Emergent Narrative – towards a narrative theory of Virtual Reality

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Ph.D. Thesis **2007**

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Submitted in Partial Fulfilment of the Requirements of the
Degree of Doctor of Philosophy, March 2007

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Acknowledgments

I wish to express my gratitude to Professor David Roberts for accepting to take on the supervision of this thesis in its late stages and for his commitment and dedication in assisting and supporting my research effort. I am also deeply indebted to Professor Ruth Aylett, for believing in me, offering me this fantastic opportunity and allowing me to pursue such a fulfilling experience. I would also like to thank her for her tremendous support and guidance. I am also thankful to Professor Ana Paiva and her group at INESC-id (Portugal), especially Joao and Marco for their brilliance and technical help.

I would also like to express my gratitude to all the interesting people I have met at the Centre for Virtual Environments and to the many friends I have made whilst conducting my PhD. To Carlos, Cecilia and the little ones, also to Nikkos, Fred, Kevin, Miguel, Simon, Mike, Mei, Oliver, Robin and Michael, with whom I enjoyed every minute of working and socialising with. Special thanks also to Sue, Linda, Karen, Norman, and all the rest of the CVE. I am also grateful to the people I came across whilst conducting my research. Thanks to Ian, Carl, Matthew, Judy and others for their comments, knowledge, constructive criticism, advice and technical help.

Finally, I would like to thank my family for supporting me through this project. I would like to express my gratitude to my parents and brother for believing in me. I am also deeply indebted to my wife Paula for all her help and effort in keeping up my motivation and dedication to this project. Finally I would like to thank my little boys (Jules and Oscar) for reminding me on a daily basis that there are many things to enjoy in life.

Declaration

No portion of the work referred to in this thesis has been submitted in support of an application for another degree or qualification of this or any other university or other institution of learning.

I declare that this thesis is work carried out by myself. Some of the work reported has been previously published.

Abstract

The recent improvements and developments on Intelligent Agents (IA), Artificial Intelligence (AI) and 3D visualisation, coupled with an increasing desire to integrate interactivity within virtual spaces bring concerns in regard to the articulation of narratives in such environments. Although the literal interpretation of the narrative term relates to “a story or description of events” and “a narrated account, the art, technique, or process of narrating” (URL: Cambridge-dictionary), (URL: Online Dictionary), computational approaches towards story articulation in Virtual Environments (VEs) present much diversity. Whilst this work does not attempt to settle differences within the Interactive Storytelling (IS) research community, it is motivated by the desire to investigate several aspects of the problem by focusing on the development of a novel narrative concept whose aim is to understand the mechanism and requirements for the generation of immersive and meaningful interactive dramas. The emergent (EN) narrative concept argues for a process-based view of the narrative as opposed to a more traditional authored-artefact approach. Whilst borrowing on studies and works carried out within the IS community, the elaboration of the EN concept investigates in depth the origins and applications of interactivity in the context of storytelling, the narrative concepts and theories and explore with great interest the roles played by characters and emotions within an interactive framework, resulting in a novel dynamic character-based narrative model. The work presented herein describes a theoretical and an empirical study of narrative in respect to its articulation within intelligent agents and virtual environments. The work presented in this document relates to the elaboration of a novel narrative model dedicated to interaction.

Chapter 1

Introduction

> Time is construction.
>
> - *Paul Valery.*

1.1 Introduction

Virtual Reality (VR) has now progressed beyond the simple act of technical discovery towards a valid medium in its own right. A systematic exploration of the potentials, possibilities, advantages and constraints of this technology now needs to be carried out in relation to different types of functionality and application. Given that VR is of specific interest to the AI community in the domains of storytelling and intelligent characters, these are particularly relevant areas for research. Just as narrative in film was originally seen through the lens of narrative in the novel, so there is a tendency to consider narrative in VR in relation to film or television, or to even earlier narrative theories. Despite some very influential work based on this approach ((Bates 92), (Perlin et al 96), (Hayes-Roth 95), (Mateas 97), (Mateas et al 99)), a thorough investigation of the nature of VR itself should be conducted in order to identify narrative forms and means of communication specific to this medium.

The work presented in this thesis emanates from several disciplines such as narrative understanding, narratology, synthetic agents, characterisation, emotion modelling and computer science. The initial aim of the research is to understand and

solve the issues related to the narrative paradox. This phenomenon occurs in virtual environments when interactivity is integrated within a narrative frame and/or vice versa. The concept of a 'narrative paradox' in Virtual Environments (VEs) is now well established (Aylett 99). This revolves around the conflict between pre-authored narrative structures – especially plot - and the freedom a VE offers a user in physical movement and interaction, integral to a feeling of physical presence and immersion. Thus establishing the clash between narrative structure and interactivity as the major research problem in relation to this investigation.

1.2 Summary of Main Contributions

In order to cover the necessary research grounds in solving the narrative paradox introduced in this chapter, the work presented herein features contributions for each phase of the research process, namely; theoretical formulation, system design/articulation and technical implementation. The thesis' main contributions are presented below:

- The formulation of a novel theoretical solution to the problem of reconciliation between interactivity and narratives (i.e. The emergent narrative concept). This concept is based on both a theoretical and empirical study of the articulation of narratives and narrative elements within real-time interactive virtual environments. It also features a deep reflection on the representation, display and articulation of emergent approaches, particularly regarding the role of the user.

- The definition of a novel story management approach that draws lessons from interactive practices such as the ones commonly observed in Role-Playing games (RPGs), interactive theatre, IMPROV or video games. It also constitutes a contribution on the development of a methodology for the authoring of emergent

narrative systems and features the representation of characterisation and performances via XML configuration files (eXtensible Mark-up Language: XML is a text mark-up language for interchange of structured data).

- The design and implementation of an affectively driven agent action-selection mechanism, aiming to generate dramatically interesting events. Essentially based on a discussion on the particular relationship between emotions and dramas and the essential role of emotions on the unfolding and understanding of narratives, a novel agent architecture approach (i.e. double appraisal) is discussed, described and implemented.

Secondary contributions include a contribution on the methodology for the evaluation of emergent narrative systems and results obtained from real users with regards to a series of system simulations (Chapter 8). Similarly, results of experiments measuring characterisation, behavioural believability and drama perception within different system configurations are discussed in the same chapter.

1.3 Narrative

1.3.1 VR as a narrative medium

This work argues that VR should be considered as a specific narrative medium alongside other narrative forms such as theatre, literature or cinema. Each of these present peculiarities that differentiate them from each other and determines their relative narrative forms, means of communication and display of content in relation to a story. A story is neither told nor shown in the same way according to the medium in which it is displayed, nor is its content or its intensity the same. The very different nature of media means that a narrative has either to be told or shown in different ways, varying the intensity of different aspects or parts of the content in order to achieve a satisfying effect on the person(s) to whom it is communicated or

displayed. The recent cinematic adaptation of *The Lord of the Rings* (Tolkien 54) illustrates this point, differing as it did in a number of respects from the original text, reflecting for example the more external visual perspective of film as against the internal character-centred commentary of a novel. What is possible in a novel is not obviously realisable in a motion picture and vice versa. By their characteristics, narrative media generate different narrative forms that allow them to transmit the narrative in the most efficient way. Virtual reality, as a narrative medium, through its interactivity and other peculiarities, presents characteristics that none of the previously mentioned narrative forms usually possess, and should therefore be recognised as such.

[Table 1.3.1A] below, presents a comparative table of the four major narrative media discussed in this chapter with regard to determining factors; namely time and space dependency, narrative representation, presence and interactivity.

	Cinema	Theatre	Literature	VR
Time and space dependency	Low	Medium	Low	High
Narrative Representation	Visual	Visual	Mental	Visual
Presence	Not physical	Physical	Not physical	Immersive
Interactivity	No	No/Yes[1]	No	Yes

Table 1.3.1A: Comparative table of different narrative forms

It shows that whilst VR shares the same visual narrative representation as Cinema and Theatre (Visual), it relates differently to other factors such as presence (immersive as opposed to physical or not physical) and dependency on time and space (which is strong since it is the only medium that is expressed in real-time). Finally, VR is also a narrative medium that has been designed for interaction

[1] Whilst classical theatre is passive from the audience's perspective, certain forms of modern theatre are interactive.

between virtual realities and users. In this work, we regard interactivity as “an action that occurs as two or more objects have an effect upon one another” (URL:Wikipedia-Interaction). “Objects”, in the case of this thesis, can be represented by characters, users, props or virtual environments.

In the main, its ability to interact with a user stands as a truly differentiating element and is arguably a sufficient condition for the consideration of VR as a narrative medium of its own.

1.3.2 Narrative considerations

Representing and communicating stories in Virtual Reality and 3D virtual environments is a challenge that involves the consideration of essential narrative elements such as the role of the user, the form and nature of the story, the capabilities of the narrative medium and ongoing issues about user interactivity and immersion. There has been, understandably, during recent years, an increasing interest from the AI community in storytelling[2] and the development of models for computational story/narrative management. Stories have been studied for centuries and narrative theories originate from Plato (Plato 360BC). This section reviews relevant models representative of the wide spectrum (plot-based to character-based) of work inspired by the study of the narrative question (i.e. narrative consideration, study and analysis) and presents relevant theories emanating from both ends of the aforementioned spectrum of works.

Until the recent development of VR in the world of communication and entertainment, Plato’s categorisation of stories could almost be considered as a universal rule. Stories were either told by the author/poet directly (Diegesis) or

[2] The work in this thesis refers without distinction, due to the definitional closeness of the terms, to stories, narratives, story-telling and interactive dramas

shown to the audience through the use of characters (Mimesis). This work looks at the relevance of this approach in regard to the possibilities brought by VR technologies. In addition to studying Aristotle's plot consideration (Aristotle 330BC), it also considers from a practical and critical perspective Propp (Propp 28) and Campbell's meta-structural (Campbell 49) interpretation of the narrative matter.

Since such a study depends a great deal, as with any theoretical work, on the validity of the fundamental principles it is built upon, the work presented in this thesis is based on the assessment of narrative theories together with the critical consideration of linking them contextually, historically and chronologically to their media of expression. This document takes the position that such theories should not only be studied as pieces of theoretical contribution, but also with respect to their potential in contributing to the development of an interactive narrative medium. Consequently, the study of Cinema, Literature, Theatre or Performance based narrative media, should be regarded as equally important to those based on classical narrative theories and are therefore taken into consideration in the reviews of both Bordwell (Bordwell 86) and Chatman's works (Chatman 78).

Finally, the narrative theories advanced by the Russian Formalists, the French Structuralists and Heath's philosophical approach (Lapsey et al 88) all have their roots in linguistics and view the use of language as representing the basis of cinema and of narrative in general. Eichenbaum in (Bordwell 86) viewed film shots as being linked into phrases and sentences and Tynianov in (Bordwell 86) sought for language structure in cinematic equivalents. The linguistic interpretation of the narrative question with respect to the VR medium and particularly the works of Greimas (Greimas 66), Todorov (Todorov 66) and Barthes (Barthes 66) is reviewed in Chapter 2.

A broad range of knowledge in different research domains is needed for the implementation of computational narrative systems. In addition to the obvious and essential knowledge of both VR and synthetic agents and knowledge of areas such as narratology, cinema and theatre theories, knowledge of performance-based practices is also required. This review aims to cover the most relevant works in each of these. However, it does not aim to conduct an in-depth review of all these areas but to provide sufficient knowledge for the design of a system suitably adapted to the articulation of narratives within virtual environments.

1.4 Emotions

The study of emotions, the way they are modelled, generated and implemented within a computational framework is also an area of great relevance in the development of a system of the type discussed in this thesis. Whilst not always recognised as an essential parameter of the whole storytelling experience within the research community, one would have to consider the central and essential role played by emotions within dramatic techniques. There is a clear link between emotions and drama and an actor's interpretation of a character can be assessed with respect to how well s/he reflects the character's internal state of mind. In turn, a successful interpretation will allow a spectator to understand a character's motivations and personality. This type of implicit affective communication between a static spectator and a static character allows the spectator to feel emotions whilst watching or reading a drama. From a narrative perspective, our natural ability to understand and communicate on an emotional basis is a tool used by authors to manage and maintain contextualisation. Furthermore, since actions or events are not seen out of context if their causes are understood (i.e. emotionally, logically,

deliberatively), they also play a role in preserving the general coherence of the drama.

Emotions in drama, independently of their forms or representations, are expressed through the character, upon whom the responsibility of communicating emotions with a spectator or reader relies. Although photography, music, editing and directing techniques provide essential support in generating emotions, they are ultimately channelled through the character. Since the Emergent Narrative concept (EN) revolves strongly around a conception of a character-based drama, the position taken in this thesis is that emotions should occupy a central role in the system design. The EN concept intends to generate narratives by means of meaningful actions and events (i.e. emotionally and cognitively speaking) within an agent framework. It is therefore essential that emotion modelling techniques are understood and taken into account for agents' implementation if they are to communicate implicitly with the user and maintain cognitive cohesion and contextualisation.

The aim of the EN concept is to provide essential knowledge in understanding the relationship between drama and emotions, from a character and user perspective. In order to achieve sufficient knowledge in this area, this thesis will study several pieces of seminal work in this field such as the cognitive structure of emotions developed by Ortony, Clore and Collins (Ortony et al 88), and Lazarus's appraisal system (Lazarus 91). These concepts should provide influential techniques and understanding for the design of agent action-selection perception mechanisms. The acquired knowledge should also prove of great relevance in the design of assessment methods for the evaluation of the EN concept presented in Chapter 8.

1.5 The Emergent Narrative (EN) hypothesis

The goal defined at the start of the present research is to develop a theory of emergent narrative that would be designed with the intention of solving the narrative paradox (c.f. Section 1.1) by producing a story system practically demonstrating the value of such narrative principles and articulations. However, this approach should be distinguished from Jenkins's definition of the emergent narrative term (Jenkins 04). He described emergent narratives as "not pre-structured or pre-programmed, taking shape through the game-play, yet they are not as unstructured, chaotic and frustrating as life itself". This vision has fuelled the "meta-debate" (Aarseth 05), between ludologists and narrativists within the computer game community. Although such a concept is advocated in this thesis, it is important to differentiate between the two interpretations of the term. The vision of an emergent narrative described therein relies on "game-play" and interactions between characters and does not explicitly display a narrative structure whilst still seeking for dramatic and narrative outcomes (i.e. via characters rather than overall plot). However, an element of structure and pre-programming has to be present for the concept to be concretely implemented. The EN concept tends to agree with the necessity of narrative structures, but expresses the strong belief that interaction-oriented approaches should be sought. The EN concept referred to in this document, relates to the interpretation of the term described in this section.

The research presented in this thesis is part of a wider research field (interactive storytelling) where a certain number of techniques and approaches have

already been identified. These can be distinguished according to several criteria as showed in **[Table 1.5A]**.

Approach (user consideration)	**Authorial** **Non-Authorial**
Interaction (story representation)	**Linear** **Branching** **Universal Plan** **Generative**
Authoring Level	**Plot-based representation** **Character-based representation**

Table 1.5A: Interactive storytelling approaches

On the higher level, the distinction revolves around the role played by the user in the interactive system. The user either assumes the role of the author of a story (authorial approach) or that of a participant/spectator (non-authorial approach). On the lower level, distinctions are made on the mode of interaction of the system and the way stories are articulated. Finally, a distinction is made regarding the system's level of authoring; high-level plot authoring or low-level character-based authoring. A story can be represented in several ways in an interactive storytelling system:

- The linear approach proposed by the likes of cinema, literature or classical theatre.
- The branching approach or "tree" structure where several plot changes are pre-arranged and pre-programmed into the system

- The Universal plan approach where every single story element is encoded in the system and narrative decisions are made according to the availability of these elements
- The generative approach where the story is regarded as a process and unfolds as the interaction takes place.

