to lure the player to where the action is.

IDA is the only other system that we know of that has directly explored the use of prediction (anticipation in our terms) to guide plot unfolding. In many ways the approach is very similar to ours and seems to have been independently conceived at about the same time. One difference is the use of player modelling in IDA which we have avoided as it is notoriously difficult and error prone. A telling example of this is the infamous paper clip found in Microsoft Office products. In our approach anticipation is used as a general mechanism for guiding plot unfolding rather than as a tool for predicting player behaviour.

4.8 Erasmatron

Since the early nineties Chris Crawford has been working on what is arguably one of the broadest approaches to interactive storytelling that we have encountered. The Erasmatron engine, the result of his efforts, is still continuously being improved (Crawford 2005). The engine includes a broad range of technologies for building interactive story worlds including a reactive drama manager and a personality model for believable characters.

Crawford's work is heavily inspired by the structure of natural language both as an explanatory framework for reasoning about the process of storytelling but also as a model for structuring the Erasmatron system and authoring story world content. Erasmatron uses a sentence-like structure in the form *Subject Verb DirectObject IndirectObject* to describe objects and actions in the story world. For instance, Jack Gives Jill a pail of water. Crawford emphasizes that thinking in verbs, the actions that are possible in the story world, is fundamental to story world developers.

The drama manager that sequences events is reactive; all events occur as responses to previous events. Each executed event is stored in a history book, a trace of what has happened in the world so far akin to a working memory for the system. Events in Erasmatron are causally and temporally connected; certain events require that other events have taken place before they can themselves be triggered. The history book is used by the engine to check that preconditions for candidate events are fulfilled before executing them.

In addition Erasmatron provides a development environment for creating story worlds, using its verb-based scripting system. To date research on development environments for interactive storytelling systems has been scarce.

An interesting aspect of the Erasmatron system is that characters in the story world can use anticipation to predict how other characters would react in response to their actions. More specifically what is anticipated by the system is the emotional reaction a character would have to a certain event. This information is used by characters to regulate their behaviour. For instance, if Bart contemplates stealing Lisa's saxophone, he would anticipate the consequences of this action to find out how Lisa would feel about it. As Lisa is very fond or her saxophone she would become very sad if it was stolen, which might dissuade Bart from stealing it.

The approach taken by Crawford to accomplish this type of anticipatory behaviour is to specify for each event how a character would feel if that event took place. As far as we understand Erasmatron's anticipatory process it is a lookup of some pre-defined value rather than a simulation of an event. The system finds the appropriate event and simply looks up the attached emotional value for the character in question. However, the action in itself is not executed which means that side effects of the action (e.g. that the saxophone is removed from Lisa's room) or the effects of subsequent actions that might be triggered are not included in the calculation.

The focus on anticipating emotional reactions "one-step-ahead" is no doubt broad enough to cover a large variety of situations. However at times there are other aspects that you might want to anticipate. For instance, sometimes you might be more interested in the tendency for action rather than an emotional reaction; what would Lisa do if Bart stole her saxophone rather than how would she feel. Would she cry or would she try to get even? From a global perspective this latter type of anticipation seems useful for monitoring and planning the progress of a story as a whole.

All in all Crawford's approach is best described as a bottom-up character-based approach. The tools provided by the Erasmatron system are mainly there for creating

characters with interesting personalities and exciting relationships to each other, providing them with incentives to take action in the world, and describing a repertoire of possible actions. As the player interacts with characters within the story world their inclination to perform certain action will change, thereby causing the story to adapt.

However, in his book Crawford discusses the use of "overview values" as a way of monitoring and guiding story development from a global perspective. An overview value can for instance be the combined level of happiness that characters in the story world are feeling, or the fraction of actions (verbs in Crawford's terminology) that players have used. The use of such variables corresponds to a more top-down approach. However, Crawford does not provide any detailed examples of how exactly overview values are actually used in the system.

Part II
Developing an Interactive Story

Part two of this thesis covers the work we have done related to developing interactive storytelling systems. Chapter five will start by describing a scenario that we created which combines storytelling and gaming elements. It will provide the reader with an understanding of the kind of experience that was the basis for our work. With the scenario as a starting point chapter six will then delve into our work on using anticipation as a means of controlling how a plot unfolds. Emotions and social relations among characters is a particularly important aspect of our scenario. The question is how that aspect should be made visible to a player. Chapter seven will go into our work on creating a presentation system that makes emotions and relations salient in a player's experience.

5 The Party: Creating a Scenario for an Interactive Story

Performing research on interactive storytelling as a purely abstract phenomenon, without taking into consideration details, contextual factors, twists or quirks of any particular story, is difficult in the same sense that building a house without considering where it is to be built or what it should be built of, or painting a picture without considering which type of canvas and colours to use, is difficult. Without a particular instance to work on the end result will never reach its final shape. It is not until one starts working with whatever particular materials and circumstances that are at hand that many questions that need to be addressed and decisions that need to be made present themselves. Should the house be built from bricks or wood? Is it placed in a slope? Is it to be an oil painting on canvas or graffiti art on the side of a subway car? Is it to be a heroic war story or a tender love story? Will it be presented on a computer screen standing on a desk or projected on the wall of a museum? Depending on how such questions are answered the final shape of the object under consideration, be it a storytelling system, a house or a painting, takes on different forms.

The purpose of this chapter is to sketch a particular story, or more accurately a scenario, that will be used as a basis for discussions regarding various aspects of interactive storytelling, and also provide examples where they are required. Its' function is to ground discussions in the rest of the thesis in a particular story thus making them less abstract and de-contextualised.

The scenario was not created all at once but rather evolved over a long period of time. Bits and pieces were added and removed in time with current projects and interests. It has been argued that a flaw in traditional HCI research is that it hides away the complexity of the design process (Fällman 2003). The finished products (a system, or a piece of research for instance) are presented without giving an account of how they came to exist, what choices, mistakes, changes or insights were made that affected the outcome during the journey.

In the following text we will attempt to provide an account of how the scenario came into existence, its purpose at different times, and how both the scenario and purpose have changed over time. Hence we will give an account of the final product, the scenario, as well as the *process* of arriving at it. In short we will present the story of how the party scenario came into existence and gradually developed.

5.1 The Party Scenario

The scenario revolves around three girls organizing a party for their friends. The girls are all around 15 years of age and attend the same school in an upper class area outside of Stockholm. The main characters are generally bored with their life situations and pine for something fun and exciting to do. When the player enters the story summer and graduation from ninth grade is approaching fast. It is "party season" with lots of student parties being planned and taking place all over the city. For various reasons going to one

of the parties being arranged by their school mates is not an option for the girls. Hence if they want to go to a party they will have to organize one of their own.

From the main characters perspective the most important purpose of the party is to get some excitement into their lives and something fun to do while organizing it. But there are other motives as well. For instance the party is seen as an opportunity to attract the in crowd and get to hang out with the cool people, and just maybe get a foot into that social circle themselves. There is also the motive of love, as a party is a perfect excuse for inviting people you would like to date so you can socialize with them as if by chance.

Players take on the role of one of the main characters, while the other two are controlled by the computer. Players will be placed in a role of manoeuvring and negotiating between strong-willed characters, while at the same time fulfilling their own interests and social goals. Players are called upon to perform actions in the game – such as deciding who to invite, or where to stage the party – that may have social and emotional consequences. For instance if someone that one of the characters does not like is invited she may become angry and feel less inclined to stage the party at her house. In order to repair the relation to the character and get her in a better mood other actions have to be taken, e.g. flattery. As unfolding of the story is partly determined by the web of relations between characters (who is on friendly terms with who?, who is in love with who? etc) a fundamental aspect of the game play is to be sensitive to, and take into consideration social and emotional relations with the other – computer controlled – characters in the story. Within each "scene" players create the setting for the next scene through their actions and interactions within the story world. Hence just like in real life players have some, but not unlimited, freedom to choose in which direction their destiny should evolve.

There are two experiential flavours introduced by the scenario: a storytelling flavour and a gaming flavour. From a gaming perspective the players "task" is to make the party happen. That is players have to overcome any obstacles encountered along the way while planning the party. Obstacles can for instance be to find a place where to hold the party or find a way to get the "in crowd" interested in coming to the party. To win the game the player has to complete the plans for the party.

From a story telling perspective the scenario revolves around the changing relations of the main characters including values such as friendship, popularity, shame and love. The tension/complication of the game arises from these dynamic relations. From a storytelling perspective there is no real concept of winning in the scenario. Instead the experience itself (was it entertaining or boring) determines if it was a success.

It may be possible to combine the gaming and storytelling flavours by viewing the winning condition of the game differently. Instead of having the party as their main goal players may opt to play around with the relationships between the characters and e.g. become as friendly as possible with one or both characters, or make one or both characters very upset. The winning condition in this sense consists of a player defined social configuration.

5.1.1 The abstract story

Attempting to describe the abstract story, in Chris Crawford's terms, told by the party scenario is not an easy task as it mixes elements from both stories and games. At its core the scenario is a story about friendship relations and how they change depending on player actions. Hence a possible abstraction of the story is:

Three friends facing a challenge work together to overcome difficulties and in the process their friendship is changed forever.

The challenge of the story is organizing the party. But depending on how the player acts it can lead to a positive or a negative change in friendship relations. Maybe the characters will discover that in the face of difficulties their friendship will not last forever, or conversely that facing and overcoming the challenge will strengthen their friendship.

The story is framed by the plans being made for the party which introduce tasks for the player that are part of the game like aspects of the scenario. But it also introduces *pressure* which is needed for characters to reveal their true natures. According to McKee

> "Pressure is essential. Choices made when nothing is at risk mean little. If a character tells the truth in a situation when telling a lie would gain him nothing, the choice is trivial, the moment expresses nothing. But if the same character insists on telling the truth when a lie would save his life, then we sense that honesty is at the core of his nature" (McKee 1997 p.101)

In the party scenario there is a limited amount of time available and many things to organize and agree upon. This provides many opportunities for characters, including the player, to reveal their true nature.

When all tasks have been solved and all conflicts resolved the time aspect also sets the boundary for when the story material has run its course to completion and, using Dewey's definition, become "an experience" (Dewey 1934). When we get there we have exhausted the story material and there is nothing more for us to do.

5.1.2 Several implementations

The party scenario has been used in several implementations focusing on different aspects of interactive storytelling. The first implementation was a purely text based version focusing on the impact of using emotion models for character believability and its impact on the story, see Figure 10. The prototype features agents whose emotional state partly determines how the plot unfolds. The dialog is scripted in that the player can only select from a limited set of statements in each situation.

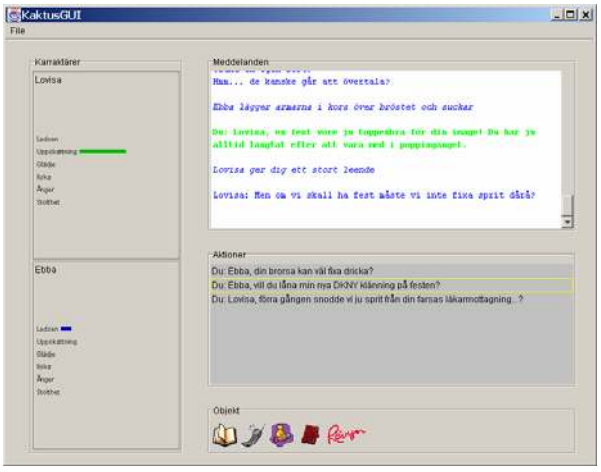


Figure 10 The text based implementation of the scenario

The second implementation used Macromedia Director to create a 2D graphical rendition of the scenario, see Figure 11. The focus of the second implementation was on creating emotional expressivity for characters, by making facial expressions readable, and also moving to free-form text input. In this version the users could express themselves freely just like in a chat. However, the system could only interpret sentences from in a very limited domain.

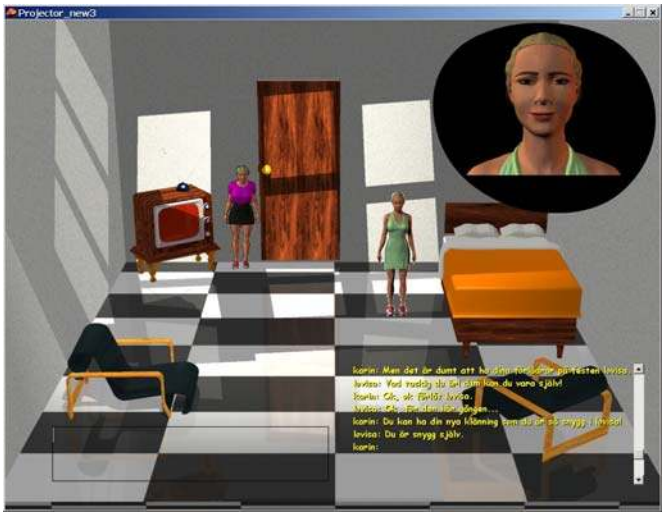


Figure 11 Director implementation of the scenario

A third implementation created a full 3D rendition of the scenario and expanded on the work done in the second implementation regarding emotional expressivity by introducing extra-diegetic expressivity enhancers, based on comic frames, colour and shape theory, and cinematography, see Figure 12.

Figure 12 Full 3D implementation from the MagiCster project

The final implementation was created as mod for Half-Life 2 and continued on the work done in the third implementation, see Figure 13. The focus of this prototype was

to continue our work on enhancing expressivity by introducing dynamic frames aiming to support storytelling on the level of spectacle.

Figure 13 SOURCE implementation

5.2 Evolution of the scenario

The starting point for the work presented in this chapter was an interest in the nature of believability in general and emotionally and socially believable characters in particular. As a vehicle for both practical and theoretical research we started developing the party scenario described above. Eventually that work resulted in an interest in storytelling and gaming as an area of application for believable characters. Hence, from initially having been used as a scenario for experimenting with believability and believable characters, the scenario evolved into the dramatic game scenario which has a stronger focus on storytelling. Stories and characters are however intimately related as characters are one of the central features of stories. Stories tell about important events that happen to characters in the story. Understanding a story involves understanding its characters and their actions. One of the functions of stories is to attribute intentions, beliefs, emotions and other mental states to characters, thereby making them understandable.

The party scenario is quite simple, but considerable effort went into making sure that it would feel "authentic" to players. Our initial goals for the scenario was to provide an environment that stimulates the player in anthropomorphic, narrative and social inference-making, as well as providing an emotional experience. To this end we wanted to make a computer game in which the player is placed in a complex world with a host of other characters. Our aim was to give characters a psychological depth and not only be reactive, but also proactive. We wanted to avoid the feeling that characters exist solely to entertain players. Instead they should be seen as having lives of their own, which they will go about living if the player for some reason stops acting. We wanted to avoid situations where nothing happens simply because the player has not given any 'orders'. We also wanted interaction in the game to take place both between the player and characters as well as between characters themselves.

We wanted events occurring in the story world to be appraised by each character with respect to its goals and concerns. This appraisal should have an effect on the reactions and future behaviour of the character. Throughout the game social relations will change and transform according to the actions taken by the player, and there has to be continuous appraisals of the social consequences of one's actions. Not only does the player have to maintain social relations with other characters in the game, but in doing so also has to take into consideration characters' relations with other characters.

Another design goal we had was that story events should not be transparent, but distributed unevenly across characters and protagonist/player. We didn't want the player to have an omniscient God's-eye-point-of view into the narrative world, but rather wanted to force them to make an effort to find out the intentions and emotions of other characters.

5.2.1 Intended user-group

Around the time when development of the Kaktus scenario started most available games on the market were targeted towards an adolescent male audience. Although there were some efforts, notably by Brenda Laurel and her company Purple Moon, to create games specifically targeted towards teenage girls they were a small minority (Laurel 2001). There was a serious, and legitimate (?), worry in the research community that because many young girls first experience with computers (playing a game) would be a negative one it could turn them off from a continued career in computing (Gorriz and Medina 2000). Now, nearly a decade later the situation is much the same, although statistics show that more girls are actually playing games than previously, and that they are playing the same games that boys are playing. From an outside perspective it seems as if this change is a result of new generations starting to play games rather than any serious shift in the style of games being produced.

Influenced by the spirit of the time we decided right from the start that Kaktus would be a scenario targeted towards teenage girls. We wanted to provide an experience that would not revolve around monster bashing but rather the use of social skills something which girls develop earlier and are generally considered better at and more interested in (Beato 1997).

While the choice of teenage girls as the target audience may make it difficult for some (adult) players to identify with the characters, the situation and their own role, we still felt it was a justified choice given our goals.

5.2.2 Creating Characters

One of the first activities that we undertook in order to develop the scenario was to create character sheets listing important traits of the main characters. Each character is described by a set of parameters describing different traits of the character, as well as an account of the characters background. The traits we used included both psychologically validated traits, such as the "big five" (Goldberg 1990), but also traits of a more folk-psychological nature (Persson *et al.* 2001). Hence, traits can be related to a characters personality (e.g., extrovert) as well as other things, e.g., whether a character is rich or not. In this way traits set bounds for the way a character is likely to behave in a given situation. This has to be defined in relation to the plot and the different situations in which the game takes place.

The initially rather long list of traits was condensed and reworked to a smaller set of traits that were later included in the character model used in the first implementation of the party scenario. Most of the original traits were kept as character records describing the characters and rounding them out, but were not used in the actual running system. The final set of traits describing the characters was:

- Dominance – the characters tendency to take charge and decide things, as well as its unwillingness to let others do the same.
- Confidence – the characters confidence in themselves and their capabilities and actions
- Selfishness – how self-centred is the character? Is it all me, me, me or is there room for other people as well?
- Creativity – is the character the one that comes up with all the fun and bright ideas?
- Cheerfulness – is the character an easy going happy go lucky type or more of a brooding dark figure?
- Loyalty – is the character loyal to friends and family or doesn't loyalty matter when a good opportunity arises?
- Compassion – does the character care about how others are feeling and listen to them or does it not care?
- Sensitivity – is the character clad in iron armour not getting hurt and not showing emotions or is she wearing her heart on her sleeve?

In addition we also performed interviews with teenage girls to learn something about their situation, what problems they had, the style of language they used etc.

A small scale user study of the first version of the party game that was performed to get design feedback, confirmed that most subjects viewed the characters as credible fifteen year old girls (Laaksolahti *et al.* 2001). The characters, their attitudes, the language they used, their problems (be popular, etc) were considered familiar and very typical for teenage girls.

Both computer controlled characters were described as a bit cautious and easily influenced by the subjects which corresponds well with how they were intended to be perceived. The player character is the most outgoing and creative of the three characters and the one most likely to "get things going".

One reason for choosing the most outgoing and dynamic character as the player character was to ensure that the user had a large action potential. If a more withdrawn and introspective character would have been chosen as the player character it might have been difficult for the player to act in the game world while at the same time staying in character. Ultimately the choice of player character should be left to players themselves. They should be able to choose a character that they can identify or empathize with or perhaps the other way around, choose a character they don't understand at all, but would like to understand better. Being able to choose which character to play makes it possible to illustrate different perspectives of the same story to the player. For instance, instead of a winner's story we get to hear the loosing sides' perspective on the events of the story as well. Many games employ the same sort of mechanism allowing players to choose different sides to experience events from many perspectives (e.g. StarCraft a Real-Time Strategy Game from Blizzard Entertainment[4]).

[4] http://www.blizzard.com/starcraft/

5.2.3 Multiple characters

The party scenario contains two computer controlled characters while the player acts as a third character. A potential benefit of this setup is that it makes story progression less dependent on the player. For instance, if the player is inactive, or does the wrong thing, the characters can act together to make sure that the story moves forward, e.g. by discussing whom to invite to the party between themselves. The important thing is that characters always have a counterpart that they know is available and whom they can act together with.

However, having characters acting between themselves can also lead to users feeling marginalized. In a small study, aiming to explore evaluation methods for interactive storytelling, Façade by Mateas and Stern was one of the systems that were evaluated (see section 120). Several users reported that as the quarrel between Chip and Grace, the computer controlled main characters of the story, escalated they felt more and more like bystanders unable to influence what was happening and ultimately diminishing their sense of involvement in the story.

5.2.4 Setting the scene

In order to give characters a context we created an introductory scenario, a prologue, to the game. The prologue introduces the characters giving a first glimpse of their personalities as well as setting the scene for the game by introducing challenges to overcome. The following is a version of the original prologue.

Persons:

Karin –petite, pretty face. Wears expensive well-fitting clothes. Has long, dark brown hair and blue-greenish eyes.

Ebba –average built, on the borderline of being a bit plump. Hair cut short, dark blond, blue eyed, pretty in a traditional Swedish way. Not as expensive clothes as Karin.

Lovisa –a bit taller than the other two, blond hair, shoulder length. Good looking but not stunning. Average clothes with a posh touch.

Detached house in a posh Stockholm suburb

Interiors: Lovisa's room, white walls, parquet flooring, posters and photos on the walls. A bed with a dark blue coverlet, a small sofa and an armchair in white, and some brightly-colored pillows. A desk with a computer on top of it. Stereo and TV. Lovisa is lying on the bed staring up at the roof, humming along with the music ("Thong Song"). Sprawled in the sofa is Karin, chewing a gum while fidgeting on her cell phone. Ebba is sitting in the armchair, leafing through the latest issue of "Vecko-Revyn" (a Swedish magazine for teenage girls).

A beep from a cell phone.

Karin: pressing the buttons of her phone, mumbling "No way…"

Karin: "Kalle and Sara did it last night!"

Ebba: looking at her, bored, sighs.

Lovisa: rolls around and faces the other two "Who cares?"

A moment of silence.

Lovisa: "I'm so fucking bored!!!"

Ebba: (a bit impudent) "So what are you gonna do about it then?"

Lovisa: (cynical) "Oh, I know! We could make chocolate cake and tea and make it one of your favourite nights!"

Ebba: (dejected) "I really like chocolate cake…"

Lovisa: "Isn't it about time that you start worrying about your weight?"

Karin: "Lisa and the others were going to watch Petter at "Grönan " tonight."

Lovisa: "Why don't we ever do anything fun… was that tonight? Girls, we don't even have anything to do on our graduation day. That sucks!!"

Karin: "Have you heard that Edvin have chosen the science programme next year?"

Ebba: "What? He doesn't even have a good grade in mathematics…"

Lovisa: "Stop it! You're boring! What are we going to do about graduation?"

Karin: "Johnny is having a party in his dad's workshop…"

Lovisa: "And exactly how fun would it be celebrating with them?

Karin: (just going on) "…and the school will organise something for everyone in ninth grade…"

Ebba: "Where all the teachers are going to be…"

Karin: "…And Lisa is probably going to have a party somewhere"

Lovisa: "That bitch! I wouldn't dream of showing up at her party!"

Karin: (a bit sulky) "Yeah, arrange your own party then"

Ebba: "Noooo… you can't do that!"

Lovisa: "Why couldn't we have a party? If we get rid of my parents we could be here… Karin, your brother could be the DJ!"

Karin: "Are you serious?"

Lovisa: "Come on! I'll be fun! Talk to your brother, then we have to write an invitation list, and we need to get booze somehow…"

The selection of theme for the scenario was inspired by several things, among others the previously mentioned interviews we performed with teenage girls. Another inspiration were movies we watched and in particular "Välkommen till festen", a movie by Swedish director Ella Lemhagen. The movie tells the story of a teenage new year's party painting a dramatic and somewhat dark picture of what can happen at such a party.

In the user study of the first version of the party game most subjects found the scenario, the situation itself, to portray teenage life very accurately. Subjects commented aspects of the scenario such as "[so typical] sitting there talking, trying to figure out how to become popular" or "it is so typical ninth grade, having to get rid of your parents" and "that's exactly the way it is [being in ninth grade]".

5.2.5 Being yourself or playing a role

Players of the party game will not act as themselves in the virtual world, but rather 'place themselves in the shoes' of a fictive protagonist. Their representation in the game world will not be an instantiation of the user (avatar) but rather a character. In the game world, users will not act so much as 'themselves' but as they think the character would act in any given situation. The player will have conversations with other (artificial)

characters, but those conversations will be mediated via the role played by the user. The experience we want to achieve is that of role-playing or acting.

A reason for wanting players to assume a role instead of simply playing themselves is that it makes it easier to keep the story within bounds. The role creates expectations about how a character should act thereby somewhat limiting the possible directions that need to be considered. However, acting in character does more than limit possibilities. It also provides players with a rich material to work with that can fuel interaction, suggesting actions to take that may sometimes not lie in line with players' real personalities. This "liberating" aspect of role-playing has found its use in other areas as well. Designers have for instance come up with the idea of designing for *extreme characters* such as drug dealers or the pope as a way of challenging the notion of representing the target user group with prototypical characters, especially when designing experience oriented products, as "… it ignores the full spectrum of human, emotions, it only addresses those recognized as socially or culturally desirable (Djajadiningrat *et al.* 2000). Instead designing for extreme characters involves designing for characters that have exaggerated emotional attitudes (life situations), thereby discovering aspects that would otherwise have remained hidden. For instance Frens (1999) designed a set of appointment managers for a drug-dealer, the pope and a polyandrous twenty-year old respectively. As could be expected the designs for these three extreme characters all turned out to be very different due to the special needs and traits projected by the characters.

Although players do not play 'themselves' they should merge their person with the character as much as possible. The player should not only understand how the protagonist thinks and feels, but also experience some affect congruent with the protagonist. The protagonist's concerns should become the player's concerns; the destiny of the protagonist should be made as close as possible to the life of the player. Identification, however, does not seem to require that the player share every value, morals, knowledge and view of life as the character does. Spectators and readers can strongly identify with cinema or literary characters that are quite different from themselves (Persson 2000). Rather, identification requires that the user in some way can understand and relate to the situation in which the protagonist is placed (e.g., "I could really identify with Selma in Dancer in the Dark, because I know what it's like to have a child that you love above everything else").

On the other hand, the player should not be over-constrained by a role. The amount of non-interactive exposition describing the player's role should be limited. The player should not have the feeling of playing a role, of actively having to think about how the character they are playing would react. Players should "ease into" their role; the role should be the "natural" way to act in the environment, given the dramatic situation. Any role-related scripting of the interaction (Murray 1997) should occur as a natural by-product of their interaction in the world.

If a player has problems identifying with a given character, the scenario could allow the user to access the narrative via one of several characters. For instance, if one has problems with identifying with (the perspective of) Romeo, the player should be able to choose Julia instead. The basic narrative, however, should remain the same. This will enable the player to play with identities (Turkle 1995). However, this feature has not been included in any implementation of the party scenario.

5.2.6 Means of interaction

An important issue for any interactive storytelling effort is deciding how and when players should be able to interact with the story and story-world. In the utopian vision of interactive storytelling introduced by the TV show Star Trek: The next generation and as presented by Murray (1997) there is no difference between how players interact with fictional characters and events while immersed in the story world created by the holodeck, and how they would go about interacting with real persons in real life. Players are immersed in an illusion of a world created by the holodeck including visual, aural, sensual and olfactory sensations that is indistinguishable from the real world. When eating an imaginary apple it feels as if eating a real apple, when touching a characters face it feels like touching a real face, when punching a character in the face your hand hurts. Fictional characters appear as real as real persons in that they can speak, think, feel and act. Players on the holodeck can do all the things that they would, or would not, do in real life: discuss with a friend, shout at the boss, steal a fortune, kill an enemy, kiss a loved one, valiantly stay in the heat of battle or cowardly run away. There is no struggling with an interface between the player and the world because the player is in the world and can act directly on what s/he experiences. Actions are direct and the effects of actions are immediately visible.

Unfortunately (or fortunately depending on how you see it) we are not even close to being able to create something even remotely resembling the holodeck. Instead, for good or worse, we are stuck with ordinary computers and interaction devices such as mice, keyboards and sometimes microphones. Hence our question is limited to how those devices can be used to interact with storytelling systems.

Szilas (Szilas 2004) notes that an interactive drama aiming to provide any notable degree of freedom to players will require a large repertoire of possible actions for them to choose from. This in turn can lead to a problem of choice as players get overwhelmed by the number of possibilities and can ultimately ruin the experience. To analyze the problem Szilas suggests a taxonomy of possible interfaces to interactive dramas based on how actions understood by the system map to actions that players can actually perform, see Figure 14.

A *filtering interface* is one in which there are actions that the system is able to interpret but that do not correspond to any actions that players are able to perform; the interface acts as a filter. For instance, the system can present the most relevant actions for the situation to the player while hiding away the rest. Context sensitive menus is an example a filtering interface.

In a *redundant interface* more than one player action can have the same interpretation, that is, the player can accomplish the same result via more than one action. While a redundant interface does not reduce the number of choices available to players (on the contrary) it does cater for different play styles and styles of expression.

In a *direct interface* each player action can be interpreted by the system and furthermore each player action has a unique interpretation. For a direct interface to be feasible the interface must be well designed as the number of possible actions that have to be presented to the player at any given moment grows in time with the systems capabilities. One of the classical HCI problems is to present a large number of choices to users and many of the interface components such as dropdown lists, menus were created in response to that problem. However, as noted by Szilas interfaces built up from traditional user interface components runs a risk of disrupting the feeling of immersion in the story (Szilas 2004).

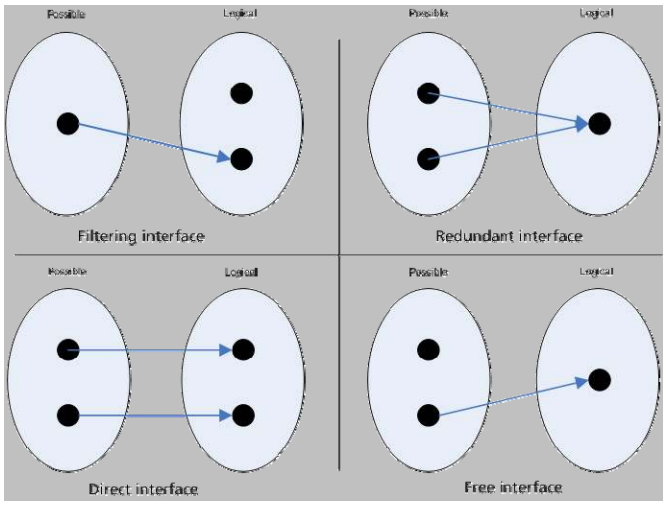


Figure 14 Different interface styles by Szilas

Finally the *free interface* is one in which there are actions that players can perform but the system cannot interpret, or has no implementation for. In other words players are given more expressive power than the system can handle. A prototypical example of a free interface is a free text interface where players type sentences or commands to the system without knowing in advance whether the system will be able to interpret it or not. While free interfaces provide players with superior expressive capability they can also be quite frustrating if the system repeatedly fails to interpret or misinterprets player input.

Interfaces for games have followed an evolutionary curve roughly similar to that of other computer interfaces. From text based command line interfaces to graphical point-and-click interfaces. In interactive storytelling systems however language based interfaces, relying on textual input in one form or the other, have proved to be prevalent.

Researchers in interactive storytelling have often envisioned interaction in storytelling systems as a conversation using natural language (Loyall 1997; Mateas and Stern 2004). Players immersed in the story world act as one of its main characters and in addition to anything else they may be doing are talking to other characters in the story. This "talking to other characters" is the main point of interaction with the system, and the activity that has the greatest impact on story progression. There are many reasons for the prominence of natural language dialogue as a means for interaction. One is the notion, reaching its pinnacle in the idea of the holodeck, of the player as an actor or equal partner in the story world that should be able to do or say what other characters can do or say.

Another is the importance of characters for stories. Stories revolve around characters and events that happen to them. The kind of dramatic events that drive the story forward are not action packed but rather emotional and social, and usually mediated through dialogue. Hence it makes sense that players in turn should be able to respond to characters concerning those events.

Language based interfaces come in different forms ranging from pure command line interfaces like in the text based adventure games produced by infocom in the early 80's , to free form natural language interfaces such as the one found in façade. In command line interfaces players issue commands such as "go west" or "open door" at a prompt, while free form NLP interfaces attempt to mimic a conversation. In the latter there is no

notion of sending commands to the game using language. Instead players are free to enter any text they wish which is then interpreted by the system as something the player said in a dialogue. A difficulty of the free form NLP interfaces is that automated natural language understanding is not very advanced except in extremely limited domains. In an interface where players can enter anything a vast majority of sentences are likely to remain beyond the systems capabilities.

A third option addressing this issue that has been investigated by some researchers (Crawford 2005; Szilas and Kavakli 2006) are structured grammar interfaces where players constantly are presented with all valid (or sometimes only the most likely) continuations of the sentence they are constructing. The system only understands a very limited repertoire of words and this is also reflected in the input system. In such a system all sentences produced by players can be understood by the system as they are constructed from known words combined in known ways. Most structured grammar approaches resemble the command line interfaces in that the sentences produced resemble commands issued to an avatar instead of lines in a dialogue. For instance, using the "Deikto" language developed by Crawford, the sentence "I think you should go to the church Mary" becomes "I advise Mary that she go church".

Interactive storytelling systems using non-language based interfaces are not been very common but there are some examples such as the Haunt2 system by Magerko (Magerko and Laird 2003). In Haunt2 the player acts as a ghost trying to find out who murdered him. Players experience the story by piecing together clues from overheard conversations that the residents of the inn they are haunting are having. Players interact with the story by trying to make the residents perform actions, e.g. by scaring them or causing noise in a location to lure people there, that will eventually solve the murder. Haunt2 is an interesting example of a system that overcomes the language barrier of interactive storytelling in an innovative way although it requires a very specific kind of scenario.

A downside of the focus on natural language dialogue is that other means of interaction may have been overlooked that are not directly modelled on conversations. For instance we have yet to see an interactive storytelling system that uses gestures or body postures as an interaction channel or at least an input channel. Imagine a storytelling system where you are playing a mime that has to communicate through body language

For the party scenario we wanted to use some form of dialog is the main interaction modality. We wanted the system to be very robust when responding to inappropriate and unintelligible input. Although the characters' dialog and 'intelligence' are narrowly focused around the topic of the story, the characters should have a large variety of dramatically appropriate responses to off-the-wall remarks from the player. Initially we opted for scripted pieces of dialogue that the user could choose from akin to most adventure games. Later we moved to a freer form of input where players used the keyboard to type text and characters answered using text, speech or other modalities.

5.3 Designing experiences

An interesting question is whether it is possible to *design* experiences in the first place or just favourable conditions for having certain kinds of experiences, a topic we shall return to in later chapters? It seems quite clear that for instance movie directors have a very specific experience in mind when creating a movie, an experience that they want to convey to their viewers. The movie experience is not, however, entirely determined by the director's efforts but is also influenced by how specific viewers interpret what they

see and hear, how they fill in the gaps in the story left by the director and what their personal movie preferences are. The experience of the movie is created in *interaction* with the material presented by the movie and active viewers trying to make sense of what they see based on their own personal experiences and dispositions. In this sense all experiences are unique, personal and impossible to replicate.

However, while the details of each individual experience are unique, movies can create similar experiences for different viewers. Experiences can share commonalities between themselves in a broad sense. For instance, 1979 academy award winning film Kramer vs Kramer is a story about a marriage breaking up when Joanna, a house wife feeling confined in her role breaks up from her husband Ted and son Billy to "find herself". Ted who has up until then been focusing on his career is left to take care of his son eventually losing his prestigious job because of it. Later Joanna returns to "claim" Billy and a custody battle ensues. While viewers may agree that this is the broad outline of the movie they may not agree on who they empathize with, who they think is right or wrong, who they think grows most as a person over the course of the story or what the morale of the story is. They may even disagree on technical aspects of the movie experience such as photography and or cinematography. This opens up for the possibility of broadly designing experiences while details are determined, inferred or created by players.

We may compare this to Crawford's notion of abstract stories, in which the details are different for each individual player while the broad outline of the story, or the morale of the story, stays the same.

It is possible for a story to have more than one morale. For instance, Kramer vs Kramer could be a story of a repressed woman who breaks free to find herself and grow as a person, or a story about a man who learns to know his son and revaluates the importance of his priorities in life, and grows as a person.

In interactive stories the difference between individual experiences is likely to be larger than in movies because players partly control how the story is presented. Players will traverse the story universe in very different ways resulting in different experiences. Nevertheless the incarnation of the abstract story, the story world that players are experiencing, sets the bounds for what kind of experiences that can be had thus making them somewhat similar.

6 Anticipatory Plot Guidance

Like so many other ideas regarding interactive storytelling, the idea of using anticipation in interactive storytelling dates back to Brenda Laurel's seminal work (Laurel 1986). In her thesis she describes an expert system that acts as a computerized playwright directing characters on stage in order to create an interactive dramatic experience. The basic principle underlying the playwright is that of anticipation; prediction of future states in order to inform decisions in the present. The playwright collects suggestions from each character about what they would like to do next, and then evaluates/simulates the effect of each action until it finds an acceptable one. To help the system decide which actions are acceptable and which are not the system uses a formal specification of the intended drama. Although the playwright system was never implemented Laurels work has had – and continues to have – a tremendous impact on the field.

Anticipatory systems can be classified based on the role of the predictive model M. The classification scheme introduced by Butz et al. (2002) distinguishes between four types of anticipatory systems:

- *Implicitly Anticipatory Systems* are systems without any predictive model M but where implicit anticipatory information is encoded by nature or a designer in the interplay between sensors, algorithms and actuators.
- *Payoff Anticipatory Systems* consider predictions regarding the possible payoff of different actions to decide on which actions to execute. Typically preconditions estimate the payoff of an action.
- *Sensory Anticipatory Systems* use predictions about future states to influence sensory processing. Although state predictions are made they do not directly influence decision making, but instead function as a way to prepare the system for a certain kind of input.
- *State Anticipatory Systems* use predictions of future states to directly influence current decision making.

Davidsson (2003) adds a further dimension to the categorization by considering how predictions are affected by the quality of the world model used and the properties of the environment. Agents that have complete world-models and operate in a deterministic environment are said to be linearly anticipatory as they are always able to predict exactly what will happen. Agents that have incomplete world-models or operate in a non-deterministic environment on the other hand face a harder task, since they need to evaluate a tree of possibilities, see Figure 15.

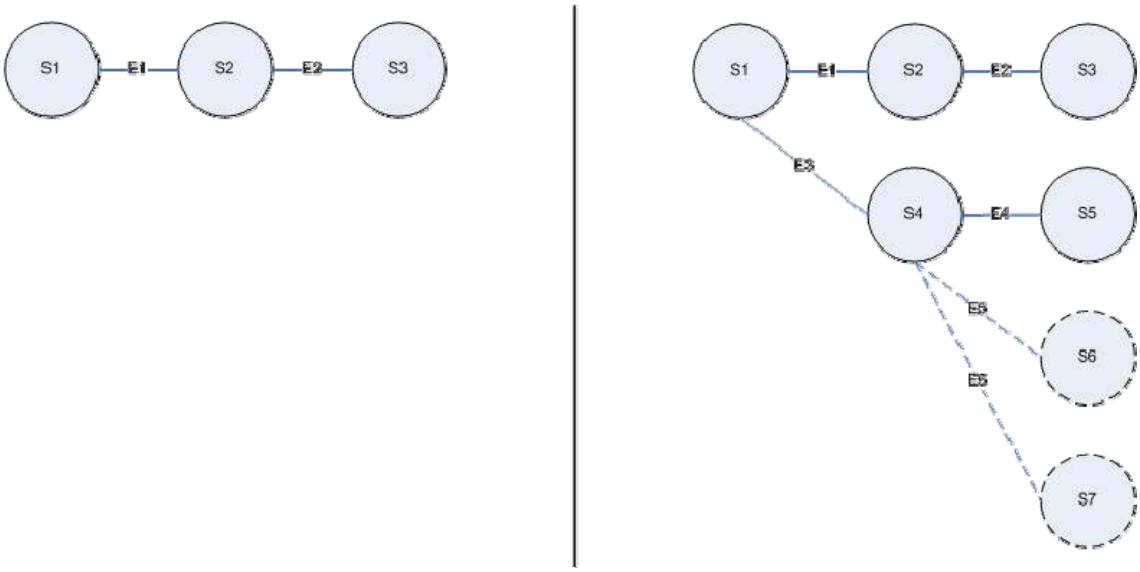


Figure 15 Linear vs. Tree anticipation

Predictions about future states can influence S in many ways. A simple approach, suggested by Rosen (1974), is to divide the state space of S into desirable and undesirable regions, or in Rosen's own words:

> "Let us imagine the state space of S (and hence of M) to be partitioned into regions corresponding to "desirable" and "undesirable" states. As long as the trajectory in M remains in a "desirable region", no action is taken by M through the effectors E. As soon as the M-trajectory moves into an "undesirable" region [...] the effector system is activated to change the dynamics of S in such a way as to keep the S-trajectory out of the "undesirable" region." (Rosen 1974p.247).

Hence, if a system remains in a desirable state most of the time an anticipatory system will rarely have to interfere with the system's normal execution.

Anticipatory planning has been applied in various domains including classifier systems (Butz and Goldberg 2002) and stock market prediction (Edmonds 2002). Davidsson presents a linearly anticipatory agent framework that combines reactive and deliberative behaviour (Davidsson 1996; Davidsson 2003). The framework is illustrated by simple path-finding agents, but more complex scenarios are also considered. A similar framework is used by Boman et al. (Boman *et al.* 2000) to implement a multi agent system handling energy management in a public building. In computer games anticipation has been used to make 'bots' in the computer game Quake smarter (Laird 2001). The SOAR Quakebot uses a state anticipatory mechanism to predict what enemies are likely to do based on what it would do itself in a similar situation. The predictions are then used to ambush enemies and deny them 'power-ups'.

6.1 Plot guidance

The following is a shortened version of an article (Laaksolahti and Boman 2003) that appeared in an edited book on "Anticipatory Behavior in Adaptive Learning Systems".

Interactive narrative is a form of entertainment that invites users to step into and interact with a fictive world. In contrast to traditional non-interactive narratives, participants in an interactive narrative are active in the creation of their own

experiences. Through their actions, players interact with other agents (some of which might be artificial) and artefacts in the world—an experience that can be compared to role-playing or acting. Interactive narrative promises to empower players with a greater variety of offerings but also the capacity to deal with them (Vorderer 2000), leading to deeper and more engaging experiences.

Stories may be told in many different ways, depending on the order in which events are disclosed to the player. Plot control concerns itself with deciding which event of a story to present next, not to create entirely new stories (cf. Wibroe *et al.* 2001). The player should have the feeling that anything may happen while being nudged through the story along various story arcs (Galyean 1995). At the same time the player should feel that the choices she makes has a non-trivial impact on how the plot unfolds.

Plot guidance involves searching among a possibly huge amount of unfoldings for one that fulfils (some of) the author's intentions for the story (cf. Weyhrauch 1997). The search of the state space quickly becomes intractable, however, as the number of scenes grow. For a scenario consisting of as little as 16 scenes (with a normal movie having 40-60 scenes) search would have to consider billions of states.

Limiting the depth of the search can reduce the size of the state space but can also result in bad plot unfoldings (i.e., the player can get stuck).

We hypothesize that anticipatory systems can provide an alternative means to efficient plot guidance. Robert Rosen suggests that the simplest way for anticipations to affect the properties of a dynamic system S through a model M is the following is the one described above.

The system does not have to consider full trajectories but only those that start in the current state of S and stretch some time into the future. This gives the system a look-ahead similar to that provided by search. By contrast, Rosen's description suggests that the main concern for an anticipatory system is to detect and avoid bad trajectories instead of finding good ones. Hence, ideally the anticipatory system will not interfere with the object system's execution.

6.2 A Scenario

Our ongoing Kaktus project, described in chapter 5, aims to create truly interactive socio-emotionally rich stories in which the player actively participates and influences the plot in non-trivial ways. Our aim is to create a socially and emotionally engaging experience rather than an action-packed one. Hence, our focus is on socio-emotional interaction with characters in a scenario rather than monster bashing.

The scenario centres around three teen-age girls named Karin, Ebba, and Lovisa. The player of Kaktus acts as one of the girls while the system controls the others. We enter the story at a time when the girls are planning to organize a party for their friends. The story evolves over a period of several days prior to the party. During this period decisions have to be made concerning different matters related to the party, for instance, whom to invite, negotiating with parents about lending the house (or some other locale), what kind of food (if any) to serve, if alcohol should be allowed at the party, choice of music, etc. In addition to organizing the party, the game involves establishing and maintaining social relationships with the characters of the game. In order to be successful, the player must adopt the role of a teenage girl, be sensitive to the social and emotional cues in the environment, and act on the basis of those.

In the traditional arts, a story is described as a sequence of events that through conflict changes dramatic values of importance for the characters of the story (see e.g.

Chatman 1978; McKee 1997) or section 2.1 above. Values are typically on a spectrum between counterpoints (e.g., love/hate, death/life, courage/cowardice, strength/weakness, good/evil).

For example, the Kaktus scenario revolves around the values:

- love/hate is illustrated by Lovisa's secret love for a boy in the local hockey team which may change due to events in the game.
- friendship/enmity is of great importance in the scenario. Plot unfolding – and ultimately success in arranging the party – depends on the players ability to interpret and manipulate the social configurations between characters.
- boredom/exhilaration is one of the main driving forces of the game. Boredom is the main reason for the girls to organize the party.

Story events are classified according to how much they change story values. Using the terminology of Robert McKee the smallest value changing event is the beat. It consists of an action/reaction pair that causes minor but significant changes to at least one story value. A scene is built from beats and causes moderate changes to values. Scenes are the most fundamental building blocks of stories forming the arc of the story, or

> the selection of events from characters' life stories that is composed into a strategic sequence to arouse specific emotions and to express a specific view of life. (McKee 1997 p.33)

On the next level comes the scene sequence and acts. Acts are strings of sequences causing major value reversals. Finally the story itself is a long irreversible change of values.

Using this definition of story events we can outline the story of our scenario through the following scenes:

q1. Introduction of Karin, Ebba and Lovisa, their current state of mind, and conception of the party idea.
q2. Karin and Lovisa find out that Ebba cannot afford to organize a party.
q3. Lovisa's secret love for Niklas is revealed to Karin.
q4. Plans are made to hold the party at Lovisa's house.
q5. How to get hold of alcohol to the party is discussed.
q6. Karin, Ebba, and Lovisa invite people to the party.
q7. The girls decide not to have a party.

Each scene consists of beats detailing its content. Minimally a scene consists of beats detailing responses to input from the player. For instance, lines of dialog exchanged between characters and the player, or beats implementing (inter-) agent behaviours, such as behaviours for two agents to have a row. We will not go further into details regarding beats here.

6.3 System overview

As discussed above, there is a fundamental conflict between interactivity and narrative. In narrative media experiences, such as suspense, comic effects or sympathy often

depend on the ability to specify a sequence of events in the 'right order'. In interactive narratives, in which the player occasionally takes control of what will happen next, such effects are difficult to achieve. A player, in a few mouse clicks, may ruin an experience that has painstakingly been designed by an author. By limiting the amount of options, a player may be pushed along an intended path, but at the same time such a design will decrease her amount of influence over the story.

Stories are ultimately about characters, and hence agents have long been considered vital elements in many story-telling systems (cf. Bates 1992; Hayes-Roth *et al.* 1997; Andersen and Callesen 2001; Paiva *et al.* 2001). To date there has been a fair amount of research regarding various aspects of interactive narratives. However, most agent-based interactive narrative systems have adopted a locally reactive approach, where individual agents within the system ground their actions in their own perception of the current situation (Loyall 1997). Comparatively little effort has gone into research on how to integrate local reactivity with a global deliberative plot control mechanism (Weyhrauch 1997; Mateas and Stern 2000).

Selecting what events to recount and how to order them is what makes up the plot of a story. Kaktus adopts an agent-based approach to story-telling where characters in the guise of artificial agents or human players have a central role. Characters are the primary vehicles for conveying dramatic action and progress along different story arcs. As the scenario relies heavily on social and emotional interaction, artificial agents are required to simulate human behaviour to some extent and be capable of 'reasoning' about emotions, interpersonal relationships, and consequences of actions.

6.3.1 Implementation

Kaktus uses a Belief Desire Intention (BDI) approach to model agents (Bratman *et al.* 1991). This approach gives agents a rudimentary personality in that they pursue subjective goals, based on equally subjective models of their environment. The core of our system is based on the JAM (for Java Agent Model) agent architecture (Huber 1999) to which we supply an extension for doing anticipatory planning. The anatomy of a JAM agent is divided into five parts: a world model, a plan library, an interpreter, an intention structure, and an observer (see Figure 16).

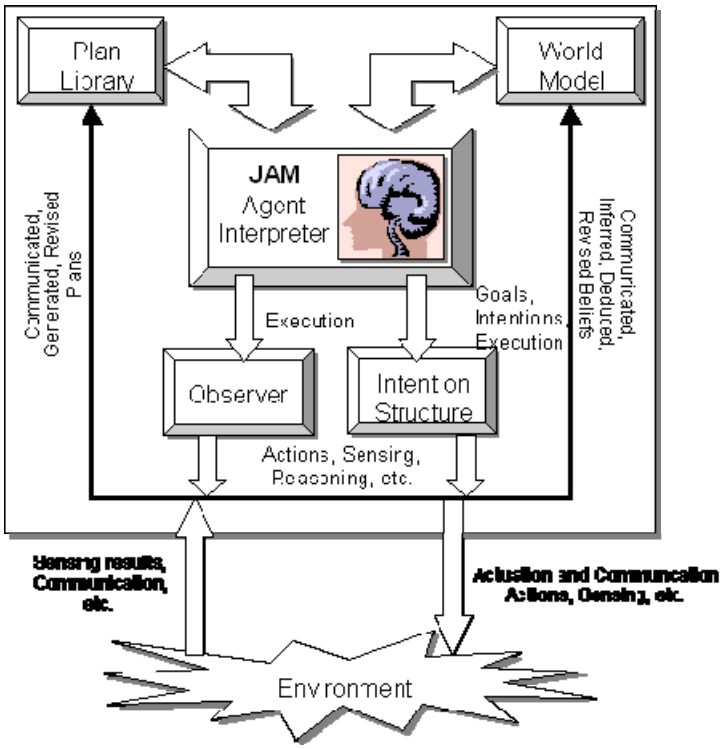


Figure 16 The JAM Agent Architecture

The world model is a database that represents the beliefs of the agent. The plan library is a collection of plans that the agent can use to achieve its goals. The interpreter reasons about what the agent should do and when it should do it. The intention structure is an internal model of the goals and activities the agent currently has committed itself to and keeps track of progress the agent has made toward accomplishing those goals. The observer is a special plan that the agent executes between plan steps in order to perform functionality outside the scope of its normal goal/plan-based reasoning.

A high level overview of the system is given in Figure 17. The system consists of four basic components:

- A graphical front-end/user interface
- An I/O manager
- A story manager
- An ensemble of JAM agents

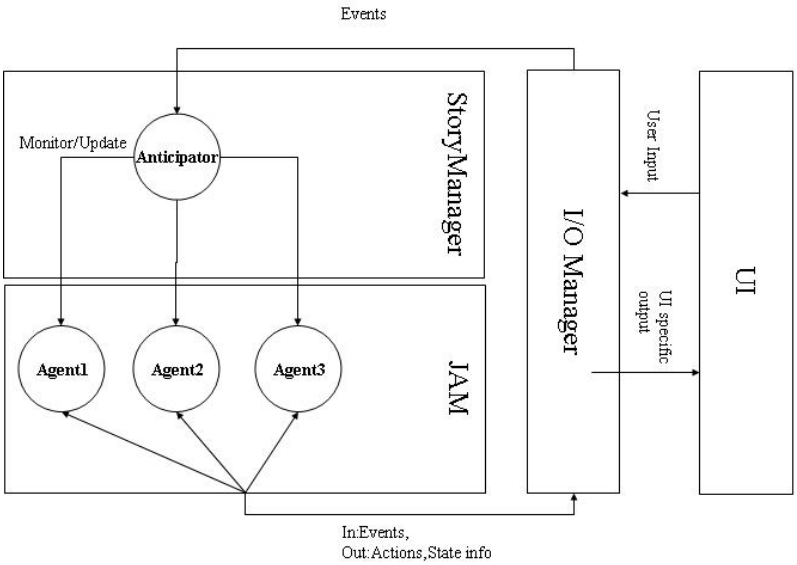


Figure 17 System overview

The front-end is separated from the rest of the system according to a Model-View pattern. This facilitates having more than one type of interface to the system. Depending on the capabilities of the front-end some low-level functionality may be implemented in it, e.g., low-level movement primitives for agents.

The I/O Manager sits between the front-end and the story manager. The tasks performed by the I/O Manager vary depending on the type of front-end used. Minimally it consists of converting user input to internal formats and system output to front-end specific formats. For instance, text that the user has typed is converted to dialog moves and output is converted to formats such as Facial Animation Parameters (FAP), Body Animation Parameters (BAP) or ID's of animation files to play.

After conversion to an internal format user interface events are forwarded to the story manager. The story manager acts on the information it receives and continuously reflects the state of the system back to the front-end.

Each character in the story is represented by a JAM agent with a distinct set of goals, plans and intentions. During game play agents act autonomously, but are from time to time given direction by the story manager.

The story manager embodies the anticipatory planning mechanisms of the system through the anticipator (cf. Davidsson 2003). The anticipator monitors the progress of the story and decides on appropriate courses of action. The decisions are realised by modifying the state of agents—or tuning other system parameters—in order to accomplish the intended course of action. This includes, but is not limited to, adding or retracting information from an agent's world model, adding or deleting plans from an agent's plan repository and adding or deleting goals from an agent's list of goals.

We utilize the observer functionality of JAM agents to communicate with the anticipator giving it a chance to inspect and modify the state of an agent between each planning step. While this scheme does not provide the anticipator with uninterrupted insight into an agents mind it is sufficient for our needs, since in effect the anticipator can make changes to an agent's state before the agent chooses and/or executes an action.

Other distributions of responsibility are also possible, e.g., the agent community could manage without a super agent deciding on appropriate courses of action through voting or the super agent can act more as an advisor, guiding agents when they are uncertain of what to do (cf. Boman *et al.* 2000).

The anticipator uses copies of each agent to simulate execution of the system. The simulation has no side effects, such as output to the front-end. In an interactive application such as ours, generating output and waiting for input are operations that typically make up the bulk of execution time. In a simulation these operations can, and should, be left out, thus freeing time for running the simulation itself. Hence we do not anticipate a need for creating simpler models of our agents, in order to achieve faster than real time performance for the anticipator.

In addition to the anticipator, the story manager contains a model of desired plot unfoldings. The plot model is encoded as a finite automaton which is described in detail in Section 6.6. The model includes bookkeeping aspects of the system state such as which scenes have been played, which scenes are currently playable, and which scene is currently active.

Each scene contains a set of beats encoded as JAM plans and goals. When a scene first becomes active agents in the scene are given goals and plans that enable them to perform the scene. Conversely, when a scene becomes inactive goals and plans specific to that scene are removed from agents' plan libraries and goal stacks. In this way the story manager portions out directions for the story in suitable chunks.

To illustrate how the anticipator works we will describe the sequence of events that takes place during execution of the system.

The party game application contains several agents, each potentially running in its own separate thread. Agents request the turn to speak whenever they feel the desire to do so along the lines outlined in D3.2. In the party game application we also have to overcome the problem of synchronizing turn taking in some fashion. One solution is to model turn taking behaviour as an auction that is only open for a specified time slot. Agents can request the turn whenever it is available. The first agent that requests the turn starts the auction by posting a bid for the turn in terms of motivation to speak. Following the first bid the auction stays open for a specified amount of time. After the auction closes the turn goes to the highest bidder. All agents that placed bids on the turn during the auction are informed about who received the turn and who else took part in the auction.

The mechanism allows agents to mimic situations where several people want to speak simultaneously with a time aspect added to the equation. If some agent repeatedly keeps winning the turn, blocking other agents from speaking, the 'frustration' felt by those agents may affect their desire to speak the next time the turn becomes available. In situations where there is no competition for the turn the time aspect of course is not an issue.

As the goal of the game is to entertain players by letting them experience a dramatic arc we must also work towards achieving that goal. If agents were completely free to regulate the turn taking behaviour themselves this would be hard to achieve. Hence the system has the opportunity to intervene in the process by giving the turn to another agent instead of the winning one. Which agent is given the turn is determined based on an evaluation of the dramatic consequences of a turn. If any dramatically undesirable effects of a turn are detected – e.g. the dramatic arc becomes too distorted – the turn instead passes to another agent. The procedure is repeated until a dramatically pleasing turn is found, or if none exists, all agents have been tried. In the latter case the least undesirable turn is chosen for execution.

The player of the game holds a privileged position. If the player requests the turn it is usually given to her, since unresponsiveness to player input might quickly break the illusion we are attempting to uphold. As a result the player has a great influence on how the game proceeds.

The party game belongs to the state anticipatory category of system in that it explicitly tries to predict future outcomes and allows them to influence present behaviour. The main loop of the game uses a turn-based algorithm. For each cycle the turn is given to an agent along the lines described above. After the speaking agent has executed its turn the effect of the turn for the other agents is calculated, and so on. The point where anticipation comes into play is when assigning the turn to an agent. When the competition for a turn closes an execution manager runs a simulation of the agents to decide whether any of them have undesirable consequences. That is the execution manager attempts to predict what the next state would be and let that influence present behaviour. In our case we only simulate a single turn. However, if desired the execution manager could run longer simulations.

Linking the terminology of anticipatory systems to components in the party game is relatively straightforward. The object system S clearly consists of the agents themselves, as it is their behaviour that we wish to anticipate. The model M consists of copies of the agents that are made when simulating the agent community, but also a model of the desired execution path of the system. This model takes the form of a finite state machine, which will be described below. Finally, the system only has a single effector which is choosing which agent should receive the turn. More complex – and active – effectors are certainly possible. For instance effectors performing some limited "brain surgery" on agents by adding or removing goals, facts or plans. However we decided to adopt a simple solution before turning to complex solutions that would require more work.

Anticipation is used to control the agent community as a whole. However, it can also be beneficial for the believability of individual agents. For instance, an agent that predicts that a fellow agent will become very sad by what it has to say may instead chose to keep quiet or not tell the whole truth, which would mimic empathic behaviour. The framework that we have implemented also allows these kinds of anticipatory agents to be constructed.

Compared to traditional planning techniques, for instance search used by Weyhrauch (1997) to combine scenes into desirable plot paths, anticipation as described here is a more passive way of planning. Anticipation as used in the party game application gives the system a look-ahead similar to that provided by search. By contrast, Rosen's description suggests that the main concern for an anticipatory system is to detect and avoid undesirable states instead of actively searching for the best. Instead of searching for an optimum the goal is to avoid minima.

The environment facing agents in our scenario is deterministic in the sense that agents will behave in the same way given the same circumstances. This is in line with the requirement of consistency of behaviour, which is an important component of believability (Isbister & Nass, 2000). Having a human user involved adds an element of uncertainty to the system in that the system cannot predict what the user's next action will be or how the user will act if a certain event takes place. Extending the system with a user model might be a way of reducing uncertainty by integrating the user into the prediction process. However, constructing accurate user models of this type is notoriously difficult and lies outside the scope of this thesis.

6.3.2 An example

After the system is started each agent's observer plan will eventually be executed. The observer calls a synchronization method in the anticipator passing a reference to the agent as a parameter. Through the reference the anticipator has access to the agent's world model, plan library, and intentional structure, which together control the behaviour of the agents. The anticipator copies information from the agent, such as facts from its world model or the current goal of the agent, and stores it in a copy of the agent. The copy is later used for making predictions about the agent's future behaviour. If there are several agents in the system, the anticipator waits for all of them to call the synchronization method in order to get a snapshot of each agent's state, before relinquishing control.

Next, the anticipator starts a simulation of the system using the copied information. At regular intervals each agent observer plan calls the synchronization method again. If the anticipator, based on its simulation, predicts that the system will end up in an undesired state, it searches for an appropriate effector to apply (see Section 6.5). In case there is more than one agent using the anticipator, it waits for all of them (or at least the ones that are affected by the chosen effector) to call the synchronization method in order to gain access to the entire system state, before it applies the effector.

Given that there is a user involved, providing input which may be hard for the system to predict, the synchronization can also act as a sensibility check of the anticipator's predictions. If the actual state does not evolve according to predictions the anticipator can discard the current predictions, gather new information, and start the cycle anew.

As an example consider the simple agent described in Figure 18. This agent has the single top-level goal of ACHIEVE live to pursue. The goal is achieved through displaying idle time behaviour or, if the agent is on friendly terms with Karin, gossip about Lovisa's infatuation with Niklas.

Let us suppose that in the anticipator's simulation this agent has come to a point where it has selected gossip as its next plan to execute. However, suppose further that global story constraints dictate that for the time being this is not a good plan, since it leads to an undesirable state. The anticipator then starts a search for an effector (or effectors) that can prevent this situation from arising.

In this case three effectors are found: lower the friendship value between the agent and Karin thus preventing the plan from becoming active, remove the plan from the agent's plan library (or replace it with a less harmful one) or give the agent a new goal with a higher priority. For simplicity let us suppose that the anticipator chooses to lower the friendship value between the agent and Karin. After this is done the agent resumes normal execution but with a new value on the friendship relation to Karin. At some later point in time when the agent would normally have selected the gossip plan for execution it now displays idle time behaviour instead, and the undesired state is avoided. This cycle is repeated until the user stops playing or the plot has reached its conclusion.

The same basic procedure is also applicable when more than one agent is involved. However it is likely that different effectors will need to be applied to each agent, resulting in a larger number of applied effectors than in the single agent case. For instance, to initiate a fight between two agents regarding some matter, they will need opposing views of the matter at hand, different knowledge, different arguments, etc.

```
GOALS:
      ACHIEVE live;
FACTS:
      FACT friends "Lovisa" "Karin" 1;
      FACT in_love "Lovisa" "Niklas";
PLAN:
{
NAME:
      "live"
GOAL:
      ACHIEVE live;
BODY:
      FACT friends "Lovisa"  "Karin" $strength;
      OR
      {
           TEST( > $strength 1);
           ACHIEVE gossip;
      }
      {
      EXECUTE doIdle;
      };
}
PLAN:
NAME:
      "gossip"
GOAL:
      ACHIEVE gossip;
BODY:
      RETRIEVE in_love "Lovisa" $who;
      PERFORM tell "Karin" "in_love" "Lovisa" $who;
EFFECTS:
      ASSERT knows "Karin" "in_love" "Lovisa" $who;
}
```

Figure 18 An example of a JAM agent

6.4 Anticipatory system

Using the classification scheme introduced earlier we can regard our system as a *state anticipatory system*. Through simulation, the anticipator forms explicit predictions about future states in order to avoid undesirable ones. Currently our model is limited in that we do not explicitly model players in any way. However, modelling users is notoriously difficult. Hence we will rely on empirical tests of the current system to indicate whether such an extension would be worth the added effort.

Implicit model.

6.4.1 The model M

Our model M is a finite automaton, in which each state corresponds to a scene. In Figure 19, the seven scenes of the Kaktus scenario are represented as states q1 through q7. Note that M only contains story-functional scenes as described in section 2. Descriptive events are accessible from most of the kernel events. However, since they do not influence the plot they are not included here. The start state is q1, while the set of end states is {q4, q6, q7}. The design method is top-down, in that M was completed only after the key scenes had been identified. Note that one may also proceed bottom-up, letting M depict sequential plot development from the start state to the end state of M. This entails that the design of M is more important than design of the plot. In this case, the states of M are compositional and scenes are identified as natural halts or crossroads in the evolution

of the plot. Hence, if plot emergence is studied, a bottom-up design seems adequate. For conventional interactive game design, however, top-down is the default choice.

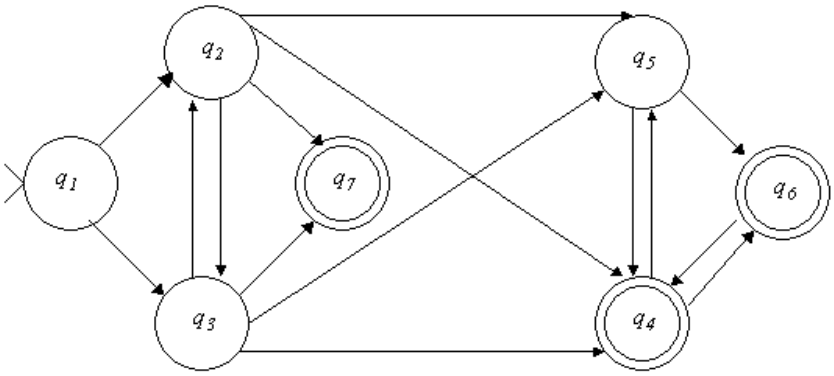


Figure 19 The model M

Finite automata also lend themselves to non-sequential development of plot. Models have previously been restricted to directed acyclic graphs (Weyhrauch 1997). We argue that instead cycles should be regarded as an opportunity. Many forms of interaction build their narrative framework on plot cycles, e.g., the repeated mouse chases in Tom & Jerry cartoons.

We will show below that problems related to computational complexity and model design complexity can be avoided. In fact, we have harsh constraints for the execution of M, since the time complexity must be low enough to allow for faster than real-time execution.

The state transitions in M are labelled *a0*, *a1*, . . . indicating that each transition is different. (For clarity of exposition, we have not labelled the edges in Figure 19.) In practice, there might be simple scenarios or small parts of an interactive drama in which transitions may be reused. However, for scenarios of the size and complexity we consider, uniqueness can be stipulated, especially since this stipulation has no mathematical significance. Each transition am from qi to qj could be interpreted as (an ordinary Hoare triple with) pre- and post conditions. The precondition is the state described as qi plus the added conditions described in am, and the post condition is simply qj.

Each transition am corresponds to a set of conditions that can be either true or false. Conditions are represented by one of the symbols (Cage 2005) denoting *false*, *true* and *either* respectively. A set of conditions is represented by a fixed length string where each position in the string corresponds to a particular condition.

This means that transitions encode the desired value for all conditions in the system. However the wild card symbol '?' can be used in circumstances when the value of a condition is irrelevant to a transition.

In our implementation conditions are represented by Java classes that are stored in a database. Each condition is evaluated at most once each cycle. The result of the evaluation is stored internally in the condition and can be reused later on. Currently we have implemented the following general purpose condition types:

- Range
- Boolean
- Greater

- Less
- Equal

These classes can be used to place conditions on any system parameters including story values, e.g., to prevent a transition from one climactic scene to another.

In addition we have implemented a set of conditions specific to agents that relate directly to facts, goals, plans, and emotions that an agent may have.

- Knows
- Feels
- HasGoal
- HasPlan

The language that M accepts is the set of words accepted. Each word is a sequence of names of transitions, e.g., *a0a3a4a3a4a6*. Therefore, an ordinary finite automaton suffices. Should any manipulation be required in M, a finite state transducer (or if the language was very complicated, a Turing machine) would be required (see e.g. Simon 1999). The preconditions described in am are usually fairly complicated, and we will describe only one transition in the automaton pertaining to our Kaktus scenario.

The transition we will describe takes us from a state where Karin (the player) does not know about Lovisa's romantic interest in Niklas to one where Ebba tells her about it. This is a climactic scene where many story values temporarily are at their extremes. There are several preconditions that must be fulfilled for this transition to take place. Assuming that the transition is named am let us consider the set of preconditions {p(am)}j .

- {p(am)}1 states that Karin must be unknowing about Lovisa's interest in Niklas, or the transition will not make any sense.
- {p(am)}2 tells us that Lovisa must be unwilling to have the party, since getting to know about and later inviting Niklas to the party is a way of persuading Lovisa.
- {p(am)}3 requires that Ebba actually wants to have the party. If she does not, she may not have a strong enough incentive to break her silence and tell Karin about Lovisa and Niklas.
- {p(am)}4 states that Ebba must be on speaking terms with Karin or she will be reluctant to tell Karin anything.

Preconditions also act as constraints on story values. For instance, Lovisa's love for Niklas can be expressed as an interval (0 . . . 9). Let us call an update of this interval a parameter update, and let us define a radical parameter update as a parameter update in which the value changes with at least five units. Given that a good dramatic arc should oscillate between dramatic scenes and quieter ones, we can consider, e.g., oscillations between states with at least one radical parameter update and states without such updates. The oscillatory sequence of scenes can now be achieved through preconditions constraining certain transitions.

6.5 The set of effectors E

In the following discussion we will, for simplicity, assume that all system parameters including agent goals, plans, intentions and relationships are stored in a global database. An effector will in Kaktus be a function updating a value in the database. We thus consider updates to be atomic operations on S, or the environmental updates to S (cf. Rosen 1974 p.248). In order to drag the plot from an undesired to a desired state, a single update will hardly ever suffice. Depending on how much S needs to be altered any number of updates may be necessary. We amalgamate our terminology with that of McKee to achieve the following list of value-changing actions, in increasing order of importance to the plot:

- parameter update
- beat
- scene
- scene sequence
- act

A fairly small subset of E will typically constitute a beat. A larger subset of E is required for a scene change. Scene sequences and acts pertain to aspects of story design so domain specific that they will be left out of our discussion.

Below we give a short list of possible effectors in the Kaktus scenario:

- Simulate a player action, i.e. pretend that the player did something she actually did not.
- Filter out some player action.
- Introduce/remove a character.
- Alter the flow of time to bring about or delay an event.
- Start/stop a topic of discussion.
- Create a disruptive event such as throwing a temper tantrum or starting a row with another character.
- Give the player a hint or provide some information.

Effectors can have different functions. Weyhrauch divides his so-called MOE MOVES, which roughly correspond to effectors, into causers, deniers, delayers, substitutions, and hints. Their respective function is to cause an event, stop an event from happening or deny access to an object, delay an event, substitute an event with combinations of other events, and finally give hints about unexplored paths.

Some effectors may not have any immediate impact on the plot e.g., turning on the light in an empty room or placing an item in that room. Such effectors can, however, create favourable conditions for alternative plot unfoldings in the long term. For instance, the player might find the item placed in the room and use it to overcome an obstacle at some later instant.

Other effectors can have a growing influence over time. Imagine for instance an effector instructing an agent to kill every other agent it encounters. At first such an act would have limited impact on the plot but as the agent roamed the world killing other agents, the effect would become increasingly noticeable.

It is important to remember that while the revision of story values during the drama describes the intended dramatic arc, these values are never directly manipulated. For instance, Lovisa's love for Niklas is never directly increased or decreased. Instead they are updated as a result of tuning other system parameters.

Finally, we wish to stress the importance of creating effectors that do not tweak parameters in a way that interferes with user experiences of the narrative. There should be no unexplained or unexplainable twists or turns to the story brought on by the application of any effectors. It is important that transitions from one state of affairs to another are made accessible and understandable to the player (Sengers 1998). Hence the design of good effectors will likely require equal amounts of artistic work and engineering.

6.6 Top down design of automata

Our top-down design process for the modelling of an interactive drama (after the initial cast of characters, rudimentary plot design, and means to player interaction have been determined) consists of the following steps.

1. Describe the entire scenario as a finite automaton
2. For some state/transition pairs, list the resulting state
3. Partition the class of states into desirable/undesirable states
4. Partition the class of desirable states into ordinary/end states
5. Review the graph of the automaton, and iterate from 1 if necessary

We will now review these steps in turn, in order to further explain M and E.

The first step is ideally carried out by a team of authors. The team lists a number of scenes, and then for each scene, a number of beats. The scenes must then be linked into sequences by means of scene transitions. For each scene transition, a number of parameters and their required values are identified and arranged in a database. The first output of the team may be rudimentary, approximately at the level of our Kaktus scenario. The artistic part of the work carried out should affect the implementation, and vice versa, to some extent. For instance, detailing the parameters listed, such as when pondering whether life/death is a Boolean parameter, or an interval, has an artistic aspect as well as a direct influence on the implementation in the database of parameters and their values.

The really hard work begins in step 2. The reason step 2 does not read "For each state/transition pair, list the resulting state" is that this task is insurmountable and also unnecessary. It is insurmountable because the number of transitions is equal to the number of combinations of parameter values in the entire database, which for interesting portions of dramas will be huge. It is unnecessary because most of these combinations will not, and sometimes even cannot, occur. In fact, the objective of our anticipatory system is to steer clear of more than 99 per cent of these combinations. We will therefore happily leave many transitions non-specified, and seemingly also the execution of M undetermined. We will show why this is not problematic.

Since each state in M is a scene, listing only the interesting transitions between these scenes is likely to result in an automaton in which all states are desirable. Hence, much of the work in step 3 is already done. Steps 2 and 3 also reflect artistic vision and imagination, however, in that the authors should try to imagine interesting undesirable

states too. Figure 20 shows a transition a16 leading to a situation in which Karin (alias the player) expresses an interest in Niklas. This is clearly an undesired state since we have no scene dealing with such a situation. Furthermore it prevents us from using scene q3 where Lovisa's love for Niklas is revealed. However it is possible to recover from this situation, e.g., by revealing that Karin's declaration of love was only a joke. Here, transition a17 takes us back to desired territory. The necessity of explicitly listing undesirable states, and not simply stipulating that the listed states are desirable and the rest undesirable, is explained by the fact that the anticipatory system must be resilient. This resilience is a form of fault tolerance: if the changes to the interactive drama that M suggests requires too radical parameter updates to be performed within one scene, or if there is a latency in the real-time parameter updating, the drama may be in limbo for a limited time. This means that M will be in an undesirable state during that time.