The emergent narrative concept argues for a process view of the narrative as opposed to a more traditional authorial approach. The mechanism investigated consists of generating a narrative by the interactions between characters rather than the authored narrative types in more widespread use. The narrative experience would consist of a dynamic process where as well as the user, intelligent agents would control and determine the unfolding of the narrative. In this respect, such an approach requires an innovative dynamic character-based narrative model. The system investigated is an **emergent character-based generative system** and is referred to, in this thesis, as the emergent narrative concept (EN). It is based on the hypothesis that **"the narrative paradox discussed in this chapter could be solved via a character approach, as opposed to a more common plot-based structure".**

1.6 Methodology

In order to achieve the objectives set in this thesis, a methodology featuring both theoretical and empirical studies has been used and, as a result of necessary investigations, covered a wide range of disciplines.

The first objective is to contribute to the recognition of VR as a valid narrative medium and open the way for a constructive narrative debate. The formulation of the EN concept itself represents a first step towards such a debate, and a call for the formulation of an adapted and suitable narrative theory proper to

VR. The study of the EN concept also calls for the consideration of other related domains such as emotion modelling and cognitive science in an effort to create intelligent agents that are not only aware of their bodies and functions, but also prepared to assume social and dramatic responsibilities within the story's agent characters (non-player characters) and the character played by the user.

The formulation of the EN theory is based on the study of relevant narrative theories with respect to both their potential value for a character-based narrative approach and their abilities to support interactivity. Thus, the role of the user is also an important element of the study. In parallel to this, empirical data was also gathered with respect to performance-based and alternative narrative media, as opposed to the classic ones (i.e. Cinema, Literature and Theatre). This data concerned narrative forms such as interactive theatre (i.e. IMPROV, Street and Forum Theatres) and video and role-playing games.

Existing narrative systems were also regarded as a source of inspiration and therefore particular attention was given to their study. Since there are many approaches to story articulation within VR, only the most relevant published works have been studied. The study comprises the agent approaches proposed by Cavazza (Cavazza et al 01), Young (Young 99), Szilas (Szilas et al 05) and also the drama manager pioneered by Mateas (Mateas 01). Systems and grand scale projects are also represented in this study and the technical architectures of projects such as IMPROV (Perlin et al 96) OZ (Bates et al 94), ALIVE (Blumberg 95), TEATRIX (Prada et al 00), MRE (Rickel et al 01) and VICTEC (Aylett et al 06) are also investigated.

Since the emergent narrative concept is formulated around a "bottom-up" approach, its implementation is by nature more complex and concrete than its more traditional "top-down" counterpart. Rather than descending straight from the author

to the characters according to a pre-determined and authored structure as seen in traditional narrative media, the storyline in the Emergent Narrative approach unfolds from the characters' interactions with each other. Since the characters' actions have an impact on the story world, this contributes to a non-deterministic and emergent structure rising from the characters to the main storyline. The implementation of such a system is technically demanding. Not only is the design of appropriate characters a complex task which requires a certain level of expertise, it also has to be coupled with state-of-the-art agent approaches such as continuous planning and multi-agent interaction models. It is not however in the scope of this thesis to produce and develop whole agent architectures and systems; the core of this work focuses on the sole problem of narrative articulation within virtual environments. Consequently, the decision has been made to develop the demonstrator illustrating the validity of this thesis based on existing agent frameworks. Details of agent frameworks and systems are discussed in Chapter 5.

1.7 Overview of the Thesis

The body of this thesis is split into nine chapters, which are outlined below:

- Chapter 1 presented the introduction to the thesis
- Chapter 2 reviews the literature on narrative theory. The review pays attention to classic narrative approaches and narratology.
- Chapter 3 reviews some of the most significant narrative systems developed in recent years. The review pays attention to their relevance regarding provision of a potential answer to the "Narrative paradox".
- Chapter 4 reviews relevant literature on emotions models and concepts and pays attention to their relevance regarding interactive storytelling and dramatisation.

- Chapter 5 reviews relevant architectures on synthetic characters. The review pays particular attention to their potential suitability towards an emergent narrative approach.

- Chapter 6 presents the theoretical formulation of an emergent narrative concept.

- Chapter 7 discusses the design approach for the development of interactive dramas within the recommendations discussed in Chapter 6. It also details the technical implementation of a novel double appraisal mechanism developed in order to provide a technical solution to the specific topic of this thesis.

- Chapter 8 discusses results and details of the evaluation process and illustrates the discussion with appropriate graphs and figures.

- Chapter 9 offers conclusions to the work described in this thesis and offers recommendations for future research and/or developments on the Emergent Narrative concept.

Chapter 2

Narrative theories

> From nothing, one can build a great story
>
> -*Properce.*
>
> The meaning of a story is acquired by participating a little
>
> -*Antonio Baldini*

2.1 Introduction

Narrative concepts have been developed over the years in cinematic, theatrical, and literary research. One potential assumption is that these established concepts could be transposed to Virtual Reality (VR) and form the backbone of interactive storytelling. However, assessing narrative theories according to their relevance to a narrative approach to VR proves to be a challenging task. One big issue lies in finding a common ground between theories so that they can be considered, analysed and compared. If a comparative approach to the characteristics of different media appears reasonable, a similar approach to narrative theories seems more questionable. Whilst the theories discussed in this chapter are essentially plot-based and classically approach the user as a spectator, the spectrum of abstraction on which they rely is such that, for instance, a direct comparison between Aristotelian and Structuralist considerations would prove difficult due to the different nature of the conceptual frameworks involved.

In order to develop a narrative theory for VR, it is therefore necessary to consider the relevance of these different approaches individually. The narrative theories presented in this thesis have been categorised according to a high-level narrative concept first put forward by Plato (Plato 360BC) and then also considered by Bordwell (Bordwell 86). The Platonic categories of “Diegesis” (the poet directly addresses the audience) and “Mimesis” (the poet addresses the audience through the use of characters) are applied to both the narrative theories and to the various narrative media under consideration, including VR. In this work, Diegetic theories and narrative forms relate to the “telling”, as seen in the tradition of oral storytelling, original Greek drama (at least the chorus) and substantially in the novel. Mimetic forms and theories relate to the “showing”, as seen in present forms of theatre or cinema.

Such a categorisation allows grouping under one high-level concept theories emanating from different disciplines (i.e. philosophy, mythology, formalism, structuralism, linguistics and cinematics) and considers narrative as a representation, a structure or a process. The visual aspects of VR may suggest that priority should be given to mimetic rather than diegetic considerations. However, both can potentially make a positive contribution, so in this respect they are both equally considered in this work.

2.2 Mimetic narrative approaches and theories

2.2.1 Aristotle – Muthos and Mimesis

Aristotle **(**Aristotle 330BC**)** was in all probability the first to apply logical and ordered reasoning to the investigation of narratives in his poetics in order to identify their different structures and components. In this particular work, Aristotle distances

himself from his teacher Plato, not because of his logical method, but because his subject matter, poetry, was recognised but condemned by Plato.

Aristotle focused mainly on tragedy, and identified its six main components: *Action, Character, Thought, Language, Pattern and Enactment* (spectacle) – *Muthos* (plot) and *Mimesis* (mimetic activity) being the two main concepts. Aristotle defined Mimesis as the representation or portrayal of actions and behaviours – a dramatic enactment; and Muthos as the arrangement of the incidents or the organisation of the events that form the overall plot structure of the narrative. Although Mimesis and Muthos might seem equally important, Mimesis is defined according to Muthos, making Muthos of prime importance. Aristotle clearly saw the structure of the plot as essential to the construction of the narrative and considered its components of prime importance in the narrative structure. The plot structure constituted the primary significance of poetic drama in (Aristotle 330BC) (chapter VI) and the poet was considered a “maker of plot structure” (Aristotle 330BC) (chapter II). Given that the tragedy of the day portrayed plot, in the form of fate, as dominant over character, this emphasis is understandable.

In 1991, Laurel (Laurel 91) presented a model of the Aristotelian theory, in which she identified two different types of relations between the components of the structure of tragedy. Aristotle’s six hierarchical components were related to each other in one direction, from action to enactment, by an authorial view of the narrative represented by the plot (i.e. formal cause); and, in the opposite direction, from enactment to action, by the audience view of the narrative represented by its understanding of the plot (i.e. material cause). The main components of the narrative structure were thus linked by two opposite causal chains.

However, this theory did not integrate interactivity. The emergence of interest from the AI community required the model to be adapted to suit user actions and interactions within the plot. Mateas **(**Mateas 01, 02**)** put forward a neo-Aristotelian theory [Figure 2.2.1A], in which the roles and limitations of the user could be represented as a character in the drama.

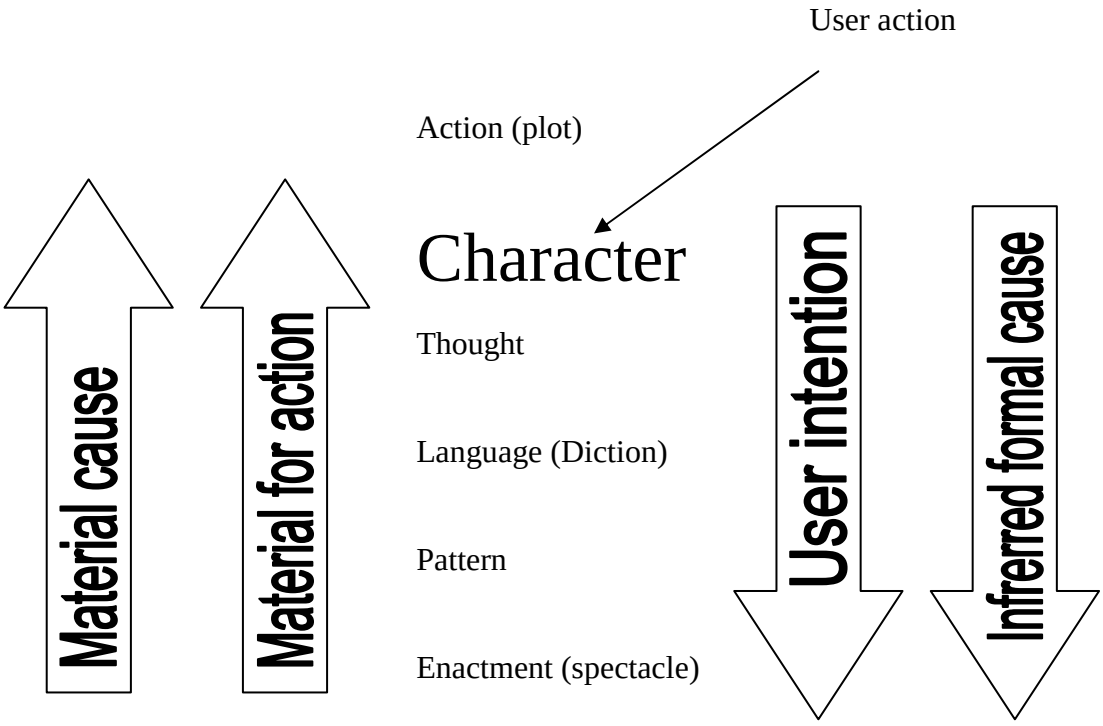


Figure 2.2.1A: Neo-Aristotelian Theory of Drama in (Mateas 01)

The user's interaction is integrated by the addition of two extra opposite causal chains. The user's intention plays the role of the formal cause, from action to enactment, as an authorial perspective on the narrative. The material cause is represented by the limitations on the user (material resources constraints from below and plot constraints from the plot authorial level). In this model, it is interesting to see that user actions are situated at the character level in Aristotle's narrative structure.

The AI community in recent years has been strongly influenced by the Aristotelian approach to narrative and has recently produced significant work based on those concepts (Riedl et al 05). However, Aristotle's plot centred approach does not include interactivity between the author and the user as a possible factor or component of the narrative. When transposed to VR, the Aristotelian approach to narrative presents three main constraints:

Firstly, its plot oriented structure makes the integration of interaction difficult and conflicts with the freedom VR potentially offers to the user and can therefore be highly restrictive. Recent Neo-Aristotelian theories developed within the AI community (Mateas et al 05) include user interactions and give more importance to the characters. However, the dominance of plot requires mechanisms to force the user back into a desired action sequence. Techniques have been developed in the video-games industry to bring back players within a story line whilst limiting the impression given to a user of a pre-determined plot that must be conformed to. These techniques include for instance multiple choices in adventure games that all lead to the same point in a story. Another common technique is to design large environments as in role-playing games (RPGs) where tasks cannot be achieved or do not make sense if the player has not reached a certain story level. The sense of presence experienced within a story can be greatly affected if the user is not seamlessly led towards a plot line. Mateas achieves this through the concept of *beats*, which operate like episodes on a desired route. In effect this requires the author of the system to explicitly define the content of a universal plan (Mateas et al 03) covering all possible branching points. This approach, when applied to a large story environment with many characters requires the generation of a large number of

branching points that would be intractable both from an authorial and computational perspective and an issue for the authoring of interactive experiences.

Secondly, Aristotelian and Neo-Aristotelian theories are essentially authorial narrative models. In these approaches, the plot and its structure are of prime importance and the character is regarded as a narrative element that must conform to plot instructions in order for the story to gain form and cohesion. Since the EN approach focuses primarily on character and only allows a limited role for pre-determined plot structures, these narrative considerations conflict with the character-based narrative approach investigated in this thesis.

Finally, given that Aristotle gives little theoretical weight to the role of emotions in narrative, apart from the "catharsis" concept (Aristotle 330BC), it is not surprising that subsequent theories do not pay any particular attention to emotions and their values. Chapter 4 underlines the important role assumed by emotions in human cognition, as well as being a major factor in the establishment of believability (Magnenat-Thalmann et al 05). A narrative theory for VR must encompass the emotional contribution to believability, which contributes towards providing the user with a unique immersive experience. Eisenstein's expressionist approach (Bordwell 86) regarded narration as the manifestation of some essential emotional quality of the story. With this aim of a satisfactory user experience in mind, this expressionist narrative conception might be included in the consideration of a narrative model proper to VR.

2.2.2 Bordwell – Cinema and narration

Theatre and cinema clearly work largely from a mimetic perspective, sharing a particular awareness of the spectator's visual engagement. Cinema and film theorists have added to the general Aristotelian conception of mimesis, by including the

conception of narration from different perspectives (i.e. camera angles) to emphasise dramatic structure. The camera can then be thought of "as an observer ideally mobile in space and time" (Bordwell 86) or an invisible observer. However, Bordwell (Bordwell 86) argues that this only partially cover the narrative functions of other film techniques.

The narrative study conducted by David Bordwell is of particular interest for this work in the sense that despite the study being a major contribution to the understanding of narrative in cinema, it presents a thorough description and a deep understanding of narrative theories. Not only does it contribute valuable information regarding the evolution of narrative considerations in cinema, it also contextually and chronologically presents relevant narrative theories such as the ones developed by the Russian Formalists or the French Structuralists.

Conceptions regarding essential matters such as story and discourse or the opposition between mimetic and diegetic are discussed in a methodological attempt to identify a narrative model proper to cinema. It is not unrealistic to imagine a similar approach applied towards the definition of a narrative model such as the one we argue for. Research on the emergent narrative concept benefits from Bordwell's work in the sense that he contributes essential knowledge on the historical and contextual background of narrative theories as well as providing the tools for an accurate assessment of their potential benefits.

The theories covered in Bordwell's work have had a substantial impact on technical aspects of cinematography through the use of particular camera angles and positions, but their contribution to the theory sought for VR is more problematic. In cinema, the camera is under authorial control, so that the ideal observer it represents is in some sense the narrator. In VR, the camera is identified with the user, and

removing user control over it directly contradicts the freedom to move that is one of the major defining characteristics of the medium. In a way, VR moves beyond mimesis – "showing"- with its implication of direction, to "experiencing". Thus, although both cinema and VR share a synthetic visual aspect, there are fundamental differences between them that make the narrative theory of film much less relevant than one might have assumed.

There are, however, a certain number of comments made by Bordwell that are directly relevant. He indicates that there are three different ways to study and interpret narrative and storytelling. Indeed, narrative can be treated as a representation, the portrayal of some reality or its broader meanings. It can also be seen as a structure, a particular way of combining parts to make a whole. This is the direction undertaken by both Russian Formalists and French Structuralists through the study and elaboration of narrative grammars or other analytic models. Finally, narrative can be studied as a process, becoming the activity of selecting, arranging and rendering story material in order to achieve a specific time bound effect on the perceiver. The latter point relates directly to the vision of an Emergent Narrative concept. Bordwell, however, underlines the fact that in practice, the three approaches often overlap. It may then be that in setting forth a theory of narration for VR, this investigation should at some point touch upon matters of representation and structure, in particular when dealing with user role and participation. In addition to theoretically delimiting mimetic and diegetic theories of narration, Bordwell's contribution towards this particular investigation is also to reflect on essential narrative elements that must be taken into account in developing any narrative theory. Such elements comprise of principles of narration such as the Sjuzet (i.e. "how the reader becomes aware of what happened") (Tomashevsky 66) and its

construction; style; genre; temporal stratagems; and temporal construction in general, but also the construction of space and its representation, and the perspective of the viewer. In this respect, it is apparent from the hypothesis on the emergent narrative concept described in the previous chapter that a serious and thorough investigation of viewer and user perspective should be a source of theoretical progress towards a narrative definition and a model articulation. The role of the user is described in the theoretical formulation of the concept in Chapter 6 and represents one of the core topics of the debate for such an approach.

2.3 Diegetic narrative approaches and theories

2.3.1 Narrative macro-structural definitions

Another approach to narrative structures and theories is to consider the narrative as a logical sequence of actions, each action possessing a set of functions relative to the narrative. This perspective, which fits in conveniently with AI planning approaches, attracted the interest of the AI community to the study of Russian folklorist Vladimir Propp. Propp wrote his *"Morphology of the folktale"* in 1928 (first English translation in 1958) (Propp 28). Formalist and later structuralist approaches to the macro structural level of narrative rest on its forms rather than on the substance of its content. In his research for structural analysis of Russian tales, Propp identified 31 functions in an attempt to classify and structure the narratives of Russian folk tales. His empirical analysis was based on over 450 Russian tales; this sample was then classified and a sub-set of 100 tales produced. These functions form the core of the narrative, the *Dramatis Personae*. However, because some functions are contradictory and should not appear in the same structure, only 25 could be described as constants.

In order to compare the structure of various tales, Propp designed a system of symbolic identifiers, one for each function. In was then possible to represent the pattern of a particular tale with a sequence of symbols, allowing the analyst to make comparisons and help with classification. The functions are part of a chronological and logical structure. They should fit into one consecutive story, always appear in the same order and non-logical sequences should not occur.

Since it is impossible to group all the tales in the world under a single set of generic functions, such as abstention, interdiction or violation, Propp broke down these generic functions into a set of sub-classes, each of them affiliated to a single function, making a universal grouping achievable. The number of sub-classes is specific to the function and depends on its nature, complexity and role. Propp regarded the structure of fairy tales as all based on a single type, the quest type adventure story. The number of functions known to be found in fairy tales is limited, and the sequence of functions is always identical. He suggested a view of the tale's narrative structure as a seven-part model **[Appendix A]**.

Therefore, all functions described in this section should be considered as appearing in the order in which they are listed. Some can be grouped into pairs and can cause the occurrence or non-occurrence of certain events that could change the structure of the narrative and its classification. Propp also identified some narrative elements (***Auxiliary elements of the tale***). Placed in between the functions, their role is to link the functions to each other (symbol §), bring elements of trebling (to make or become triple. i.e. in the case of fairy tales, success is met at third attempt, symbol □), or help in the display of motivations within the goals and mission of the hero(es), (symbol mov).

Since Vladimir Propp's "morphology of folktales" (Propp 28), several authors have been interested in the identification and understanding of plot structure and its components, and eventually adopted a fairly similar approach. American mythologist Joseph Campbell (Campbell 49) studied the adventure of the hero in mythology and identified four distinct parts to the development and unfolding of the adventure, as well as summarising them in a cyclical diagram **[Figure 2.3.1A]**. Campbell's approach, although emanating from another discipline (i.e. Mythology) can be presented as a meta-structural consideration of plot and, like Propp, he took an interest in the journey of the hero; the main protagonist of the tale or myth. The cyclical diagram he proposed is composed of four main periods, namely the departure, the initiation, the return and the reign and death. The study of Campbell's model reveals instructive similarities between his model of hero in the myth and Propp's representation of the folktale. Whilst presented in a cyclical fashion, the model described above is yet another version of the Muthos representation.

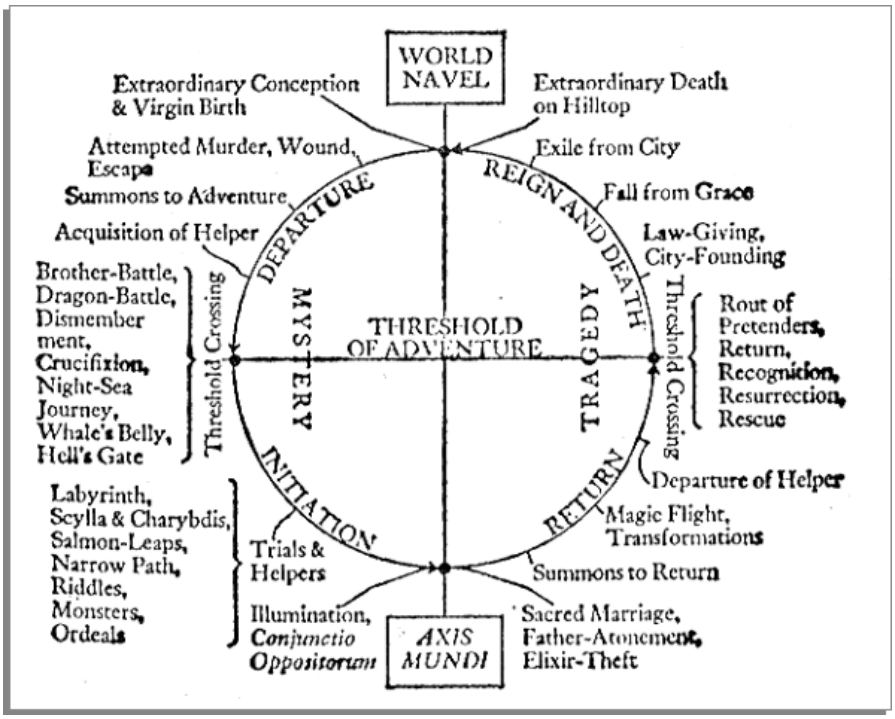


Figure2.3.1A Campbell's cyclical diagram of plot in (Campbell 49)

However, it was Bulgarian structuralist Tzvetan Todorov (Todorov 70) who helped to introduce meta-structural plot considerations and Propp in particular to French structuralists, and brought the most significant contribution to the understanding of plot structure when he developed a similar technique and presented the plot recurrences in algebraic formulae, identifying and distinguishing narrative noun-subjects (characters), narrative adjectives (situations) and narrative predicates (actions).

However, once taken out of a quest type storyline, macro-structural narrative approaches quickly find their limits. The need for narrative to emerge through interaction fits poorly into Propp or Campbell's rather prescriptive narrative structure and fairly reductive consideration of the character's role. Furthermore, with respect to the narrative, it collides with the character-based concept of emergent narrative. Whereas a narrative model could certainly be successfully implemented into VR through quest-type entertaining games, its contribution towards a narrative model like the one we argue for seems to be limited. Chatman (Chatman 78) argued that such an approach (i.e. categorisation) "*may become so broad as to be inane, virtually identical with those of narrative structure itself*", and identified another dimension to narrative, the discourse.

2.3.2 Structuralist and formalist narrative considerations

The narrative theories advanced by the Russian Formalists, the French structuralists and Heath's philosophical approach in (Lapsey et al 88) all have their roots in linguistics and the use of language, therefore it seems reasonable to think of them as inclined towards a diegetic approach. The Russian formalists, however, in their study of cinema and its narrative components, did not construct a comprehensive model. They advanced considerations such as Fabula ("the set of events tied together which

are communicated to us in the course of the work, what has in effect happened") and Sjuzet ("how the reader becomes aware of what happened", "the order of appearance (of the events) in the work itself") (Tomashevsky 66), as of prime importance in the understanding of narrative. The macro structural approach advanced by Propp (Propp 28) has been applied in AI community as a tangible model for the development of storytelling systems (Waraich et al 98, Paiva et al 01).

Chatman (Chatman 78) however, argues against the narrative universality of macro structural models. It is not clear, for example, that Propp's model applies to soap operas in the way it does to Russian fairy stories, or indeed that it would apply to the myths and fairy-stories of non-European cultures such as the Chinese. The French structuralists later explored the structures of narrative based on a linguistic approach. Works by Greimas (Greimas 66), Todorov (Todorov 70) and especially Barthes (Barthes 66) can be cited here.

In the works of the French literary critic and structuralist Roland Barthes, (Barthes 66), stories are innumerable; they are communicated by many means (i.e., in language, both oral and written; in images, both fixed and moving; in gesture/movement); are present in many forms (i.e., myth, tale, fable, essay, story, tragedy, drama, comedy, pantomime, painting, stained glass, cinema, comics, conversation) and in any time, period, place, society or class. Taking this into account, Barthes defined stories as universal, international, trans-historic and cross-cultural.

Barthes believed in the existence of a universal model to which any story must refer (a sort of narrative parallel to Chomsky's deep grammar (Chomsky 75)). It seemed reasonable to use linguistics itself as a foundation for the structural analysis of narrative. Russian Formalist and French structuralists recognised that we

should not study the literary text itself but its 'literariness' (Todorov 67), literary theory being the study of the nature of literature. **[Figure 2.3.2A]** presents a structuralist vision of the narrative and its different elements.

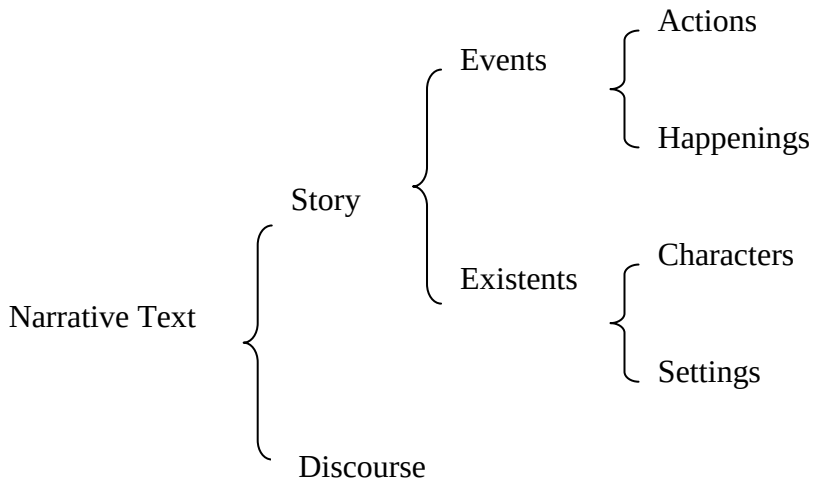


Figure2.3.2A Structuralist narrative representation in (Chatman 78)

Like the Russian formalists who made the distinction between the 'Fabula' and 'Sjuzet' (plot) (Tomashevsky 66) Chatman added to the debate by arguing that the narrative text must be divided into two different distinct parts – the story and the discourse. As Chatman (Chatman 78) explains in simple terms, 'the story is the 'what' in a narrative that is depicted, discourse the 'how it is told'' **[Appendix B]**.

Barthes (Barthes 66) argued that the meaning of a story is not something revealed at the end of the story but uncovered throughout it. He identified three hierarchical levels of narrative linked by a progressive integration mode; Functions, Actions and Narratives. Barthes' definition of a function is a unit of content, each function being either distributive (corresponding to the sort of functions identified by Propp, i.e., distributive classes) or integrative (indexing functions, not involving complementary or causal information but information still necessary to the meaning of the narrative, the understanding of the character i.e., integrative classes).

Relationships between the unit and its components are different. Functions (distributive classes) have a metonymic relationship within the unit, as indexes (integrative classes) have a metaphorical relationship within the unit.

Functions deal with the functionality of doing (e.g. actions), whilst indexes are concerned with the functionality of being (i.e. revealing (integrating) a character, feeling or atmosphere). The distributive class of functions is separated into two sub-classes of narrative units: the cardinal functions (core, articulation of the story) and the catalysis functions (to fill in the 'blanks' in the narrative space). The cardinal functions represent the risk elements of a story, whilst the catalysis functions represent security zones in the story. A catalysis function takes place between two cardinal functions without changing the nature and the meaning of the sentence (for example: the phone rang (cardinal 1), Bond walked to the office (catalysis) and picked up the phone (cardinal 2). The actions of the phone ringing and Bond picking up the phone are meaningful to the story and could be interpreted as causes for events within the story. The action of Bond walking to the office is of much less importance and would not result in any causal effect within the story. Narrative events follow not only the logic of connection but also the logic of hierarchy where some events are more important than others.

In Chatman's work, the Cardinal and Catalysis functions are interpreted as Kernel and Satellites, kernels representing the 'narrative moments that give rise to cruxes in the direction taken by events', and satellites representing minor plot events **[Figure 2.3.2B]**.