Note that analogously to the constraints placed on transitions from one climactic scene to another we can place constraints on the number and magnitude of parameter updates allowed by a single scene transition. If an undesirable state and its transitions leading back to a desirable state can be specified in advance, the drama can be led back on a desirable path. The player might in this case feel that the plot goes weird on her temporarily, but since things go back to normal, or at least come closer to what is expected by the player, after a short time, she might accept that she could not fully understand what was going on. The tuning of resilience procedures is a delicate matter and must be tested empirically. Since we do not explicitly model the player in the way Weyhrauch and others do, we envisage such tests to be user studies. We recognize that there might be tacit iteration between steps 2 and 3, but their identification here as discrete steps is motivated by the fact that the number of such iterations will decrease with increased experience of the suggested design process.

Step 4 is relatively simple. Even if the preceding steps were only moderately successful, step 4 is meaningful already for automata with only desirable states; that M is in a desirable state does not entail that the drama could stop in any state. Instead, most desirable states will have transitions to one or more end states, in which the plot comes to a natural conclusion. If we for instance consider interactive computer games, M will normally have a single end state, in which the end credits are rolled out and all game processes are then killed. Note that an undesirable state cannot be an end state.

Step 5 is a return to the discussions that largely ran in step 1. The depiction of M as a state diagram is a pedagogical and instructive basis for self-criticism and revision. Since this step depends so largely on the form of interactive drama and on the working group, we will not pursue the reasons for iteration here.

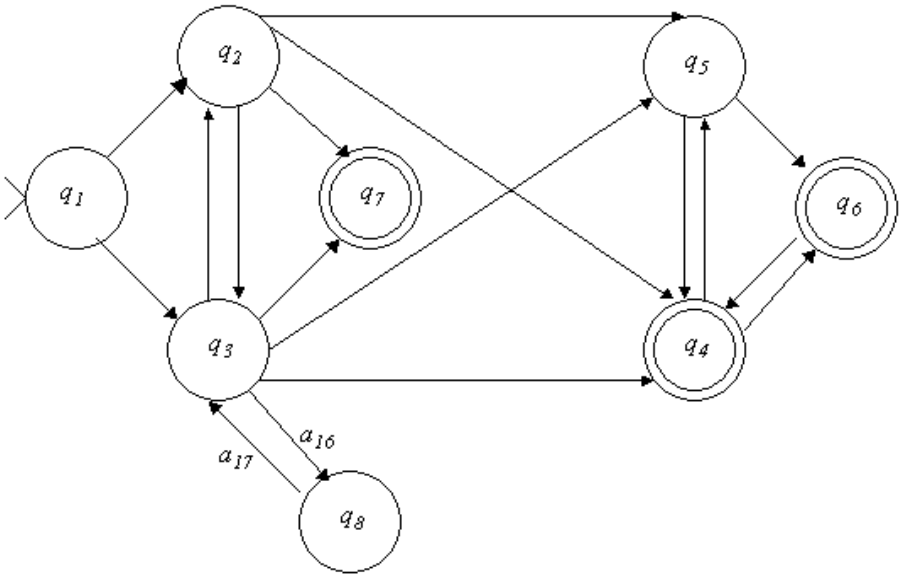


Figure 20. The model M with an undesirable state added

Although there is no difference with respect to expressive power between the classes of non-deterministic automata and their subclass of deterministic automata, i.e. they accept the same class of languages; we must pinpoint which kind of non-determinism we allow for. There are three reasons for non-determinism in an automaton in general:

- Transitions are labelled with strings of length different from 1
- Undefined transitions
- Choices between transitions with identical labels

As explained earlier, our transitions can be labelled by fairly long strings, since each transition may have to fulfil a large number of preconditions in terms of plot parameter values. However, a string label *a1a3a4* from *q3* to *q4* for example, is easily converted to a sequence of transitions: from *q3* to a new state *q´3* labeled *a1*, from *q´3* to another new state *q´´3* labelled *a3*, and from *q´´3* to *q4* labelled *a4*. Note that the designer would never see the two new states, as we are now describing a kind of compilation procedure, so the objection that *q3'* and *q3´´* do not correspond to scenes is irrelevant.

For completeness, we should also stress that we cannot allow for labels of length 0, i.e. the empty string. This is of no significance to our construction of M. Just like our string labels can be seen as shorthand, so can our incompleteness with respect to the state/transition pairs mentioned in step 2, which leads to undefined transitions. We simply stipulate that each transition not depicted in the state diagram of M leads to a dead state, i.e. a state with no edges directed to another state in M. This dead state is our garbage bin, and is naturally an undesired state. The only reason for non-determinism out of the three in the above list that we would like to recognize as significant is choice. We would like to allow for one out of several different scenes to follow a given scene stochastically. In an interactive drama with this possibility, the player may act in an identical fashion in two separate game rounds and still experience different unfoldings of the plot. This type of non-determinism is thus not only tolerated, but encouraged, in order for the drama to become less predictive.

7 Extra-Diegetic Story Support

Most work within interactive storytelling so far has focused on the levels of plot and character in the Aristotelian model. The goal has been to create models of plot that can be dynamically constructed, and models of character behaviour that lets characters believably act out the plot. As discussed in chapter 2 believability arises from a complex set of expectations that a character has to meet. In comparison relatively little effort seems to have been devoted to investigating what can be done on the level of spectacle to aid the construction of stories (although there are examples, cf. El-Nasr 2004).

Stories are about characters which need to be believable for the story to make sense. In the games industry increased believability has usually equalled increased graphical realism. However, the perception of believability is not a steady upwards curve, increased realism in appearance and movement only results in increased believability up to a point. Just before completely humanlike appearance and movement there is a deep plunge in believability. This gap is called the "Uncanny Valley" (Mori 1970) and it represents a point where a person observing a character experiences an almost realistic appearance but just enough off to seem eerie or disquieting to the observer. Hence, a question that we were interested in was how to increase believability without resorting to increased realism.

Our starting point was that since emotions and social relations are such an important part of our scenario, we wanted to make those aspects salient to players. If a player does not notice or understand those aspects of the scenario, the story does not make sense.

7.1 Making emotions visible

A common way of expressing the state of a character in games is to show bars, charts, and similar types of visualisations in the interface that are directly mapped to variables in the character's internal state. For instance health and mana bars, showing how close to death and how much magic energy that a character possesses respectively, are ubiquitous in many game genres. The same concept can be extended to other aspects of a characters state such as emotions. For instance a characters emotions could be shown as a bar ranging from happy to sad or as a set of bars showing the intensity of different emotions if a more complex emotional model was used. The first version of the dramatic game contained a visualisation of each characters emotional state that consisted of a bar for each emotion included in the underlying emotional model. By consulting the bars one could literally peek inside the head of a character to find out what it was presently feeling. In our case the visualisation was only used for debugging purposes and was never shown to players as we felt that it conveyed a rather mechanistic view of emotions. By glancing at the emotion bars one could quickly see that a character was feeling "happy 5", but as the representation was so abstract and far from how emotions are conveyed in real-life, one could not "feel" the characters emotions. When making a character's emotions as abstract as bars in the user interface they lose their meaning and become resources that we have to manage like we manage material possessions such as ammo, gold, health or mana.

However, we wanted the experience to be one of recognition, perhaps empathy, and at least understanding, rather than resource management. While we wanted to work with visual representations of emotional expressions we wanted to move from the feel of "seeing is knowing" conveyed by the bar interface, to an experience where "seeing is feeling".

Our first design attempted to address the problem of making a character's emotional expressions salient to players. We wished to create something that was similar to the simple text snippets describing a character's emotions that were used in the very first prototype of the dramatic game. These snippets described, in sometimes somewhat ambiguous terms, actions that a character made to convey its feelings, e.g., "Lovisa tilts her head" or "Ebba hides her face in her hands". As we felt that these expressions had worked quite well in the textual format we decided to continue working on them and translate them to a graphical format. The design goal for the expressions remained the same; that they should be un-intrusive, sometimes ambiguous expressions that should blend into the players overall experience.

At the time we were experimenting with a graphical version of the dramatic game created in Macromedia Director. One of our first undertakings was to create graphical representations of the characters in the scenario that could be used in the game. While the visual representation of the game scenario was 2 dimensional we decided to model the characters themselves in 3D. Using the modelling software we also created a set of facial and upper body animations for the characters that roughly corresponded to the textual snippets that were previously used. However, we now had to decide how to make those expressions readily visible to the player. In the general case limited screen size can sometimes make it difficult for a player to read a character's facial – and bodily – expressions since they need to be of a certain size to be readable. If they are too small they run the risk of going unnoticed. Hence we wanted to find ways of overcoming this limitation.

Our first idea was to let characters take up a larger portion of the screen by simply zooming in on them whenever they were expressing emotions. However this idea has the drawback of momentarily taking over the player's control of the game which can be confusing. It also doesn't solve the problem of showing the expressions of multiple characters simultaneously. Instead we decided to include emotional expressions as overlays on the players screen. Like a second or third camera popping up to show a close-up view of a character expressing an emotion and that disappears when the expression is complete. Using this method we can make the expressions of multiple characters salient simultaneously while letting the player stay in control of the game.

To accomplish this each characters facial and upper body animations were pre-rendered as video clips that could be played back in Director and other media players. During runtime whenever a sufficiently large change in a characters emotional state is detected, a matching animation is selected and played back in an overlay on the players screen. Figure 21shows a screenshot from the game where Lovisa expresses her feeling of anger at being called stupid, and Figure 22 shows a screenshot where Ebba and Lovisa are flattered at being called good looking.

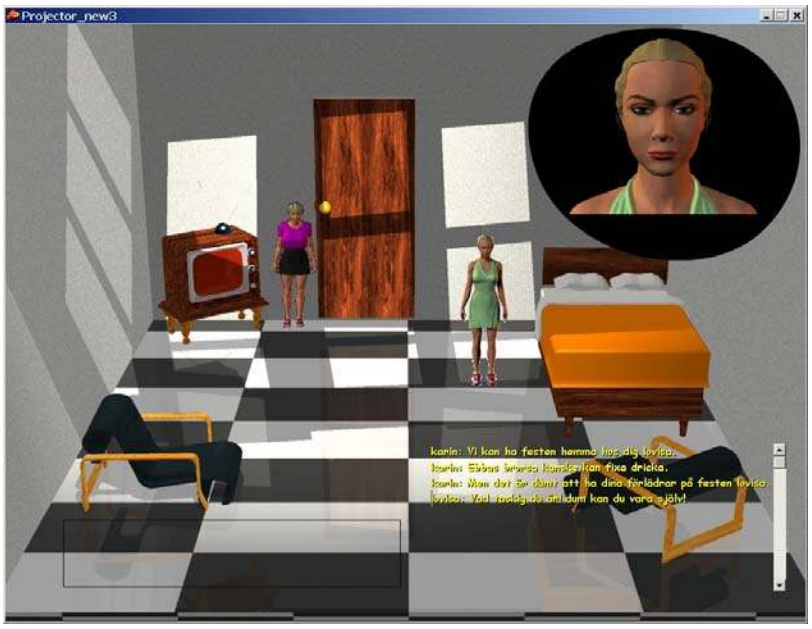


Figure 21 Lovisa shows anger in an overlay on the players screen

Figure 22 Two characters showing expressions simultaneously

7.2 From believability to expressivity

As we stated in the beginning of this chapter believability is often equated with realism. Research on believable agents has so far resulted in agents capable of expressing their personality through gaze, facial expressions, gestures, body posture and synthesized speech in a synchronized fashion (Pelachaud *et al.* 2002; Rist and Schmitt 2003). However, media such as comics teach us that a less detailed representation often does a better job (McCloud 1995). By using an iconic representation users can more easily identify with a character and attribute traits to it that are not apparent in the graphical

representation. Abstraction of this kind has less to do with leaving details out than focusing on certain fundamental details according to McCloud.

Consequently instead of focusing on increased realism as a means of increasing believability, we could instead focus on making the important details more salient. We can focus on expressivity instead of realism.

The interesting thing with this shift is that it allows us to take into consideration other believability/expressivity factors as well. Believability is not only affected by the internal state or appearance of characters. For instance, movies show us that there are several factors that are external to any character or even the world in which they exist. Examples of such factors include music, sound effects and visual effects. When watching a movie we can hear music reinforcing the dramatic tension in a scene, or view the character through different lenses for dramatic effect. By altering these factors different dramatic and emotional effects can be constructed, clarified or enhanced without changing the content or the appearance of the character (Mascelli 1965; Bordwell and Thompson 2001).

It is informative to think about believability as discussed here as existing in different spheres or layers originating from the character and spreading outwards. Figure 23 illustrates this concept.

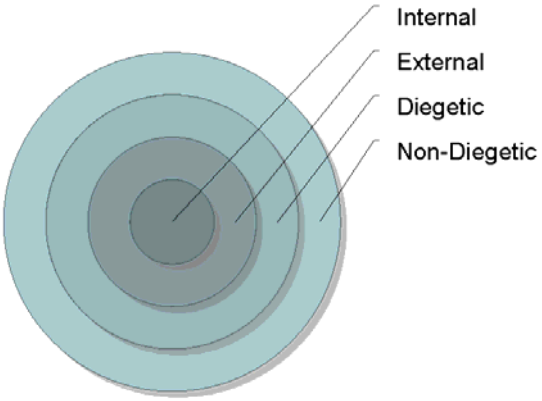


Figure 23 A layered model of believability

The internal layer refers to a character's internal processes, for instance emotion models, social models and reasoning capabilities. A character can be said to be internally believable when it's internal processes makes it perform actions in the world that are plausible given what we know of the characters personality, emotional state, relation ship to other characters etc.

Internal processes or the results of those are visible to observers in the world through the external layer, for instance through facial expressions, gestures or movement schemes. A character is externally believable when it performs actions in a way that allows us to recognize the meaning of those actions in a reliable manner.

In isolation a character's behaviour, as experienced by a beholder, may be believable but in the wrong setting or context it may still be un-believable. The diegetic sphere refers to a character's believability in relation to the world or setting it exists in. As previously mentioned a character surviving a piano dropped on its head from the roof of a three storey building is believable in a Donald Duck cartoon, but hardly in a production of hamlet.

The outmost layer is the extra-diegetic layer which refers to believability factors that are not part of the story world as it is experienced by the characters residing in it. Rather

they are situated outside the story world and are targeted at the player as a means of enhancing, explaining or modifying the experience of what is going on in the world. Visual effects, sound effects, and music are all examples of believability factors belonging to this layer.

The model of believability presented here is an extension, and simplification, of the model presented in (Persson *et al.* 2001). The external layer of the present model corresponds to the expectations on visual appearance and behaviour found in the old model while the inner layer includes all of the psychological, folk psychological, affective and other behaviours that were discussed there. In addition the model has been extended with the diegetic and extra-diegetic layers which account for believability factors related to the world and beyond. While we do not claim it to be a generally applicable model, it has been informative in our work by allowing us to understand the role of various believability factors.

7.3 Cinematography, colour, shape and comics

Our use of overlays showing a close up of characters when they are expressing emotions inspired us to continue working on film techniques. Hence we turned to cinematography.

Generally, there is more to making a movie than simply filming what is put in front of the camera. A filmmaker also has to consider the cinematographic qualities of the shots (Bordwell and Thompson). Cinematography refers to how something is filmed – in contrast to what is being filmed – and typically involves three factors:

- Photographic aspects of a shot, e.g. what kind of film emulsion or filters are used when filming can make a shot more or less grainy.
- Framing of a shot, i.e. what is included in the camera rectangle and its location within the rectangle. For instance, a shot can be centred on a person talking to someone outside the frame, or both persons can be visible on opposite sides of the frame.
- The duration of a shot. A shot can be very long, e.g. showing a person giving a speech, or short, showing the person giving the speech and then rapidly cutting to the audience's reactions to the speech. As a general rule shots last between two and eight seconds.

By altering these factors different dramatic and emotional effects can be constructed although the content remains the same. We have focused on the framing and duration aspects of cinematography leaving photographic aspects for later work.

Most work in automated cinematography has so far focused on techniques for describing and solving the geometric constraints of a scene, such as where to place the camera given two characters talking to each other so that none of the characters are occluded (Hornung *et al.* 2003). In contrast very little work seems to be available on how cinematography can actually be used to make a scene more expressive, understandable or believable. Our work belongs to this second category in that less has been spent on the geometry of cinematography than on exploring the expressiveness afforded by cinematographic techniques.

In order to give film a defined structure, it helps to think of it as a hierarchy. At the top level there is a series of scenes showing us a situation or action. Each scene is composed of several shots – the interval between two camera cuts or movements. During a shot the camera has a specific camera placement. The camera placement

determines what is shown during a shot, for instance a close-up of a speaking character or a view over-the-shoulder of a listening character.

Over the years filmmakers have accumulated knowledge about how to apply cinematography in various situations. This knowledge has been condensed into cinematographic idioms that encode working knowledge about how to set up and sequence shots to capture a specific situation or action. Idioms function as recipes for combining shots into a pleasing whole as described above. For instance, an idiom can describe how to film a conversation between two characters. Using idioms consisting of commonly used shots will make a player feel comfortable watching a scene since s/he recognises the film language.

Lighting is another aspect that influences how we perceive characters. For instance a shot can be very dark and gloomy, light from the sides casting sinister shadows, or it can be bright and happy. Lighting is however outside the scope of our own work.

In addition to purely cinematographic qualities we also wanted to add other aspects such as colour and shape to our system. That colour affects our emotions and how we perceive things is a well-known fact (Derefeldt and Berggrund 1994). The exact way in which they affect us depends on many factors such as inherent properties of the colour, expectations and previous experiences as well as cultural affiliation. For instance Goethe created a colour wheel showing the psychological effect of each colour (Goethe 1976). He divided colours into two groups - the plus side (from red through orange to yellow) and the minus side (from green through violet to blue). Colours on the plus side produce excitement and cheerfulness. Colours on the minus side are associated with weakness and unsettled feelings.

The shape of objects can have similar effects on how we perceive things. Within fields such as industrial design, the shape of objects and how they are interpreted is an important topic. Round shapes with soft curves are generally interpreted as friendly and positive while angular, harder shapes are interpreted as more negative (Monö; Ståhl 2005). Comic artists have also embraced the power of shape and often manipulate the shape of panels and "speech bubbles" to clarify what is going on in a strip or to produce different emotional effects (McCloud 1995).

We wanted to see how we could transfer and automate some of these ideas for an interactive storytelling experience. Our aim was to create a system that could add extra-diegetic believability to characters and support the storytelling process at the level of spectacle.

7.4 A second attempt: expressiveness with shape and colour

To experiment with these ideas we implemented a component that acted as a cinematographer, in that it could sequence shots in order to show what was going on in a scene. At the time we were working on a prototype of the party scenario that was created as part of the Magicster project which dealt with believable characters. The system was rather complex, consisting of numerous parts running on different computers. We will give a short overview of the systems architecture below.

7.4.1 An architecture overview

The system essentially consists of two parts; the party server and the party player which communicate over the Open Agent Architecture (OAA). Both the server and player parts of the system are assembled from a number of other components. Figure 24 gives an overview of the system. The server part (party server) housed the characters and the game world. The player part in turn consisted of the Greta server (Pelachaud *et al.*) which generated sound files (WAV) from text that characters uttered, lip synched facial expressions for characters (FAP), and timing information files for the emotional expressions.

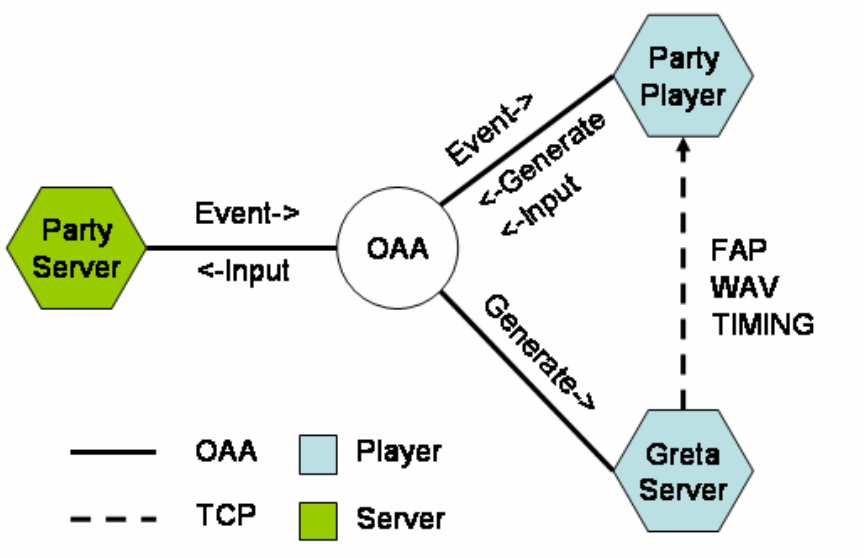


Figure 24 Architecture of the Magicster system

Players communicate with the system through typed text. The statements that players' type are sent as input events to the party server where they are parsed. When an avatar speaks, an event is sent in the other direction informing the player part of the system. The event contains information about speaker and listeners, changes in social relationships between avatars as well as an APML (Affective Plan Mark-up Language) expression containing the speaker's utterance. APML allows text to be marked up with the emotional expression that a character has when speaking it. After the party player has received the event a generation request is sent to the Greta server. Once the generation process has completed the resulting Facial Animation Parameter (FAP), WAV (sound file) and animation timing info files (TIM) are sent via a socket connection to the player. Finally, the animation is shown to the player of the game.

7.4.2 The cinematographer

The cinematographer is situated between the game world and the renderer component. It is designed to help convey characters' facial expressions and body language, as well as attitudes within a group. The cinematographer accomplishes this by acting as an intelligent camera that knows when to switch between characters in an appropriate way, or more broadly, uses cinematographic techniques to enhance and

clarify the state of a single agent, a group of agents or a whole scene. One could say that the cinematographer acts as an amplifier of social and emotional signals. In Figure 25 we see a close-up of one of the characters in the drama.

Figure 25 Close-up of one of the characters

The cinematographer uses borders with different colours and shapes around the camera windows to enhance emotions and social relations. Following the theories of Goethe a bluish frame would be used in a situation when characters are showing negative emotions or when a relation deteriorates, and a reddish frame would be used when showing positive emotions or when a relation improves. Similarly a jagged frame can for instance mean that a character is angry or that the relation between two characters is tense, while a softly rounded frame can mean that the character is feeling good or the relation is good, see

Figure 26. By framing shots we add an extra-diegetic emotional channel to the display that functions as an amplifier. Emotions and attitudes expressed through facial expressions, gestures or words that normally may be hard to detect have a chance of coming to the player's attention.

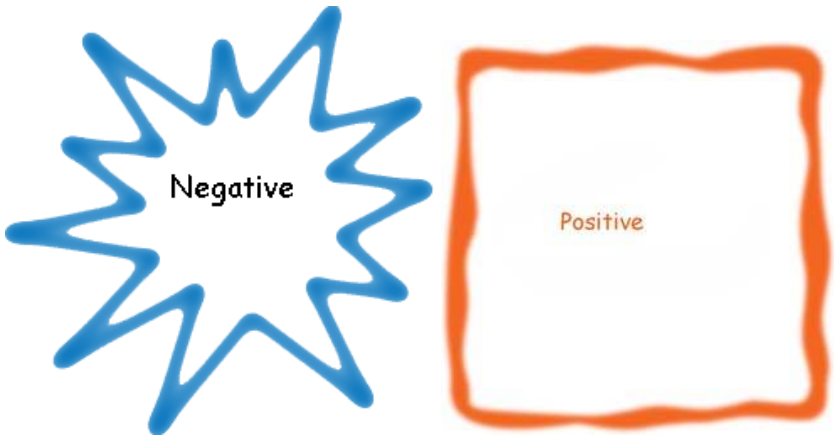


Figure 26 Example of negative and positive frames

In addition the cinematographer has the ability to animate the camera windows on the screen to illustrate e.g. changing relations by altering the distance between two camera views on screen, see Figure 27. A growing distance could e.g. signify a deteriorating social relationship whereas a shrinking distance would signify the opposite. In cases where group dynamics is a vital part of the game scenario, it is important that

this aspect is made clear to the player. In combination with the use of borders this can result in displays looking somewhat like comic book panels.

Figure 27 Two camera windows on the screen

The borders in this version of the system were static and had to be created in advance by combining two images, one mask image and one border image.

Idioms

The core of the system is a set of cinematographic idioms that decide how to sequence shots and various shot types. Each idiom controls how the camera(s) should act or react within a certain type of scene. Apart from camera placement the cinematographer also uses other techniques to enhance a scene. To make certain that the player does not miss any of the action in the scenario the cinematographer has the ability to display several cameras at once if needed, either as overlays in the main camera window or as separate cameras on the screen.

Idioms can have varying degrees of specificity ranging from very general, such as a general "two-talk" idiom as depicted in Figure 28, to very specific, such as an "short angry two-talk with dramatically changing relations". The cinematographer chooses the most suitable idiom from its collection of idioms based on the information it receives from the party server application. The information available for the cinematographer to base its decision on is:

- The number of characters involved in the scene
- Speaking character
- Listening character(s)
- Relationships that have changed between the speaker and listeners, including the amount, direction and unexpectedness of the change. This information is provided by the social model.
- The previous history of shots and scenes.
- Information provided by the rendering engine such as position or heading of avatars.
- FAP length

- Timing info from the animation server about the onset and duration of emotional expressions

The information above is also used by the idioms to create the shot sequences. For instance, the timing information from Greta tells us about the onset and duration of emotional expressions. Hence it is used to direct the camera at the speaker so the player does not miss emotional expressions while at the same time showing the other participants in the conversation. Idioms can be thought of as state machines where each node represents a certain shot type. For instance, the two talk idiom in Figure 11 starts with an establishing apex shot that shows the characters involved in the situation. Then it switches to a close up of either A or B or to an over the shoulder shot from A to B. As the scene progresses the camera switches between the different shots as dictated by the transitions and their conditions.

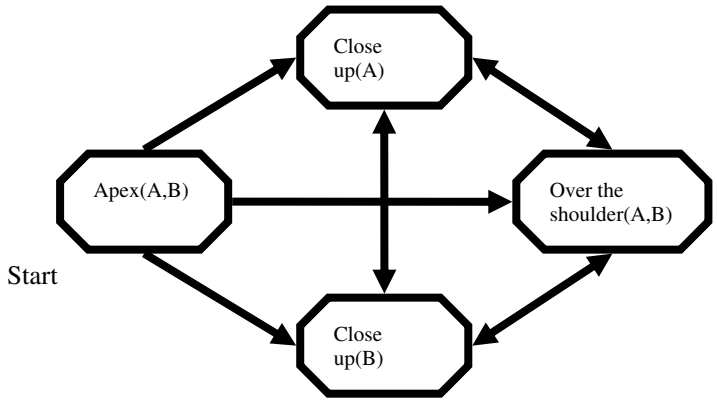


Figure 28 A generic two-talk idion

There are a number of rules that are widely accepted as truths within cinematography. For instance that shot showing the actors of a scene should be used to establish the situation for the viewer. However, none of these rules are automatically enforced by the cinematographer. Rather it is up to the authors of idioms to make sure that they are followed or not. In some cases breaking rules may be what you want to do.

Scenes

A scene in the cinematographer's view corresponds to a turn with the corresponding FAP, WAV and TIM files. The duration of a scene is in general determined by the length of the FAP/WAV file. However, if the file is very short the scene may be 'padded' to reach an acceptable duration. In general a scene should not be shorter than the duration of a single shot (2 seconds) but can be arbitrarily long.

Scenes have a sequence of pre-shots, a sequence of shots belonging to the actual FAP animation and a sequence of post-shots. Post and pre sequences can be used for establishing and closing shots or for padding the scene with shots in case it is too short to illustrate what is needed. For instance, if the scene is less than 2 seconds long, the cinematographer may add an establishing shot to the list of pre-shots, instead of adding it to the sequence of shots belonging to the FAP animation. Post shots can be used to show changing relations or to simply keep the camera on the target for a short period of time after the animation finishes, avoiding jerky cuts.

7.5 Expressiveness using dynamic shapes

In our last iteration of the cinematography component we wanted to improve on the framing ideas that we had previously worked on. In particular we wanted to make the frames more dynamic. This time we used the SOURCE engine, a commercial game engine that also powers games like Half-Life 2 as our platform. The system that we implemented was much simpler than the Magicster prototype in that it only focused on the cinematography component.

We created a shape generation function based on the Supershape formula, a mathematical equation which is an extension of the equations for the sphere and the elipse (Bourke 2002). The function takes a set of six parameters and generates a closed 2D shape that can be used as the basis for a frame. By varying the values of the parameters different shapes can be created. This allowed us to automate the process of creating frames so that different shapes can be created in runtime. In addition shapes can be animated by systematically varying the parameter values in runtime. We also added the ability add texture to the shapes or even use dynamic textures that are generated in runtime. Frames are stored as material files which are combinations of a shader and any textures that it needs.

The whole shape generation part of the system is implemented as a shader, a small piece of software that is executed by the graphics processor instead of the CPU. This allows for fast execution of the shape generation function. Once the shape is created it is blended with three images: the image which is to be framed (usually a shot showing a character), the background image, and the shape texture. The result is a shot that blends smoothly into the overall display. Figure 29 shows two examples of frames generated by the system.

Figure 29 Two frames generated by the system

The system can be used in a variety of ways apart from showing facial expressions of a character. It can be used to display a series of shots as a comic strip, in a sense like an overlay of narrative structure or like the previous system it can be used to illustrate social relationships through moving frames. In fact, the ways in which it can be used is only limited by the developer's imagination.

In order to make the system usable without having to modify the source code the cinematography system was made scriptable using the LUA extension language. By using the scripting language most aspects of the cinematography system can be controlled. This can for instance be used to create canned shot sequences that are triggered at runtime.

We also wanted to make it possible to create frames without having to resort to editing of text files. Hence we created a frame creation tool which can be used to graphically create frames. The tool consists of a simple GUI with controls for all supershape parameters that can be adjusted at runtime to see the resulting shape. While it is a leap forward from editing text files, it is still not as intuitive as we would like, mostly due to the sometimes hard to grasp dependencies between supershape parameters. In the future we would like to create an interface that would allow us to use a two-dimensional model such as Russel's model (Russell, 1980) to choose a basic shape and colour range and then add controls to tweak the shape.

Part III
Evaluating Interactive Storytelling Experiences

Part three of this thesis will cover our work on evaluation of interactive storytelling experiences. In chapter eight we will provide an introduction to evaluation of experiences and also list properties that we consider important for evaluation methods. The chapter also introduces an exploratory study that we performed in order to evaluate two methods. Chapter nine explains one of the methods, Repertory Grid Technique, and how we adapted it to fit our needs. The next chapter goes into the second method, Sensual Evaluation Instrument, and explains how the method was developed and its underlying ideas. Chapter eleven presents the study itself and results obtained from it, whereas chapter twelve summarises the experiences from the study. Finally, chapter thirteen revisits our research questions and reviews how they were addressed.

8 Dramatic Evaluation

In our daily life we are surrounded by applications, such as computer games, whose primary purpose it is to provide experiences rather than make us more efficient at tasks. Within the HCI community, this has lately spurred an increasing recognition of the importance of evaluating non-task related aspects of application usage (Blythe *et al.* 2004; McCarthy and Wright 2004). Instead of focusing on task-completion time, productivity or efficiency the important questions instead include: what kind of experience does an application provide and what emotions does it evoke? Unfortunately the traditional HCI tools available to practitioners are often not suited for evaluating such aspects. Hence there is a need to find evaluation methods that can capture some of the experiential aspects of using games and other experience-focused applications.

One area suffering from this lack of methods is interactive storytelling. This emerging art and research field concerns itself with techniques and theories for creating and explaining stories in which players interact with the storyline affecting its progression and outcome. The bulk of research conducted so far has focused on technical aspects, such as finding story representations that lend themselves to interactive manipulation and mechanisms for doing so. However, to date very few working systems have actually been produced. As a result, evaluation of interactive storytelling systems is an area that has not received much attention.

There are many reasons for wanting to evaluate an interactive storytelling system including but not limited to; a wish to learn something about what kind of experience it offers, understanding how different parts of the system contribute to that experience, or finding out how well the system performs according to some technical evaluation criteria (such as how many formally "wrong turns" the system made in the story). Depending on the purpose of the evaluation it will range from experiential to technical.

From an experiential point of view the first two motives are the most important and what shall be the focus of this chapter. Technical evaluation is by no means unimportant, but for an experience it does in a sense not really matter how many formally wrong turns a system makes as long as the experience turns out as intended. This does not necessarily mean that the experience must be 'good' or 'pleasurable' because an interactive storytelling experience can very well be agitating or discomforting but at the same time thought provoking (See e.g. Frasca 2004). In addition Laurel notes that many film genres, such as horror movies, depend on fact that even the most negative emotions can be 'pleasurable' in a dramatic context (Laurel 1993).

Interactive storytelling experiences can be evaluated both from an authorial view as well as a player view. In the former the author's intentions are compared to what the player actually experiences while in the latter the only important aspect is the actual experience. An authorial view does not mean that an author needs to have a specific plotline in mind, but simply that s/he has an idea of what kind of experience he wishes to create. If the author intended to create a tragedy but users experienced it as a comedy, then clearly the experience was not what the author intended regardless of how much the player enjoyed it. If the author intended to create a tragedy and the player experienced a tragedy albeit a different one than the author intended, the experience might still be congruent with the intended one. This latter view rhymes well with the

notion of abstract stories as suggested by Crawford (Crawford 2005) and discussed earlier in this thesis.

8.1 Evaluating Experiences

Some proponents of what is known as "third wave HCI" (see e.g.Bødker 2006) have argued that in our efforts to analyse, understand and construct experiences we are in fact making them less interesting (Boehner *et al.* 2005; Boehner *et al.* 2007). We are demystifying what should not be demystified but should remain a piece of wonder and magic in people's lives.

Experiences, according to this school of thought, are ineffable, subjective undividable units that do not easily lend themselves to deconstruction or description (Boehner 2006). For instance, people recognize a good story when they see one, without having to – or even being able to – resort to a detailed analysis of underlying reasons. This is at odds with many attempts to understand experiences. The argument goes that when we attempt to measure and analyse experiences they are simplifying them, forcing them into preconceived explanatory frameworks and are in the process de-contextualising them, making them loose their meaning to the individual that experienced them. This brings to mind the paradox of Schroedinger's cat (Schroedinger 1983). Erwin Schroedinger was a physicist that devised the famous thought experiment involving a cat to illustrate the indeterminacy of quantum mechanics. The experiment involves a cat placed inside a box together with a device that has a random chance of killing the cat. As long as the box is not opened there is no way of measuring the state of the cat, and it happily exists in a combination of states, i.e. it is both dead and alive. But as soon as the state of the cat is measured, i.e. the box is opened, the cat, through the act of measurement is forced into either an alive or a dead state. An ineffable view of experiences seems to take a similar standpoint. If we attempt to measure an experience, the measurement system interferes with the experience, and forces it to assume a state. In that translation, from something indefinable, something consisting of multiple possibilities, to something defined, a single possibility, qualities of the experience are lost. Hence, according to the ineffable view we cannot expect to get any real knowledge about experiences, in as much as there is such a thing, out of an evaluation, and moreover it suggests maybe we should not even try. That is to say, at least not using traditional evaluation methods out of the box.

While we wholeheartedly support the notion of unity of experience and support the idea of letting the magic of people's lives remain unscathed, we do believe that it is possible to find a middle ground where we can actually speak about qualities of experiences without reducing them to something less than the original. Like a rope is spliced together from numerous smaller strands which we can discern and talk about without detracting from the "ropeness" of the whole, an experience is built up from smaller strands that we can talk about without detracting from the whole—from the unity of experience. This does not in any way mean that the experiential strands, or qualities, are universal and the same for everyone. Instead they are subjective and experienced in their own way by each user. Only by collecting a number of stories from users can we begin to form some (practical) knowledge about how certain qualities are formed and how they relate to each other.

But in order to do that we need to find evaluation methods that provide us with handles for talking about user experiences without reducing them to something abstract and distant from their lived reality. The methods we use need to foster a dialog between

users and researchers, and ensure that it is the voice of the users that is salient in the results.