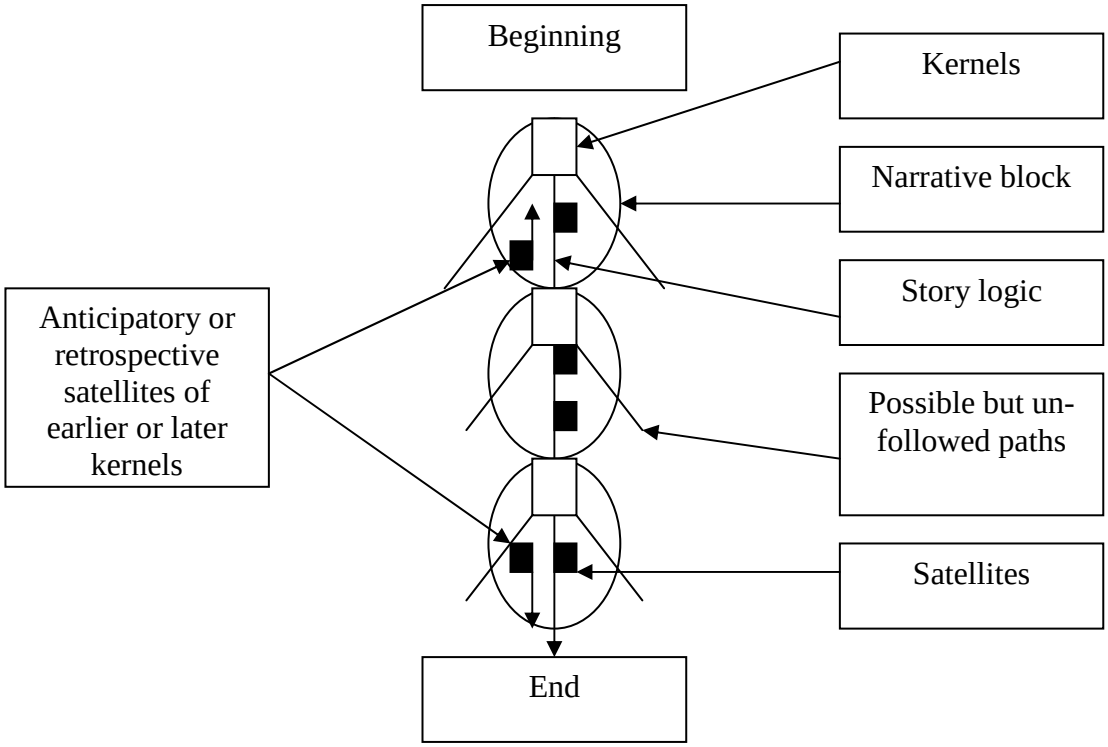


Figure2.3.2B Chatman's narrative articulation in (Chatman 78)

Barthes also identified a set of two sub-classes in the integrative class (i.e. indexes): feature-based units and informants. Feature-based units are implicit and continuous, their role inside a story is to establish or amplify behaviours, feelings, atmospheres or philosophies; informants help the identification and location of time and space. Feature-based units imply a descriptive activity (i.e., acknowledgement of behaviours or atmospheres) and informants usually bring knowledge and help to fix fiction into reality.

To summarise, Barthes' units at the functional level consist of Cardinal functions, Catalysis functions, Indexing units and Informants. The action level of the narrative is represented by the actions of different characters, and he saw the identification of grammatical categories as key to the action level. However, as these categories can only be defined through language rather than reality, characters can only find their meaning in terms of units at the action level if these are integrated to a

third level of the description, the narrative level. Barthes suggested that the narrative level is composed of a mixture of two different systems of signs, personal (i.e. the author as a subject - discourse) and a-personal (i.e. the story as the instrument of expression - story). The narrative is therefore composed of narrative signs and operators that reintegrate functions and actions in the narrative communication; articulated around the person delivering the story, and the person receiving the story.

Martin (Martin 86) regrouped Structuralist, formalist and Chatman's consideration of the narrative definition in a self-explicit diagram **[Appendix C]**. Barthes, as well as other French Structuralists, approaches narrative from a completely different angle and in a different context from the consideration of an Emergent Narrative model. The level of abstraction on which his valuable and conclusive analysis is based makes it difficult for direct computational application, although Cavazza, Mead and Charles (Cavazza et al 01(2)) successfully implemented a storytelling system borrowing from this model. The fact that the narrative is seen as a process in the EN concept poses compatibility problems with an analytical perception of the story. Although it is important to recognize the validity such perception brought to the understanding of narrative structure, it is believed in this thesis that the foundations for a fully interactive character-based narrative should be sought in a rather less generic and more specific model.

Since the analysis of structure is inescapably tied to a view of narrative-as-artefact, the applicability of structuralist theories conflicts with the real-time process based approach sought with the EN concept. Despite the evident analytical benefits of such approaches, it is therefore also questionable to consider their use in the process view of building a narrative in a VR environment. Considering the prime importance of user interactions in VR applications, a process approach to narrative,

based on character interaction (among them the user) would be more suitable and appropriate. A similar approach taken by Heath, argued that, when considering the relation between subject (i.e. user) and text, the narrative organisation of images and representations maintained the subject in position within the text. “The subject is caught up by the text and bound not into position but into the process of narrativisation, the text moving the subject in a constantly shifting regulation and containment” (Heath 81). The consideration of “narrativisation” and the role of the user shares similarities with the “storification” process discussed in Chapter 6 and described in (Louchart et al 02).

2.4 Contemporary and interactive approaches

In the wake of the emergence of Virtual Reality technologies and the success of video gaming in the last couple of decades, scholars in the interactive storytelling commnunity have adapted to the changing world and approached narratives from a different angle. Rather than study narratives for their structure or articulation mechanisms, the focus has slightly shifted and narratives are now studied for their potential to engage a user interactively. These relatively new approaches should be considered as direct contributions to the Virtual Storytelling research community and are of direct relevance to the type of research conducted in this thesis. However, different stances have been taken on the potential of interactive dramas and on interactivity itself. An ongoing debate currently involves two schools of thoughts on these topics.

On one hand, the “Ludologists”, a movement that has emerged from the video-games communities, refutes any claims that video games should be regarded as either a form of narrative or text. Their approach could be summarised to the simple fact that a video game is a “game whose foundation lies on the dynamics of

play and interaction being the most important and fundamental part of the game" (URL: Wikipedia-Ludologist), there is no narrative element or theory of narration involved in the process.

On another hand, the "Narrativists" believe in the power of new computer formats such as video games to "expand the possibilities of expression available for storytelling" (URL: Wikipedia- Narrativists). The term has been proposed by Mateas and refers to "a scholar who uses narrative and literary theory as the foundation upon which to build a theory of interactive media" (Mateas 02). Interactivity is regarded not as "an essential part of the game" but as the combination of the procedural and the participatory property which together afford the pleasure of agency" (URL: Wikipedia-Narrativists). This approach, considers the characters as protagonists of a drama and players as co-authors or actively participating to the unfolding of the story.

Whilst the EN and the Narrativist approaches have several elements in common, they do not share the same ideology and are therefore distinct from each other. The belief in this thesis is that there are still too many factors and aspects to be investigated within the interactive drama research field (i.e. the important role of emotions and cognitive empathy) to take a clear stance on the validity of one approach over another (i.e. Ludologists vs. Narrativists). The debate itself is certainly confusing since Ludologists refute the idea of narrative meaning in games but justify their claims via the use of narratology. On another hand, Narrativists transpose the whole storytelling concept away from narratology by considering interactivity. From an external perspective, the core of the debate seems however to lie in the opposition between theory-based and practice-based interpretations of narratives. One side of the argument (Ludologists) backs up claims upon theoretical

grounds whilst the other (Narrativists) partially refutes these grounds in favour of more practice-based solutions. Doubts have been raised upon the validity of such a debate in the belief that misunderstandings and misconceptions from both communities have somewhat cluttered discussions (Frasca 03). Both perspectives on the debate are described in Section 2.4.2.

Finally, a third stance is to look at the bigger picture and step back from the ongoing debate in order to investigate the potential of interactive storytelling from the perspective of the user/player. This approach investigates interactive mechanisms and regards the understanding of interactivity as essential in identifying both the roles and dynamics involved in interactive dramas. This approach is described in the next section through the work of ML Ryan. Further contemporary concepts such as the one advanced by Chris Crawford (i.e. "Erasmotron" (Crawford 04)) are discussed in Chapter 6 along with the theoretical formulation of the EN concept.

2.4.1 Marie-Laure Ryan – Understanding interactivity

In the face of interactive drama and the emergence of projects such as Façade (Mateas et al 05), Marie-Laure Ryan (Ryan 01, Ryan 01(2)) has been interested in investigating the sources of interactivity rather than narrativity itself. In an attempt to understand the inherent mechanisms and articulation issues related to interactive drama and virtual storytelling, she approached the research question from the perspective of interactivity. Her approach contemplated the bigger picture and aimed at understanding the exact involvement of a user in such applications. Her findings are worth comment and bring real insight to one of the core elements of the problem considered in this work (i.e. interactivity).

The concept of interactivity has fuelled most of the research on virtual storytelling or interactive storytelling. The challenge set up by the introduction of

interactivity within the way we entertain or educate ourselves has been the real animator of recent research in this area. Interaction with stories requires a major rethink about the way in which narrative media are approached. Whilst it is necessary to have a comprehensive knowledge of narrative media and theories, it is equally as important to understand in depth the functionality of interaction.

Ryan has been looking at these issues from the perspective of a user and has identified a dichotomy between what she defines as internal versus external interactivity. In other words, this concerns the presence of the user within the story-world, either represented inside as a player or character (internal) or outside (external) when experiencing a god-like point of view on the environment. The other dimension to add concerns the causal relationship between the user's interactions with the story-world, do they have any effect at all on the unfolding of the story or are they merely limited to observational functionalities. This is described in Ryan's (Ryan 05) terms as the ontological (user decisions affect the plot) versus exploratory (user decisions do not affect plot) interactivity.

Ryan identifies four main types of interactions where the role and interactive potential of the users vary dramatically. The peripheral interactivity regroups applications where "the story is framed by an interactive interface, but this interactivity affects neither the story itself, nor the order of presentation" (Ryan 05). This can be interpreted as an External-Exploratory interactivity type when referred to Ryan's categorisation in **[Figure 2.4.1A]**.

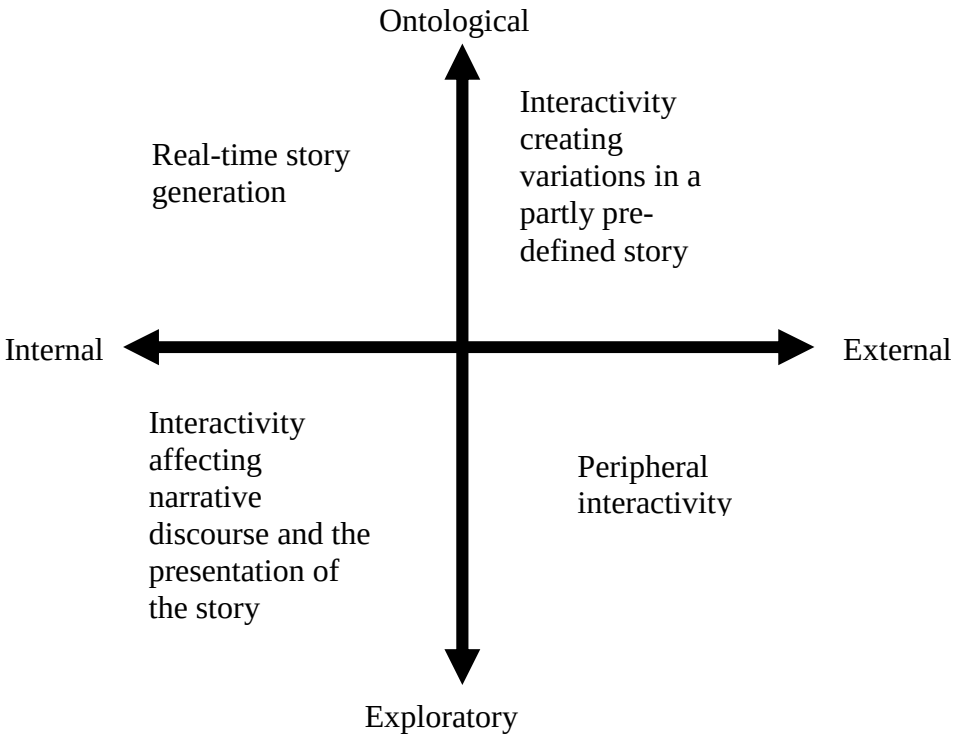


Figure2.4.1A Ryan's interactivity classification (Ryan 05)

The Internal-Exploratory type of interaction concerns forms of interactions that have an effect on the narrative discourse and the overall presentation of the story. The applications falling into this category are those where "the materials that constitute the story are fully pre-determined but the text's interactive mechanisms allow for a highly variable presentation" (Ryan 05). Hypertext is an application type that could be described in those terms for instance. Ontological-External interactivity represents the interactivity encountered when a system creates or generates variations in a partly pre-defined story. "On this level the user plays the role of a member of the story-world, and the system grants him some freedom of action, but the purpose of the user's agency is to progress along a fixed storyline" (Ryan 05). This particular approach describes by and large the interactive and "pseudo-

narrative" mechanisms involved in today's video-games such as console–based RPG, or quest type games (i.e. Star Wars series, Lord of the Rings etc). Finally, the Internal-Ontological interactive form relates more accurately to the type of interaction considered in this work in the sense that stories are not pre-determined and are generated by the co-operation between both users and the system. The non-deterministic factor has its importance in this case as it allows for the concept of emergence to take place and raises the issue of generating plot. Ryan does however highlight the issue of plot conduction in this interactive form and declares that "Aristotle has written the rules for traditional drama, but there are to this day no poetics and no set of guidelines for interactive drama" (Ryan 05). Whereas this thesis does not attempt to rewrite Aristotle's poetics for an interactive medium, it does however aim at contributing knowledge towards the establishment of such guidelines.

2.4.2 The Ludologists versus Narrativist debate

The whole issue around this debate is interesting and deserves some attention in the scope of this thesis. Frasca summarises the issue by stating that "Ludologists are supposed to focus on game mechanics and reject any room in the field for analyzing games as narrative, whilst Narratologists argue that games are closely connected to stories" (Frasca 03). Although this is a somewhat simplistic definition of the problem, it covers the essentials of the argument. Ludologists as a movement emerged in response to scholars' failure in exploiting narratology in video-game study. Juul's describes in detail the failure of the Narratologist approach in interpreting the mechanisms linked to video gaming (Juul 01) and discards on this grounds any possibility for interactive drama, by defining interactive drama as a contradiction in terms. A certain number of approaches related to Narratology have

already been discarded in this chapter. To the same extent, this thesis has also exposed the limitations of these theories in coping with interactive mechanisms. However, it does not subscribe to a total rejection of the work published by the likes of Mateas (Mateas et al 05) or Murray (Murray 98) in the sense that their works do not strictly apply narrative theories. The model presented by Mateas is indeed a neo-Aristotelian model, as opposed to a strictly Aristotelian model (Mateas 01) and has been designed with particular attention to the integration of interactive elements to an existing theory of narrative. Whilst the Ludologist movement appears to use the terms Narratologist and Narrativist indiscriminately, the belief expressed in this work is that there is also a real distinction to be made, since there is a difference between defining actual theories (Narratologist) and using them as a starting point for the elaboration of others more suited to a particular media (Narrativist – in this debate). “The de facto definition of a Narratologist in this so-called debate seems to be a scholar that either claims that games are closely connected to narrative and/or that they should be analysed – at least in part – through narratology” (Frasca 03).

As rightly pointed out by Frasca in (Frasca 03), no scholar has ever proclaimed being part of such a movement and the core issue of the argument seems to be linked to the interactive nature of video games. Ludologists are interested in understanding video game mechanisms, whilst others aim at understanding the mechanisms that could potentially lead to a theory of interactive narrative by looking at video games from a narrative perspective. Both parties recognize that video games present and articulate narrative elements, be it through the player’s inner storification process (Louchart et al 05), or in a more structural manner when “a story is imposed and related to the player” (Aarseth 05). Since, one can argue that traditional narrative theories are irrelevant when dealing with the interactive phenomenon (the position

taken in this thesis), one could understand the Ludologists' position and the reasons why they would refute narrativist approaches. On another hand, so-called Narrativists, have not formally applied narrative theories in their implementation works and have adapted models to suit interactivity (Mateas 01).

It is not within the scope of this thesis to join this debate on a theoretical basis. However, it is interesting to note that it appears that both approaches are trying to encompass similar processes, in particular the question of how to deal with interactivity (be it from a player's practical perspective or from a more abstract narrative point of view). This debate, by actually taking place, is evidence of the importance and relevance of interactivity in interactive dramas. In this particular context (i.e. interactive drama), the question of interactivity and its modalities appears to slightly overcome the form of the drama itself. The position taken in this thesis is that, in order to create meaningful actions, the understanding of the mechanisms related to interactivity and their use in achieving narrative coherence takes precedence on an overall plot or story structure.

2.5 Conclusions and further studies

The study of both mimetic and diegetic approaches to narrative in this chapter have led to the conclusion that none of them seem to be directly applicable to VR and that they could not directly contribute to solving the narrative paradox. From this analysis, a process view of story, as opposed to an artifact-based view of narrative, seems significant and should be investigated.

Since key issues concerning narrative in VR have also been identified in this chapter and it has been argued that narrative forms within VR should not be approached from a structuralist or analytical angle, it seems therefore necessary to

aim the EN investigation at a participation-based narrative structure. Drawing on the VR characteristics of immersion and interactivity, there is a need for the EN model to be particularly sensitive to questions of believability and the role of the user. Contrary to traditional narrative media (i.e. cinema, theatre, literature), users in a 3D virtual environment play a central part in the building of the story and their own overall experience; since it depends upon their actions, reactions and behaviors within the world itself. For this reason, a character-centred approach appears more suitable than a plot-centred Aristotelian model. The EN model must consequently give the freedom that VR potentially offers to the user, whilst supporting a non-restrictive and flexible approach to any possible plot development.

As the investigation conducted in this chapter did not identify elements for such a model in the media and theories studied, other narrative forms, must consequently be considered. Models based primarily on the user or spectator's experience rather than proceeding from an authorial or analytic based perspective should offer an appropriate alternative to the narrative forms investigated so far. Participative models should also present different techniques for the management of real time and the exploitation of its characteristics in the dynamic understanding of the story by the user (i.e. the "storification" process described by Aylett and Louchart (Aylett 00, Louchart et al 05)). The proposed investigation of participative narrative media presents potential in identifying key elements towards a narrative theory of VR and the formulation of the EN concept. The theoretical formulation described in Chapter 6 proposes a review of such alternative participative models.

As shown by the position taken in this work regarding the debate animating the game and narrative communities (Ludologists versus Narratologists), it is believed, in this thesis, that a better understanding of interactivity and its modalities

is key to understanding interactive dramas and their mechanisms. When considering the character approach suggested in this section, an agent-based design seems particularly suitable to both characters and the factors influencing interactivity (i.e. story, character, context, situation, etc) as described by Ryan (Ryan 05). The EN concept itself should be identified with what she identified as Internal-Ontological interactivity and should set some guidelines for interactive dramatic productions.

Chapter 3

Narrative systems

> A story should have a beginning, a middle, and an end... but not necessarily in that order.
>
> -*Jean-Luc Godard*
>
> The architecture of a story can be a little bit different if it's a true story.
>
> -*Joel Coen*

3.1 Introduction

The domains of interactive storytelling and AI-based narrative applications provide a wide variety of approaches towards the narrative question and how it should be addressed. Researchers, in their quest for interactive storytelling systems, are following several distinct paths. The development of such systems requires an awareness of research domains such as intelligent agents, conventional and interactive drama, emotional and social considerations, contextual constraints, interactivity, narrative dynamics and structures, decision making mechanisms, and time and space reasoning. The diversity of narrative theories adds further difficulties in assessing this particular research area. Before considering a representative collection of relevant works produced in recent years in more detail, and in an effort

to look at the bigger picture, it is interesting to reflect on the use of the term virtual storytelling, and its different interpretations.

Virtual Storytelling may be defined as the art of telling stories via a Virtual Reality medium, or as the act of generating stories virtually (i.e. computationally). In the latter case, the resulting story can be expressed via classic narrative channels such as voice, images or text. As shown in Chapter 1, the way in which a story is told can also depend on the nature of the narrative medium. This thesis argues that, of all the factors influencing the conception of narrative systems, the different stances taken with respect to the author ("teller") and the spectator ("listener") [Aristotle 330BC] within the dynamics of a story have had the greatest impact on the development of different approaches. Aristotle's elementary categorisation of narrative roles (Aristotle 330BC) could lay the basis for the development of a comparative framework aiming at investigating the different strategies and concepts feeding the Virtual Storytelling debate.

There are, however, certain questions relating to story roles and processes that need to be addressed when considering any narrative approach. These are summarised in **[Table 3.1A]**.

What is the role of the recipient (story target) of the story?
How are the possible story roles (author/spectator/participant) handled?
Is there any participant role and how is it handled?

Table 3.1A Narrative considerations

In theory, the statement that every story requires an author is valid, independently from the type of story depicted or displayed. However, this statement becomes problematic if it is assumed that there is only one type of authorial control. If one considers a story as a sequence of events, then it is clear that one can consider

a number of different levels of control. **[Table 3.1B]** gives one possible abstraction hierarchy of the type one would find in hierarchical AI planning systems (Aylett 99).

LEVEL	DESCRIPTION
Plot	e.g. boy meets girl; boy loses girl; boy performs heroic feat; boy regains girl
Character level abstract action sequences	e.g. boy sees girl at party; boy goes up to girl; boy greets girl
Execution level 1	Cognitively-determined actions, e.g. language "Hi there"
Execution level 2	Reactively-determined actions e.g. facial expression "smiles shyly"

Table 3.1B: The Narrative's different level of controls

"Different types of authorship already work at different levels of control. For instance, the combined authorship of the theatrical playwright and director operates at a higher level of abstraction than the one exercised by a screenwriter and a cinema director" (Aylett et al 03). The playwright can only reliably author at the level of cognitively-determined actions (language), while the theatre play director can only direct actors during rehearsals and trust them to deliver the desired interpretation on stage in real-time. The cinema director is able to exercise control right down to reactively determined actions, using whatever number of 'takes' is required to achieve the perfect illustration of authorial vision. Unsurprisingly, most of today's great cinema directors are depicted as perfectionists controlling details at every single step of the movie realisation, from shooting to editing.

It is also important to relate the degree of authorial control to the degree of interactivity when the story is presented. In principle, the lower down the hierarchy authorial control is exercised at story-creation time, the less the flexibility at performance time. Cinema directors cannot vary the physical representation of their

authored story at presentation time since they are not physically present in the cinema and therefore cannot intervene. Live performers such as stand up comedians, storytellers or musicians, whose level of authorship at creation-time lies higher up the hierarchy, possess a high level of control and flexibility over the unfolding of their performances and can adapt specifically to their audience. The level of authorship exercised by the performer is more suitable to real-time interactions and therefore more relevant to interactive Virtual Storytelling.

The discussion undertaken in this section raises a certain number of questions in relation to a Virtual Storytelling system:

- What is the minimum level of authorship required for Virtual Storytelling?
- Is the mere use of a Virtual Environment sufficient for a particular story to be considered an example of Virtual Storytelling?

When reviewing current projects, it is clear that these questions are seldom explicitly answered, and that each project is guided by its own implicit ideas on the roles, activities and requirements of both author and environment. Thus a wide range of designs can be included in the term Virtual Storytelling: from non-graphical storytelling systems that virtually generate dramatic stories, to systems that attempt to involve users in taking part in, and partially creating, non pre-determined stories within rich graphical environments.

These two cases embody very different balances between authorial control at story-creation time and real-time representation flexibility. Nevertheless both, in their own way and according to their own interpretations of the field, comply with a broad definition of Virtual Storytelling. Rather than contest the validity of these two different perspectives as Virtual Storytelling components, it seems more sensible to

refine the taxonomy of Virtual Storytelling projects and applications according to their levels of authorship, flexibility and the presence or not of graphical representation.

If authorial control relates more to story-creation time, then the role of the spectator (i.e. reader/spectator/listener) clearly relates to story-presentation time.

- What is the role of the user (i.e. target/participant/user) to whom the story is displayed?
- What is the range of actions available to the spectator?
- Is spectator in any case the right title for someone experiencing a presented Virtual Storytelling?

Once again, the answers depend very much on the particular type of Virtual Storytelling displayed. For instance, a common approach to the problem is the integration of Intelligent Agents (IA) within the storytelling framework (implementation examples are discussed in the next section of this chapter). In this particular case, if one considers a storytelling application that generates stories via the animation of IA in accordance to a certain plot structure, the role of spectators differs depending on whether or not they are allowed to intervene and interact with the different agents during the performance, so that they have an input on the unfolding of the overall story. If spectators are denied any input then the term is correct since their only course of action is to watch and listen. However, once they are expected to have any sort of input into the story, they cease to be spectators and become participants.

Although the role of the participant within Virtual Storytelling has not yet been clearly articulated, it is nevertheless important to make the distinction between a spectator and a participant. Where the range of actions potentially being carried out

by the spectator is very limited, the participant can play a substantial role in the elaboration and unfolding of a story. Depending on the design of the application, participants can be considered as authors, when delegated authorship powers and given the possibility of carrying out authorial activities; as stimuli for story generators that articulate a story around their choices and reactions; or as participants in non-predetermined systems where their actions directly influence the unfolding of the story as well as helping in writing it. The narrative abstraction hierarchy of **[Table 3.1B]** presents the different levels where participant interaction can take place, and the concept of interleaving authoring and presentation provides another axis for categorisation. Thus, Boal's definition of a spect-actor (Boal 79) in which a drama divides into interactive and non-interactive segments.

It is important to add that the subjective experience of spectating and participating are not at all the same. The spectator can frequently take an impartial or even 'god-like' view, knowing more than any individual character does about the story, while the participant is confined to the perspective of the character and role portrayed. This apparent limitation may, however, not be felt due to the need to take responsibility for the actions being carried out in the story. The 'commitment to action' required from the participating user can be seen as consuming the attention that might otherwise have been more widely deployed across the story in the spectating role.

In addition to linking the different works reviewed contextually and historically, the review of storytelling systems in the next section takes some of the narrative aspects, elements and agents issues discussed above into consideration. In **[Table 3.1C]**, popular and relevant narrative systems are summarised. It contains 5 columns, namely project, author, user role, date and interactive design. A certain

number of these projects are interrelated to each other and are indicated by a linking bracket. In order not to cover the same arguments twice, related projects are discussed in the same section of the document. The interactive design column relates to the research direction pursued in dealing with interactivity, and the different approaches presented in this chapter have been introduced in Chapter 1.

Project	Author	User role	Interactive design	Focus
Façade (2005)	Micheal Mateas Andrew Stern	Participant	Universal planning	Plot-Based
FABULIST (2005)	Michael Young / Mark Riedl USC	Participant	Branching	Plot-Based
IDA (2005)	Brian Majerko / John Laird	Participant / Author	Branching narrative	Plot-Based
I-Storytelling (2001 – now)	Marc Cavazza Fred Charles	Participant / spectator	Character-based Universal plan	Character-based
IMPROV (1996)	Ken Perlin - Goldberg	Author	Scripting	Plot-Based
IMPROV-Puppets (1997)	Barbara Hayes-Roth – Robert Van Gent	Author	Scripting	Plot-Based
IDTension (2005)	Nicolas Szilas	Participant	Branching Narrative	Plot-Based
MRE/Carmen (2001)	Jonathan Gratch – Stacy Marsella	Participant	Branching narrative	Character-Based
PUPPET (1996)	Paul Marshall, Yvonne Rogers, Mike Scaife	Participant / spectator / author	Emergent	Character-based

Table 3.1C: Relevant narrative systems

3.2 Participative Storytelling system

Although the majority of the systems described in this chapter focus on the research domain of storytelling, it is important to understand that certain terms such as interactivity, users, spectators or stories do not have the same significance from one project to another. Therefore, relevant projects are described in relation to their

research context and specific fields of work, and differences in interpretations are highlighted when required.

This section covers relevant research work that approaches interactivity within drama or storytelling from a user centred perspective where the user is an active and participating element, integral to the whole interactive drama experience, which is the focus of this thesis.

Projects are reviewed with regard to the narrative paradox and the conceptual/practical approaches undertaken for agent and story planning. Particular attention is given to the identification of their main focus:

- Is the centre of attention the overall story or the experience of the user via a character?
- How is interactivity approached and dealt with?

Answering questions such as these, together with investigating narrative and implementation components, will contribute to the categorisation of virtual storytelling projects.

3.2.1 Façade – (Michael Mateas, Andrew Stern)

Façade represents one of the most awaited and interesting projects to be released in recent years. Its official released coincided with the First Annual Conference on Artificial Intelligence and Interactive and Digital Entertainment (AIIDE) at Los Angeles in 2005 (Mateas et al 05). The Façade application is a first-person real-time drama and represents the first implementation of the “Beat” concept, a narrative approach developed by Michael Mateas (Georgia Institute of Technology) and Andrew Stern (URL:InteractiveStory.net) (Mateas et al 05) based on McKee’s principles of screen-writing (McKee 97). A “beat” is basically comprised of story elements, which can be described as micro-episodes within the drama, and operates

at the action level of a story. In the particular case of Façade, since, the action is largely based on conversation and social settings, the beats are primarily comprised of dialog behaviours. The story manager in the system selects only one “beat” at a time and bases its selection on the user intervention or input. The narrative sequencing of the drama is therefore a direct result of the interaction between the user and the story manager. In addition to its complex architecture, Façade operates using natural language inputs from the user. This technique allows more freedom to a user in terms of input and generating interesting narrative events. It does, however, require more input at authorial level in terms of covering the field of potential inputs generated by a user, increasing the development time for such applications. Currently, the team behind Façade is working on developing an authoring tool that would operate at a higher level in order to allow artists, as opposed to computer scientists, to generate interactive dramas using the Façade architecture. This development supports the belief that the authorial level on which Façade operates is too low for it to be exploited in a creative manner by arts students, playwrights or directors interested in pioneering the emerging field of digital entertainment. **[Figure 3.2.1A]** shows a screenshot of the application.

Figure 3.2.1A: Screen shot from the Façade interactive drama (Mateas et al 05)

Façade is a step forward towards the implementation of virtual dramas in which users can interact freely within a story in a satisfying manner. In this respect, the architecture developed for this system allows for the interactive dynamic generation of drama based on user input. This approach articulates the drama around users and their decisions or actions.

Façade is primarily a plot-based application whose articulation is dependent on the behaviour of the user. The characters in Façade serve the plot and its articulation/unfolding. This system corresponds to a universal branching/planning approach and has a problem with combinatorial explosion. Façade demanded a lot of authorial effort and took several years to produce, whilst still only presenting one single location and two characters. Despite this, it can still be broken as it relies on the author to keep the beats consistent for the characters and predict user input.

The architecture **[Figure 3.2.1B]** that controls Façade aims to sequence parts of pre-determined and pre-written stories or narrative events in order to form an

overall dramatic experience. The sequencing is dynamically articulated via the inputs provided by a participant user.