8.2 Criteria for evaluating interactive stories

What then should methods for evaluating an interactive story reveal? As a starting point we can consider what a method could tell us about the experience of playing story like games, in particular with respect to qualities that have been claimed to be characteristic for interactive stories, such as *agency*, *immersion* and *transformation* (Murray 1997).

Of these qualities we are mostly interested in agency and somewhat less in immersion as they have both received quite a lot of attention in the literature. Agency in particular has been claimed to be the quality that defines an interactive storytelling experience (Mateas 2001). Transformation, in the sense of being able to replay a story and have a different experience, is also an important criterion related to agency as it points to the variability of the story. Without transformation, agency would have a hard time manifesting itself.

Aspects that must not be forgotten when dealing with the characteristic qualities of interactive storytelling experiences are the more general *dramatic qualities*. Hence we were interested in finding methods that could tell us something about the dramatic qualities of the experience. Do players in fact experience a dramatic progression with an increasing level of dramatic tension, and what were in such cases factors that contributed to that experience?

Emotion is an important aspect of all experiences, one that binds an experience into a whole. Dewey states that:

> Emotion is the moving and cementing force. It selects what is congruous and dyes what is selected with its color, thereby giving qualitative unity to materials externally disparate and dissimilar. It thus provides unity in and through the varied parts of an experience. (Dewey 1934 p. 44)

However emotions are not static but change in time with the experience itself just as a dramatic experience does.

> Joy, sorrow, hope, fear, anger, curiosity, are treated as if each in itself were a sort of entity that enters full-made upon the scene, an entity that may last a long time or a short time, but whose duration, whose growth and career, is irrelevant to its nature. In fact emotions are qualities, when they are significant, of a complex experience that moves and changes. (Dewey 1934 p. 43)

As emotions are such an integral part of experiences, methods for evaluating interactive storytelling should take emotions into consideration as well. Emotion research is currently a hot topic attracting researchers from many field including psychology, linguistics, computer science, HCI, and philosophy. Of special interest to us is the work being carried out on evaluation of emotion as reported in e.g. (Isbister and Höök 2005).

Finally on a general level we were interested in finding methods for investigating the dynamic gestalt of interactive stories as discussed in chapter 3 above. Most experiences of interactive entertainment develop over time, changing from one instant to the next. Hence, we wanted to find methods that granted us access to that experience and allowed us to study its constituent parts and their development over time.

In summary, we wanted the methods for evaluating interactive storytelling experiences that we were looking for to be able to tell us something about:

- Agency
- Immersion
- Transformation
- Drama
- Emotions
- Dynamic Gestalt

8.3 Criteria for evaluation methods

A concern that we had when considering what methods to use was that we wanted them to respect the player's experience. Instead of trying to force the experience into some preconceived framework we wanted the player's own voice to come through in the material. As far as possible we sought to avoid abstracting a player's experience and instead keep it close to the original.

But in order to do that we need to find evaluation methods that provide us with handles for talking about user experiences without reducing them to something abstract and distant from their lived reality. The methods we use need to foster a dialog between users and researchers, and ensure that it is the voice of the users that is salient in the results.

From a practical perspective we looked for methods that would be usable by developers of interactive storytelling systems, to aid them in their development process. This means among other things that methods should be usable without spending unreasonable amounts of time, effort or money on the evaluation process itself. Like rules that are too complex will eventually be ignored, evaluation methods that are too complex will not be used.

In summary, the criteria that the methods should fulfil are:

- Respect the players experience
- Foster a dialog between researchers and participants
- Reasonable effort
- Reasonable cost

8.4 An Exploratory Study

In an effort to explore methods for evaluating experiences of playing dramatic games we performed a qualitative study where two methods with very different characteristics were used to evaluate gaming sessions. The study was a qualitative one interested in the unique and subjective experiences of participants. Hence we have not focused on aggregating data. Rather, each participant's test record is a story of its own. Our main goal with the study was to experiment with and learn how, if at all, the described methods could be useful for evaluating interactive stories.

We decided to evaluate two methods, one existing method and one experimental, on three different interactive stories and games. The methods were chosen because they fulfilled the requirements stated earlier but still have very different characteristics providing for a richer material. Each of the methods gives a different view of a player's

experience. The Sensual Evaluation Instrument (SEI) provides an in the moment view of a player's experience. Objects are handled *while* playing a game indicating how the player experiences the game while actually playing it.

In contrast the Repertory Grid Technique (RGT) provides a reflected account of a player's experience. Although what they are evaluating is their own experience it is not necessarily identical to the one that they had while playing the game. Players have the full range of their experience at their disposal and have had some time to digest it. Often it is not until you can relate pieces of an experience to the whole, or outcome, that you can make sense of it. A personal favourite example of this is given in Bryan Singer's 1995 film "The Usual Suspects". The plot of the film revolves around "Verbal" Kint, survivor of a massacre onboard a boat in the San Pedro harbour. While investigating the massacre the movie reconstructs events leading up to the massacre through the story that "Verbal" reluctantly tells the police when he is questioned. His story begins six weeks earlier when five criminals (the usual suspects) are dragged in by the New York police desperate for suspects on a hijacked truck, and gradually unfurls into a complex scenario involving criminal master mind Kayser Soeze, a man known for his ruthlessness that few have ever seen. Being a crippled con-man Verbal on the other hand is portrayed as a harmless figure that accidentally got involved in something out of his league. Eventually the boat massacre is determined to be a deed of Kayser Soeze and Verbal is released by the police. However, the closing scene of the movie, where Verbal walks toward a car and suddenly loses his disability, while the detective that questioned Verbal finds an increasing amount of evidence indicating that his story was fabricated, leaves us with the suggestion that Verbal Kint and Kayser Soeze are in fact one and the same.

While the story until the very end is an exciting and entertaining crime story the complete reversal at the end, casts everything in a new light and forces us to re-evaluate everything that happened in the movie. Even without spectacular reversals, a story once it has come to an end and is reflected on, provides a different experience than one that is currently unfolding. This we learnt already when we were working with a user evaluation of an early system named Agneta & Frida (Höök *et al.* 1999). Participants in the study would show one kind of reaction while interacting with the two characters and a completely different reaction when they filled in a questionnaire afterwards. Without the whole to tie everything together it can be difficult to even know what the experience is like.

9 Dynamic Gestalt and the Repertory Grid Technique

When dealing with reports of subjective experiences a common problem is that either subjects are allowed to express themselves freely, possibly rendering large amounts of qualitative data that it is difficult to structure and compare across subjects, or the evaluators will set the boundaries for what can be expressed by asking a set of predefined questions decided by the experimental leader in a questionnaire, interview, or similar. In contrast, the basic idea behind the Repertory Grid Technique is to elicit a set of personal constructs (or dimensions) for each participant which are then used to evaluate the objects being studied.

The Repertory Grid Technique is based on Kelly's Personal Construct Theory (Kelly 1955). It is a tool that was designed by Kelly to gain access to a person's system of constructs by asking the person to compare and contrast "relevant examples". Kelly originally used the tool for investigating interpersonal relationships by having people classify a selection of persons that were important to them along a set of constructs describing relationships that were elicited. The method has later been used for many other purposes including knowledge modelling and management, construction of expert systems, and lately for capturing subjective experiential aspects of a person's interaction with various forms of technology (Fällman and Waterworth 2005). Fällman and Waterworth also provide a good introduction to the method's underpinnings and use in the context of evaluation of artefacts.

Constructs are elicited by comparing elements to each other in various ways and extracting their similarities and dissimilarities. Constructs are usually bi-polar, taking on values between two extremes. For instance, we can judge people along dimensions such as tall-short or light-heavy. The most common elicitation method, and the one originally used by Kelly, is triading in which three elements at a time are compared to each other. Elements are arranged into groups of three either randomly or according to some predefined scheme. The process of elicitation itself consists of two steps: first the person performing the task is asked to name a quality that two of the elements share but not the third. Second the person is asked to name the quality that differentiates the third element from the other two. The two qualities that are elicited form the opposite poles of a construct, a subjective dimension along which elements can be differentiated. The elicitation process typically continues until the person performing it is unable to easily find any additional constructs. Together, the resulting set of constructs describes the features that a person deems to be important (or at least salient) for the elements in question.

Other methods of elicitation include, but are not limited to, pairing and symmetry breaking. In pairing, or dyadic elicitation, two elements are compared. Like in triading a quality that distinguishes one from the other is first elicited, and then the person is asked to name the contrast or opposite of that quality. In break symmetry elicitation the starting point is an existing repertory grid that contains overly similar elements or constructs. To further distinguish elements a new construct that can separate them more is elicited by comparing two similar elements and describing them in antonymic terms. In the case of overly similar constructs new elements that have opposing values along

the constructs in question are elicited for instance "Name a person that is both tall AND fat".

The next step in the process is to form a repertory grid by rating all elements along the elicited constructs. Typically a numeric scale is used where one pole of a construct corresponds to the low extreme of the scale while the other pole corresponds to the high extreme of the scale. For instance for a construct describing people as short or tall using a five point scale, 1 would correspond to short and 5 to tall.

Once the grid has been constructed various forms of statistical and other analyses can be performed to further explore the grid data. The most basic form of analysis that is typically performed is to create a display matrix which shows the numerical values assigned to the elements along all constructs. The resulting table contains one row for each construct that shows the rating for each element (for that construct), and one column for each element that shows the ratings for all constructs.

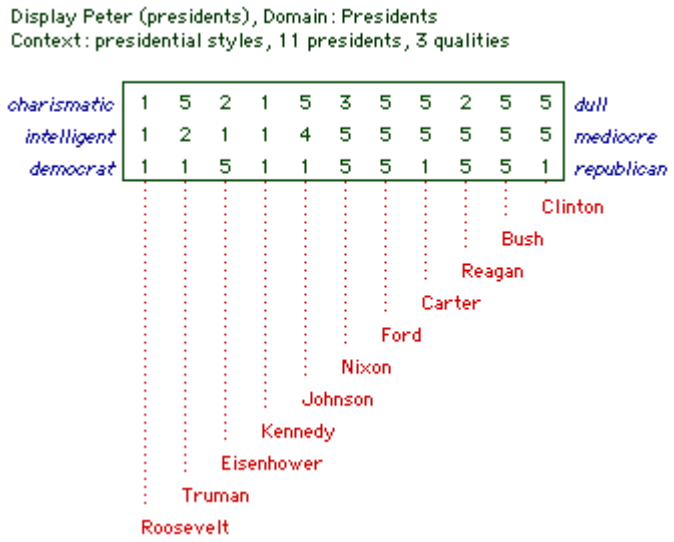


Figure 30 A display matrix for a grid comparing American presidents

Figure 30 shows an example of a display matrix for a grid comparing American presidents available at the webgrid site[5]. Here we can see that e.g. Roosevelt is considered charismatic (1 on the charismatic-dull construct) while Bush is considered dull (5 on the same construct).

Another form of analysis that is typically performed is clustering of elements and constructs to find similarities in the data. A common algorithm used for this purpose is the FOCUS algorithm, that is used by the webgrid application. The result of the clustering process is visualized as a diagram resembling the display matrix but with elements and constructs ordered so that similar ones are adjacent to each other. In addition a tree structure along the side or top of the diagram visually indicates the degree of similarity between elements/constructs. Figure 31 shows an example of a FOCUS diagram generated from the same presidential data that was used for the display matrix. Elements are considered similar if they have similar ratings along the constructs. For instance, we can see that both Bush and Ford are considered to be dull, mediocre republicans (both having a rating of 1 on all constructs), and are thus placed next to each other in the diagram, while Kennedy and Roosevelt are adjacent because they are both charismatic, intelligent democrats (both have a rating of 5 on all constructs). Constructs on the other hand are considered similar if they contain similar ratings for each of the

[5] http://tiger.cpsc.ucalgary.ca/

elements. Here we can see that dull-charismatic, and mediocre-intelligent are considered to be fairly similar because they have similar ratings.

The tree structure on the right of the diagram also shows us the degree of similarity between elements/constructs. Here we can see that the elements Roosevelt and Kennedy are 100% similar and that the constructs dull-charismatic, and mediocre-intelligent are 80% similar to each other.

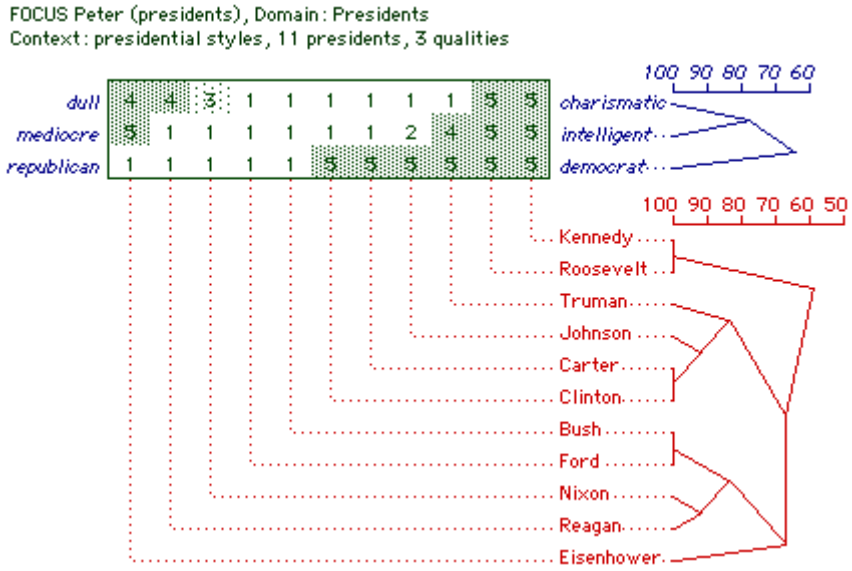


Figure 31 A clustering analysis of a repertory grid.

A final way of analysing grid data that is commonly used is principal component analysis. Here each construct is treated as a vector in a multi-dimensional space. The vectors are rotated to provide the best fit to the grid data and then projected to a two dimensional plane. The result is a diagram showing each construct as a line, an axis in the space, and each element as a point placed at the coordinate corresponding to its ratings along all constructs (axes). The diagram shows how well the constructs separate the elements and also which elements that are similar. The closer they are the more similar their ratings along the constructs are. Figure 32 shows an example of a principal component analysis and its associated diagram generated from the presidential data.

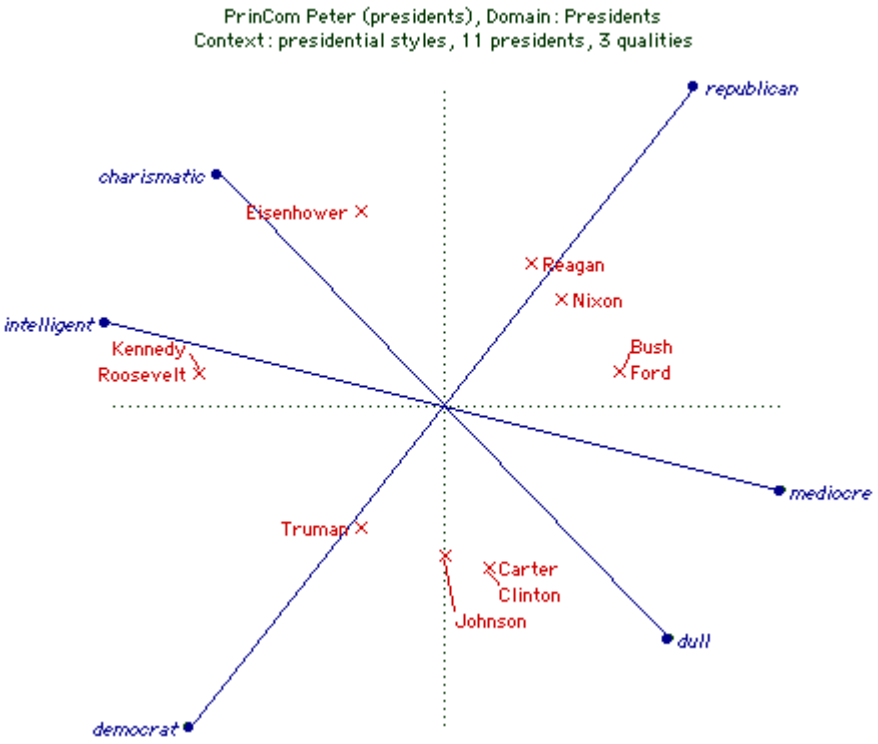


Figure 32 A principal component analysis of a repertory grid

9.1 Adapting the Repertory Grid Technique

As far as we know RGT has not previously been used for evaluating the dynamic progression of an experience—its dynamic gestalt (Löwgren and Stolterman 2004). Hence our use of the RGT method for evaluating such experiences presented us with a few problems that had to be solved. To date RGT has been used to evaluate concept structures, and more recently to evaluate qualities of objects. As these are in a sense static it is easy to compare them in different ways and from those comparisons extract distinguishing qualities. Even in the case of artefacts that are used dynamically, such as a mobile phone, the experience of use is usually condensed into qualities that are ascribed to the phone itself, e.g. easy menus. What "easy menus" in reality refers to is the experience of navigating through the menu structure as it evolves over time. Note that we are not trying to separate the material cause of the experience, the menu in this case, from the experience itself; it is an undistinguishable part of it. Rather we are trying to make the point that evaluating artefacts and evaluating the experience of artefacts is not necessarily the same thing. A trademark feature of interactive experiences is that they are dynamic; they evolve over time, changing in time with the patterns of interaction that emerge. Therefore we needed to find a way of using RGT that would let us tap into this stream of experience and study its journey towards fulfilment.

An approach that would not have required a modification of the RGT method would have been to simply let participants play all three games, or preferably a larger number of games, and then performed a traditional RGT evaluation comparing the three games. This would have resulted in the same kind of condensed qualities that could be ascribed to the games, as in the mobile phone example above.

However as this would have required more time and effort from both experimenters and participants, and still would not have let us study the dynamic gestalt of the experience itself, we decided to try another route.

The solution we came up with was to record each participant's session to a computer's hard drive, and afterwards divide the recording into segments which were then used as elements in the RGT evaluation. By doing this we hoped to be able to capture the discerning qualities of the experience through the elicitation process (much as we would in a normal RGT evaluation), but also the development of those qualities over time through the rating process. The evaluation became within each game rather than between the three games.

9.1.1 Analysing grid data

A question of some interest to us was whether the analysis methods that are commonly used to analyse grid data would be useful for our purposes. Below we will give examples of how we believe that such methods can be useful for analysing experiences. The examples we provide are based on material from the study which will be discussed in detail in chapter 11. Here we only bring up a few illustrating examples to show why we picked one particular analysis method. Note that the examples are intended to exemplify how traditional RGT methods can be used in the context of experiences. As such they have been chosen for clarity and sometimes focus on aspects that may seem trivial.

The display matrix, the simplest form of analysis, does not seem to provide very much in the way of analytical power. However the matrix does provide a barebones view of the grid data that can be useful for exploration. In addition, as noted by Fällman (2003) one thing that the display matrix does preserve is the order in which the constructs were elicited. In theory this could say something about how salient constructs are to the participant or possibly how eliciting one construct triggers the elicitation of others. But as triading of elements is random and elicitation of constructs will depend on the elements being considered, it is questionable.

Figure 33 shows a display matrix generated from participant S9's repertory grid. The table shows that the participant thinks that the episode in the game corresponding to movie segment F7 is exciting (a rating of 1 on the *exciting – frustrating* construct) while F12 is frustrating (rated 5 on the same construct).

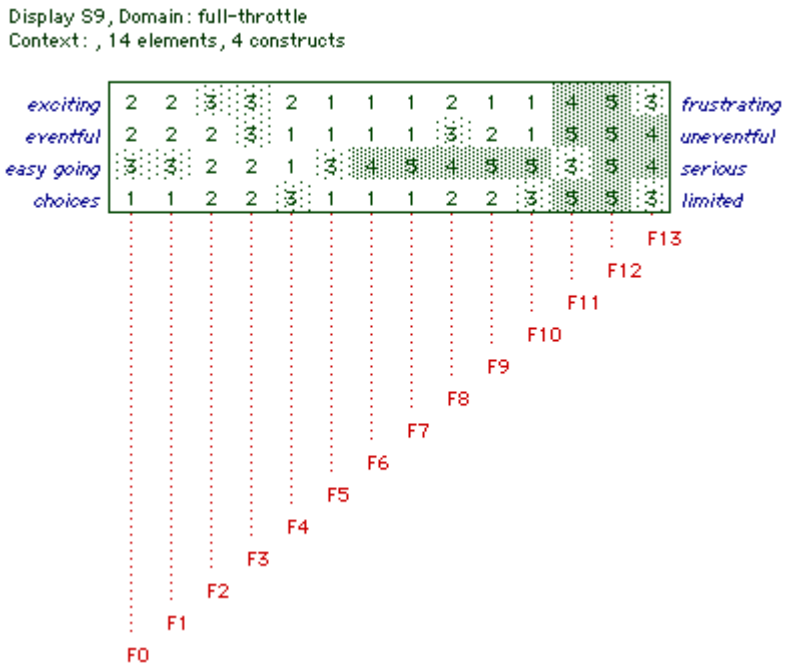


Figure 33 A display matrix showing participant S9's grid

While reviewing the display matrices we noticed that for some participants the elements and constructs seemed very similar. This was confirmed when we moved on analysing the grid data using the FOCUS algorithm. Figure 34 shows a focus graph for participant S7. Here we can for instance see that the constructs *follow the story – explorative* and *unengaging – engaging* are similar (~90% similarity according to the clustering algorithm), meaning that they have similar ratings for all elements. One possible explanation for similarity between constructs is that that are used as synonyms for describing the same kind of experience which means that they can be merged. This is the approach used by Fällman for condensing the repertory grids of multiple participants. By entering the data from all participants into a single grid and applying the clustering algorithm, groups of constructs that are similar emerge, and can be combined (Fällman 2003).

However, although constructs are sometimes very alike in terms of numerical similarity they do not always seem to be used as synonyms. Instead similarity (or antonymity) can hint at possible cause and effect relationships in the player's experience. For instance in the case of participant S7 in the previous example the reason why s/he feels more engaged might be due to the fact that s/he had more opportunity to explore the game rather than being stuck in the story, resulting in the similarity between the constructs. This in turn tells us something about the importance of the interactiveness of this particular story and a potential lack of alternatives. It may well have been that users lacked alternatives, but still found the story engaging. For this user, however, this is not true. When asked about how controlled s/he felt by the game in the interview part of the evaluation the participants reply seems to give credit to this explanation: "Fifty, fifty. You always want to be able to do more, try out new things once you got the taste for it. So, in certain parts you could do a lot, while other parts became a bit more boring…"

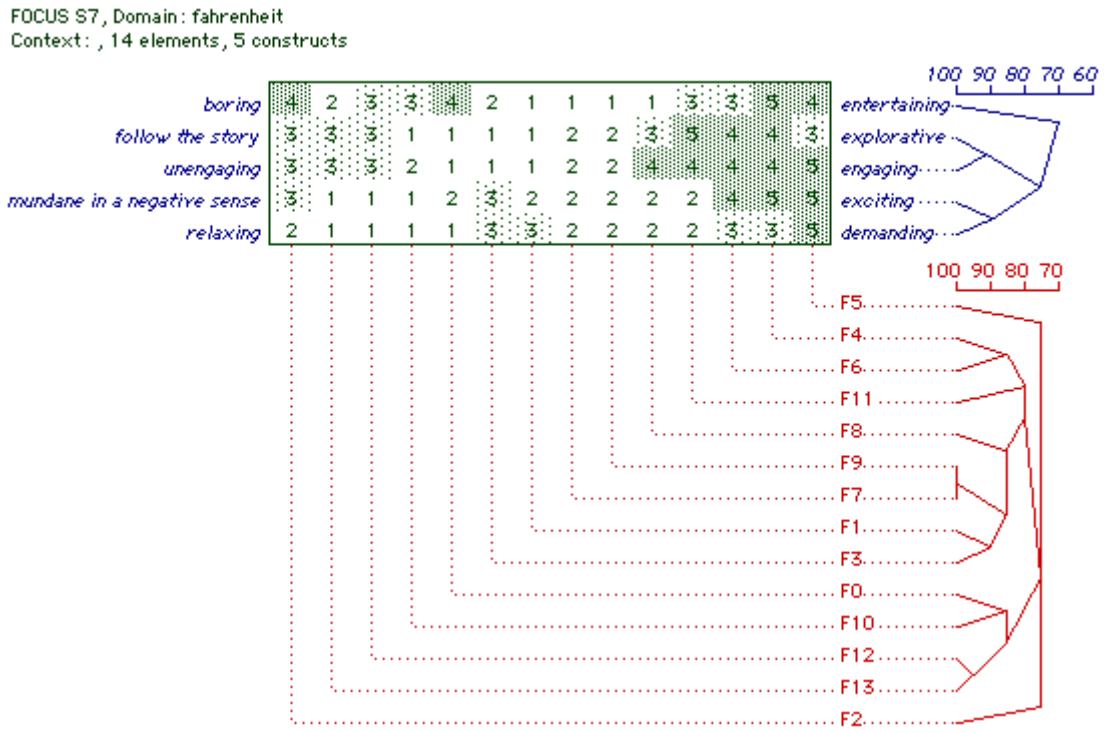


Figure 34 A focus graph analysis of participant S7's repertory grid

It is not immediately apparent how an indication of similarity between elements could be useful in our case as the elements are movie clips from a gaming experience. However, one possible use is that a similarity comparison can provide an overview of the variety of experiences within the larger experience. Does it consist of a string of unique experiences, each with its own rating, is it dominated by a few larger experiences that permeate the whole, or is it something in between? Hence, while the number of constructs may give an indication about the qualities of an experience, similarity/diversity in rating may give an indication about the dynamicity of the experience. For instance, an experience may have many facets (constructs) that do not change very much indicating a less dynamic experience. But you may also have only a few constructs that change a great deal during the session, indicating a more dynamic experience. For instance, in participant S2's focus graph we can see that there are two groups of elements that have exactly the same ratings: F0, F6, F8, F11 and F9, F10, F12. Together these two groups account for half of the elements in the grid.

Two important aspects of this participant's experience thus seems to be a sense of *open argument, being out of it, and dejection* on the one hand and *open argument, being out of it, and expectation*, on the other hand. As we can see the only difference between the groups is that the first group has a rating of 1 (dejection) on the *dejection – expectation* construct, while the second group has a rating of 4 (towards expectation) on the same construct. As the rest of the constructs in both groups all have the same rating they do not provide an explanation in terms of cause and effect as discussed earlier for the participant's rating. In cases like this we need more information to understand the cause of the differences between the ratings and may point at areas of the experience that require further investigation. In the interview the participant stated that s/he did not feel that s/he could influence the progression of the story very much "…except in the end when I constantly kissed her [grace], that might have had some influence…". Looking at the sequence number of the segments included in the second group, F9,F10,F12, we see that they all happened towards the end of the participant's session.

Hence one explanation for the difference in ratings between the two groups is that in the latter case the participant experienced a sense of expectation at what would happen in response to the kisses.

Sometimes it may also be possible to find the same kind of causal links that were described earlier while comparing elements instead of constructs, although we did not find any good examples of that in our data. Using participant S2's grid as an example (Figure 35) an experience could for instance be described as having a higher sense of participation because of a more hidden argument.

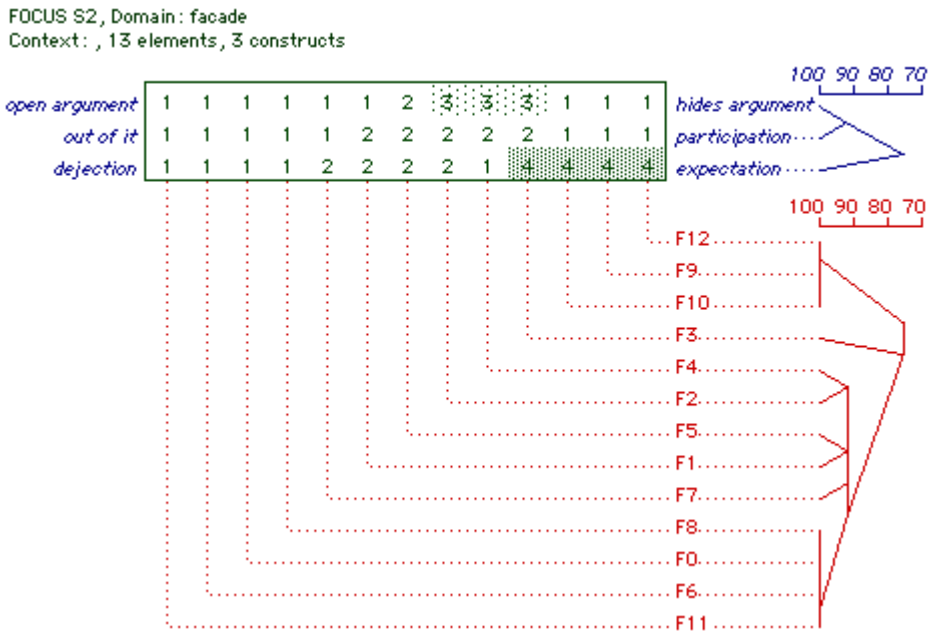


Figure 35 A focus graph showing participant S2's grid

9.1.2 Comparing grids

In order to analyze multi-participant grids they need to be merged. If the number of elements is fixed, grids can be merged along the lines described by Fällman (Fällman 2003). However, when working with a variable number of elements, as was the case in our study; along with the fact that each element in essence is unique, elements depict episodes from one participant's experience; there is no straightforward way of automatically comparing or merging grids. Even in cases where the number of video clips, as well as their length, is identical, the content of the clips themselves will most likely differ rendering a comparison of the same element from different players useless. One possible way of making grids comparable would be to sequence the video at important moments as defined by a researcher. However, in doing so we would move away from our goal of not forcing a player's experience into a pre-defined framework, as we would be telling the player what is important and what is not. Since we did not wish to do that manual comparison of grids analysed along the lines described above seems the only reasonable alternative.

There are however at least two approaches that may provide us with some added analytical power regarding multiple grids. First, constructs can be viewed as labels describing the experience; second, the development of constructs over time can be plotted giving us the means for a visual comparison of experiences. To our knowledge

these two approaches constitute an addition to the ways in which RGT has previously been used.

In classical dramatic theory stories are often visualized as curves that describe the emotional tension created in the reader/spectator (Laurel 1993). Tension is caused by unresolved conflicts and unsettled emotions in the story. During the exposition phase tension rises slowly as the setting of the story and its main characters are introduced. An inciting incident then adds momentum to the story leading to a quick rise in tension. Eventually tension builds to a climax where conflicts and emotions are resolved. After the climax tension quickly drops and the story eventually ends.

One of the ideas we had when performing the RGT evaluation was that we wanted to plot the elements along a time axis, to see if anything resembling a dramatic arc would sometimes emerge. If nothing else it would give us a better overview of how a participants experience develops over time.

Individually, each curve can be viewed as one aspect of the player's experience, and shows how that aspect evolved over the course of the session. Together the graphs can give a broad overview of the dynamic gestalt of an experience such as an interactive story. Using a plot like the one we have suggested could be a useful tool for designers and developers debugging their interactive storytelling systems.

In section 12.2 below we will come back to how well the RGT method managed to capture the design qualities that are important in interactive storytelling.

10 The Sensual Evaluation Instrument

The Sensual Evaluation Instrument (SEI) is an experimental tool for non-verbal self report of affective state that is under development (Isbister *et al.* 2006; Isbister *et al.* 2007). The basic idea of SEI is that subjects will use a set of designed physical shapes while interacting with the object of evaluation to convey their experience, instead of reporting in verbally. The instrument consists of a set of organically shaped objects that are meant to evoke different emotions in users albeit without having a predefined meaning. Instead, users are free to make their own coupling between objects and emotions. Figure 36 shows an overview of the sensual evaluation instrument objects.

Figure 36 The Sensual Evaluation Instrument object set

In the present chapter we will give an account of how the instrument was developed. It is not included as a contribution to this thesis although the author has been involved in its design and development. For the work presented here we were concerned with exploring what the instrument could tell us about interactive storytelling experiences, rather than developing the instrument *per se*. However some results regarding the calibration procedure described below are relevant for this discussion and are therefore presented here rather than later on for clarity.

The following section is based on two previously published articles (Isbister *et al.* 2006; Isbister *et al.* 2007) which will influence the presentation style in these sections.

10.1 Developing the SEI

Practitioners in the CHI community have become increasingly convinced of the importance of affect—both in terms of designing experiences for users which take it into account (Picard 1997; Norman 2004), and also in terms of developing measures for user satisfaction with such systems (Isbister and Höök 2005).

There are various modes of approach to measuring affect. Traditionally, affect has been ascertained in two primary ways: using questionnaires administered after an experience, which ask the user to rate his/her feelings about what occurred, and analysis of videotaped sessions with users that typically combine interpretation of think-aloud commentary with deciphering of other cues of emotion (smiling, gestures and the like) to develop an impression of user's affective reactions. In recent years, additional tools based upon biometrics have evolved – measuring galvanic skin response, detecting small movements of the muscles of the face, tracking pressure on the mouse (Picard and Daily 2005). These signals provide a complex trace of the user's affect which many in our community (and in the psychological and physiological communities) are still working to understand adequately.

Our own efforts in developing an affective assessment tool have been shaped by our past work in understanding and enhancing nonverbal communication, our commitment to user-centred design, and our interest in trans-cultural methods to support global design practice.

The Sensual Evaluation Instrument project emerged from a European Network of Excellence initiative called HUMAINE (mentioned above in section 1.2) focused on the study of affective systems. Our work group in the project is dedicated to exploring ways and means for evaluating a system's affective impact on users. As we gathered sources and learned about existing methods, we found that there was still much work to do in refining methods for eliciting and understanding user affect.

With the Sensual Evaluation Instrument we wanted to create a tool that allows flexibility for users to adapt it to their own style of expressing affect, toward creating a dialog between designers and users that enhances design. While we did aim for some level of consistency in response to the instrument's qualities, we were not solely focused on consistent use patterns nor would we claim that this is a highly accurate tool for measuring affect. In this regard the aims of the project differ radically from other self-report measures, and our instrument should be viewed as complementary to rather than as an alternative to other measures.

Our research approach arises from several baseline principles:

1. a belief that freeing the person giving us affective feedback from words, and incorporating the use of their body to give feedback, will be beneficial;
2. the belief that self-report is a valuable practice, as part of a user-centred design approach;
3. an interest in creating a flexible and portable tool that can be widely used, that could transcend language and culture;
4. the desire to create an expressive, open ended tool that does not remove all ambiguity from communication by the user but rather offers a range of expressive possibilities.

In Support of a Body-based, Nonverbal Approach

Neurophysiologists and psychologists have in recent years proposed that our brains, rather than operating in a wholly logical, conscious verbal manner, actually process information and make decisions using various layers working in parallel, complementary ways (Damasio 1994). They have demonstrated, for example, that we can learn something new and 'intuitively' put it into action before we are able to consciously verbalize it (Myers 2002). Affective processing, in particular, has been shown to occur at levels other than the cognitive/word-oriented level of the brain (e.g. the primal nature of fear: see LeDoux 1996). Emotions are experienced by both body and mind. Often, they are evoked by sub-symbolic stimuli, such as colours, shapes, gestures, or music.

If we rely on the verbal channel for self-report of affect during interaction with a system, we may be missing out on much of this information, as it is filtered through the person's verbal system. Several of the project members have explored the role of nonverbal expression in interface in the past, and have found the body to be an important channel for communicating affect and other qualities (Isbister and Nass 2000; Fagerberg *et al.* 2003). We decided that our affective instrument would be sensual and physical in nature, to allow us to access this part of a person's experience more directly. In addition, we hoped that avoiding verbalization would make it more likely that users could give in-line feedback without their task being as disrupted as if they had to explicitly verbalize their current affect.

User-centred Design Values

In our group, we had a long-standing commitment to user-centred design practice, and finding ways to bring users into the design process earlier in development cycles to strengthen final design outcomes. To the extent that a usability practice is intuitive and simple to operate and analyze, it becomes more likely to be adopted for use during development, especially during early stages when significant change is still possible. Our experience has been that tools which have a hope of being used well in early design practice need to be flexible—allowing for variance in user's approaches and mental models of what they are doing, and ranges of mode of expression. A modicum of ambiguity in the tool at this stage is good rather than bad, as it allows users to co-define the meaning of their feedback with the designer, to reach a richer shared picture of what is going on (Gaver *et al.* 2003). This is especially appropriate for a tool to measure affect – models of emotion from the realm of psychology are not always fully descriptive of (or useful in the context of) measuring affective reaction to a system. Some emotions rarely come into play when engaging with computer systems, and the ebb and flow of reaction to a system is not necessarily the same as that which occurs in face to face interaction among people. Part of the hidden work of this project, then, was learning about which emotions are truly relevant in the context of evolving successful interaction with computer systems, and offering ways to express those emotions with our research instrument.

Practical Considerations: A Portable, Flexible, Cross-culturally Valid Instrument

By avoiding verbalization, we also realized that we had a chance of developing a less culturally dependent research instrument. Questionnaires must normally be translated and counter-translated to insure that they are truly measuring the target emotion, even though there is strong evidence for trans-cultural similarities in basic emotional response.

Perhaps a nonverbal, body-based approach could tap more directly into these shared responses, saving designers time and energy, and again, leading to greater likelihood of early user participation in design. We were inspired by the work of Liz Sanders (Sanders 2008), Bill Gaver et al. (Gaver *et al.* 1999; Djajadiningrat *et al.* 2000; Gaver *et al.* 2003), and others, in conducting inquiries that move freely beyond the lab and into various cultural settings. Thus from the beginning, one end goal of our project was the creation of a 'kit' that could be easily shipped to others around the world for use.

And Finally, in Support of Fun

In the context of the SEI development, we took the notion of 'Functional Aesthetics' (Djajadiningrat *et al.* 2000) to our hearts and would like to extend this notion to the design of methodologies as well as end products. Particularly in the study of affect, we feel the experience of giving feedback should be pleasant in and of itself.

10.1.1 Designing the Sensual Evaluation Instrument

The SEI object set was designed through an iterative process that went through several stages. The first stage started by exploring work-to-date on nonverbal self report measures. There was some history of the standardization and use of nonverbal scales in psychology (e.g. PONS (the Profile of Nonverbal Sensitivity) (DiPaulo and Rosenthal 1979), from which we could draw lessons.

Most work done on nonverbal systems of evaluation has involved anthropomorphic imagery (likenesses of human faces and/or bodies). For example, researchers who work with children have established the value and reliability of face-based Likert scales for determining emotional responses to systems and situations (e.g. Wong and Baker's work on children's subjective evaluation of pain—see Figure 37) (Wong and Baker 1988).

Figure 37 A pain scale used to help children indicate their level of discomfort.

There are also popular uses of nonverbal affective scales (thumbs-up and down movie ratings, the 'little man' on the San Francisco Chronicle movie review page (http://www.sfgate.com/eguide/movies/reviews/ see Figure 38), indicating that calibration and use of nonverbal scales is possible and appealing in everyday contexts.

Figure 38 The San Francisco Chronicle's movie review system uses facial expression and body posture to indicate a movie's quality.

Finally, there has been some work in the product design community on mapping product qualities to affective reactions, for example, the facial wheel (Figure 39) used by

Wensveen and colleagues in developing an affectively appropriate alarm clock (Wensveen 1999; Wensveen *et al.* 2000).

Our wish was to move away from discrete, pre-defined emotional labels such as faces, figures, or names, and move toward some form of nonverbal code that allowed more open-ended interpretation but that still evoked emotion without explicitly representing the human form. We also hoped to extend the sensory experience of this instrument beyond the purely visual.

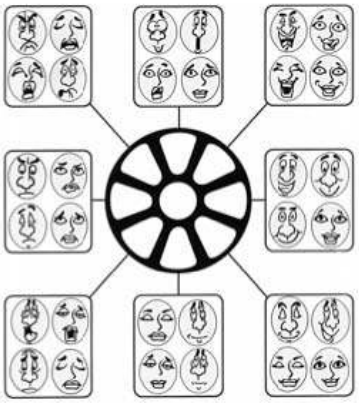


Figure 39 Facial expressions arranged along the axes of arousal and valence, used to help product designers gauge user emotions about designs.

There is some non-representational work on sensing emotion in alternate sensory channels. For example in his book Sentics, Clynes describes characteristic movement patterns on a touch pad when users are asked to 'perform' a particular emotion with their finger (Desmet 2003). Sundström's et al. work on eMoto, a non-representational system for adding affective content to SMS messages on mobile phones, is an example of the use of gesture and touch to generate an emotional response (Fagerberg *et al.* 2003). Product designers know that surface materials and their tactile qualities can profoundly impact users' emotional response to products (Green and Jordan 2002), but there has been little systematic work done up to know to assess the specific emotional effects of various materials.

Exploration One: Personal Home Objects

To begin the project, we decided to apply one traditional model of emotion to everyday household objects, to see what sort of physical properties caused them to be arrayed in which places in the emotional spectrum. We worked from the Russell circle (Russell 1980), which arrays emotions along two axes: arousal and valence. A high arousal, high valence emotion such as ecstatic joy would be located in the upper right quadrant, for example, whereas a low arousal, low valence emotion such as depression would be located in the lower left quadrant. The way we represented this was through using the animated, colourful representation created by Anna Ståhl (2005). We had several researchers bring in objects that had emotional meaning for them, and array them upon a circle projected onto the floor (see Figure 40). This early experiment revealed many properties of objects that help to evoke emotion: material, shape, 'give' in the hand, colour, size, as well as memories associated with the object.

Figure 40 Household objects arrayed on the Russell circle

Exploration Two: Coloured Cylinders

We decided to isolate one dimension of the many object properties we found in step one, and test how people would use this dimension to convey their emotions while interacting with a system. We chose colour as our first variable, as colour had strong connotations in the first test. We crafted coloured objects that could be held in the hand, and which were similar in weight, texture and other properties, differing only in colour. Then we brought in several people not familiar with our research, and asked them to do three things:

1. Create their own taxonomy of the objects, using the projected Russell circle (as we did in the initial test).
2. Interact with a computer game that evoked strong emotions, and use the objects to convey how they felt.
3. Discuss with us how it was to use the objects to convey emotion.

Our testing revealed that some people used the coloured objects to create a personal taxonomy of affect, but others found that their own narrative connotations for colours (e.g. red and green remind me of Christmas) got in the way of crafting and re-using a personal affective taxonomy during the game play. We also found that users were experiencing emotions that did not match neatly to their initial taxonomy, and were not sure how to indicate them—such as mild frustration, confusion, anticipation, and the like. These were not what they typically thought of as 'emotions' in the everyday sense, so they hadn't really planned how they would express them.

Based upon these results, we made two key design decisions:

1. We would move to a more biomorphic framework upon which to vary the objects, one that we hoped was less subject to narrative overlays. We drew from work by Disney animators in crafting less explicitly anthropomorphic forms that still managed to strongly convey emotion. We were also influenced by prior investigation into qualities of movement and its analysis (e.g. the work of Laban; see

(Fagerberg *et al.* 2003) for further discussion of movement analysis and expression of affect.)

2. We would take note of the emotions that users expressed during this test, and incorporate system-use-based emotions into our subsequent design thinking. How might one express mild frustration, confusion, and the like? These were the sorts of feedback we wanted to support with our instrument.

Creating the object set

At this point we solicited the support of a professional sculptor who had experience in crafting biomorphic forms. Rainey Straus (see www.raineystraus.com for more examples of her work) crafted a set of objects that had biomorphic qualities, working from ongoing discussions with us, and from a list of emotions we provided that was based upon our exploratory studies. The initial list was:

- Confusion (I don't get what is going on here)
- Frustration (what the system just did drove me nuts; or, I can't solve this level and I hate this right now)
- Fear (the game is making me anxious; or, I think I might have erased the wrong files)
- Happiness at success (I just cracked a new level; or, I just figure out how to do something new)
- Surprise (positive – something good that I wasn't expecting happened; or negative – something bad I was not expecting happened)
- Satisfaction (something happened that I like)
- Contentment (all is well. Things are going smoothly)
- Frantic stress (things are out of control, too much going on)
- Flow (I'm in a groove right now, really enjoying working with the system, we feel as one)
- Neutral (not feeling anything in particular at the moment, just working…)

She crafted a total of eight objects, not necessarily meant to be a one-to-one mapping to these emotions, but rather a successful set of tools for evoking/expressing this range of emotions (see Figure 41) and Straus created the objects in clay, then we had them cast in plastic in order to have a durable surface and multiples for use in different lab settings.

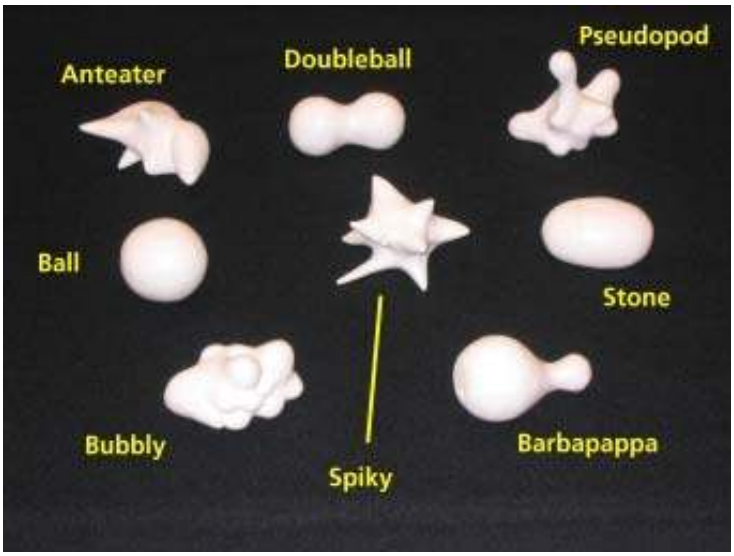


Figure 41 The Sensual Evaluation Instrument objects.

Internally, we assigned names to the objects to make it easier to code data and speak about them. Figure 41 shows the names assigned to the objects (barbapappa is named after a figure from a French animated cartoon popular in Sweden). We did not use these or any other names for the objects with participants.

10.1.2 Testing the object set

With the cast objects in hand, we designed a study to assess whether this new instrument would allow people to provide meaningful affective feedback while they engaged in interaction with a computer system. The aim of the study was both to explore use potential for the object set, and also to engage the students and faculty in a discussion of the act of using the objects, and potential interactions/innovations toward a refined design.

The study consisted of the following five phases:

- Explanation of research purpose and orientation to the objects. In this phase, the participant was shown the objects and encouraged to handle them, and the experimenter described the purpose of the research and emphasized that any type of usage of the objects to convey affective state was fine (multiple objects at once, movement of objects, and so forth).
- Use of objects with a subset of the IAPS (International Affective Picture Set). In this phase, the participant was shown a series of images taken from the IAPS (Lang *et al.* 2005) and asked to use the SEI objects to indicate affective response to each picture. (See the Findings section for examples of the images used). The images were selected because their arousal/valence scores mapped roughly to the emotions that the artist initially intended to convey with the objects.
- Use of objects with a computer game. In this phase, the participant played through the first puzzle in a PC adventure game, The Curse of Monkey Island, and was instructed to use the objects to indicate affect during play. The experimenter was present during this phase, and was available to offer hints/tips on using the game during play.

– Use of objects during a chat. After the game, the participant was asked to chat using AIM instant messaging with the experimenter's assistant, to discuss how it was to play the game. The experimenter left the room during this portion, after instructing the participant to use the objects to indicate affect while chatting.
– A discussion of how it was to use the objects to give affective feedback. At the end, the experimenter returned and walked the participant through a series of questions about what it was like to use the objects, including solicitation of suggestions for improvement of the SEI. Questions included: What was it like to use the objects to express emotion? Did you find that you had a consistent set of mappings? How hard or easy was it to use them? Any other thoughts? Suggestions for changes or alternatives?

The sessions were digitally recorded (with participants' consent), using a picture within picture format, so that we could later analyze usage in conjunction with what the participant was seeing on-screen. The study was first performed in the US and later replicated in Sweden in order to make cross-cultural comparisons possible. The results from the studies are reported in (Isbister *et al.* 2006) and (Isbister *et al.* 2007). In addition to the US results, the latter also includes the Swedish results and makes a cross-cultural comparison between the countries.

Results

The studies showed that there is great variance in how the objects are used. Some prefer to use a single object at a time, some use several objects simultaneously and sometimes stack them on top of each other, and others prefer to hold "active" objects in their hand while interacting with the system being evaluated. Frequency of use during the sessions also varied considerably (0-57 for US participants and 0-37 for Swedish participants). Some participants did not use the objects at all while others more or less constantly interacted with the objects in some way.

There were also patterns in usage during the session, and in discussion afterward that suggested consistent underlying dimensional mappings. Participants tended to describe the smooth, rounded objects with fewer protrusions as happy, or calm, or fun in the post-discussion, and to use them when in such situations during play or chat. The ball was frequently given a higher energy positive attribution than the stone, which was described as boring or as zenlike calm in post-discussion. Spiky and anteater got fear and anger attributions from most participants. Anteater was however, also described as an object that could shift meaning as it is rounded on one side and spiky on the other. Malicious humour was suggested as one interpretation of the object by both Swedish and US participants. Barbapappa was often used to indicate humour. Bubbly was used for both humour and for confusion and frustration. Many participants commented that the bubbly form seemed chaotic and suggested confusion or indeterminacy. Pseudopod received some similar reactions—one participant used this to indicate that he had a goal in mind but it wasn't wholly resolved—a feeling of directed anticipation.

During the calibration task of the study many participants showed a tendency to select objects due to similarities in the contours of the SEI object and what was in the photo—for example, spiky looked like the shark's teeth or the fireworks, and bubbly resembled the beehive. As this did not happen during the other two tasks IAPS may not be the most reliable way of calibrating the SEI, as it relies on still images that can be analyzed purely visually rather than unfolding snippets of experience.

A full account of the results from both studies can be found in (Isbister *et al.* 2006; Isbister *et al.* 2007).

Anecdotal Discussion

Participants gave us both positive and negative feedback about this method of providing affective information about using a system.

Participants commented that they liked holding the objects in their hands—especially the smoother ones. One participant remarked that "They were fun to play with, just to roll them around in your hand". This participant had an object in hand almost constantly during the session. Several participants said that they would rather use the objects than fill out a questionnaire. One participant said that "I'd do this over surveys any day. I hate surveys!" The participant explained that he liked being able to give feedback during as opposed to after, and that he liked having more than one object and being able to change their orientation.

Some participants found the object set less than ideal for them and wanted more varied objects. For these participants emotions such as joy, sadness and despair did not seem to be present in the object set. Furthermore stone and ball were seen as too similar and in addition participants did not seem to find double ball very useful.

Participants also made some very interesting suggestions for evolving the instrument, which included:

- adding the ability to squeeze or shape the objects somehow with one's own grip, to further indicate emotion.
- adding droopy objects to indicate despair or low energy level.
- introducing scale and texture as variables.
- having a visible representation of the objects on screen to make them easier to remember and use without disturbing the task.

General discussion of results

This testing exercise seems to indicate that we are on the right track in our design of the Sensual Evaluation Instrument. Specifically:

- It seems to be fun and engaging for people, in part because it makes use of the body and sense of touch, and also because it allows for flexibility in response.
- There are indications (through use patterns and comments afterward) that this is a feasible way to give in-process feedback without too much disruption, as we had hoped.
- Use patterns and verbal descriptions seem to indicate that this could be evolved into a reasonably consistent instrument in terms of general affective dimensions, while maintaining a flexibility of expression for participants.

We believe this approach holds promise and are pursuing it further. The first and most important follow-up step is to establish that this instrument can provide helpful feedback to a designer of a system. We will also continue to evolve the object set along the lines suggested by our findings, and also explore the possibility of embedding sensors in the objects to allow us to record and understand participant's gestures with the objects (as with the eMoto system).

10.2 A note on calibration

During the study reported in this thesis we also performed the calibration task. One of the reasons for performing a calibration session with the SEI objects before they were used in actual gaming sessions by our participants was to get an idea of what experiences they would associate with the objects. An underlying thought is that if some of the "meaning" that a participant ascribes to an object can be gleaned beforehand that "meaning" can then be ascribed to situations where the object is used.

Figure 42 Four sample images from the IAPS exemplifying high arousal/negative valence (above) and lower arousal/positive valence (below)

Considering the images arrayed by the primary dimensions used in the IAPS (arousal and valence, see Figure 42 for sample images, and Figure 43 for object use), there were similar trends in the use of objects, as has been reported in previous experiments using the SEI although not as pronounced. Images associated with high negative valence in particular did not see the same amount of usage of sharp objects as in previous experiments. An examination of the reported reasons for choosing objects reveals that participants in this study often selected objects based on other reasons than emotion. For instance, several participants selected the doubleball or ball objects in response to the picture of a gun pointed towards the viewer as they thought it resembled them of a bullet emerging from the barrel of the gun. Another subject (S2) stated that the image of a gun pointed towards the viewer reminded him of a movie poster rather than someone out to hurt you. Since he liked movies he chose the doubleball object which he associated with a positive experience. Hence in this case the image did not successfully induce the intended emotion.

Overall some images seemed to elicit a clearer response than others in the sense that some objects saw a markedly higher usage for those images. Interviews revealed that some images had rather clear associations, e.g. the bride with child image was often associated with the barbapappa object because participants thought that it resembled a pregnant woman or symbolized twosomeness, a big part and a small part united.

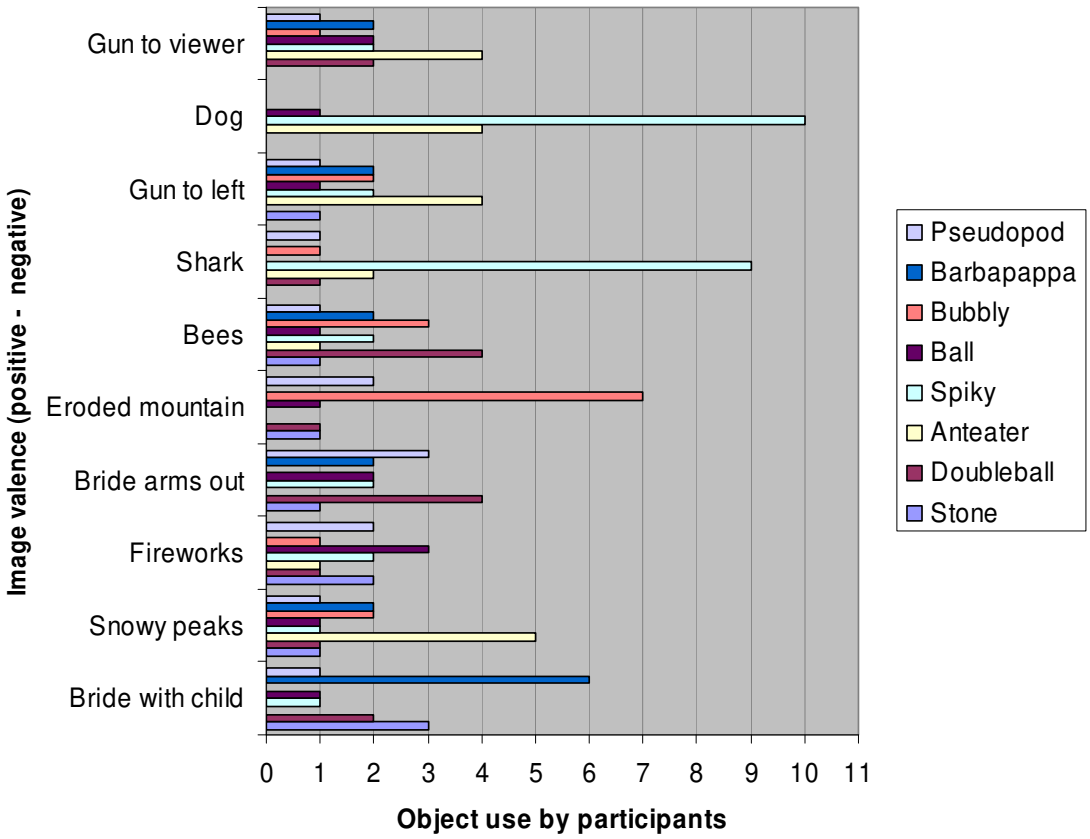


Figure 43 Usage of SEI objects during calibration ordered by image valence.

Several participants used multiple objects in response to images to modify or complement the "meaning" of another object. In fact only two images, eroded mountain and fireworks, did not see multiple object usage by any participant. Often two somewhat similar objects were used to indicate scale, more threatening than this but not as threatening as this. Other times objects were used to indicate different aspects of an image such as femininity and masculinity. Finally objects were sometimes used to (re)create a scenario – a mini story – that an image brought to mind. One subject explained why he chose spiky and ball when viewing the picture of the dog. "…it looks pretty cross, I've taken its bone, it is angry at me, then this can happen. It can tear me to pieces […] on the other hand I like dogs they are really nice, kind, creatures".

Like in the previous studies objects were sometimes selected based on similarities in the contours of the SEI objects and the images. Selecting ball or doubleball because it looks like a bullet coming out of a gun may be seen as a variation of the same thing. Although in such cases it is not based on similarity with anything that is in the picture per se, but based on similarity with something that might be a consequence of it. Hence our findings strengthen the suspicion from previous studies that IAPS may not be the most reliable way of calibrating the SEI.

Note that calibration methods for the SEI are an ongoing topic of research (Isbister *et al.* 2006), and that we have yet to find one that we are really happy with. We do not expect to be able to discern clear cut one-to-one mappings between objects and experiences, but rather get an understanding of broader experiential categories that are associated with object use. Likewise we do not expect usage to be exactly the same in the gaming sessions as it was in the calibration session. But we are interested to learn how large—and what kind of—differences there are in the calibration and actual usage of objects to assess the overall usefulness of the calibration step in the evaluation process.

10.3Handling objects while playing a game

One might argue that using objects while playing a game is a poor choice of method as it requires players to use their hands, which are normally used to control the game, to convey their experience. Furthermore it forces them to pay attention to something else than the game. It is true that many games, such as First-Person Shooters like Half-Life2 and Quake3, require players to constantly keep their hands on the game controls. For such games using the SEI in its current incarnation would probably be quite difficult as it would interfere with the players control over the game and ultimately the resulting experience. However, in the genre of games that we are interested in it seems to be less of a problem. In the games that we are interested in the pace of interaction is usually much slower; instead of an interaction interval that is as low as a fraction of a second which is the case in many FPS games, it is often several seconds long in interactive stories. Furthermore players of an interactive story are not necessarily involved in constantly positioning themselves in the world, e.g. for a good shot, meaning that more time is available for out of game activities such as handling objects. All in all this leaves time to interact with objects when needed.

When it comes to drawing players' attention from the game, we believe that it is possible to use the SEI without disturbing players too much. SEI is designed to be a pre-verbal tool that appeals to the immediate felt experience players have. Our hope is that players when viewing the objects should be able to simply grab the object that "talks back" to them without dwelling too long on the decision and without trying to internally verbalize or justify their choice. Thus the object along with how it is used becomes an extension, a symbol, of the players experience without breaking the player's immersion in the game.

11 An Exploratory Study

Early on we decided to evaluate more than one game as we wanted to find out what kind of differences, if any, that the methods could discern in the games. We also reasoned that evaluating multiple games would provide us with a better indication of the range of data that could be expected from the methods. Hence the SEI and RGT were used to evaluate three different interactive storytelling games: *Fahrenheit*, *Full Throttle* and *Façade*. The first two are commercial games available on the market while the third, Façade, is, as discussed above, an interactive drama developed by Michael Mateas and Andrew Stern (Mateas and Stern 2000) as part of their research. When it comes to fully-implemented interactive dramas there are not many to choose from. In fact Façade is so far the only full-fledged one[6]. All three games have received good reviews and have been popular among players. Below we will give a short description of the games and the style of interaction used in them.

Science is usually concerned with generalisations, condensed knowledge derived from statistical similarities found between samples that hold for larger populations. However, in the process of creating general knowledge the particularities of each individual sample becomes lost in the masses. Therefore it can be an informative exercise to every now and then have a closer look at the particulars of an individual. Experiences such as the ones studied in the experiment described here, are perhaps more individual than many other kinds of phenomena and hence more susceptible to the risk of losing something in the translation from particular to general.

We strongly believe that, at least for design and development purposes, a few in-depth descriptions of an experience is often sufficient for informing the process and may in some cases be the way to go.

11.1 Procedure

The procedure of the study was divided into seven phases described below. Due to time constraints each subject only played one of the three games selected for the study. The study was conducted in a laboratory environment to simplify video recording of the experiments.

Explanation of research purpose and informed consent

First participants were familiarized with the purpose of the study and our research goals and were given an overview of what would happen during the session. At this point participants also received an informed consent form they were asked to read through and sign. The consent form was also read aloud to participants by the experimental leader.

[6] Façade is available as a free download from www.interactivestory.net.

Gaming preferences questionnaire

In this phase participants were asked to fill in a short questionnaire containing a few questions regarding their gaming preferences and habits. In addition some very basic demographic information such as age was collected.

Using SEI with a subset of the International Affective Picture System

In this phase the participant used the SEI objects with a series of images from IAPS (International Affective Picture System) (Lang *et al.* 2005). The goal of IAPS is to develop a large set of emotionally-evocative colour photographs that includes content from a wide range of semantic categories, to be used in research regarding emotion and attention. Each image in the IAPS has been rated by a large number of participants over a long period of time (more than 10 years), along three dimensions: valence, arousal and dominance. The picture set, currently consisting of about 1000 images, is internationally available for research purposes.

The calibration was mainly done in order to familiarize participants with the use of the SEI objects but also to learn what kinds of emotions/experiences that were ascribed to the objects for later reference. Subjects were told to use the objects in any way that they wished and also to use as many objects as they wanted. A record of which objects each subject used was written down manually for later reference. The images were selected because their arousal/valence scores mapped roughly to the emotions that the artist initially intended to convey with the objects.

Playing a game while using the SEI objects

After calibrating the SEI, participants played their assigned game and were asked to freely use the objects while playing to express their experiences. Participants were filmed from two different angles during their gaming session in order to capture as much as possible of what was going on. The cameras were directed at the participants face and an area on the table containing the SEI objects respectively. In addition a screen capture device was used to record each participant's interaction with the game. Figure 44 shows an overview of the setup used during this phase of the study. The set-up was similar to that of the SEI studies described in chapter 10 above. A difference in study set-up was that we did not analyse facial expressions in this study.

Our intention was to let participants play their game for approximately 10 minutes. However, the amount of time played by each participant varied slightly because we wanted to be flexible. If we saw that the participant's game session developed into something interesting the playtime was extended. If however nothing out of the ordinary happened the session was terminated after about 10 minutes.

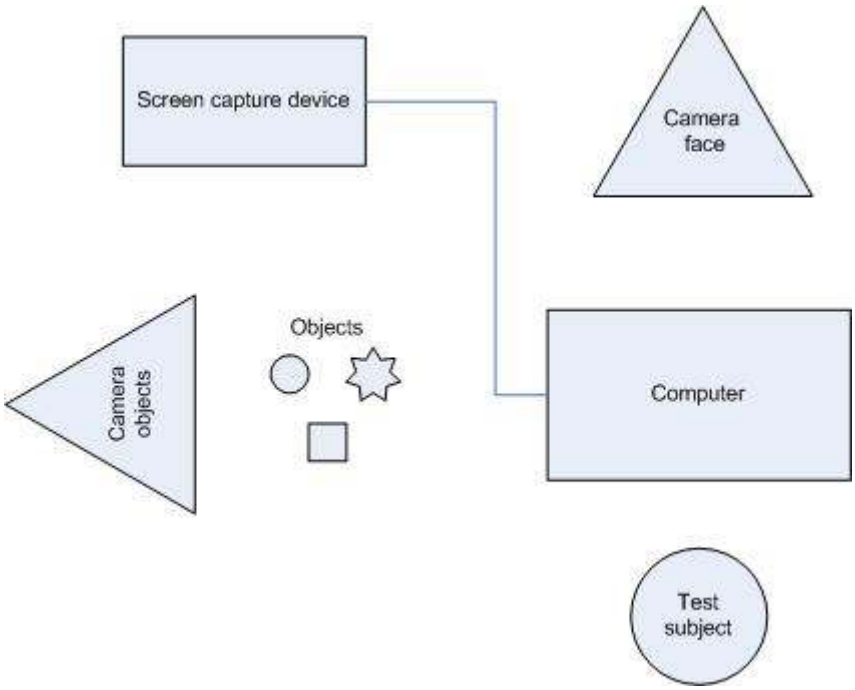


Figure 44 The setup for the experiment. Object usage, facial expressions and the users screen were recorded.

RGT construct elicitation

After the game session subjects had a short break while we prepared for the RGT session. During the break, the video stream showing the game interaction was divided into segments. We aimed for 15 segments per session, but because of limitations in the software used to split the video file the number of segments varied by +-2. The segments were then used as elements in an RGT evaluation performed by the subject. The first step was triading in which the segments were randomly selected in numbers of three and the subject extracted bipolar constructs as explained earlier (see chapter 9). Triading was performed for as long as the participants could comfortably create new constructs and was aborted when we felt that no more constructs could be extracted.

RGT rating of elements

In the next step participants were asked to look at the video segments from their own game experience from beginning to end and for each segment grade it from 1 to 5 using the bipolar constructs they had created. Throughout the RGT evaluation we used a standalone version of the WebGrid III application called Repgrid IV to record and organize the data collected from the subjects.

Figure 45 The video clips were integrated into one video file for easy viewing.

Interview while watching a video of object usage

In the final step of the study a semi-structured interview with participants was conducted. First we asked them to explain their choice of objects during the calibration session. We also replayed the game session so that they could see which objects they had used while playing the game and discussed why they chose the objects when they did. Finally a few questions were asked about their experience in general, e.g. if they thought that it had been story-like or not. As we did not know beforehand what kind of data the methods would generate the interviews were there to help us understand the methods and their usage as well as players' experience of the games.

11.2 Participants

The study involved 12 participants (3 female and 9 male) that were recruited from among friends, family and colleagues. A majority of the participants (9) were between 20-29 years old, two participants were below 20 while only one was over 30 years old.

All participants except one had prior experience of playing computer games, 8 played computer games regularly while three only played games occasionally. Two of the participants had previously played Full-Throttle and three were familiar with Fahrenheit, while Façade was a new acquaintance to all participants. Out of the 12 participants, 6 played Facade, 4 played Fahrenheit, and 2 played Full-Throttle. The reason why we did not divide the participants equally over the games was that we wanted to focus on the potentially most story-like games but still have some diversity. During the study we tried to make sure that participants played a game that they had not tried before. However one participant that played Fahrenheit in the study had actually played it before.

Most participants had a positive attitude towards computer games and enjoyed playing a variety of game genres, although adventure games and action games were the most popular ones. All participants spoke Swedish and all quotes from the study that can be found below are translated from Swedish by the author.

11.3 Overview of Results

Before going into the analysis of each game in depth, let us provide a few summarising results from all 12 subjects to provide the reader with a feel for what happened during the study.

The elicitation phase of the repertory grid technique resulted in 8 constructs for Full-Throttle, 16 for Fahrenheit, and 19 for Façade. Hence, the number of constructs elicited per person was rather small, ranging from 2-6, as shown by Figure 46. (From here and in the rest of this text, we will refer to the 12 participants in the study as S1 – S12.)

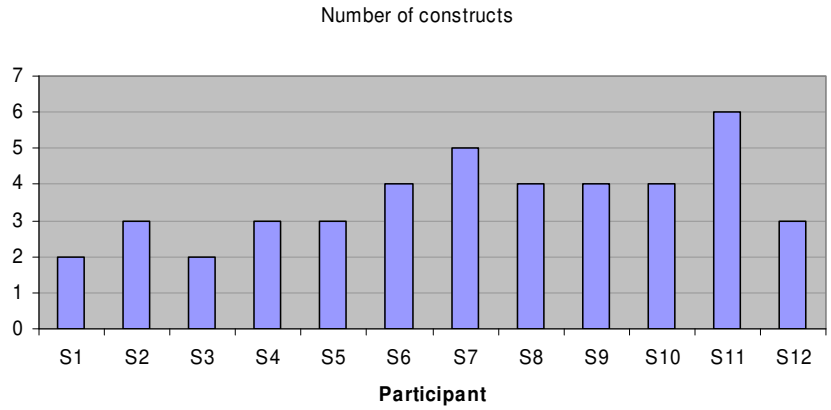


Figure 46 Number of elicited constructs per subject

Concerning the usage of SEI-objects, we found that sometimes object usage referred to what was happening on the screen, a reflection on the state of the story, while other times it referred to the players own experience of the story or the game itself. The reason for choosing a particular object during game play did not seem to be determined by associations to the shape of something on the screen except in one case. One participant attributed all object usage to similarity in contour to objects on the screen, e.g. the ball object was chosen because it resembled the eight-ball object lying on the table in Façade. Usually objects were however used to convey the participants' experience of the game as was intended.

As we had hoped participants did use objects while playing the games although there was great variation in the frequency of use. During the 10-12 minute long sessions objects were used between 1-15 times for a total of 87 times with average usage ranging from 6-9 (see Figure 47). In some cases this means that objects were used more than once per minute.

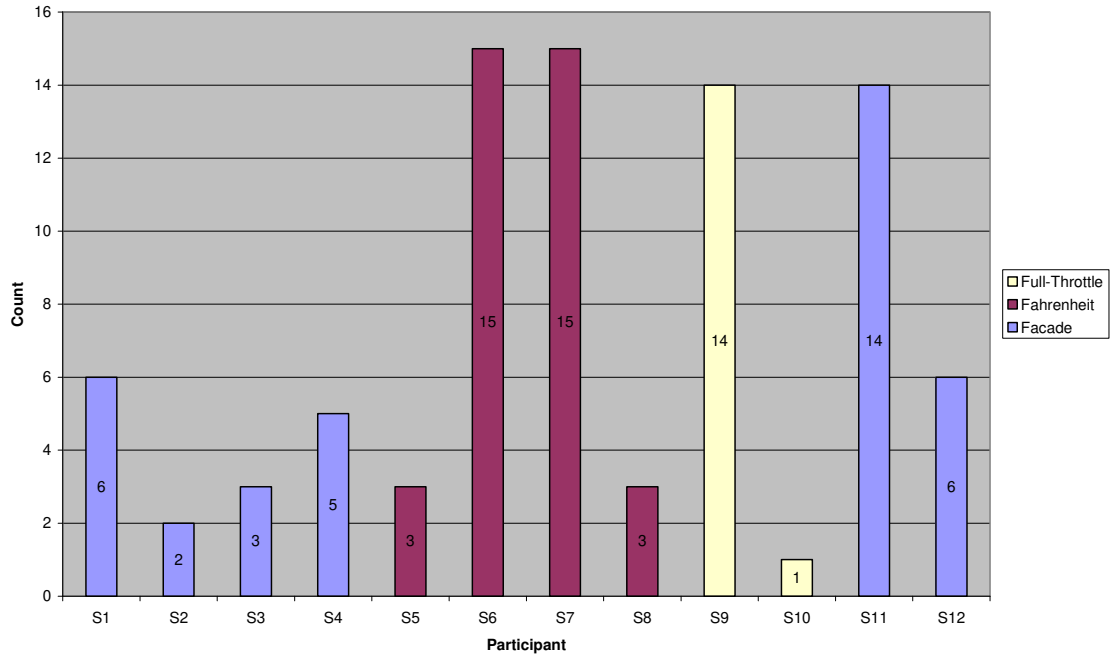


Figure 47 SEI-object usage per participant

This kind of data is interesting at least for one reason, namely that the games all have different interaction patterns. Façade is played with mouse and keyboard and requires typing to carry on the conversation with the characters, thereby keeping both hands occupied. Fahrenheit is played with a game controller which also requires both hands to operate. Furthermore there is a limited time available for performing actions which also can affect how often the objects are used. Full-Throttle is the easiest of the three games in this respect as it only requires a mouse to operate. Hence a low object usage could depend on difficulties controlling the game while handling the objects.

11.4 Façade

In Façade the setting of the game is the apartment of a couple that are long time friends of the player where the player takes part in a story resembling Edward Albee's "Who's afraid of Virginia Wolf" from 1962. The authors describe Façade in the following way:

> In Façade, you, the player, using your own name and gender, play the character of a long time friend of Grace and Trip, an attractive and materially successful couple in their early thirties. During an evening get together at their apartment that quickly turns ugly, you become entangled in the high-conflict dissolution of Grace and Trip's marriage. No one is safe as the accusations fly, sides are taken and irreversible decisions are forced to be made. By the end of this intense one act play you will have changed the course of Grace and Trip's lives motivating you to replay the drama to find out how your interaction could make things turn out differently the next time. (Mateas and Stern 2003)

Façade is a one act drama. The player can complete the game in approximately 15 minutes making the experience rather short compared to most games. However it has been argued that if an interactive drama is too long, or the player decides to take a break

from it they may have difficulties taking in the drama as a whole and ultimately making it hard for them to enjoy it the intended way (Laurel 1993).