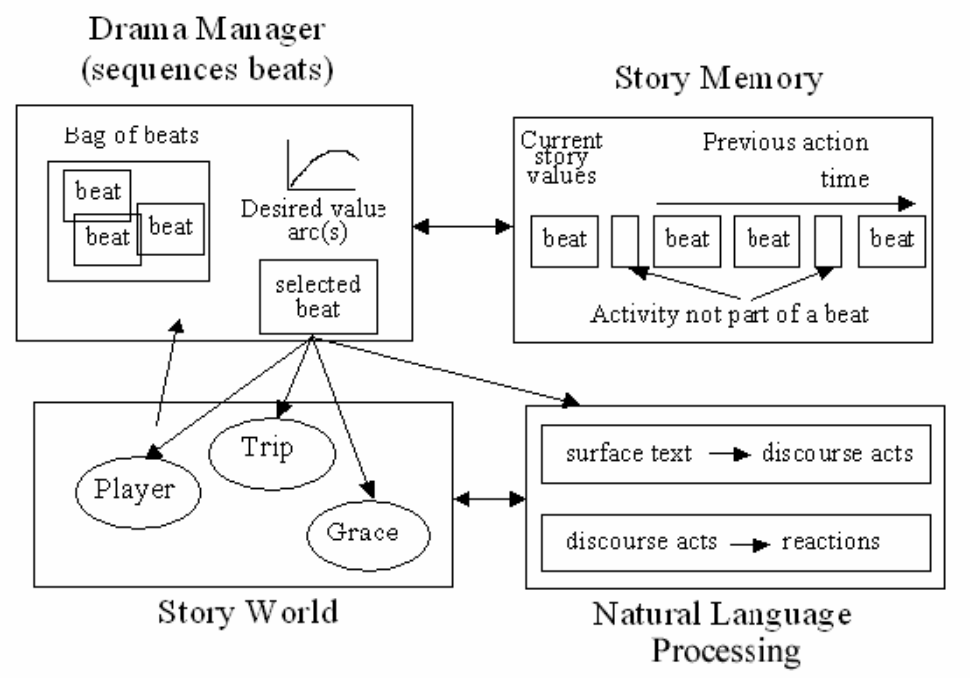


Figure 3.2.1B: The Interactive drama Façade Architecture (Mateas et al 05)

A character-based action selection mechanism would present advantages by relying more heavily on the characters to provide essential narrative events via their own autonomously driven actions. A shift of focus from plot-based considerations, as seen in Façade, to a more character-based concept would, due to its very nature, feature a less predominant representation of a narrative manager, since the action selection mechanism would indeed not be located at the level of the drama itself but at character level. The idea of a drama manager is not inconsistent with character-based action selection, however, its impact on the drama would have to be indirect and expressed through character responses, as opposed to the predominant direct impact it has on Façade for instance.

3.2.2 The Fabulist narrative planner – (M Young, M Riedl)

The Fabulist narrative planner is a project that has been developed by Mark Riedl and Michael Young from North Carolina State University (NCSU). The work carried out on the development of the Fabulist narrative planner has been influenced by methods and concepts that are more commonly used within the AI planning community. Riedl and Young, in this project, explore the possibilities of generating interactive drama via the particular technique of narrative mediation (Riedl et al 05).

This approach was motivated by the desire to bring an alternative to branching-type structures where the user is generally constrained to a pre-determined story structure. Since the pre-determined nature of branching systems dictates available interaction points and outcomes to any performance, it is argued that they bring severe limitations to user interactions. In these approaches, potential user tasks and decisions have to be implemented within the scenario beforehand, thus pre-determining the interactivity of a scenario.

The Fabulist narrative planner aims to display a dramatically interesting story to the user. The story itself is represented in the system's planning mechanism as a pre-authored linear narrative and is composed of both actions and interactions (computer character actions and user decisions). As long as the user makes decisions corresponding to those in the story plan, the story unfolds according to the ideal story represented in the narrative planner. The system, in this case, behaves in the same way the monitor of a planning system would by checking the successful execution of certain events and then executing the plan's next steps (i.e. the story). However, since the system is designed for real-time interactivity, it must be able to cope with user input not within the ideal story plan (i.e. threats to the original plan). In such a case, the Fabulist narrative planner evaluates the impact of a

user decision on its current plan and decides whether or not it should re-assess the initial story (by running the planning process from this point onwards) in order to fit with the decision made by the user. For instance, in a scenario in which the user is facing a situation where several options are available, only one of these is part of the story the Fabulist planner originally intended to tell. Therefore, in the case in which the user chooses an option that greatly diverges from that original plan, it is necessary for the planner to re-plan the story from this point onwards in order to deliver the user a satisfying story. However, this might not be necessary if the option chosen by the user, whilst diverging from the original story plan, can still be reunited with the original story.

The new linear story generated can therefore display a different output than the one originally planned. Thus the story changes direction from the point onwards of the user decision (deviation point). However, the story in the planning system should be a story that is coherent with the actions and decisions made by the user. In simple terms, the Fabulist narrative planner dynamically generates alternative storylines to user input if required. These stories are represented and loaded in the system via plans composed of successive causally related steps. **[Figure 3.2.2A]** illustrates a mediation tree in (Riedl et al 05). It shows the overall story plan (top) and the possibilities of alternatives stories available. It also clearly indicates that causally related steps are themselves the products of causal chaining.

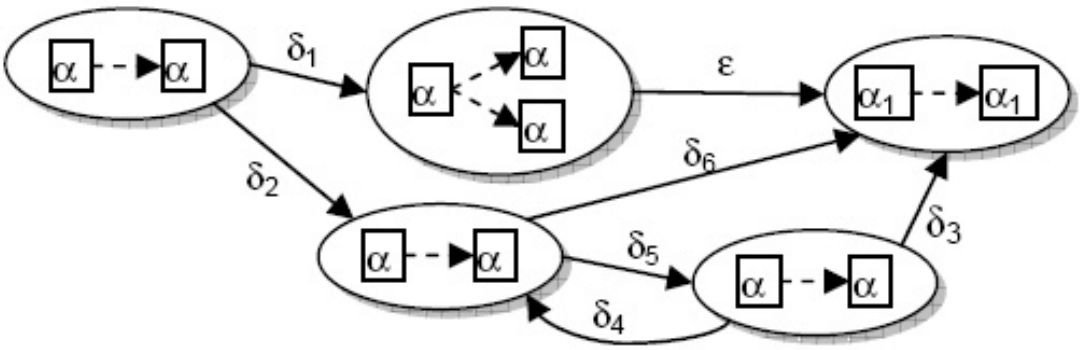


Figure 3.2.2A: A mediation tree (Riedl et al 05)

This approach attempts to maintain narrative coherence within an interactive drama scenario but cannot guarantee characters will remain coherent. As a concept, it is the inverse of a character-based approach.

However, using planning techniques to tackle the various technical problems of producing interactive drama brings these two concepts closer than one might have first assumed. The use of a continuous planner supports dynamic updating during the execution of a story plan and is instrumental in generating a story that fits with the interactions of a user. This idea is common practice in Role-Playing-Games (RPGs) in which the Game-Master constantly monitors the activity of the players and articulates dynamically the unfolding of the game session accordingly. Whilst there is a strong accent on storytelling in these applications, the main aim that provides satisfaction (entertainment-wise) to players, is similar to the will to satisfy a user in the Fabulist narrative planner.

There is also a strong link between RPGs and the development of the EN approach. Since the EN design is influenced by practices in RPGs (chapter 2), the ideas of dynamic monitoring and updating are essential parts of the design with user satisfaction being one the main aims of the EN concept. Like the Fabulist narrative planner, the system built for this thesis includes a continuous planner and updates

goals and intentions as the story unfolds. However, unlike Fabulist which is plot-based, the EN concept is character-based and deals with overall character experience rather than overall story per se, as seen in the Fabulist application. Thus, in this thesis, the continuous planner does not focus on the overall story generated by the system but on individual character goals, intentions and actions and is located within each character rather than acting globally. Therefore, the EN approach aims at dynamically updating elements allowing character decision-making. Consequently, it generates story elements and events rather than dictating actions to Non-Player-Characters (NPC), or determining the outcome of user action with regard to an overall story structure, as is the case in the Fabulist narrative planner. Young (Young 06) explains that in certain cases where the story planner has determined a storyline and lacks options to alter it on the basis of user actions, it can control the outcome of the user action. For instance, if the user shoots another character and the death of the character runs against the desired story, the system could determine the outcome of the action performed by the user (i.e. miss the target). Whilst this course of action could also be desired by a Game-Master in the EN approach, since characters have autonomy over their own actions, it guarantees that these actions are executed “in character”. This is not the case in the Fabulist application and can cause characters to make decisions that do not correspond to their character personae.

3.2.3 Interactive Drama Architecture – (B Magerko – J Laird)

The approach undertaken by Brian Magerko and John Laird of the University of Michigan differs in several aspects from the other work described in this section. It is also linked to another research project carried out in the AI domain; the intelligent “QuakeBots” (Laird 00) developed by John Laird. The Interactive Drama Architecture (IDA) developed by Brian Magerko was created in this project as the

action-selection mechanism of its director agent. Magerko and Laird's vision of interactive drama is author-centric; it is regarded as the development of a system aiming at facilitating the transit and communication between a human author and an interactive virtual environment displaying the author's artistic vision in a dynamic fashion (Magerko et al 03). The IDA system aims to create a mechanism that moves a story along a series of interactions between players and synthetic characters within a story world but also according to authorial input (i.e. story content) via a virtual director. The IDA architecture aims to bring together most of the necessary components for interactive drama. These elements are described by Magerko in (Magerko et al 05). "A generic interactive drama is comprised of the following features: the player, a story world for the story to take place, characters to perform the story, an author, a story representation for the author to use and the storytelling mechanism".

The Interactive Drama Architecture (IDA) approaches storytelling from a different angle than most narrative systems. It proposes a model that not only focuses on the display offered to a spectator/user, but also on the mechanisms involved in communicating the vision of an author to both the user and the story world. The management of the overall relationship between storytelling elements appears to be more complex and ambitious than in most recent research on the problem. The IDA not only takes the management of a player in an interactive story world into account, but also the human author, virtual characters and a virtual director. The system architecture is articulated as follows **[Figure 3.2.3A]**:

- A human author writes a story and defines the story's integral elements. The story definition is subsequently used to delimit the story space.

- The story (world, environment and structure) is then communicated to a virtual director agent whose role is to organise and tell the story to a user. It assumes the responsibility of staging the story via the control of semi-autonomous intelligent agents. Their goals and behaviours are directly based on the behaviour dictated to them by the director.
- The director itself bases its interventions on the actions, decisions, and interventions made by the immersed player and the plot specified by the author.

The director makes story decisions in a way reminiscent of the "QuakeBot" project. It projects the player's future behaviour (i.e. anticipating the player's intended actions) to shape its direction of the rest of the story.

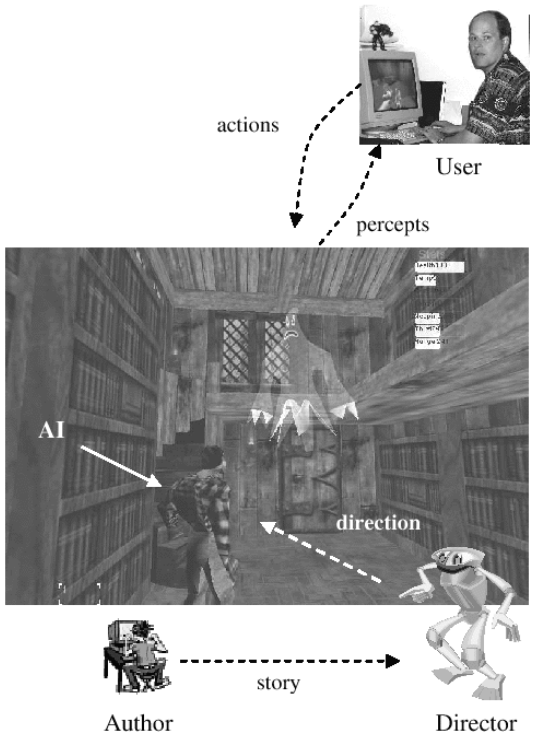


Figure 3.2.3A: The Interactive Drama Architecture (IDA) (Magerko et al 05)

Magerko and Laird have developed a game environment using the Unreal Tournament game engine (URL: Unreal Tournament) called Haunt2. The scenario

application consists of a structured story, synthetic characters, the story director and a 3D virtual environment managed by the Unreal Tournament game engine. This work is relevant in many ways to the research depicted in this thesis. Although the approach is fundamentally different from the work on the EN concept (i.e. the importance given to a plot centred approach and the emphasis on the role of the author), it shares common elements such as clear ties and influences from Role Playing Games (RPGs). However, the take on RPGs for the IDA architecture somewhat differs from the one pursued in this thesis. Whereas the IDA bases the design of its director agent on the role played by the game-master in RPGs, the type of game-master considered actually differs from the one on which the work presented in this thesis is based.

Louchart and Aylett (Louchart et al 04) presented a relatively complete description of RPG and identified several different types of RPGs, mainly regrouped into three categories, “Board RPG”, “Conflicting RPG” and “Live RPG”. With regard to this categorisation, the interventions undertaken by the IDA director relate to the “Board” type game-master whose role is to direct the unfolding of a campaign according to both a pre-determined plot and pre-determined plot variations. Plot variations are designed to cover the players’ potential interactions and decisions within a campaign session. A pre-determined story or plot is therefore built for interactions and presents a universal planagram. The nature of RPGs is generally episodic and a campaign is composed of a several gaming sessions. Their number varies depending on the scale of the campaign, its level of complexity and the game-master’s skills. The episodic nature of these games lies in the fact that the plot writing needs to be conducted at regular intervals or when required (i.e. major plot situation or character development) by the campaign so it can present a coherent and

structured story. At the end of each session, the writer/game-master decides on the direction in which the story should evolve and further develops the original plot accordingly. This is different from the approach pursued in this thesis where authoring draws on a lot of the techniques used “Live” RPGs, as opposed to “Board RPGs”.

Live RPGs take place in both real-life and real-time. In the domain of interactive drama, real-time is an important feature that delimits the margin of operation/intervention for the author of a performance or virtual experience. Most “Live” RPG authoring is carried out prior to the performance and a great deal of freedom is given to the characters and their motivations. The whole experience largely relies on the player’s abilities to assume the role assigned to them (i.e. keep in role) and a limited number of other means of controlling the story unfolding on a corrective basis. These control methods are described in detail in Chapter 6. Therefore, the fact that the role of the game-master is perceived differently in the IDA and EN concepts justifies their differences on the importance that should be accorded to that of an overall plot structure within narrative systems.

However, although implemented at different levels of abstraction within their architectures, both systems implement a mechanism allowing characters (EN) or story managers (IDA) to make decisions with regard to projected outputs on the result of one’s action/interaction. This thesis shares the belief that such a mechanism is essential to maintain a dynamic system that responds adequately to the constraints of user interaction, be it at story or character level.

Finally, the view of the role played by the author in an interactive drama is different in both concepts. The IDA architecture is built in order to integrate the author within the interactive drama definition process whereas the EN approach

reduces his role to a less interventionist form. This duality in perspectives reflects the driving forces behind these two concepts. The EN approach focuses on the experience of a user/participant over story agency whilst IDA's aims at creating, developing and articulating a plot structure.

3.2.4 I-Storytelling – (M Cavazza)

The application developed by Cavazza et al at the University of Teesside (UK) differs from the work described in this section by its emphasis on characters. It represents one of the main research applications developed in the interactive storytelling (IS) field in recent years. This character-based interactive storytelling system features an approach where plot lines are described within the roles of the characters. A story in the system is defined by a set of independent Hierarchical Task Network (HTN) plans, which are created for each character (Cavazza et al 02). This approach aims to exploit the relationship and strong ties between characters and plot, both essential elements in interactive storytelling. In this case, the character's action-decision directly dictates the execution of a plot. The plot is the result of the interaction of several factors such as randomisation of characters and props in the story environment, non-deterministic user intervention and character behavioural responses to both each other and dramatic situations. The virtual characters act, rather than being controlled by a story or plot (Cavazza et al 02) and user interventions consist of actions carried out on narrative objects. Narrative objects are significant elements in the unfolding of the plot, in the sense that they can alter its course if subject to user intervention. The way in which user interventions are determined is also characteristic of this approach. Since the user's interpretation of the story conditions their likelihood of intervening and interacting with narrative objects, it also strongly influences the drama environment and the occurrence of

specific actions and events within the story. This system also implements planning techniques with respect to the agent action-selection mechanism and re-planning following user interventions. **[Appendix D]** shows an example of a character plan representation in I-Storytelling.

The story or plot is embedded within the characters' planning trees **[Appendix D]**, making it, like the character's behaviours and actions, both deterministic and specific. However, the system produces many different stories, whose outcomes vary greatly, because user intervention and character interactions contribute to the generation of variants of the same main storyline. Such a system presents the advantages of bringing flexibility to a pre-determined plot whilst still allowing for user interaction with the story world.

An extension of this work is based around the necessity of generating language for interaction and the articulation of story elements (Cavazza et al 05). Current research by the same research team aims to integrate and generate dialogue within narrative situations, in order to bring to interactive storytelling applications the aesthetic qualities of non-interactive media such as cinema or theatre. One of the main features of the system is the fact that it is the first that really featured a character-based system. Although plot still figures prominently within the structure of the application, the use of autonomous agents with real story altering powers make this system a landmark of the research on interactive storytelling. **[Figure 3.2.4]** shows a screenshot of the application (developed with the Unreal Tournament game engine).

Whilst I-Storytelling is a character-based system, it still presents limitations. Since it does not use generative planning, the planning trees act as character universal plans. Therefore, producing large scenarios would be a complex task. User

intervention is also limited in the sense that the user role is still primarily a spectator one.

Figure 3.2.4B: A screenshot of the system output (Cavazza et al 02)

The Emergent Narrative (EN) system featured in this thesis is also a character-based system. Like the I-Storytelling system, interactions between users and virtual characters are the main generative source of narrative events, elements and actions. They are used in these approaches to determine points in space and time depicting where and when the unfolding narrative is altered. A character-based approach brings an undeniable advantage in interactive drama by granting the user a certain freedom (time and space) for both intervention and interaction. Since events are not tied to time and location constraints and can be altered at any time without preventing the unfolding of the narrative, the user is in a position where he can benefit from a certain freedom of movement or action. This can be lacking in other plot-based-systems.

The EN concept, however, differs from the one presented in this section because user intervention or agent reaction/action does not alter a pre-determined plan and does not aim to generate a variant form of a certain storyline. Whereas the system described in this section implements a story within the characters' goals and

actions, resulting in a tree type planning approach for character articulation, the EN approach views a story as a theme for a simulation. Because the character configuration has a direct influence on its possibilities to act, interact or react, it is difficult to determine story outputs from the characters' definitions. The whole consideration of a plot in the EN approach is kept to its most hypothetical form. Although this method forces the development team to cover more ground on character definition than in other systems, it certainly provides the user with the potential of more interesting events, whilst not being restricted to generating variants of a given story. However, it is generally argued that plot control mechanisms are elements insuring the coherence and agency of a story (Propp 28). This thesis argues for coherence control mechanisms within such systems at a character level rather than on an overall meta-level. This is discussed in Chapter 6.

Finally, both the I-storytelling and EN approaches recognise the necessity for dialogue to be used as a generative source of narrative events and elements and both have developed mechanisms to take dialogue into account within action-selection mechanisms and reactive structures. It seems that both systems are influenced by research carried out in the domain of speech recognition and speech generation, and are currently articulated around the use of speech and dialogue acts (Bunt 81, Searle 69, Austin 62). It is, however, probable that these approaches will, in the near future, tend towards dialogue articulation techniques that are more appropriate to dramatisation and the conduction of stories with an interactive intervening user.

3.2.5 IDTension – (Nicolas Szilas)

The model and architecture developed by Szilas relates to the particular domain of narratology and presents a branching design. The influence of this research field is noticeable in the overall design of the IDTension architecture and its representation

of narrative components such as discourse, the story and the perception of a drama (Szilas 03). The main argument is that a story should be determined by three essential elements, namely; the discourse by which a message is conveyed; the story itself, comprised of a succession of events and character actions (executed and interpreted according to its own set of rules); and finally, a model of how the narrative is perceived by the user. Interestingly, Szilas also implicitly suggests that the Structuralist approach to narrative perception is incomplete and should take into account other factors such as the role played by emotions and conflict (Szilas 99) on this particular topic. Szilas points out that "If the perception layer is omitted, it would give a syntactically correct narrative, but the audience would neither understand nor get engaged in it" (Szilas 03). The latter point is of particular relevance to the emergent narrative approach, in that it underlines strongly the role of emotions within a narrative framework and correlates some of the views further expressed in this thesis (Chapter 4).

IDTension, as a system, is an interesting and relevant piece of software. The user is playing the role of a character (e.g. a prisoner in a pirate ship scenario, whose goal is to escape) and chooses actions according to a drop down menu listing all the actions he/she could potentially carry out. As the story progresses, the list of actions is updated so that the user always has to make a choice that is contextually correct within the unfolding of the ongoing narrative. Such an approach does address the narrative paradox, as does the EN concept work. However, this is only a partial solution as Szilas does not refer to the quality of the stories generated and does not comment on the user's interactive experience. The implementation of IDTension supports some of the previous publications related to this thesis (Louchart et al 05, Aylett et al 03), notably on the value of characterisation and role-play in regard to

the narrative paradox. Although the EN approach shares the overall role-play concept, the two systems are different and do not share the same developmental and technical approaches. This thesis proposes that an agent-based implementation is best suited to the development of interactive drama. Szilas approached interactive storytelling from a different angle and produced a modular architecture comprised of five main modules, namely, the world of the story, the narrative logic, the narrative sequencer, the model of the user and the theatre.

In this architecture, the world of the story module is comprised of the content created by the author such as different characters, goals, obstacles etc. The narrative Logic module is in charge of calculating the possible options in terms of actions offered to the user. These actions are then processed by the narrative sequencer module, whose role is to order the actions according to interest. The ordering of the actions is achieved by consulting the model of the user module. This module's aim is to estimate the emotion of the user by consulting a list of pre-determined narrative effects, thus ranking the actions per impact on the person of the user. Finally, the theatre module manages the interactions between computer and user and seems to organise the graphical representation of the system, the graphic module.

The interactions between the components modules of IDTension are summarised in the following figure **[Figure 3.2.5A]**.

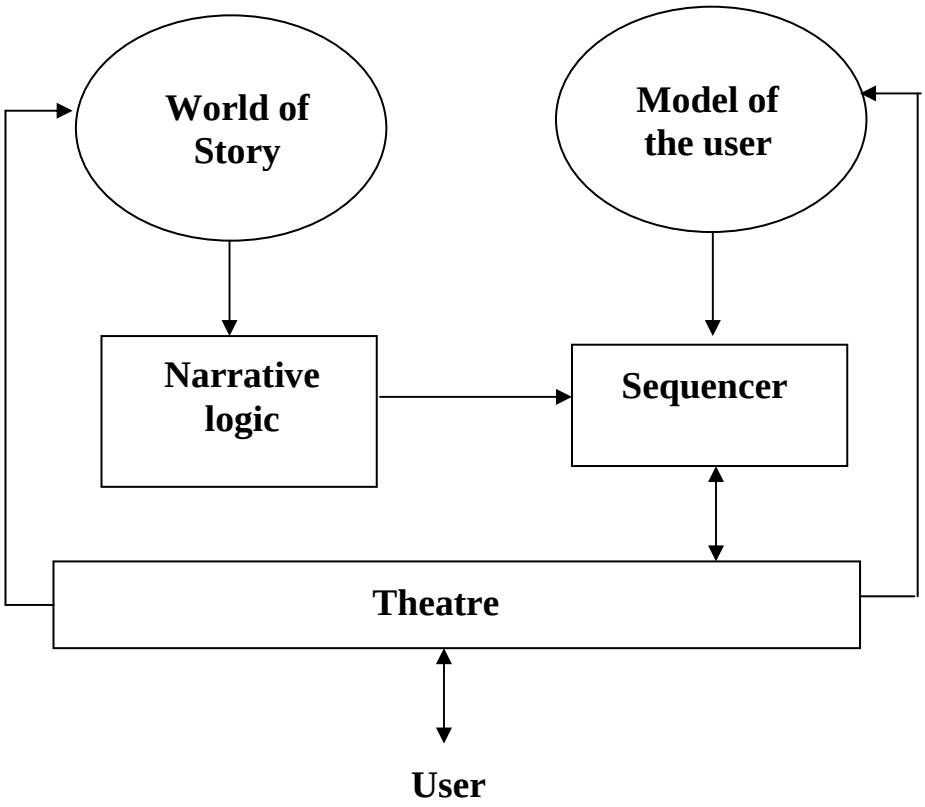


Figure 3.2.5A: IDTension general architecture (Szilas et al 03)

Whilst IDTension represents another landmark in research work in the field, there are again aspects that differ from the EN approach. Within the world of the story module, IDTension operates at a high-level global representation of the story world and the story in general. This view of the story as a whole directs the story and its unfolding in real-time. It also controls the actions of the other protagonists of the interactive drama, and organises the actions of the story world apart from the user. This means that the actions carried out by the characters are not the results of their own reasoning, but of IDTension's drama manager interpreting the user's actions. Such an approach could potentially lead to characters not acting "in character". Providing that characters' reactions and goals have been implemented in regard to their emotions and mood, the agent-based approach proposed in this thesis would

maintain a dynamic update of tensions and relationships between characters, and therefore would reduce the risk of “out of character” actions or reactions. Similarly, an agent-based design would allow for the representation of the user as a character and would provide accurate dynamic feedback to each agent regarding a user’s actions. As it stands, an overall consideration of the story does not allow for accurate feedback to be sent to the different characters and seems to limit the possibilities of an action to be taken directly in response to user interaction. It is the belief in this thesis that by designing an agent architecture and treating each character as a separate and individual agent, characters’ responses to user interactions would conform to their personalities. Since any action undertaken by a character is to be taken in role, according to its own set of actions, goals and intentions, along with its emotional state, therefore, contextual integrity should as a result be kept, and actions protected from appearing to be out of context within the boundaries of the ongoing story.

3.2.6 MRE / Carmen’s Bright IDEAS

These two projects are often referenced as key projects in the interactive storytelling (IS) field. They involved a group of researchers and aimed to create pedagogical and experience-based learning systems. Both projects are agent-based and present different approaches on the way the user should be considered within an IS environment. The Mission Rehearsal Exercise (MRE) project regarded the user as a character in an immersive environment whereas Carmen’s Bright IDEAS aimed towards a more exploratory and presentational approach where the user could control the agent’s intentions in order to influence the unfolding of a drama. Whilst they are two different projects, due to the close ties between them (overlapping development

team), they are briefly introduced together in this section. A more detailed analysis of the MRE architecture (i.e. EMA) is presented in Chapter 5.

The Mission Rehearsal Exercise (MRE) project was a very large-scale research project developed by the Institute for Creative Technologies (ICT) at the University of Southern California (USC). One of the main aims of the project was to bring together researchers in simulation technology to collaborate with people from the entertainment industry (Swartout et al 01, 05). The project delivered a series of scenarios oriented around military operations with a strong pedagogical approach towards users (i.e. military personnel) in certain areas such as decision-making, communication and crowd management. MRE mixes human users, semi-scripted characters, which are AI-based and emotion-based virtual humans, in real-life scenarios. The stories present the user with dilemmas and aim to interactively engage the user towards the achievement of pedagogical objectives. The approach pursued in MRE is a hybrid compromise between storytelling, interactivity and agent-based techniques in order to practically achieve the development of such a system. The MRE shares common features with the Emergent Narrative (EN) concept developed in this thesis, notably:

- An agent-based approach
- An immersive environment
- The user plays the role of a character
- Emotion models are represented in the agent's action-decision mechanism

The two concepts differ, however, on the degree of freedom offered to the human participant. The MRE purposely limits the range of interactions, decisions, and situations available to the user and features the "StoryNet" approach. It

"accommodates unstructured interactive "freeplay" with agents as well as structured sequences of events that can be used to create vignettes that engage participants" (Swartout et al 01). The story is decomposed into nodes and linear narrative sequences **[Figure 3.2.6A]**.

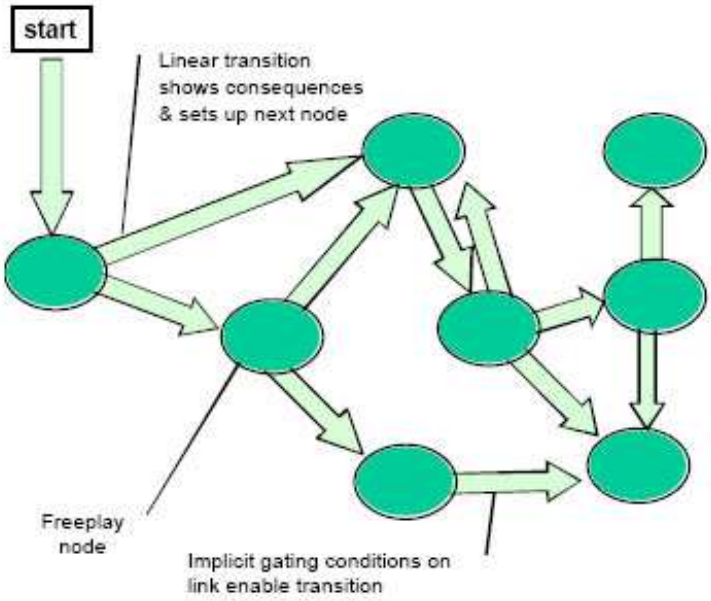


Figure 3.2.6A StoryNet (Swartout et al 01)

The user interaction is limited to the nodes and is either comprised of coping strategies (pre-defined tasks) or action-decisions within particular situations. This approach, whilst efficient within the particular concept of the MRE project, is not compatible with the EN concept's views of unrestricted freedom for the user/participant and emergent non-linear approach to IS.

Carmen's Bright IDEAS is also an agent-based story environment that exploits the interactions between intelligent agents as the basis for the unfolding of a pedagogical story. The project is an interactive health intervention program that aims at assisting mothers of paediatric cancer patients via problem solving skills (Marsella et al 00). In this system, the characters are autonomous and act upon decisions made by the user. Their actions are then processed via a director/cinematographer agent

that manages them with regard to a story structure and "presents the story so as to achieve best dramatic effect". Whilst the role of the user in Carmen's Bright IDEAS differs from that in the EN concept (god-like versus character-based perspective), the consideration of dramatic effect/impact is interesting, despite relating to presentational issues rather than agent action-selection mechanisms. Overall, its agent perspective is relevant to the EN approach described in this thesis as it demonstrates the potential for agent-based systems to sustain highly emotional and meaningful drama. Its presentational approach is, however, in direct conflict with the idea of an immersive emergent environment proposed in this thesis.

3.3 Authoring Storytelling system

The work described in this section is based around the vision of a user whose role is to author stories. Therefore the interaction takes place at authoring time, and this type of user is referred to in this thesis as the user author. The stance it takes is that interactivity can be achieved in storytelling and drama through a transition of the user from spectator, as in cinema, theatre or literature, to author. The main differentiation between authoring and participative storytelling systems lies in the way the relationship between the user and the whole storytelling experience is perceived.

Since EN adopts a character-based approach to interactive storytelling, author-centred applications could be seen as of limited interest. However, because of the active role played by the user (as author), the work discussed in this section considers aspects not covered where the user is solely regarded as the subject experiencing the interactive drama. This section covers the narrative elements

directly relevant to authoring systems and also identifies how such an approach can be adapted for the EN concept.

Finally, authoring system approaches have produced some of the pioneering work of IS and should be acknowledged as such.