Players interact with the game world in Façade using a mouse and keyboard. The player can move around in the apartment using the arrow keys and interact with objects by clicking them with the mouse. Certain objects, including Trip and Grace, have hints stating what a mouse click will accomplish that appear when hovering the mouse pointer over them. For instance, when hovering over trip or Grace's torso a click will accomplish a hug, while a click on the lips will give her a kiss.

The main mode of interaction is however natural language as the player can have a conversation with the characters. Trip and Grace make conversation with the player by using pre-recorded speech. The player on the other hand uses textual input like in a chat to make their contributions to the dialogue. The system implements a broad but shallow approach to natural language understanding, meaning that characters are able to respond to a large repertoire of sentences that the player might enter but has no deep understanding of the semantics of what the player is saying. Instead the system applies a straightforward but effective mapping of surface text to meaning representation that is adequate for the purposes of the drama.

Figure 48 The player takes part in Trip and Graces argument about interior design.

11.4.1 An in-depth view of player S11

This participant is a male teenager with a positive attitude towards computer games. He plays games regularly and prefers to play role-playing games and strategy games when doing so. In the study he played Façade which he had not encountered previously.

The following is a transcript of the player's session. The length of the session was 10 minutes and 24 seconds. The video from the session was divided into 13 segments of approximately 48 seconds length. A transcript of each segment is presented below with screen shots from the captured video. The video was recorded directly to a computer's hard drive in a heavily compressed format. Hence, the quality of the screenshots is not the best but is hopefully good enough to give a feeling for what the player experienced. The player's actions, such as moving around the apartment or typing conversing with Trip and Grace by typing text, is marked in boldface. We also provide an account of which SEI objects were used during each segment together with the player's motivation for using the object from the post session interview.

Transcript of S11's session

When the player enters the scene he has been invited over to Trip and Grace, a couple of long time friends. The scene fades in and he finds himself outside an apartment door.

Segment Fo

The player stands outside trip and graces door and overhears an argument they are having.

'Trip, when are you going to get rid of this' Grace says in a tired voice. 'What Grace? This?' 'Yes!' 'Alright, alright, I'll do it right now!' 'You know I've asked you about this several times!' 'I know, I know! I'll get rid of it in just a minute.' 'Fine Trip! Fine!,' Grace says as if she is not believing him. Trip comes out of the apartment and says 'Player! Hey! I thought I heard someone out here! God it has been so long since we've seen you'.

In the middle of the clip the player picked up the spiky object and held it briefly in his hand. "All of a sudden there was heated dialog behind the door. It was something of a shock to me, so I chose the object that felt closest to that".

Segment F1

'How are you doing man?' Trip says. **'Fine' the player types.** 'Great! Wow, it's great to see you after so long! Well come on in' Trip says and moves into the apartment. 'Uuuuh…let me go and get Grace' Trip says and walks towards the kitchen. **The player moves into the apartment and walks around the corner towards the kitchen.** He can hear Grace talk to Trip in a hushed voice. Grace comes out of the kitchen just as the player is about to enter it.

'No, no. Here we are' she says and moves past the player into the living room. 'Player, Hi how are you? Oh god, it's been such a long time!' she says. 'Yeah, yeah. How are you doing?' Trip wonders. 'I just asked him that Grace says' sounding a bit annoyed. 'I can ask too!' Trip says defensively. **'I'm fine' the player types.**

In the middle of the clip the player picks up the ball object and holds it in his hand. He commented that "When it was this calm and inviting, you could just walk in, then the atmosphere was nice". Later he picks up the stone object stating that they mean the same thing, a nice calm atmosphere.

Segment F2

'You look fabulous! Come on in and make yourself at home' Grace says and moves further into the living room. 'Oh thanks' the player types. 'So, Player. I'm hoping you can help me understand where I went wrong with my new decorating' Grace says and chuckles. **While she is talking the player moves to stand in front of her. 'Nope' the player types.** 'See, I told you he would like it. There's nothing wrong with it!' Trip says.

'Yes there is' the player types. 'Oh...ah' Grace says hesitantly. 'So, I tried for a certain kind of style in this room. But it is clearly just not happening. This is a mess!' she says. **'I agree' the player types. '**Aaah' Grace says smiling. 'I've been waiting for someone to say that.'

Here the player becomes a slightly confused about what is happening when they are discussing interior decoration and selects the bubbly object to convey that. He stated that "It reminded me of slight confusion as it sprawls all over the place".

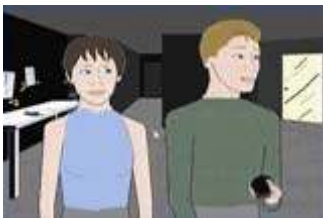
Segment F3

'What are you talking about?' Trip says not believing his ears. 'Trip, he is just being honest about my decorating. Which I appreciate' Grace says. 'But...I still think this looks just fine!' Trip says. 'Huh, you two are really getting along well tonight' he continues. Meanwhile the player has been typing **'No it doesn't' he types.** Suddenly the phone rings. 'Oh, I'll get it' Grace says and walks towards the phone. 'No, no, no' Trip says. '

Our friend is here, we can let the answering machine get it' he explains. 'No I want to...' Grace starts. 'Grace, don't be rude' Trip interrupts. 'Why are you expecting a phone call?' he asks and moves to stand in front of the player. 'No, are you?' Grace says in a lowered voice. 'No...' Trip replies. **'Amusing' the player types.** The answering machine picks up the phone, just as Trip starts to say something. It is trips mother calling. 'Trips parents are sweet people! Really down to earth!' Grace says. 'No, they are ignorant' Trip says.

As the phone starts to ring and Trip and Grace argue about whether or not to answer the phone, the player picks up the anteater object. He said that "Here things got a bit more aggressive. As the phone started to ring he became angry and then she became angry".

Segment F4.



Trips mother talks on in the background asking him to call if he's not travelling, and saying he's not called in a while. Trip, becomes embarrassed. 'Oh, player you have got to take a look at this photo from our recent trip to Italy' Trip says and moves over to a picture on the wall. 'Oooh Trip' Grace moans. 'No Grace our friend will love this' Trip says. **The player moves over to Trip. '**Player, come over here and sit on the couch with me!' Grace says.

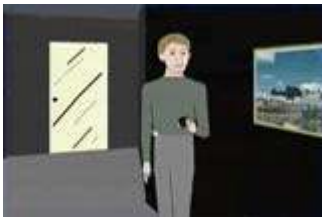
'Grace!' Trip whines. **The player moves over to Grace by the couch. '**See, your weird obsession with Italy is making our friend uncomfortable' Grace says smugly. **'Sure is' the player types. '**Ye…Ye…Yes, no. It was just a weekend getaway' Grace stammers. 'Player, You know. All the buildings there were so old and crumpling' she continues.

A few moments after Trip's mother has started recording her message on the answering machine, the player picks up the spiky object stating that he was surprised: "I had expected someone else".

Later when Trip wants the player to take a look at the picture from Italy, suddenly shifting the focus from the phone to the picture, he picks up the bubbly object. The player stated that "It was the same thing as before. And now they involved me in the whole thing again". Previously the player used the bubbly object for confusion and when asked confirmed that the sudden, slightly confusing, shift from talking about the phone call to talking about the picture was the reason for choosing it this time.

The final use of objects in this segment comes after Grace explains that the journey to Italy was just a weekend getaway. The player picks up the ball object stating that "All became calm again. They weren't so stressed anymore and their voices calmed down".

Segment F5



'Everything there was just falling apart! Eeew!' Grace says in disgust. 'I would have been perfectly....' **'Awful' the player interrupts. '**No, no, no' Grace stammers. 'Never mind it was a mess...' she says and falls silent. 'You can bet on it ...' Trip says. 'Well, I dont know about that...' he continues. 'Trip will you put that thing away? It is ridiculous' Grace says referring to the magic eight-ball that he is holding in his hand.

'I like it! I can carry it around' Trip says defensively. **The player moves over to Trip, who is still standing by the picture.** 'Sigh, Player. You are not enjoying this are you?' Grace asks and moves towards the player. 'What?' Trip exclaims. **'Nope' the player types**. 'You don't...agree?' Grace says in surprise. 'Ok, Well....' she says and looks confused. 'Grace, come on! It's not helping for you to say that' Trip says sounding annoyed. 'Trip, it's ok if we disagree!' Grace says. 'Disagreeing? We are not disagreeing!' he replies.

No objects were used during this clip.

Segment F6

'How rude' the player types. Trip looks surprised. 'N...no, we are not disagreeing!' he stammers. There is a moment's pause. 'Oh my god! Oh my god! I'm so bad' Trip says sounding dramatic. 'What!?' Grace barks. 'I haven't got us drinks!' Trip says with a smile forming on his lips. 'Oh it's good, because you will be the first to try my recently acquired set of imported drinking glasses' Trip says excitedly and moves to the bar.

'My dad bought Trip a silver cocktail shaker for Christmas present a few years back. That was his dream' Grace says. 'Why don't I make us one of my new drink inventions' Trip says. 'I call it Graces inn...' he says. **'Ok' the player interrupts**. 'Ah. Player you have deliciously looking taste' Trip says and winks. 'It's a secret. Trip doesn't even like the taste of alcohol' Grace says in a mock whisper. 'What? So player how does that sound?' Trip says. 'Player Trip is getting a bit carried away. Maybe you just want some juice…' Grace says. **'Ok' the player types.**

As Trip states his opinion, that he and Grace are not disagreeing, the player picks up the anteater object. "It was where he said 'We're not disagreeing'. It was kind of an attack [on Grace] on his part. They were not getting along". Later on, when Trip is offering to make the player a drink and complements him on his "deliciously looking taste" the player picks up the stone object. He said that "I picked it because Trip was nice again, offering to make drinks and all".

Segment F7

'Ok Trip you heard him!' Grace says. 'No, this is not the way to celebrate our get together!' Trip says defiantly. 'How about this! You open up one of those three gallon jugs of red wine like your dad did the first time we ate dinner at your parents' house' Grace says vehemently. 'What!?' Trip says looking astonished. 'Yeah! Your parents would never drink these cheesy cocktails you are trying to impress people with!' Grace says.
'Are you trying to embarrass me!? Bullshit!' Trip spits out. 'No I thought it was fun! I really like that about your parents!' Grace shouts. 'Ah! You are driving me insane!' Trip shouts and rushes out from behind the bar muttering. 'You think you are better than me just because I don't come from a rich background! You do! I know it' Trip shouts.

When Grace urges Trip to open up a big jug of wine the player picks up the anteater object as the situation becomes tense again: "They are threatening, the conflict surfaces again". As Trip accuses Grace of trying to embarrass him and she responds the player lets go of the anteater object and picks up the spiky object as the discussion became even more "heated" than before. From now on the player keeps the spiky object in his hand for long periods of time as the argument between Trip and Grace escalates.

Segment F8.

'Sigh player. Can you believe this?' Grace asks. **'No' the player types.** 'Huh, what? What are you saying?' Trip asks upset. 'Sometimes I feel like our whole marriage is just for show! I don't know what you really feel!' Grace shouts. 'Ok player, I need to ask you something' Trip starts. 'Yes or no. Isn't the goal in life, and in marriage, to improve your life. To have more than you did before' he asks. 'What?' Grace says sounding surprised. 'I mean, shouldn't you get married...' Trip continues. **'Perhaps' the player interrupts**. 'What!?' Trip says in surprise.

During the whole segment the player keeps the spiky object in his hand, only briefly releasing it to type. At the end as he types 'perhaps' he lets go of it.

Segment F9.

'Huh. Ok. Sure' Trip says. After a moment he continues. 'Grace, you won't let me be who I want to be. Who I am!' he shouts. 'Oh god' Grace says. 'This is who I am now! God damn it!' Trip yells and moves to the kitchen. 'Oh! Good! Get out of my sight!' Grace says. 'I don't want to look at you! Damn it Trip!' she says. **The player moves to the kitchen where Trip is.** 'God damn it Grace!' Trip sighs. After a few moments he says 'Player, this hasn't happened before'.

The player picks up the spiky object again when Trip yells at Grace that she will not let him be who he is and even swears, a fact that the player commented on.

Segment F10

'Oh really' the player types. Trip turns to the player. 'What, what are you saying?' he says. 'Are you talking to me?' Grace shouts from the living room. 'Noo!' Trip says. 'Trip you are just soo...' Grace starts. 'Oh, so we are talking about me again are we?' Trip says and moves out into the living room again. **The player follows him**. 'Player. Take a look around this apartment. It has got everything that anyone would ever want! But Grace!?

No she is never satisfied!' Trip says looking at his and Grace's wedding picture on the wall. 'Trip! I'm so sick of this' Grace says. After a long pause Trip says 'I mean...We have got everything!' 'Trip, you just don't…' Grace starts. **'Nope' the player types.**

The player continues to hold on to the spiky object only letting it go when he types something.

Segment F11.

'Player! Give me some advice here!' Trip says. 'Let's talk some more about Trip' Grace says. 'Look around here, we are doing really well!' Trip says. 'God Trip' I can't believe...' Grace starts. **'Yes' the player types. '**Yes!? See Grace, our friend knows a good life when he sees it' Trip says triumphantly. 'Player, oh my god' Grace says. **The player moves over to Grace. '**No I want us to focus on Grace' Trip says. 'Trip you're the reason we live like pretentious...'

Grace says. 'Like your parents you mean?' Trip interrupts. 'Trip I don't need any of this stuff! It's all you!' Grace shouts. A long silence follows. Eventually Trip speaks. 'Let's continue focusing on Grace.'

The player continues to hold on to the spiky object only letting it go when he types something.

Segment F12.

'Player, all this time I just keep thinking that I should have been painting' Grace says. 'Why don't you just do it then?, Trip responds. **'Yes' the player types**. 'Yes?' Grace wonders. 'Just you saying that should really help her' Trip says. 'Well...if I could be a painter I would...' Grace says hesitantly. 'Let's keep talking about Grace' Trip says. 'Even though you are a creative director at work and even though you are always redecorating the apartment, you are not an artist!' Trip says. 'I'm sorry you are not!' he continues.

At the end the player briefly releases the spiky object but quickly picks it up again stating that "the discussion was continuously heated".

Summary

The transcript shows that the player's use of SEI objects was limited to 5 objects (stone, ball, bubbly, anteater and spiky) that were used in total 14 times. Spiky and anteater accounted for more than half of the usage. The player used spiky and anteater to express a sense of aggression and conflict although spiky was used once to indicate a sense of

surprise (see segment F4 above). Spiky and anteater were also used to indicate scale, where spiky was more aggressive than anteater (see segment F7). The rounded objects stone and ball were used to indicate calmness, while bubbly was used to indicate surprise. The participant used the objects by picking them up and holding them in his hand for periods of time. If he held an object when he wanted to type something he would let go of it, but if the experience that the object represented persisted he would however immediately pick it up again once he was done typing. Sometimes objects were used to express emotions that the player himself felt, such as when expressing surprise, but usually they were used to express how he experienced what he was seeing and hearing, such as the fight between Trip and Grace. All in all the player's use of objects—in combination with his motivations for using them—suggests an important dimension of his experience: a feeling of *calm and nice*, vs. a feeling of *aggression and conflict*.

When looking at the constructs elicited by the participant we can see the same pattern. During the triading phase the participant elicited 6 constructs which is the highest number of constructs that was elicited by any participant in the study. The focus diagram generated from the player's grid is shown in Figure 49. As can be seen in the diagram four of the constructs have very similar ratings: *agreeable-disagreeable*, *kind-violent*, *calm dialog-heated dialog*, and *welcome-unwelcome*. Furthermore the first three seem to be rather synonymous or at least describe aspects of the same experience: a sense of kind, agreeable, calm dialog vs. a sense of disagreeable, violent, heated dialog. This in turn seems to cause a sense of being welcomed by the characters in the first case and being unwelcome in the latter.

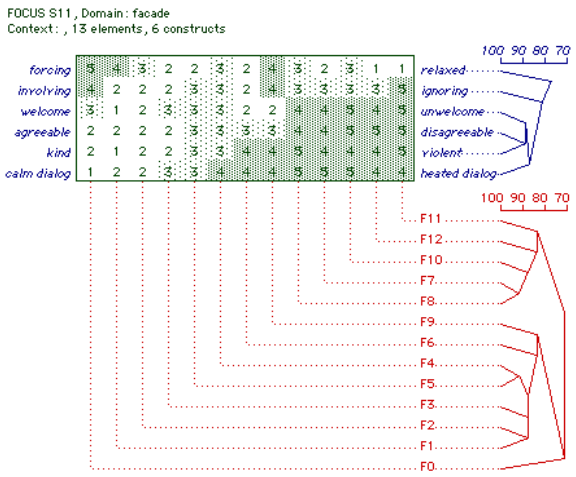


Figure 49 A FOCUS diagram generated from player S11's grid

When plotting how each segment was rated we get a series of curves that show how constructs developed over time. Figure 50 shows plots for four of the dimensions that the player elicited. The plot shows segments presented in temporal order so that F0 is the first segment, F1 the second etc. Individually, each curve can be viewed as one aspect of the player's experience, and shows how that aspect evolved over the course of the game—its dynamic gestalt. For instance ignored-involving, represents the players sense of being involved or invited into the game by the characters. Hence, the plots grants access to some experiential threads without detracting from the whole as discussed earlier (see section 8.1).

Looking at the plots we can see that as the experience unfolds and Trip and Grace argue heatedly, becoming violent and disagreeable, the player feels unwelcome and ignored by the characters as there is no room for him to participate. This directly affects his sense of agency in the game. The interview gives credit to this interpretation as the

participant stated that "the game took care of itself with very few interruptions from my side" and "Occasionally I felt somewhat part of the story but mostly they [Grace and Trip] took care of everything". When asked whether he felt that he had any influence on what would happen in the game he also said that "I felt that I had a little influence on what the next line would be, but that was it mostly". Hence it seems as if the player experienced a small degree of local agency—a sense of receiving confirmation that his actions had been noticed—while he did not experience a sense of global agency, a sense of influencing how the story unfolded.

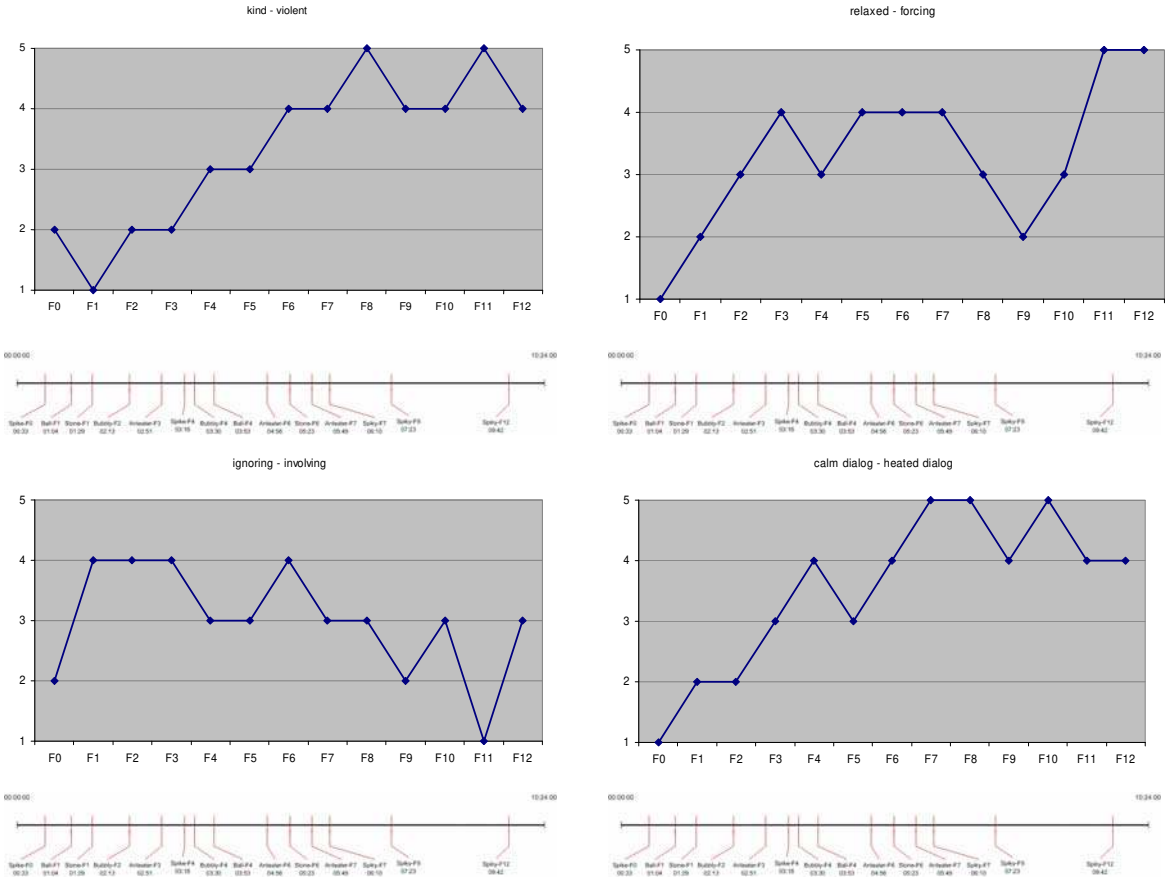


Figure 50 Plot of RGT ratings for participant S11. SEI-object usage is duplicated underneath each graph.

Although the player did not experience a sense of agency there is evidence in both SEI and RGT data of a dramatic experience. As the story progresses the player uses the spiky objects more often, and holds on to them for longer periods of time, to express his experience of conflict and antagonism in the scenario. The RGT plots also show how that experience evolves, starting with a nice and calm situation which gradually escalates into a heated argument. Looking at the plots, we see that those describing the escalating conflict have shapes that are very similar to a classic dramatic arc.

Although the player sensed the drama he might have experienced it in a detached analytic way, rather than being immersed in it actually feeling the emotional turmoil of the scene. Here RGT and SEI provide no conclusive evidence in either direction. However, the way that the player held on to the spiky object and thoughtfully rolled it around in his hand during the later parts of the session may suggest that he had become 'lost in' or 'captured by' the scenario as discussed in Chapter 3, and as a result of becoming lost may have simply forgotten to use objects. During the interview he also stated that "I was a bit involved in what would happen, not overly much, I didn't

REALLY care, but it was interesting to watch anyway" and "I wanted to hear how the dialog would evolve, how it would end". These comments suggest that the player had at least some feeling of immersion in the game.

The correspondence between object usage and RGT rating is not exact since the RGT elements are video segments that have a temporal duration and we cannot tell exactly what the participants are grading in those segments. But together they can give a richer sense of what is going on. For this player RGT and SEI paint a similar picture of the player's experience; the grading of the segments and the usage of objects usually concurs. When the spiky object is used to express a sense of conflict, the corresponding segment gets ratings indicating the same thing. However there are exceptions, by e.g. looking at the first segment F0 we can see that there is a brief moment when the participant indicates an unpleasant feeling according to object usage (spiky) while the grading of the element along the constructs indicates a relaxed (1), welcome (3) calm dialog (1) experience. During the interview the player explained his use of the spiky object in the following way: "…suddenly there was a heated dialog behind the door, a bit of a shock, so I picked the object that symbolized shock to me".

11.4.2 An in-depth view of player S12

The participant is a young male in his twenties with a positive attitude towards computer games. He plays games regularly and enjoys playing a large variety of genres including role-playing games, strategy games, action games, simulation games and finally adventure games. In the study he played Façade which he had not encountered before.

The session lasted for 10 minutes 18 seconds. The video from the session was divided into segments that are approximately 48 seconds long. However the first segment for this player was removed as the game had not started yet due to a slow start-up of the system. A transcript of the segments is provided below. The player's actions—such as moving around in the apartment or talking to Trip and Grace by typing text—are shown in boldface. Like in the previous transcript an account of object usage is also provided together with the player's motivation.

Transcript of S12's session

When the player enters the scene he has been invited over to Trip and Grace, a couple of long time friends. The scene fades in and he finds himself outside an apartment door.

Segment F2

The player enters the game and hears grace and trip talking to each other through the door. **He knocks on the door**. Grace is surprised that he is early but trip explains that he is right on time. Grace is angry that trip has not told her the right time! Trip opens the door and greets the player. **The player greets trip by typing 'hello'.** Trip invites the player to come in upon which **the player declines by typing 'no'**. Trip is surprised and again invites the player to come in, and goes to get grace. The player moves in

Towards the end of the segment, when Trip goes to get Grace, the player picks up the anteater object. He said that "…you heard the fight through the door and there was irritation. Annoyed vibes, not that I was annoyed mind you".

Segment F3

While the player looks around in the living room trip and grace can be heard talking to each other in the kitchen. Grace sounds angry over something. The player moves towards the kitchen and meets grace coming out from there. Grace greets the player and says she is happy to see him. **The player gives grace a kiss on the cheek and types 'hey'.**

Grace thinks that is sweet of him. She invites the player to make himself at home. Grace moves towards the couch and starts saying something when the phone suddenly rings. 'I'll get it' says trip. 'No, no. We have a guest! We can let the answering machine pick it up' grace responds.

No objects were used during this segment.

Segment F4

Trip starts to object but grace interrupts him asking him not to be rude. 'It's probably just the execs at work inviting you to another one of your precious high class poker...' Grace says. '**I love you Grace' the player interjects**. 'What! Oh, I, hrmm...wait a second' Grace says seeming somewhat uncomfortable with the situation. The answering machine picks up the phone call. It's Grace's father.

'I don't want to talk to him right now' Grace says. 'But, I want to say hello to him!' Trip exclaims. 'No, no Trip. We are entertaining a friend in our new apartment! The last thing I want to do is talk to my parents' Grace says. 'Grace's parents are something else. Really classy people' Trip says as he moves to stand next to Grace. 'No they are impossible! They are always expecting me to act as the dutiful daughter. It's so annoying' Grace says while the voice of Graces father talking to the answering machine can still be heard in the background. **'Give me a drink' the player types.** 'Oh, yeah. I'll fix us some drinks in a sec' Trip responds.

The player picks up the bubbly object when Graces father starts talking to the answering machine. He explained that "The situation was kind of funny […] earlier I had told Grace I love her so the situation was so bizarre, it was comical".

Segment F5

'Ah you'll be the first to sample from my new set of imported drinking glasses' Trip says with a smile. 'So, drinks! What's your poison? How does a martini sound?' Trip asks. **'Sweet' the player says.** 'No, no' says Grace. 'Maybe you would like some juice or mineral water?' she asks. **'Rum and coke'** the player types. Nothing happens. **'Rum and coke'** the player repeats. 'Oh, yeah. That's even better' Trip says, and moves to the bar. Grace sighs.

'Trip has always won friends over with the power of mixed drinks' she says. **The player moves up to grace and kisses her on the lips.** Grace and Trip are both astonished and laugh hesitantly and nervously.

No objects were used during this segment.

Segment F6

'Ha ha ha ha' the player types. 'Player! You maniac. You sex maniac. Never, afraid to push our little buttons' Trip says. **'Yes' the player types**. The situation continues to seem awkward. 'Anyway, what were we talking about?' Trip says. **'Sex' the player types.** 'Ho…Hold on. You think we should have more sex!?' asks Trip, astonished by what he is hearing. **'Yes' the player types**. Trip laughs loudly and nervously.

'You're…quite the kidder tonight' Trip says. **'Yes' the player types**. 'Never afraid to say anything that pops into your mind' trip says.

After the player confirms that he's not afraid to push Trip and Grace's buttons he picks up the pseudopod object. He explains that "the situation became even funnier, it was more intense somehow".

Segment F7

The player walks up to Grace and hugs her. 'Well, hold on...you're hugging me' she says with a nervous laughter. 'That's very nice of you. Grace, aren't you glad we invited him over?' says Trip. **The player explores the room looking at photos on the wall and items lying about.** 'Oh yeah! Let me tell you about work! I'm the lead designer on a new project' Grace says.

'Our project! It was quite the coup when I brought the account in. Printouts for bridal fashion...' Trip says. **'Shut up' the player types interrupting Trip and moves over to a shelf filled with sculptures**. Trip, is stunned.

After having said shut up to Trip and Grace the player picked up the spiky object to indicate a sense of aggressiveness. "There was a feeling of aggression in the air. I said shut up to them. It was what I felt" the player explained.

Segment F8

'Gees, it just occurred to me we need to check the ball thingy…' Grace says nervously. 'Yeah, yeah. It means…' Trip concurs. 'Oh, yeah, yeah' Grace says. **'Great' the player types. 'mhm' the player says**. 'Player, look around you. You have to admit it looks terrible?' Grace says. **'Yes terrible' the player types but neither Trip nor Grace reacts.** 'Grace no' says Trip. 'See Grace loves expensive furniture. She grew up in this really nice house, with really nice couches' he continues.

No objects were used during this segment.

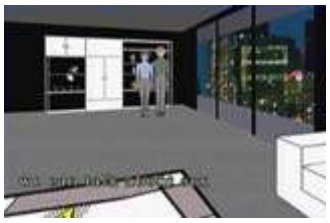
Segment F9

Grace explains that she spends all day at work designing adds for decorative objects. 'Like these sculptures' she says. 'And then it makes me think I want to design them into my apartment' she says. 'Everybody always says how much they love Grace's sculptures' Trip interjects. 'But, damn it. Now I can't take the sight of them!' Grace says. 'They're revolting' she says. 'Revolting! What?' says Trip. **'Revolting' the player types.**

'Grace, everything is fine! No one is complaining about your decorating' Trip says. 'But, it's just that...' Grace says and exhales deeply. 'There must be some way that I could...' she continues but never finishes the sentence. **'Yes?' the player types.**

After Trip explains that everyone loves Grace's sculptures the player picks up the spiky object again. "I felt their anger as they were fighting. It was more their anger I felt than any anger of my own".

Segment F10



'Ahhh, If we talk about my decorating anymore I'm going to go crazy' Grace exclaims. 'I don't know what to think, I don't...' she continues. **'We can talk about sex'** the player types interrupting her. 'Eh, wait...hey did you remember to call the cleaning woman to have her come over tomorrow?' Grace quickly asks Trip. 'What? The cleaning woman?' Trip wonders. 'Yes I had asked you to call the cleaning service for tomorrow' Grace explains.

'Yeah' trip answers after a long pause. 'Oh ok. Good. I just wanted to make sure' Grace says. **'Is someone else coming?' the player types.** 'Oh player! I thought you might like this photo I just put up from our recent trip to Italy' Trip says. 'It's a beautiful picture of the Italian countryside' he says. 'Of course he'll like it' Grace says sounding a bit annoyed. 'Grace, I know you don't like it but our friend might' Trip says. 'Player, come take a look at this!' he continues.

As Trip invites the player to come and look at the picture he again picks up the spiky object. "It was the exact same thing [as last time]. I could feel their bickering".

Segment F11

'This evening is getting more exhilarating by the minute' Grace sighs. **The player moves over to trip where he is standing beside the picture.** 'Player. This is making you uncomfortable' Grace says. 'See trip, was it really worth it to fly all the way to Italy to take that inane picture' she continues. 'Grace' trip hisses. 'I'll take the picture down tonight before I go to bed' grace sighs.

'Player, this trip to Italy was supposed to be our second honeymoon' Trip explains. 'Ohhh, was that what it was!' Grace says in mock surprise. 'I'm always the last to know' she continues. **While Grace and Trip continue to argue about the journey to Italy, the player explores the room. He tries to click the picture but nothing happens. He then turns to the bar and successfully picks up a bottle of wine. He walks over to Grace and tries to interact with her using the bottle without success.** 'Ah. You are driving me insane!' Trip exclaims to Grace. **The player moves to the kitchen, leaving Trip and Grace to their argument. On the way he leaves the wine bottle on a table.**

No objects were used during this segment.

Segment F12

'Player, where are you going?' Trip exclaims angrily. 'Don't leave the room. We need your help out here!' he continues. **The player looks around in the kitchen seeing if there is anything he can interact with.** 'Player, can you believe this!' Grace says. 'Aha you ... I can guess what you are about to say, with your damn kissing and flirting. Christ!' Trip says. **'Come here' the player types.** 'Player! Stop running away!' Trip shouts.

'What? What are you saying?' Grace says. **'Come here!' the player repeats.** 'Grace I do one little thing wrong and...' Trip says. – 'Ok, I hear you' says Grace. 'Ok, Player that's it!' Trip says firmly. 'You've got to leave!' he says.

No objects were used during this segment.

Summary

The transcript shows that the player used 4 of the 8 objects and that they were used in total 6 times. As in the previous transcript the spiky objects were used to express a sense of anger and conflict. Bubbly and pseudopod were used to express a sense of humour, with pseudopod indicating a stronger sense of humour than bubbly (see segments F4 and F6). The player used the objects by briefly lifting them up from the table before putting them down again. Objects were used both to express what the player was feeling himself (e.g. a sense of fun as seen in segment F4) and to express the experience that he was picking up from the story. The use of objects together with the players own motivations indicates that the conflict in the scenario was salient to the player.

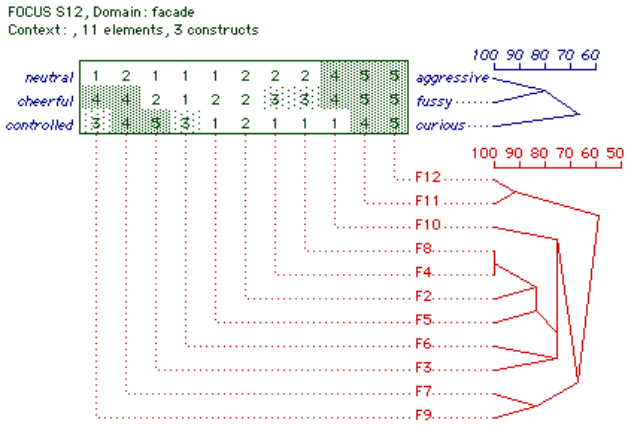


Figure 51 A FOCUS diagram generated from player S12's grid

The player elicited three constructs which are shown in Figure 51. There are no immediate synonyms although the player stated in the interview that the endpoints for the two first constructs, aggressive and fuzzy, are similar. Hence there may be some overlap between those constructs. At least one of the constructs, *neutral-aggressive*, seems to mirror the same sense of conflict as the object use. When looking at the plot of the construct (see Figure 52) we can also see that its ratings escalate as the conflict escalates. In the end the player, who has been drawn into the conflict, is even asked to leave by Trip. Looking at the plot we can see that *cheerful-fuzzy* has a similar development, starting out cheerful and ending up fuzzy.

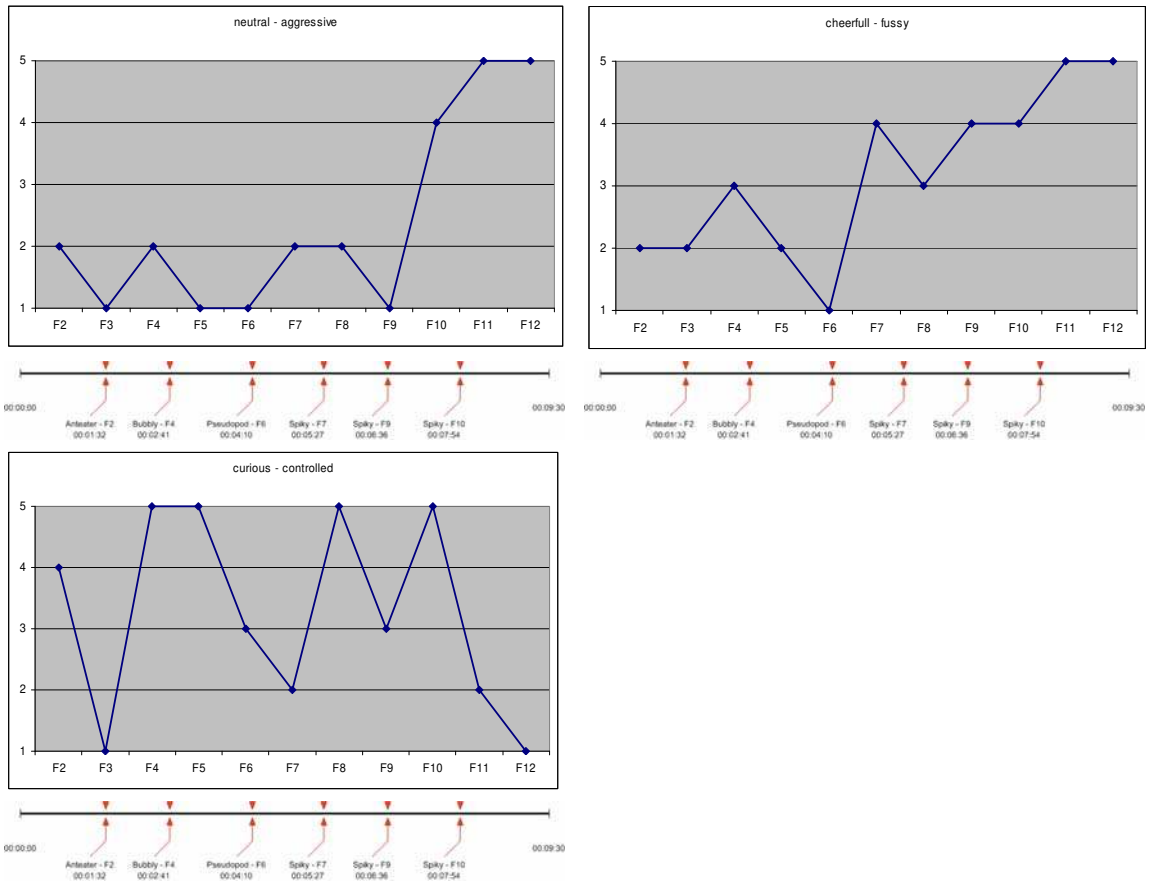


Figure 52 Plot of RGT ratings for participant S12. SEI-object usage is duplicated underneath each graph.

The player's use of objects together with how the elements were rated indicates that he did sense the escalating drama in the scenario. In time with the evolving conflict the player rated elements as increasingly aggressive and fuzzy. A major rise comes in the end as the player starts "playing along", attending to the story rather than pushing the system's limits.

SEI and RGT usage generally concurs but like in the previous case there are exceptions. In segment F7 the sense of 'fuzziness' takes a major turn upwards. In the clip the player tells Trip and Grace to shut up and then uses the spiky object to indicate a sense of aggression. At the same time the level of aggression according to the neutral-aggressive construct remains unchanged. However, in this case it seems as if it is the players own sense of aggression that is expressed. During the interview the player said "It was the feeling in the air and that I said shut up to them. […] it was what I felt". One interpretation of the situation is that the player felt that Trip and Grace were being fuzzy and became annoyed with it, hence telling them to shut up.

During the interview the player stated that he felt a great deal of agency while playing the game. He felt that his actions affected how the experience evolved to a high degree which made him more engaged in the game. He said that "When I noticed that I could influence what happened I became curious. Maybe the emotions that were induced also became stronger, like I immersed myself more when […] the game actually cared how I tried to influence things, like if I was aggressive or not". He also described the game as very free in its format. He stated that "When you limited yourself it was because you allowed yourself to be limited, not because the game forced you. Like in a dialog, you decided yourself if you wanted to take part in it or not, you sort of followed the

unwritten rules although you could break them". From these comments it is clear that the player experienced at least some degree of both agency and immersion. However, there is no SEI or RGT data that directly relates to those aspects of the player's experience.

11.4.3 Summary of Façade-experiences for S11 and S12

Summarising the results from participant S11 and S12 we can see that SEI and RGT provides some handles to their experience. For both participants SEI and RGT provide results that mostly agree and complement each other. For instance, the sense of conflict visible in the use of objects was also visible in the RGT plots for both subjects. Due to the temporal dimension of the RGT elements SEI sometimes gives a more detailed version of what is going on in a specific situation than RGT, for instance when player S11 uses a spiky object in segment F0 above.

SEI in particular provided us with information about emotional experiences, both the players' own and those that they picked up from the game. While the method does not provide a continuous account of emotional experiences it does provide an account of salient ones.

A sense of agency could be detected in one case but not in the other. In the case of player S11 the RGT data together with the interviews provides some information about—lack of—agency and also provides an explanation. For player S12 however, this was not the case. According to the interviews player S12 did experience agency but neither SEI nor RGT supported that. As you would have thought, RGT seems sensitive to what kind of constructs that are elicited.

For these participants, neither of the methods provided direct evidence for immersion although interviews suggested that they both experienced at least some degree of it.

Neither RGT nor SEI seems to say anything about transformation for Façade. For these players the methods suggest no transformative power in the sense of taking on a role as suggested by Murray. One reason may be that players in Façade are not actively playing a role but rather act as themselves. However, that does not necessarily mean that players will act as they normally would. Instead they can freely take on a role, for instance their evil twin, and act accordingly. As for transformation in the sense of re-playability, we cannot really say anything as our participants did not play the game more than once. A comparison of sessions across players (compare S11 and S12 above for instance) shows us that there is variety to be found but the question is how players themselves would experience it when playing a second time.

Another participant reported a similar experience from playing Façade. He said that "I wanted to explore my options, but after a while I realized there wasn't very much that I could do, […], your only function becomes to be an observer that is forced to watch them fight. Whatever you do it will end in one way". It should be noted that the genre that Façade represents might not have been to this participants liking which may have affected the willingness to explore the interactive possibilities of the game. S/he likened the game to "…Swedish social realism without a budget so the only thing they do is talk all through the movie and just lets the time pass". However several of the participants playing Façade reported a feeling of being ignored by the characters indicating that their sense of agency in the game was not what it should be.

11.4.4 Overall results for Façade – all six subjects

While these two in-depth descriptions of S11 and S12 provide us with a rich feeling for their experience of Façade, we also want to provide some data from all 6 Façade-participants in the study to provide the reader with a sense for the overall results.

The six participants used the SEI-objects between 2-14 times. Spiky was the object that was used most frequently by participants, more than twice as often as any of the other objects.

The following RGT-constructs were elicited from the six Façade-participants after playing the game:

Participant S11:	nice/kind	violent
	relaxing	forced
	ignoring	involving
	calm dialog	heated dialog
	welcome	unwelcome
	pleasant	unpleasant
Participant S12:	neutral	aggressive
	happily	fussy
	curious	controlled
Participant S4:	happy	annoyed, irritated
	affinity, belonging	ignored
	attention	outside
Participant S3:	calmly	irritating, annoying
	curiosity	frustration
Participant S1:	fun	irritating, annoying
	cordial	unpleasant
Participant S2:	involvement, participation	being outside, out of it
	suppress argument	open fight
	expectation	dejectedness

Three of the Façade-participants thus created constructs indicating a sense of being ignored, not being part of the game, which may point to a weaker sense of agency. None of the other games had constructs indicating the same lack of agency.

Many have also created constructs indicating a sense of irritation and unpleasantness. Participants may have perceived the fight between the characters in Façade as irritating and unpleasant.

11.5 Fahrenheit

Fahrenheit is a game created by David Cage for Quantic Dream available for the XBOX and PS2 consoles. The setting of the game is a cold wintry New York City where the player witnesses a horrible murder taking place in the toilet of a bar. The crux is that it's the player that is responsible for this horrific event. But something is wrong as you seem not to be in control of your own body. Now you are a wanted criminal sought after by the police. It is up to you to find out what really happened while not getting caught by

the authorities before you have had a chance to do so. Soon after the murder two NYC detectives show up on the scene to investigate what happened and start puzzling the pieces together.

Throughout the game the player switches between controlling the unwilling murderer that tries to find out what happened to him and the two detectives trying to catch him. Thus the story unravels from several perspectives at once giving the player a more complete picture of what is going on than any of the involved characters have, much like a movie goer knows more than the characters themselves do. In fact, Fahrenheit is described by its author as an interactive movie:

> "The concept of the game is quite simple: put the player in the shoes of the hero of a movie and let him decide what he wants to do. His actions will have consequences that will modify the story."(Cage 2005).

The game play of Fahrenheit contains many action sequences but it also makes an effort to let player's experience a story

> "My ambition with Fahrenheit was to create a game where storytelling would be at the center of the experience rather than a peripheral element. I strongly felt that it would allow me to extend the range of emotions that the game could offer. In my mind, a good story with interesting characters could convince anyone to want to play. Everybody wants to know what will happen next as long as they feel empathy for the characters."(Cage 2005).

> "I like to call this game an "Interactive Drama", which in my mind suggests the fact that the player acts and interacts in a narrative and emotional experience." (Cage 2005).

One interesting aspect of Fahrenheit is its interactive possibilities, giving the players opportunity to affect the character's story.

The game resembles both a traditional adventure game where you need to interact with other characters and solve problems, but also an action game where good reflexes and eye-hand coordination are important factors. The player character in Fahrenheit is controlled using a stock game controller with two thumb-sticks and buttons to control movement, camera angles and various actions. In some parts of the game your reflexes are being tested by e.g., requiring the player to move the thumb sticks of the controller in different directions to avoid being hit by a car. In other parts of the game the player is peacefully talking to characters in the game and interacting with objects in the environment. An interesting aspect of the game is that most of the time, such as in a conversation with another character, it enforces a pacing of the story by only allowing players a limited time to make choices. At least in that respect conversations also bear a greater resemblance to real-life conversations. The choices that players make in a conversation are generally of a yes/no character. Players do not have to type text or read long sentences to understand their options. Instead options appear as a natural outcome of the dialogue that has preceded the situation, such as whether to accept a cross from the counterpart in the conversation or not as seen in Figure 53.

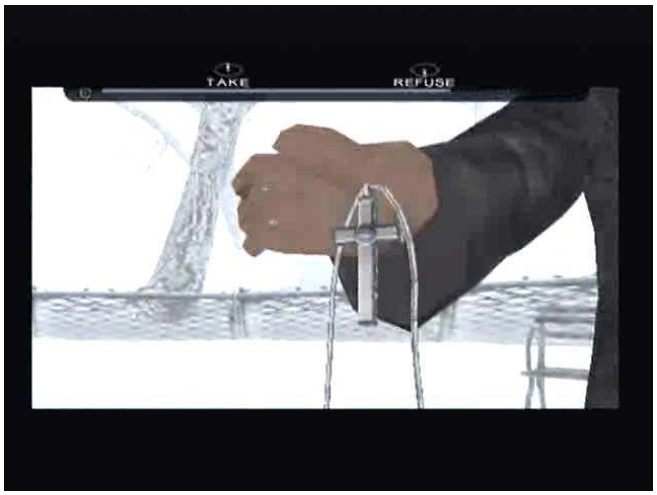


Figure 53 Pacing of the dialogue by only allowing a limited time to make a choice

11.5.1 An in-depth view of player S5

This participant is a male teenager that has a positive attitude towards computer games and plays them regularly. He prefers to play action games, adventure games and role-playing games. In the study he played Fahrenheit which he had not played previously.

The session lasted for just over 12 minutes and was divided into 14 segments of approximately 50 seconds length. A transcript of the segments is provided below. The player's actions such as moving around or making choices are marked in boldface. In situation with multiple options for the player to choose from the options are presented within brackets with the selected option in boldface, e.g. [**read on**, stop reading]. As in the previous transcripts an account of object usage along with the players motivations are presented for each segment.

Transcript of S5's session

As the player enters the scene Lucas, the character he is playing, has committed a horrible murder and is on the run from the police. However, the murder happened under very mysterious circumstances. Lucas felt as if he was a puppet on a string, with someone else controlling his actions. Now he is on his way to the park to meet his brother, Marcus, to ask for help. As he is walking to the park he ponders: "When Marcus and I were kids he took care of me, we were inseparable. However we kind of grew apart when he became a priest. But he is still the only one who might believe that I had nothing to do with this mess".

Segment Fo

The player runs into the park and locates Marcus, his brother. A cut scene starts.

'I'm happy to see you, I missed you. It's been a while' says Marcus. 'Two years' Lucas replies. 'So tell me what happened, Lucas?' Marcus says with concern in his voice. 'I killed a man Marcus' Lucas says and casts his eyes down. 'It happened at a restaurant last night. It was like I was possessed, in trance, like I was a puppet on a string. I saw what I was doing but was powerless to stop it!' Lucas explains.

Segment F1

'My God! I can't believe this Lucas! Tell me it wasn't you. You're not capable of something like that!' Marcus says.

[Wrists, **Alone**, Details] 'You went to this restaurant alone?' Marcus asks.

'Yeah...Tiffany and I broke up about a month ago. I try to get out of the apartment as much as possible. It's just so ... empty there without her you know' Lucas says in a husky voice.

[**Wrists**, Details] 'And there is this too' Lucas says and shows some strange symbols that have been carved into his wrists. 'You cut your wrists!' Marcus exclaims. 'Before the murder I carved these symbols on my arm with a knife. I don't know if they mean anything' Lucas says shaking his head.

[Trance, **Drugs**, Witnesses, Who Knows] 'Had you been drinking? Taking drugs?' Marcus asks. 'You know I don't do that Marcus' Lucas says.

[Witnesses, **Who knows**, Trance] 'Who else have you told all this to?' Marcus asks.

Segment F2

'No one! You're the only person I could trust' Lucas says. 'While I was doing this horrible thing I saw something or rather someone' he continues. 'Was somebody else there with you?' Marcus asks. 'No it was sort of like a vision. I saw a man in the middle of hundred candles. And, and, … there was this little girl' Lucas says shaking his head.

[Powers, What now, **Little girl**] 'You saw a little girl' Marcus asks with surprise in his voice. 'She seemed alone...lost. She asked me to help her. What happened to me Marcus? What am I supposed to do?' Lucas says and paces about nervously. 'You know me better than anyone Marcus. Help me!' he says. 'Lucas, I'm...I'm a bit lost here' Marcus says shaking his head. 'This whole story is just so bizarre!' he continues. [**Police**, Sick].

Segment F3

'It might be better if you told your story to the police' Marcus says. 'Turn yourself in before they find you!' 'Do you really think the police will believe a story like that!? They'll throw me in prison for the rest of my life and I'll never find out what really happened!' Lucas says in an upset voice. 'I am a priest Lucas. The fact that you have taken a life is a very serious matter' Marcus replies. 'I told you that it wasn't me Marcus! All these years and nothing has changed! You still never listen to me!' Lucas says.

'Lucas, don't ask that I make a choice between my faith and my brother' Marcus says shaking his head.

[Convince, **Break off**] 'Somebody used me to commit a crime, and I'm going to find out what happened and why. No matter the cost! I'm sorry Marcus, I shouldn't have come to see you' Lucas says as he backs away from his brother.

Segment F4

Marcus extends a necklace with a crucifix to Lucas and says in a sad voice 'Here, you need this more than I do' 'Marcus you know that I don't believe in that' Lucas replies.

[**Take**, Refuse] 'Thanks' Lucas says and walks away from his brother.

Suddenly he is overtaken by a vision of a small kid falling into the icy waters of the nearby pond.

Segment F5

Lucas realizes that he has to stop the kid, but at the same time a policeman that might recognize him from the crime scene approaches along the road. Like the vision foresaw the kid falls into the water. A bar showing how much time the player has to act before the kid dies appears. **The player runs toward the place where the kid fell into the icy water, and jumps in. pressing buttons to swim. The player swims towards the kid who has lost his consciousness, grabs hold of him, and eventually succeeds in bringing him to the surface.**

Segment F6

The player notices that the kid's heart is no longer beating and **performs CPR timing button presses to do it**. A crowd has formed around them, including the policeman.

Segment F7

The kid regains consciousness. The crowd comments on the courage of the player and calls him a hero. The policeman from the murder scene and Lucas look into each other's faces. The policeman clearly has recognized Lucas but instead of arresting him a small smile forms on his lips. 'I don't know why he didn't arrest me' Lucas ponders. 'Maybe he decided I was even. I had taken a life and given one back'. When he leaves the park Lucas feels better about himself

As the kid regains consciousness the player picks up the ball object. "I just accomplished something, I saved a life. It was nice" he said.

Segment F8

The scene shifts to a police station. The player acts as Carla a detective investigating the case. Carla can't get the case out of her head. Something is wrong, she thinks, but what? **The player walks into the police station and is greeted by the officer at the desk**. They exchange a few words before the player walks up the stairs to the next floor.

Segment F9

The player opens a door and enters a floor with detectives sitting at desks working. The player walks around exploring the office space. She is greeted by some detectives and makes some small talk with them. **The player walks up to an office door and knocks on it.** No one answers.

Segment F10

The player walks up to another door and knocks on it. There is no one there either. Carla looks at her watch wondering where Tyler could be and decides she'd better give him a ring. **The player walks up to the coffee machine and presses a button to get a cup of coffee.**

The player seems to have accidentally pushed the button on the coffee machine as he was looking for the phone. In response to this he selected the double ball object to indicate that he was a bit annoyed. He said "I was happy, but something was a bit wrong…".

Segment F11

The player walks around in the office space trying to figure out what to do. A colleague asks Carla to remind Tyler that he owes him money, which makes her feel stressed. Carla says she can't help him. **The player finds the office that Carla shares with Tyler.**

Segment F12

Just as the player is about to open the door an officer walks by and says that he has some results on the test from the restaurant murder. Carla says she will talk to him as soon as Tyler gets in. **The player enters the office. The player walks over to the desk and picks up the phone to call Tyler**. Tyler picks up the phone and yawns realizing he has overslept. Carla urges him to get a move on.

The player spent some time looking for the phone with which to call Tyler. As the player finds the office and the cut scene starts to play the player picked up the ball object. He said "Mission accomplished, when the cut scene started to play I knew I had come to the right place".

Segment F13

'I'm on my way' Tyler says. The scene shifts to Tyler's apartment where the player controls Tyler. Tyler gets up to take a shower before heading off to work, while his girlfriend promises to make coffee.

Summary

Participant S5 used SEI objects sparingly. His use was restricted to ball and doubleball which were used on three occasions. Ball was used to indicate a sense of success or accomplishment, while doubleball was used to indicate slight annoyance (see segment F10). The subject used objects by briefly picking them up before putting them down again. Due to the low object usage it is difficult to say anything about this participant's experience based on it. In the interview the participant stated that he thought the game was rather uneventful, which might have affected his usage.

Looking at the constructs elicited by the participant in Figure 54 we can see that the *uneventful-challenge* and *inactive-active* constructs are rather similar, indicating the level of activity in the game. Comparing the plot of inactive-active Figure 55 with the transcript we can see that the highest sense of activity is reached in the sequence where the boy falls into the pond. The same peak also shows in the unimportant-curious construct.

It is hard to draw any conclusions about agency from the either SEI usage or RGT data. Uneventful-challenge might hint at some level of agency as the peaks are reached in situations where the player is doing something else than speaking. For SEI, usage was too scarce to provide much information. In the interview the participant said that he did not think that his actions influenced the course of the game very much.

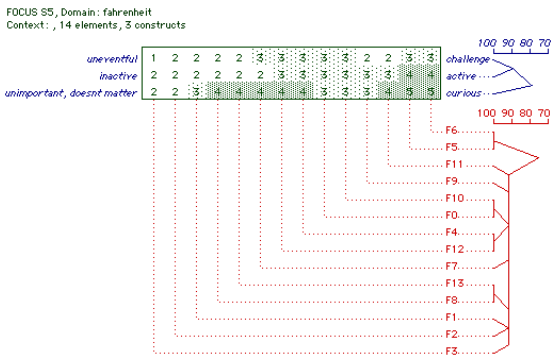


Figure 54 A FOCUS diagram generated from player S5's grid

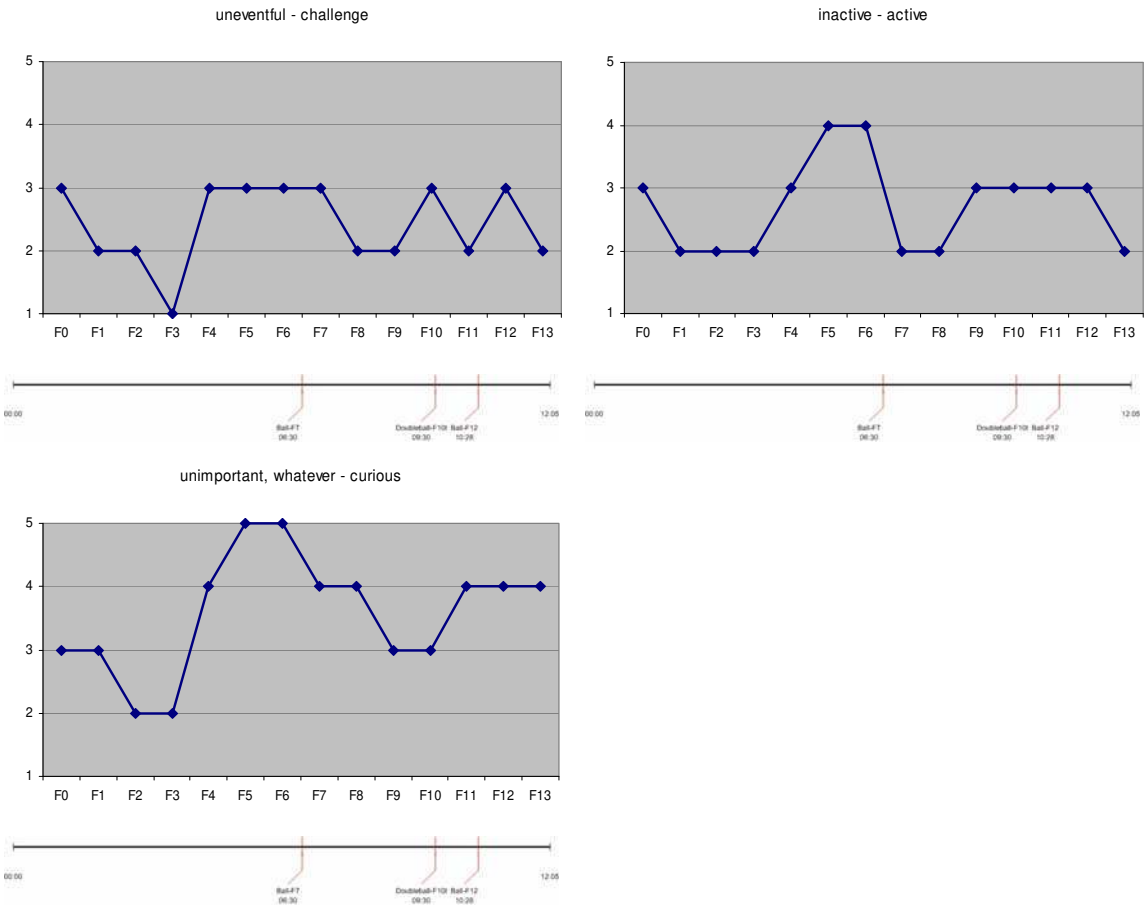


Figure 55 Plot of RGT ratings for participant S5. SEI-object usage is duplicated underneath each graph.

It is possible that the unimportant-curious construct could indicate a sense of immersion in the game in the sense of being curious about what will happen next in the story. Looking at how it evolves we see that it also peaks in the sequence where the boy falls into the pond. However during the interview the participant stated that he only felt slightly involved in the story. Hence, we can not say for sure.

Together the constructs provide some indication that the player experienced drama in the game, as all the curves build up to and peak at the most intense moment in the story. They do not however, give a very detailed picture of what makes the moment dramatic except that it is more challenging and active.

11.5.2 An in-depth view of player S7

This participant is a young male in his twenties with a positive attitude towards computer games. He plays games regularly and enjoys playing a wide range of genres including adventure games, action games, strategy games, and simulation games. In the study he played Fahrenheit, which he was familiar with but hadn't played before.

The session lasted for just over 12 minutes and was divided into 14 segments of approximately 50 seconds length. A transcript of the segments is provided below. The player's actions such as moving around or making choices are marked in boldface. In situation with multiple options for the player to choose from the options are presented within brackets with the selected option in boldface, e.g. [**read on**, stop reading]. As in the previous transcripts an account of object usage along with the player's motivations are presented for each segment.

Transcript of S7's session

As the player enters the scene Lucas, the character he is playing, has committed a horrible murder and is on the run from the police. However, the murder happened under very mysterious circumstances. Lucas felt as if he was a puppet on a string, with someone else controlling his actions. Now h he is on his way to the park to meet his brother, Marcus, to ask for help. As he is walking to the park he ponders: "When Marcus and I were kids he took care of me, we were inseparable. However we kind of grew apart when he became a priest. But he is still the only one who might believe that I had nothing to do with this mess".

Segment Fo

The player enters the park and quickly locates Marcus. 'Im happy to see you, I missed you. It's been a while' says Marcus. 'Two years' Lucas replies. 'So tell me what happened Lucas' Marcus says with concern in his voice. 'I killed a man Marcus' Lucas says and casts his eyes down. 'It happened at a restaurant last night. It was like I was possessed, in trance, like I was a puppet on a string. I saw what I was doing but was powerless to stop it!' Lucas says. 'My God! I can't believe this Lucas!' Marcus says in disbelief.

As Lucas explains that he was powerless the player uses the bubbly object. "Something was evolving, happening, emotions bubbled up" he explained.

Segment F1

'Tell me it wasn't you. You're not capable of something like that!' Marcus says. [Wrists, Alone, **Details**] 'This...murder, exactly how did it happen?' Marcus wonders. Lucas starts to tell his story. 'Well, after work last night I stopped at a little diner to get something to eat. I read a book at my table I think. And after it's just a black hole! I don't remember anything up until I found myself in the toilet with a knife in my hand. It..it was horrible' Lucas says.

[Wrists, **Alone**] 'You went to this restaurant alone?' Marcus asks. 'Yeah...Tiffany and I broke up

about a month ago. I try to get out of the apartment as much as possible. It's just so ... empty there without her you know' Lucas says in a husky voice. [Trance, Witnesses, Drugs, **Who Knows**] 'Who else have you told all this to?' Marcus asks. 'No one! You're the only person I could trust' says Lucas. [Drugs, **Trance**, Witnesses]

When Marcus asks Lucas what he means when he says he was in a trance the player uses the ball object. "I started feeling bored. There was too much talking going on".

Segment F2

'You said you were in some sort of ... trance. What do you mean by that? Are we talking about some kind of magic, sorcery, something like that?' Marcus asks. 'Marcus, I don't have an explanation! I'm just telling you what happened, that's all' Lucas says. 'I'm only certain about one thing! I'm not the one who really killed that man!' he says with conviction. [**Powers**, Visions] 'There's something else you need to know. I know this sounds crazy, but after the murder I…I had these... premonitions like I was seeing things that hadn't happened yet' Lucas tries to explain. [Visions, **What now**] 'What happened to me Marcus? What am I supposed to do now?' Lucas says and paces about nervously. 'You know me better than anyone Marcus. Help me!' he says. 'Lucas, I'm...I'm a bit lost here' Marcus says shaking his head. 'This whole story is just so bizarre!' he continues. [Police, **Sick**] 'Maybe...you need some professional help?' Marcus says hanging his head down. 'Most cases of possession are known to actually stem from psychiatric problems.

No objects were used in this segment.

Segment F3

[**Calm**, Aggressive] 'Marcus, I don't have a psychiatric problem. I'm not crazy!' Lucas says with emphasis. 'I AM a priest Lucas. The fact that you have taken a life is a very serious matter' Marcus says. 'I told you that it wasn't me Marcus! All these years, and nothing has changed! You still never listen to me!' Lucas says. 'Lucas, don't ask that I make a choice between my faith and my brother' Marcus pleads. [**Convince**, Break off] 'I'm not a murderer Marcus' Lucas says in exasperation. 'You're the only person that I can trust! I'm only asking you to believe me!' he says. 'Very well' Marcus replies. 'I'll do...whatever I can. But I can't do anything that goes against my beliefs!' he says. 'Look, I need to get some answers. I'll call you' Lucas says as he starts to move away from his brother. Marcus extends a chain with a crucifix to Lucas and says in a sad voice 'Here, you need this more than I do'. 'Marcus you know that I don't believe in all that' Lucas replies.

As Marcus questions Lucas' mental health the player uses the doubleball object. He stated that "I became more involved in the story and started listening more carefully to what both had to say".

Segment F4

[**Take**, Refuse] 'Thanks' Lucas says and walks away from his brother. Suddenly he is overtaken by a vision of a small kid falling into the icy waters of the nearby pond. He realizes that he has to stop the kid, but at the same time a policeman that might recognize him appears along the road. Like the vision foresaw the kid falls into the water and a bar showing how much time the player has to act appears **The player runs toward the place where the kid fell into the icy water, and jumps in**.

As Lucas walks away from his brother the player used the bubbly object. "I started to get a feeling for where this was going. Things started to happen again" he commented.

Later, as Lucas gets a vision about the kid falling into the water, the player switches to the pseudopod object commenting that "It's the same thing [feeling] but even more. Even more things started to happen".

Segment F5

The player swims down to fetch the boy and when he gets him he swims up again and pulls the boy up from the water. But the boy still seems to be unconscious. While swimming down the player must push the left and right button to swim.

The player switches back to the bubbly object as he is swimming with the boy up to the surface. "I went back to this one [bubbly] because it started to be a bit boring" he explained.

As he crawls out of the water with the boy and notices that he is unconscious the player used the spiky object. "It was more exciting again. More stressful and more exciting" he said.

Segment F6

The player starts CPR timing button presses to do it. A crowd has formed around them, including the cop. The kid regains consciousness. The crowd comments on the courage of the player and calls him a hero. The policeman from the murder scene and Lucas look into each others' faces. The policeman clearly has recognized Lucas. However, instead of arresting him a small smile forms on his lips. 'I don't know why he didn't arrest me' Lucas ponders.

As the boy regains consciousness the player goes back to the bubbly object explaining that "Things calmed down a bit. I got the situation under control".

Segment F7

'Maybe he decided I was even. I had taken a life and given one back' Lucas ponders. When he leaves the park Lucas feels better about himself.

The scene shifts to a police station. The player acts as Carla a detective investigating the case. Carla can't get the case out of her head. 'Something is wrong but what?' she thinks. **The player walks into the police station and is greeted by the officer at the desk.** They exchange a few lines.

As Lucas leaves the park the player selects the ball object again. "The excitement was over. Everything was calm again".

Segment F8

The player moves up the stairs behind the desk sergeant and opens a door to a floor with detectives sitting at desks working. The player quickly finds the office she is sharing with Tyler, her colleague. As she moves towards the office a colleague calls out to her. - Hey Carla!

No objects were used in this segment.

Segment F9

The colleague asks Carla to remind Tyler that he owes him money. Carla says she can't help him. Just as the player is about to open the door an officer walks by and says that he has some results on the test from the restaurant murder. Carla says she will talk to him as soon as Tyler gets in. **The player enters the office.** Carla looks at her watch wondering where Tyler is and thinks 'I should give him a call'.

The player selects the doubleball object when the colleague asks her to remind Tyler about the money he owes him. "The conversation started. I started listening to what he had to say".

When the officer starts talking about test results the player switches to the barbapappa object with a similar motivation. "I got interested in what he had to say. You [usually] follow the main character but now what he said caught my attention". Maybe the choice of object refers to a sense of splitting your attention.

Segment F10

The player walks over to the desk and picks up the phone to call Tyler. Tyler picks up the phone and yawns realizing he has overslept. Carla urges him to get a move on.

The player selects the stone object when placing a call to Tyler. "It was calm and you really didn't have to listen to what they said. The situation was relaxed".

Segment F11

The scene shifts to Tyler's apartment where the player is acting as Tyler. Tyler's girlfriend asks him to stay a bit longer but he says he really has to go. 'I'll make some coffee' says the girlfriend. 'Ok, I'll grab a shower and get dressed. Then I'm out of here' Tyler says and climbs out of bed. **The player walks around exploring the apartment.**

When Tyler finally gets out of bed the player selects the pseudopod object. "More things to do appeared. It made it a bit more exciting, a bit more engaging" he explained.

Segment F12

The player watches his reflection in a mirror that is hanging on the wall. 'Hey, you're a good looking guy!' You know that?' Tyler thinks. The player continues to explore the apartment and eventually finds his way to the bathroom. He steps into the shower.

When he makes his way to the bathroom the player selects the anteater object as "I felt more engaged, I noticed that I could do a lot of things".

When stepping into the shower the player selects the pseudopod object again, saying "the situation felt more relaxed".

Segment F13

Tyler steps out of the shower while his girlfriend moves towards the kitchen to make coffee. **The player makes Tyler use the toilet.**

No objects were used in this segment.

Summary

The player used all of the SEI objects for a total of 15 times. In general the participant seems to have used many of the objects to indicate the level of tension or excitement that he felt. The rounded objects were used to indicate a low level of excitement, and the ones with more protrusions to indicate a higher level of tension. Bubbly, pseudopod, and anteater were used to indicate a sense of many possibilities, and something evolving mixed with excitement. Of the rounded objects ball was used to express boredom while stone was used to express calmness. In both cases the player expresses a low energy state. Barbapappa was used to indicate interest while doubleball was used to indicate a sense of involvement. The player used objects by arranging them in a line and moving an object in front of the line when he wanted to "activate" it. Looking at the usage of objects in the transcript it is easy to see that the participant experienced a sense of evolving drama in the scenario.

Looking at the constructs elicited by the participant we can see two pairs of constructs that have similar ratings, see Figure 56. *Follow the story-explorative* and *un-*

engaging – *engaging* on the one hand and *mundane-exciting* and *relaxing-demanding* on the other hand. This could indicate that the participant felt engaged in the game when there were many options to explore, and also that the game became exciting when it was demanding. Looking at when the player felt most engaged and excited we see that it was during the incident when the boy falls into the pond which is a demanding situation. In that particular instance the situation is however not so exploratory although it is rated as highly engaging.

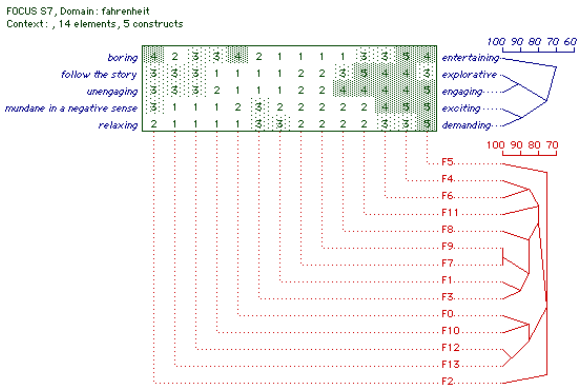
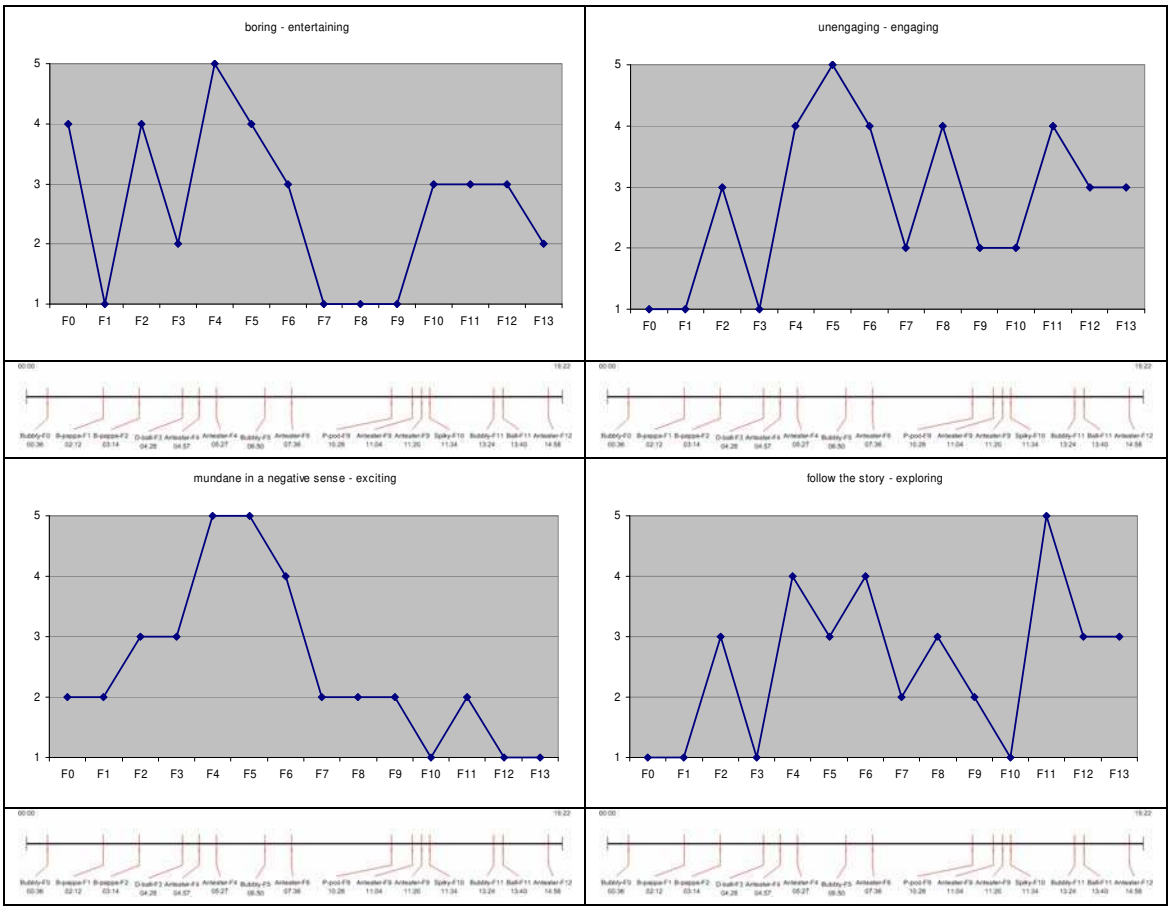


Figure 56 A FOCUS diagram generated from player S7's grid



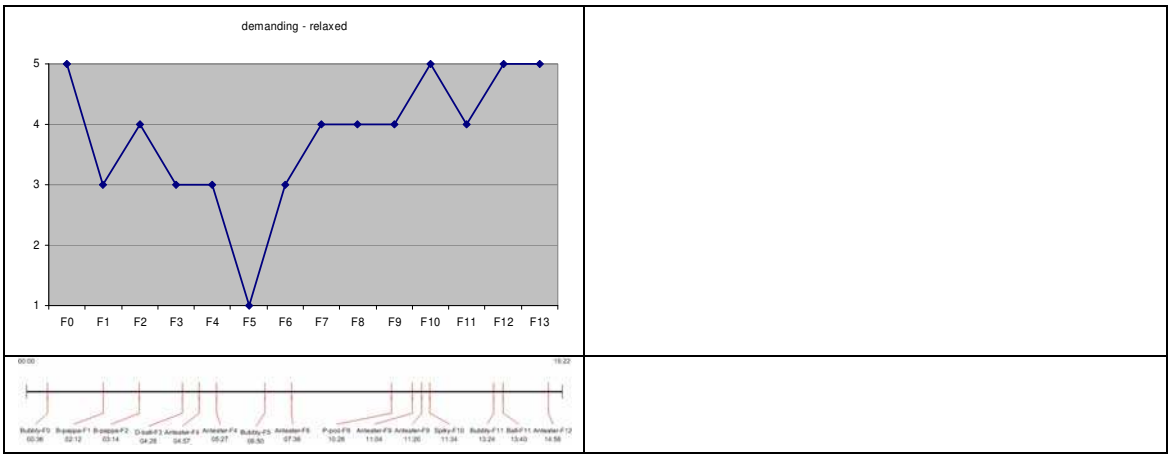


Figure 57 Plot of RGT ratings for participant S7. SEI-object usage is duplicated underneath each graph.

In the graph, see Figure 57, there is a rise of complication and excitement, similar to Freytags curve, where excitement rises to its max point in segments F4 and F5, followed by a drop to a more normal situation, see Figure 57. This is visible in the graph as well as in the usage of the objects (SEI). In the time that corresponds with the segments F4 and F5 the objects used were: bubbly, double ball and spiky. According to the interview both double ball and spiky were used to represent something exiting.

This however differed a little bit from the usage of the object bubbly that was used in two contexts in this period of time. Once to represent an increased interest, the feeling that "Something starts to happen again" and the second time to represent a slight loss of interest. This specific loss of interest for a few seconds cannot be seen in the curve.

Construct C3 (mundane-exciting) shows a reduction of excitement in element F6 which resonates with the choice of object (bubbly). During F6 the protagonist saves a child from drowning (instead of avoiding to get arrested), and in the end of the sequence he succeeds. When the participant had completed the task he used bubbly because the situation had resolved itself. He said that: "It became a little calmer, got more control over the situation". After bubbly he chose the ball that represented something even calmer "The excitement is over, everything is calm again". And as we can see in the curve this corresponds with the major reduction in excitement in the elements F6 and F7.

Agency may be gleaned from the construct follow the story - explorative. There is, for example, a large shift towards the explorative at the end of the session (F11) that also corresponds with the usage of the object chosen. The participant chose the object pseudo-pod that according to the interview represented more things to do in this context:" More things to do popped up, it became more exciting and more engaging".

The construct unengaged - engaged may hint at how immersed and caught up by the game the participant was. The highest level of engagement (according to the curve) was under the sequence (F5) where the protagonist saved the boy.

11.5.3 Overall results for Fahrenheit – all four subjects

Fahrenheit was played by four participants that used objects either three or fifteen times. Hence, object usage was very low or very high. The most frequently used object was bubbly which was used 10 times. In contrast to Façade where a single object accounted for a large part of the object usage, Fahrenheit saw a more evenly distributed usage.

Overall, object usage was not as consistent as in Façade. Still there were some sequences in the game where the participants had an equivalent experience (which can be seen by the interviews and usage of objects), even though they expressed it using different objects. For example in a scene where a small boy falls into the water most participants used objects to express something dramatic, exciting or unpleasant.

The following RGT-constructs were elicited from the four Fahrenheit-participants after playing the game:

Participant S8:	sad	action
	unimportant	important, significant
	mundane	dramatic
	annoying, irritating	neutral
Participant S7:	boring	entertaining
	unengaging	engaging
	mundane in a negative sense	exciting
	follow the story	explorative
	demanding	relaxed
Participant S6:	calm, uneventful	excitement
	uneventful	stressful
	joy	anger
	expectant, curious	bored
Participant S5:	uneventful	challenge
	inactive	active
	unimportant, doesn't matter	curious

Compared to the RGT-constructs elicited for Façade, we do not see as many irritating/annoying – pleasant constructs. Nor do we see a lot of constructs for involvement – disengagement and dialogue-related constructs. Overall, just reading this list of RGT-constructs and comparing it to the ones from Façade some of the overall 'feel' of the game comes through. While Façade seems to be more dialogue- and conflict-driven, Fahrenheit seems to be a game that is more action- or challenge-driven.

11.6 Full-Throttle

Full-Throttle is an adventure game for the PC created by Tim Shafer for Lucas Arts. The game is one in a long series of games based on the same game play concept written for the cross-platform SCUMM engine. These games resemble interactive fiction in that the player essentially gives commands to the game to navigate the world, solve puzzles, and interact with characters. However, commands are not typed, but selected by clicking on them.

In Full Throttle the player takes on the role of Ben, the leader of a motorcycle gang known as the Polecats. The villain in the game is Adrian Ripburger executive on Corley motors that manufactures motorcycles. Adrian plans to take over Corley motors by getting rid of "Old Man Corley" the founder of the company by killing him. Early on in the game Ben is framed for the murder and the hunt is on.

The player views the protagonist, Ben, from a third person perspective and moves him around by pointing and clicking on different objects and areas in the world which makes Ben walk up to the object or location. When the pointer is placed on an object that the player can interact with, it turns red. Right clicking on an object that allows interaction brings up an iconic menu that lets the player tell Ben what to do with it, for instance grab it or kick it (see Figure 58).

Figure 58 Right clicking an object brings up a menu with available actions on the object.

During the game players encounter other characters that they can talk to. Unlike Façade where players can say anything they wish, or Fahrenheit where they do not have to specifically choose between lines of dialogue, the conversation in Full Throttle is heavily scripted albeit textual. When having a conversation with another character players are presented with a set of predefined statements to choose from (see Figure 59). Choosing a statement leads to a response from the character and a new set of statements for the player to choose from. Almost inevitably you eventually end up in a loop, returning to a place in the conversation where you have already been. While sometimes this can be frustrating it is a part of the game mechanics; to try out which choices lead forward.

Figure 59 Dialogue in full throttle. By choosing "a line" the player continues the conversation.

Full-Throttle was only played by two participants and we will only provide an in-depth description of S9's experience. The reason we only had two participants was that Full-Throttle is less interesting as an interactive story than the other two games.

11.6.1 An in-depth view of player S9

This player is a man in his twenties with a positive attitude towards computer games and plays them regularly. He enjoys playing a wide range of genres including adventure games, action games, strategy games, and simulation games. In the study he played Full-Throttle which he had not played before.

The session lasted for almost 15 and a half minute thereby being the longest of the sessions. It was divided into 14 segments of approximately 1 minute and 10 seconds length. A transcript of each segment is provided below. The player's actions such as moving around or making choices are marked in boldface. As in the previous transcripts an account of object usage along with the player's motivations are presented for each segment.

A transcript of S9's session

When the player enters the scene Ben has woken up after having been knocked down for refusing to work for the games villain, Adrian Ripburger. While he was unconscious his gang has been tricked into moving on and Ben's own motorcycle has been sabotaged. He finds his way to Mo, a female mechanic, who lives nearby.

Segment F0

The player asks Mo, about the status of the motorbike. Mo explains that there are parts that need to be replaced and that the player needs to find them. In addition Mo's welding torch has been stolen and needs to be found. Mo hints that Todd, a junkyard owner living nearby might be helpful.

In the middle of the segment after having started talking to Mo the player picks up the bubbly object. The player explained: "The situation was a bit new and exciting, there were lots of options. But it wasn't exciting enough to pick spiky".

Segment F1

The player asks Mo where he can find all the missing things. Gas for the bike is also missing, for that Mo hints at a cistern. **The player explores the area at hand and picks up a gas can that is lying on the floor. The player clicks the motorcycle that Mo is working on with her back to the player and selects the watch command**. "I hate seeing her like this" Ben says. "Why? It's really my best side" Mo replies.

Just at the end of the clip the player picks up the barbapappa object and smiles in response to Mo's comment about her best side. He commented that "There were some slightly childish lines here".

Segment F2

The player walks out and finds the reporter that saved the players life. There is a conversation about what happened earlier to the player, who crashed with his bike. The player also says that he needs to stop an ambush.

The player picked up the barbapappa object again explaining that "there were some playful questions and stuff here […] but it never became childish".

Segment F3

The player asks the reporter if he can hitch a ride. The reporter replies he doesn't own a car. The player explores the surrounding.

After the conversation with the reporter has finished and the player explores the surrounding he picks up the doubleball object. "I was looking for something with many possibilities".

Segment F4

The player leaves the area, when the reporter all of a sudden runs off to a car that he has hidden and drives off. Apparently he was lying. The player walks toward the Junkyard dealer Todd's trailer.

As the reporter takes off in his car the player picks up the anteater object. "Now things became more exciting, although I should have picked the barbapappa object as well as she looked really funny, a bit like a clown, when she [the reporter] ran away".

When the player leaves the area an overview map is displayed where one can choose where to go next. At this point the player picks up the anteater object again. He explained that "At this point I entered the exciting new world. There were lots of things to try out and I didn't really know what would happen".

Segment F5

The player looks down a shaft where someone is welding. After walking around for a while trying to figure out how to proceed he knocks at the door to the trailer. Someone asks who is out there?

After having knocked on the door and hearing the elevator starting to come up the player picks up the bubbly object. "It was a bit exciting. I knew the man that had been welding was coming"

Segment F6

The trailer owner dismisses Ben by saying that "I've got no time for bums like you". The player kicks in the trailers door and explores the trailer. In a cupboard he finds a lock pick.

As he is exploring the trailer the player picks up the anteater object stating "He [the owner] could show up any minute now since I made a lot of noise when I kicked in the door".

Segment F7

The player leaves the trailer and kicks the pipe sticking out from the yard before he leaves the area. After that he goes to the Junkyard and tries knocking at the gate, when that doesn't work he kicks the door (which doesn't work either). After that, the player tries pulling the chain on the side of the door which pulls up the door.

No objects were used during this segment.

Segment F8

The player tries to jump towards the door but as soon as he let's go of the chain it falls down. The player continues trying to enter by navigating through his inventory and testing different solutions but doesn't figure it out. The player leaves the area and goes to the tower where there is petrol. There is a closed door there as well.

No objects were used during this segment.

Segment F9

The player succeeds in opening the door by using the lock pick and enters. When the player touches a long ladder up to the tower an alarm goes off.

Standing outside the electrified fence to the refinery the player picks up the pseudopod object. "There were lots of options here, as I recall" he said.

After having entered the refinery the player picks up the anteater object. "Here things became exciting. I was entering a restricted area and then you never know what will happen" the player explained.

When the alarm goes off the player again picks up the anteater object saying "There I should perhaps have picked up the spiky object instead since things got even more exciting".

Segment F10

Despite the alarm the player tries to climb up the ladder, this triggers a movie sequence where one can see the police arriving on a flying vehicle. They start shooting at the biker, which forces the biker to jump down and run away. After that the movie sequence is over the player just looks around the map.

As the police arrives on the scene the player picks up the spiky object stating that "things became even more exciting!".

Segment F11

The player tries to go back and looks around the place, checks his inventory before touching the ladder once more, which makes the alarm go off again. He runs away again.

The player tries to leave the area but Ben says 'I don't walk'.

After having escaped from the police again the player picks up the bubbly object. He explained that "What should I do now, I thought? It wasn't so exciting anymore but I still didn't feel that I had exhausted all options".

After having tried to leave the area the player picks up the ball object, saying that "here I discovered that there is nothing more to do"

Segment F12

The player goes to two places, back to the mechanic and thereafter to the junkyard again. At both places the players explores. The player pulls the chain in the end of the sequence.

No objects were used during this segment.

Segment F13

Tries to use the lock on the chain, but it still falls, pulls the chain up again.

Here the session is stopped.

As the player pulls the chain and tries to use the lock on it he picks up the anteater object. He explained that "Here I thought that I had come up with a way of opening the door. It made it exciting for a while".

Summary

The player used all objects except stone for a total of 15 times. Anteater, spiky, and bubbly were used to express varying degrees of excitement, with spiky being the most exciting and bubbly the least exciting. Objects with protrusions (anteater, bubbly, double-ball and pseudopod) were used to indicate a sense of many possibilities, except Barbapappa which was used to indicate humour. Finally ball was used to indicate a sense of being out of options. The player used objects by picking them up and briefly holding them in his hand before putting them down on the table again.

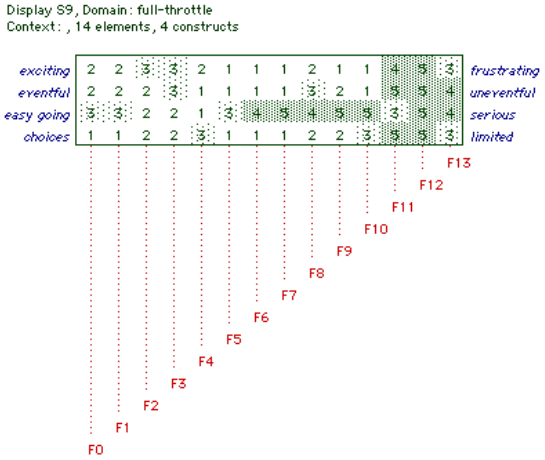


Figure 60 A FOCUS diagram generated from player S9's grid

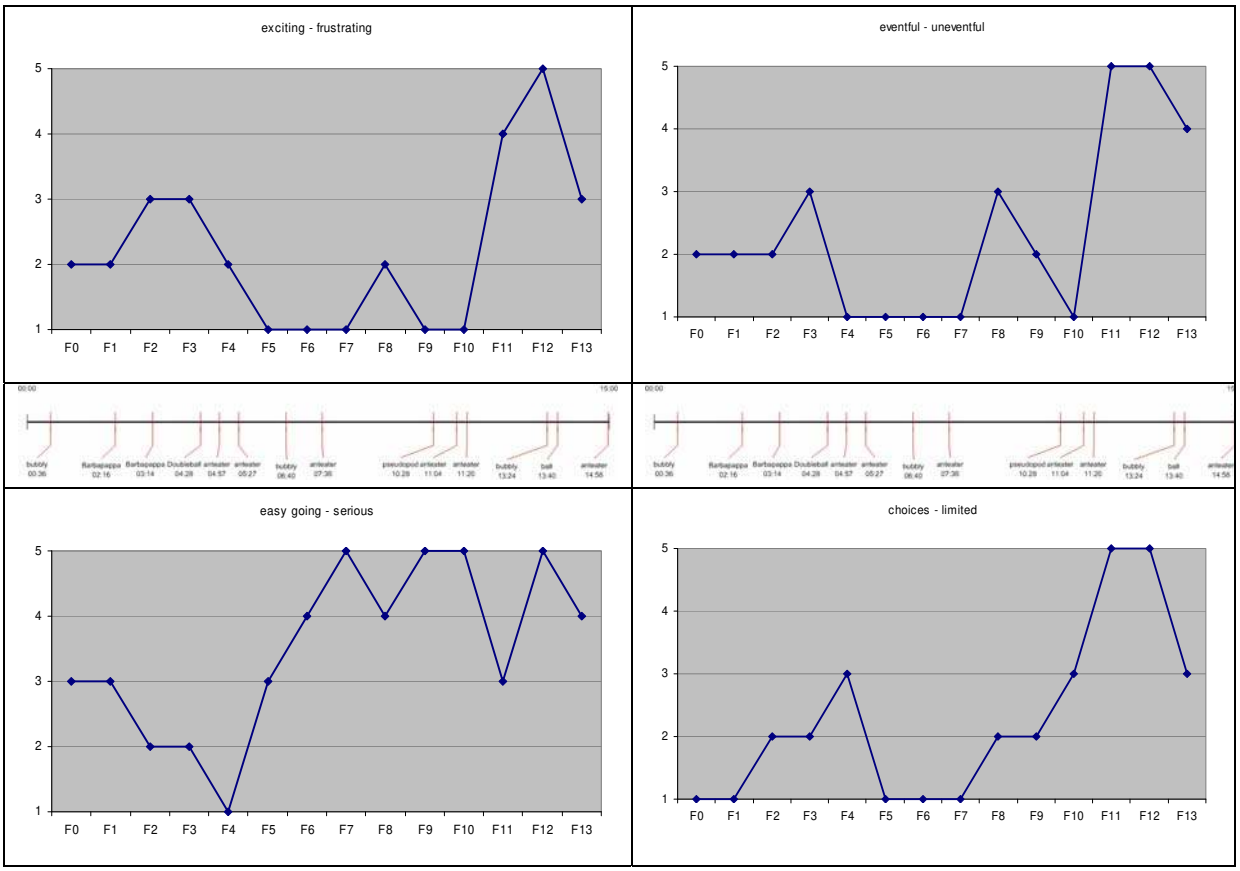


Figure 61 Plot of RGT ratings for participant S9. SEI-object usage is duplicated.

The RGT-constructs, see Figure 60 and Figure 61, reveal that this player did not have a good dramatic experience. It started with some excitement, but then moved towards frustration, a lack of events and with limited choices. This is also what the participant tells us when he explains why he choose certain SEI-objects.

11.6.2 Overall results for Full-Throttle – both subjects

As mentioned above, Full-Throttle was only played by two participants. One of the participants used an object on a single occasion while the other one used objects on 14 occasions. The participant using only one object, anteater, did so after a couple of minutes without making progress in the game, to express frustration and anxiety over not knowing what to do next. The other participant thought that the object represented excitement and in some situations also having many new things to try "Here I came out into the new exciting world, I could try out many new things, I didn't really know what to expect".

Since there were only two subjects playing this game, we cannot draw any general conclusions on whether SEI was able to capture the fleeting moment-to-moment experiences. However, at least one of the participants seemed to be able to express himself through the objects, while the other subject, who only used one object, got too frustrated and absorbed to choose anything. This is, in a sense, a result in itself. The interpretation of the game experience could be that for this newcomer to the game, the initial barrier of playing it was too high, something that a game designer might want to adjust. It also shows how getting absorbed by something can manifest itself in the absence of picking objects—something that the experimental leader should be aware of.

The two participants playing Full-Throttle elicited four constructs each as shown below. As can be seen in some cases both participants seem to express the same kind of experience. For instance, the *exciting-frustrating* and *boring-excitement* constructs seem to be similar as are the *eventful-uneventful* and *dead situations-eventful* constructs.

The following RGT-constructs were elicited from the two Full-Throttle-participants after playing the game:

Participant S9:	exciting	frustrating
	eventful	uneventful
	light, frivolous	serious
	choices	limited
Participant S10:	information rich	dramatic
	dead situations	eventful
	advisory	explorative
	boring	excitement

Compared to the RGT-constructs elicited for Façade and Fahrenheit, we do not see as many irritating/annoying – pleasant constructs as in Façade. Nor do we see a lot of constructs for involvement – disengagement and dialogue-related constructs. Instead, both subjects convey that this story had its dead spots (uneventful or dead situations). Thus, this game seems to be more of an action-game than the other two which in turn created for certain expectations that the game did not fulfil (during this short usage).

12 Reflections and critique

Let us now turn to an analysis of the SEI and modified RGT-methods and their respective value as tools for design of interactive stories. In chapter 8 we deconstructed experience of interactive stories into the following dimensions:

- Agency
- Immersion
- Transformation
- Drama
- Emotions
- Dynamic Gestalt

We also brought out the following demands on the philosophy behind the method, its cost and efficiency:

- Respect the players experience
- Foster a dialog between researchers and participants
- Reasonable effort
- Reasonable cost

Let us go through and discuss each of these for the two methods.

12.1 SEI evaluation

12.1.1 Interactive experience

In our study the use of SEI objects could pin-point the time of an experience more accurately than RGT, thus using them together may provide some benefits. SEI also gives an overview of the most salient emotions/experiences and events. Thus it can give an overview of the general ambiance of an experience. For instance Façade was associated with more negative emotions than either of the two other games.

But when it comes to capturing agency, SEI did not provide us with a good indication of when participants' felt that they were involved and could actively influence the story progression. Based on the intuition that when you are deeply engaged in something you tend to forget what is around you, we wondered whether object usage would decrease as engagement and tension in the story increased and thus be used as a measurement of immersion. In the Façade example this is in fact the case, but in the Fahrenheit example it is the other way around. In the Façade example the low object usage can also be

accounted for by the fact that the player felt out of touch with the story and did not feel s/he could influence it in any significant way. Thus, to be certain that subjects' feel immersed it has to be verified by participants themselves in the interview afterwards.

In a sense, SEI provides us with a better tool here than does RGT as subjects may well forget how involved they became, while watching the video afterwards and being asked why you stopped picking up SEI-objects will remind participants of being captured by the events (if that was the case).

It would be reasonable to believe that the objects would be neglected when participants had to interact with the objects and use a game controller at the same time, however this was not the case. The participants did in fact manage to use objects regularly (though not multiple objects at the same time). Most frequently participants held the objects for a brief time in their hand to convey an experience. One participant positioned the objects in a row. When s/he wanted to convey an experience s/he pushed the objects out of line for the length of the experience. By doing that s/he could use the objects and convey the experiences satisfyingly.

The game's ability to make players transform into the character they were acting was not captured by SEI nor by RGT.

SEI did not capture the dramatic curve as the objects cannot convey scales from more to less dramatic.

The real strength of SEI, and the reason that the method was created, lies in capturing the emotional experiences of the users. As we could see in the in-depth descriptions above, participants could talk about their SEI-objects and explain what emotions they portrayed in different situations. Through its purposefully ambiguous design the SEI objects are open for interpretation. They do not attempt to impose a meaning on the user. In addition users are free to use the objects in any way that they like. In the study the objects seem ambiguous enough to allow for many different emotions and shades of emotion experiences. This can be seen in situations, such as segment F2 for participant S9 where he says:

– The player picked up the barbapappa object again explaining that "there were some playful questions and stuff here […] but it never became childish"

Showing how the participant can express playfulness through picking the SEI-object barbapappa but at the same time express that this playfulness should not be interpreted as childish. Another example is in segment F0 for participant S11:

- In the middle of the clip the player picked up the spiky object and held it briefly in his hand. "All of a sudden there was heated dialog behind the door. It was something of a shock to me, so I chose the object that felt closest to that".

Here the spiky object, originally intended to express anger is chosen to express shock.

In our study the use of SEI objects could pin-point the time of an experience more accurately than RGT, thus using them together provides some benefits. SEI also gives an overview of the most salient emotions/experiences and events. Thus it can give an overview of the general ambiance of an experience. For instance Façade was associated with more negative emotions than either of the two other games.

Finally, when it comes to dynamic gestalt, SEI can only capture it to a limited extent, and only when subjects volunteer the information in the interview. But SEI will not provide us with an easy to grasp curve that where the game designer can see how the drama increases or decreases during game progression.

12.1.2 Method properties

The first requirement on our choice of method was that it would respect players' experience and not inscribe the ready-made interpretations that the experimental leaders or game designers might set up as goals of the interactive story. In this sense, SEI fulfils our expectations. The set of SEI-objects is somewhat limited (only eight objects), but this does not seem to have limited participants expressive needs.

The second demand was that the method would foster a dialog between researchers and participants, and again SEI fulfils this criteria. In the interview after the study session, subjects could reason about their object usage and reflect on what had happened together with the experimental leader.

When it comes to the cost of the method, SEI is very cheap. All that is required to set up a study is a videocamera (or two) and the SEI-objects themselves. The analysis also involves reasonable effort. Overall both cost and effort for analysis are very low for this method.

12.2 RGT

12.2.1 Interactive experience

Our modified RGT method proved to capture participants' sense of agency fairly well. All our subjects choose some RGT-construct that expressed agency in some form. Whether such a construct turns up in the study in turn depends on the storyness and agency of the system itself.

The study shows overall the importance of agency to the design of interactive stories. But we can also see from the study, that agency is a complex concept. It is not only about influencing the progression of events locally, but also about having a global impact on the total progression of the story. Participant S11 said "I felt that I had a little influence on what the next line would be, but that was it mostly". Hence it seems as if the player experienced a small degree of local agency—a sense of receiving confirmation that his actions had been noticed—while he did not experience a sense of global agency, a sense of influencing how the story unfolded.

Immersion is also often captured by the RGT-method. Again, it depends on the elicited constructs of participants. Likewise, we sometimes get constructs that give away aspects of participants' emotional experiences, but not as accurately and diversely as with the SEI-method.

When it comes to the dramatic experience of the game, RGT as applied in our modified version here, may capture it, but only if some of subjects' constructs entail the dramatic experience somehow. If none of the constructs really captures some aspect of a dramatic curve, we might argue that the game probably did not elicit enough of a dramatic experience in the user in the first place. We may also note that it seems as if several subjects had dramatic experiences even in sessions where they felt that the lacked agency.

One of the ideas we had when plotting the elements and object usage along a time axis, was to see if anything resembling a dramatic arc would emerge. As can be seen from the results sometimes a dramatic arc does indeed emerge. For instance in the Façade example where calm dialog-heated dialog reaches a climax in segments F5 and F6 for participant S11. However, there are no guarantees that a curve will emerge as it depends on the constructs that have been elicited.

Individually, each curve can be viewed as one aspect of a player's experience, and shows how that aspect evolved over the course of the session. Together the graphs can give a broad overview of the dynamic gestalt of an experience such as an interactive story. Using a plot like the one we have used could be a useful tool for designers and developers debugging their interactive storytelling systems.

Sometimes how one construct is used seems to give an insight into what experiences or perceptions played a part in bringing forth other experiences. For example in the Fahrenheit graph above one can see that the constructs follow the story-explorative and unengaged-engaging are similar, which could indicate that the participant felt that the explorative options played a major role in his/her engagement in the game and vice versa.

12.2.2 Method properties

Our modified RGT-method does both respect players' experience and fosters a dialog between researchers and participants. Through the elicitation process RGT provides constructs that describe the dimensions that are salient for users, not the researcher. There is no limit to the number or type of constructs that can be created. For this study we used a numerical rating scheme which may have felt unnatural to the participants, but there are other schemes that can be used, such as categorical schemes.

But compared to SEI, RGT comes with a slightly higher cost for the participants in terms of bringing our RGT-constructs. In general participants had problems creating a usable amount of constructs for the RGT evaluation. We believe one of the reasons is because of the way RGT is being used by us. Participants were asked to triangulate dynamic movie clips instead of static objects. Several experiences could be present in the same movie clip. Hence, the difficulty was not trying to find a clip that differed, but trying to find clips that had something in common. Another issue was the fact that the constructs were bipolar which one test person found to be limiting for how s/he expressed herself about the movie clips.

There is also the issue of ambiguity where two constructs had the same meaning, but were worded in a slightly different way. While this may feel confusing to the participant it is less of a problem for the researcher as similar constructs can be merged or simply pruned from the grid data. In general the whole process of capturing and segmenting video, although it is partially automated, needs to be simplified.

The cost of the RGT-method is not very high – neither in terms of study set-up and equipment, nor in terms of analysis. Using simple curves (generated in Excel) as those presented in chapter **Error! Reference source not found.**, we quickly get a feel for how the story progressed throughout the session.

12.3 Recommendations for SEI and RGT

We believe that both SEI and RGT can become valuable tools in a developer's toolbox. The time required to handle one participant in the study was well below two hours.

This included video recording the participants session, splitting the game video into segments, RGT elicitation and rating, review of SEI usage etc. As the purpose of the study was to evaluate the methods rather than the games some steps in the process might be skipped. As we see both tools as qualitative tools they would typically be used with a small number of participants, making it possible to perform an evaluation in a day or so. Furthermore with some tweaking of the setup and some further automation of the process even more time can be saved.

The equipment used was standard video cameras and computers together with open source software, making the equipment cost low. The only piece of equipment that was purchased specifically for the purposes of the study was a screen capture device (~ 50€) that allowed us to film what was happening on the participants TV/computer screen.

A lesson learnt is that some subjects will more easily deal with the SEI-objects and create RGT-constructs. Otherwise would probably do better after some training sessions. In our view, training subjects is not a bad idea.

Another practical insight is that different games or interactive stories can be played for different lengths of time, and this will probably have a major impact on the study. In our study, if we saw that the participant's game session developed into something interesting the playtime was extended for a short while. If however nothing out of the ordinary happened the session was terminated after about 10 minutes. The reason for setting an upper bound on the length of gaming sessions was purely pragmatic as only one of the three games included in the study, Façade, is short enough to be completed within a reasonable amount of time. In contrast both Full-Throttle and Fahrenheit contain enough material to sustain a gaming experience that lasts several hours. Hence shorter episodes; albeit still ones that provided a scene, a unit of experience; were selected from Full-Throttle and Fahrenheit while Façade was played from the beginning of the game. As a result we did not capture complete experiences but rather excerpts from potentially larger experiences, except in the case of Façade. If we had allowed participants to play Full-Throttle and Fahrenheit for the full time-length, both SEI and RGT would probably not have worked so well.

Both methods foster a dialog between researchers and participants. Use of SEI objects, discovery of interesting rating patterns, and fluctuations in the construct plots provide ample raw material for a discussion between researchers and participants.

As always the best protection for a players experience is not the method but the mindset of the researcher performing the study. Methods can be used in good ways and bad ways.

13 Discussion

Interactive storytelling is a phenomenon emerging in the crossroads of many scholarly, artistic, and industrial traditions. In chapter 1 we discussed how our goal was to fill in some of the white spots on the map of interactive storytelling research, mainly from a computer science and HCI-perspective, that is, creating tools and methods to support authors of interactive stories. Let us now come back to the initial questions we posed and summarise where we stand now.

13.1 Research questions revisited

This thesis set out to investigate three aspects of interactive storytelling: how plot and interactivity can be combined, how stories can be presented in a way that supports story construction in general and character believability in particular, and finally how the experience of playing an interactive story can be evaluated. Below we will briefly revisit our initial goals and see how the work that we have presented has contributed to answering those questions.

Story construction

The question that we set out to investigate was how pieces of a story can dynamically—and automatically—be sequenced into a coherent and dramatic plot. The work that we have presented illustrates the idea of regulating how a plot unfolds by looking into the future. More specifically, we have looked at preventive anticipation as a means of avoiding undesired plot twists. By simulating the progression of the story unwanted plot twists can be detected and avoided in advance. In many ways preventive anticipation as we have described it represents a milder form of plot guidance than for instance search. Instead of attempting to optimize how a story unfolds we focus on how to avoid undesired progressions. This should leave players with a greater freedom of action while at the same time keeping the story within bounds. However, the amount of intervention from the systems side will ultimately be determined by how a story developer chooses to use it.

As far as we know we presented one of the first publications on the subject of anticipatory plot guidance (Laaksolahti and Boman 2003).

Story presentation

While story construction deals with construction of plot, story presentation deals with spectacle: the sights and sounds that ultimately are the material cause of a player's experience. The second matter that we set out to investigate was how to visually present what is going on in a story world so that it supports the storytelling process. As interactive storytelling is a dynamic process authors cannot always rely on scripted material but must rely on techniques that are capable of adjusting the presentation on

the fly. Our work focused specifically on techniques for dynamically supporting the storytelling process at the level of spectacle.

Our contribution consists of techniques for making emotions and social relations among characters salient in a player's experience of an interactive story. Doing so supports the storytelling process in that events on levels below character, in Aristotle's model, become more salient and as a result makes characters more believable. This in turn ultimately leads to a greater understanding of the plot. The techniques are inspired by various arts and disciplines including cinematography, comics, colour theory and shape theory. Our work did not have any artistic ambitions. Instead we have tried to create tools and ideas that would be usable for developers of interactive stories, in which they can express themselves but still get support for automatic on the fly presentations of the story as it unfolds. Drawing an analogy to painting we have attempted to create brushes rather than paintings. Hence, the inspiration from the above mentioned disciplines was meant to inform us of relevant artistic dimensions that we could work with.

Our contribution illustrates how the process of story presentation can be automated along the dimensions that we have worked with while at the same time leaving artistic control to artists. While the techniques have not been evaluated with real players yet, plans for how to study their impact on the story telling process have been laid out. Perhaps most important in this work is our attempt to broaden the research question in the interactive storytelling area from being entirely focused on story progression and planning to also deal with all the extra-diegetic aspects of how player's come to understand and be engaged with stories.

Story evaluation

The final matter that we set out to investigate was how to evaluate interactive storytelling experiences. As such experiences are dynamic we were particularly interested in methods that would allow us to study how they develop over time. A concern in our work has been to find methods that make a player's subjective experience salient, rather than forcing the experience into a pre-existing framework. Another concern was that we wanted the methods to be usable as debugging tools by story developers in their design process. Hence we wanted methods that were simple and inexpensive to use, while at the same time they provided rich data.

Here we worked with SEI and RGT, two methods that have very different characteristics. SEI is used while playing a game while RGT is used to analyse the experience afterwards. We performed a small study of three different storytelling systems in order to evaluate what the methods could tell us about storytelling experience. Results indicate that the methods can indeed give a sense of how a player's experience develops over time, although there is no guarantee that they will. SEI results are sensitive to the amount of usage that the objects see. Sometimes users will forget to use objects and other times they will not use them as it interferes with their task. RGT results on their part are sensitive to the amount and quality of constructs that are elicited. Some participants in our study had a hard time eliciting constructs because they found the video clips that were used too similar.

However when all works out the methods can provide data about a player's experience in terms of *agency*, *immersion*, *dramatic curve experience* and *elicited emotions*, with the exception of *transformation* in the sense of taking on a role. At this point, we cannot say anything about whether the methods could capture transformation in the sense of re-playability as our participants only played the games once. The methods have so for only been used once for the purpose of evaluating interactive storytelling, hence

further studies and refinement of the methods is needed before they can become truly useful tools in the hands of a developer, though our results are promising.

Our reflections on how to capture players' experiences of interactive stories and the concepts we brought out here is yet another result that we believe will be useful to a larger community – as for example, games, affective computing and interactive character research.

13.2 Reflections on the state of Interactive Storytelling

An important characteristic of interactive storytelling as it is usually described is that it allows a player to influence the progression and outcome of a story. As a result agency has been described as the most important quality of an interactive story (Mateas 2000). Furthermore agency has often been taken to mean global agency, a player's ability to influence how a story evolves according to his own plans. However agency must be balanced against other qualities of a story such as its dramatic qualities. In some cases such qualities may actually be more important for the overall experience than a sense of global agency. Hence we would like to slightly tone down the importance of global agency for interactive storytelling experiences. It seems to us that there are stories that do not need to have a strong sense of global agency in order to provide a pleasurable experience. Imagine a prison scenario, where the player as an inmate, gets to experience the hopelessness of not being able to influence his situation. Whatever he tries, he ends up realising that he is stuck. He can try to bribe the guards to let him out and watch them laugh in his face, or attempt an escape only to be caught and dragged back to his cell. His actions do not really have any significant influence on the overall progression of the story. He is in jail, and stays in jail. What is more important in such a scenario is a sense of participation, that your actions are noticed, a sense of local agency. If that can be achieved the player can still have an experience in which he feels that he participates in the drama of the scenario.

In this work we have moved from a technology-centric to an experience-centric view of interactive storytelling. We started out with an interest in story sequencing mechanisms as that seemed like the most important problem to solve. Later we became disenchanted with that aspect of interactive storytelling as we started to question exactly what kind of expressive power such mechanisms have. Plot, the level at which story sequencing works in only the topmost layer in Aristotle's model. Below it are other layers that are equally responsible for a player's experience that are worth considering. In general we think it would be beneficial for the interactive storytelling community to start focusing as much on these levels as it does on the plot level.

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