3.3.1 IMPROV – (Ken Perlin, Athomas Goldberg)

IMPROV predates the projects covered in the previous section and was developed in 1996 by Ken Perlin and Athomas Goldberg from the Media Research Laboratory at New York University (Perlin et al 96). This project was, along with Joseph Bates' OZ project (Bates 92), seminal work in interactive storytelling during the 1990s. The Oz project is discussed in detail in Chapter 5 (TOK architecture). It is interesting to notice that although most of today's research mixes AI agent techniques and narrative research, one can see the origins of interactive storytelling research in agent and behavioural research in projects such as the ones covered in this section.

IMPROV is a system that was designed from an author-centred perspective. Its main aim was to assist in the creation of real-time behaviour-based animated actors. The author in this system played the role of a director interacting and setting up virtual actors or puppets. These actors were designed to respond to both user and agent inputs in real-time, and would all display their own personalities and moods. Factors such as personality and mood were set up by the author and embedded within a set of goals and intentions. From a technical aspect, the system developed was made of two sub-systems; an animation engine that would control the motion and animation transitions of the agents, and a behaviour engine controlled by the author that would allow for the creation of governing rules and complex behaviour for the agents to execute. In simpler terms, the IMPROV system was an integrated authoring tool for the creation and control of the minds and bodies of interactive

virtual actors. It was widely regarded by the research community and its authors as an expert system for authors whose aim was to provide a tool for the "construction of the various aspects of an interactive application" (Singer et al 96). The targeted end users for this application were not computer programmers but artists and authors with creative skills. For this reason, the main configuration of the agents and the system was generally carried out via an IMPROV scripting language whose syntax was close to English, such that non-programmers could script interactive scenarios. However, not all actions executed by the agents were pre-determined: the system allowed the author to add commands and triggers producing non-deterministic behaviour from the agents. An author could script a scene in which the agent could choose random actions from a pre-determined set, adding some emergent behaviour within a predominantly scripted environment. The author was given access to both the behaviour and animation engines in the system via a user interface and agents would refer their actions to a shared blackboard so that their actions could be coordinated with respect to each other and their scripts. IMPROV was also designed so it could incorporate several users over network connections in real-time. It had many application prospects and presented some potential in many areas, notably RPGs, simulated conferences, interactive fiction, digital puppetry and shared virtual worlds. **[Figure 3.3.1A]** shows IMPROV's user interface design, and the separation of geometry and both behaviour and animation engines.

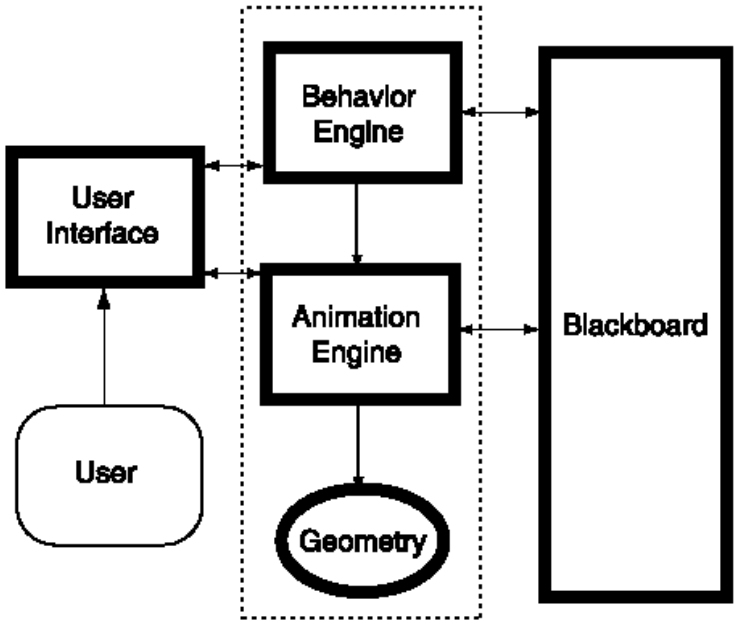


Figure 3.3.1A: IMPROV user interface design (Singer et al 96)

3.3.2 IMPROV Puppets– (Hayes-Roth, Van Gent)

Barbara Hayes-Roth and Robert Van Gent also exploited the IMPROV system in building the IMPROV-puppets system (Hayes-Roth et al 97). This system was designed to be used by children and mimicked the traditional puppet theatre play, with the exception that the directing and staging of the play was carried out by children, and intelligent agents represented the puppets which were controlled by children. Such projects are of particular relevance to the EN concept because they link artistic areas and computer science. Understandably, the IMPROV models developed in these projects differ from what it is intended to achieve with the EN concept. However, what is of interest is the manner in which stochastic behaviour (non-deterministic) is taken into account and implemented in the system so that an element of unpredictability is present in the developed scenarios. This approach has been followed in most of the systems presented in this Chapter. In these systems, non-deterministic behaviour has also been implemented at a character level, but in a more generative manner than it is the case in IMPROV.

Although these two projects do not focus on the same issues, a system such as IMPROV could be relevant to the research on the Emergent Narrative concept, in the sense that its scripting and agent architectures can be regarded as mechanisms from which narrative planners could benefit, especially with respect to the definition and communication of agent actions and responses.

3.3.3 PUPPET – (Michael Scaife, Yvonne Rogers, Paul Marshall)

PUPPET (Marshall et al 02) is a system developed by the Interact Lab at the University of Sussex that provided a populated virtual environment for children. It allowed the users to author, interpret and watch interactive drama. It presented the user with several roles with respect to interactive narrative. The user could regard the application as a drama and play the role of the audience. S/he could also control a character and interpret a role within the unfolding story and play the role of an actor. Finally the child user could also record dialogue for the different agents in the interactive narrative (i.e. scriptwriter) and re-arrange dialogue when editing the narrative (i.e. editor). Puppet was primordially a project set up in the field of early learning and aimed at researching a theoretical framework of “learning through externalisation” (Marshall et al 02). Therefore, it was not oriented directly at interactive narratives per se, but was using theatre as a metaphor. The emphasis was on developing innovative ways to motivate a child’s engagement in learning to learn, self-expression, symbolic activity and collaborative interactions.

PUPPET did not present complex narratives (i.e. the agents only had a few actions and goals to carry out), but proposed an emergent framework with which children could interact and engage. However, it is important to note that the “actor” interaction mode in PUPPET was limited and did not sustain interactivity for a prolonged period of time. It presented short interactive sessions for children between

7 and 9 years old, and generally lacked coherence (Marshall et al 02). PUPPET was an application that allowed controlling several aspects of storytelling activities (authoring, watching, and interpreting) and the relative failure of the "actor" mode could be attributed to too much diversity in its modes of interactions and does not enforce the validity of emergent structures on narrative and storytelling. However, it proved to be a very successful interactive application and demonstrated that these structures are particularly well suited to the generation and articulation of interactive content. PUPPET demonstrated that emergent approaches could be used in producing a generative storytelling application on both authoring and participating levels. The quality of its participative mode was admittedly poor (Marshall et al 02) but the project showed success in its authoring level.

The failure of PUPPET in generating convincing emergent participative narratives is not conclusive in the sense that it only presented the participant user with two characters with a very limited range of interaction and does not imply that this approach should be abandoned altogether. It could be suggested, in the particular case of PUPPET, that interactions have probably been affected by the characters' limitations in action decisions. Since character-based structures are driven by the characters' ability to carry out interesting actions and are therefore highly dependent on story-content, it is reasonable to believe that rich character content might have significantly improved, in this particular case, the overall quality of the system's interactive mode.

3.4 Summary

Interactive or Virtual Storytelling, as a research field, is a broad one, as demonstrated by the variety of applications, concepts and approaches reviewed in this chapter.

Like the EN concept, most of the work described here is based on strong convictions and a specific vision of what an interactive drama should look like. The aim, in this part of the thesis, was to objectively review these research projects and assess their relevance in terms of concept, approach or theoretical stance to the Emergent Narrative concept.

Based on the review presented in this chapter, the EN concept, although it has not yet been formally introduced in detail, proposes a novel approach to interactive storytelling in terms of user and plot considerations. Although not totally novel in the sense that bottom-up approaches to interactive issues have been explored in the past (Grand et al 99), this particular narrative concept proposes the fusing of elements borrowed from both character development theory (Izzo 97, Ryan 00, Vogler 98) and intelligent agent research in order to develop an environment dedicated to interactive drama. There is obviously more to this project than the theoretical and design issues discussed in this chapter. Chapters 4 and 5 study questions dealing with emotion modelling and agent architectures, and progress toward a more definite definition of the Emergent Narrative concept.

This section on interactive storytelling systems has, reviewed approaches and concepts as much as the systems themselves. It has also highlighted the similarities and differences between these systems and the vision of interactive drama discussed in this thesis. The projects mentioned in this section have been published and presented in leading journals and conferences in the virtual storytelling and AI domains (TIDSE, ICVS, SIGGRAPH, AIIDE etc.). The relevance and validity of the essential concepts to a theory of an Emergent concept are presented in **[Table 3.4A]**. In addition, to show where essential design elements or concepts have been

implemented, this table also aims to put into context the exact nature of the research and ambitions behind the EN concept.

Emergent Narrative concepts & approaches	Relevant project
An Interactive drama can be articulated around the user's decisions and actions. Façade illustrated that an intelligent system can take into account the actions and decisions of a user in order to make decisions and bring responsiveness to an interactive display.	Façade
The story or actions exercised within a story should be part of a dynamic system in which components of the narrative are continuously updated to reflect on the user's interactions. The idea of a continuous function within a storytelling system has been demonstrated in the Fabulist narrative planner where the system was based around a continuous planning functionality. Use of such technology brings more accuracy to the system by keeping track of what has been happening within the story and helps in providing decisions adapted to the story and the interactions of the user.	The Fabulist narrative planner
Agent-based systems could be particularly adapted to interactive drama in the sense that it would allow the simulation of characters. The IDA, which is primarily an agent system shows how such an approach can manage interactions between characters and users at a low-level of execution and has the potential to accurately replicate character actions and reactions within a simulation of a story world.	IDA
Can interactions between a user and virtual characters be the main generative source of narrative elements and events – including dialogue? I-storytelling illustrates this point quite strongly and also provides theoretical evidence that this approach could be considered as a way of developing interactive drama. Although the theoretical approach with the Emergent Narrative concept differs, this project argues this point positively.	I-Storytelling
Characterisation and role-play should be regarded in interactive storytelling as a potential solution to the narrative paradox. IDTension illustrates this point and argues well in its favour although it expresses reservations quality-wise on the resulting stories of such a system. Therefore it is conceivable that an agent-based system would answer a certain number of problems encountered within IDTension – notably context-oriented issues.	IDTension
Can stochastic (non-deterministic) behaviour be implemented at character level within an interactive storytelling system? This is precisely what IMPROV was about and the generation of non-linear stories within an agent framework. Although IMPROV was very much an authorial tool, its management of stochastic behaviour at character level shows how much character is important in interactive storytelling and reinforces our conviction for character-based systems.	IMPROV
Can emergent structures sustain interactivity? PUPPET demonstrated that these structures were particularly well suited to the generation and articulation of interactive content	PUPPET

Table 3.4A: Relevance of concepts for an Emergent Narrative system

This thesis proposes to develop, if it is to follow the type of categorisation applied to this review, an agent-based character-centred dynamic system whose story management does not lie at story-level, unlike most of these systems, but at character-level. Unlike any of the described systems, the Emergent Narrative system proposes the generation of stories from an agent perspective in what is commonly called a "bottom-up" approach. This means that the actions occurring within a scenario are of a stochastic nature. This novel approach does build on existing projects such as the ones presented in this chapter and embraces certain of their elements. However, the combination of techniques, ideas and approaches developed for the Emergent Narrative concept is a novel one in this particular research area. There are further issues to discuss in order to evaluate the viability of such an approach. Thus, the next two chapters focus on the following questions:

- Can agent architectures support characterisation?
- How can we exploit continuous planning capabilities in regard to storytelling and characterisation?
- Is it possible to realise a distributive story manager where decisions with respect to parts of the unfolding narrative are taken by the agents at a local level?
- What is the role of emotion in decision-making?
- What is the relationship between emotion and dramatisation?
- How would users and agents engage in a way that is interesting and exploitable in term of stories?
- How to define and implement the notion of emotional dramatic impact? – Would this be sufficient to ensure qualitatively interesting user experiences?

- Would agents be able to accurately model the emotions of the user and vice versa? How important would this be for the design of interactive drama?

Chapter 4

Emotion models and concepts

> I made mistakes in drama, I thought the drama was when the actor cries, but drama is when the audience cries.
>
> -*Frank Cappra*
>
> In order to define films critically, we have to find ways of defining the nature of our involvement.
>
> -*V.F.Perkins*

4.1 Introduction

Although the main investigation work undertaken in this thesis relates to both narrative theory and interactive storytelling systems, there is another important area that should be addressed - emotion. Emotions act at the heart of dramatization and represent the main means of communication between actors and their audience. A spectator will also interpret drama from an emotional perspective in many cases. Entire cinematic genres (i.e. suspense, horror, romantic drama) are based on the spectators' emotional responses. Sections 2 and 3 of this chapter focus on the role and functions of emotions from both the actor and spectator perspectives. This is essential within this thesis since actor and spectator can respectively be associated to agent and user. The emotional mechanisms involved in these two roles help to

determine the areas of the emotion research field to be considered for both the theoretical formulation and implementation of the emergent narrative concept.

Finally, this chapter reviews relevant areas of emotion research relating to emotion models and concepts. This section discusses concepts essential to understanding certain emotion-based synthetic agent architectures, which are described in Chapter 5. It also underlines decisions on the level of emotion representation required for the agents to be developed in this work. This section is divided into two distinct sub-sections; appraisal-based theories and low-level models.

4.2 Emotions in the spectator

Emotions have been identified as playing an essential role in the way we perceive and interpret dramas for a long time. Aristotle was the first to consider this topic in the "*Poetics*" (Aristotle 330BC). He referred to the concept of "catharsis" as a purging of emotions, such as fear or pity, from a spectator's perspective when watching traditional Greek tragedies. Whilst the Greek word Katharsis can be interpreted as purification, cleansing or purging, the meaning conveyed in Aristotle's works refers more to a surge of overwhelming emotions arising in the spectator as a result of watching a play. It refers to changes or releases (i.e. purge) of emotions in the spectator. This can be illustrated when considering the emotional changes in the spectator as climaxes unfold in modern cinema or in the way in which suspense allows for the build up of fear and anxiety before suddenly releasing them through various techniques. The emotional response from the audience is a basic element of the dramatic experience and is integral to the success of dramatic actions and effects.

Spectators' emotions have been widely discussed and several theories have emerged on their causes and mechanisms (Currie 95, Carroll 90, Freeland et al 95).

Philosophical discussions are taking place on the nature of emotional reactions in a dramatic context; they are particularly oriented towards the cinematic medium (Plantinga et al 99, Freeland et al 95) (i.e. philosophy of film) and deal with concepts such as authorship in cinema, the nature of the film, its validity as a source of knowledge and the idea of a philosophy of film itself. The notion of emotional engagement is also discussed and has produced several theories. Detailed consideration is outside the scope of this chapter, but it gives a brief description of the main concepts relating to this investigation.

The "simulation theory" of Currie (Currie 95) regards the spectator's emotional responses as a product of imagination. This approach is also referred to as the "pretend theory" by Carroll (Carroll 90). In simple terms, the spectator is emotionally simulating or imagining a drama as it unfolds in what Currie describes as an offline simulation. Thus, the emotions generated are described as "off-line" emotions. They are only simulated because they are not expressively demonstrated by the spectator, in the sense that they are not acted upon. In contrast to emotions experienced in real-life, off-line emotions are lower in intensity because they are only simulated. For example, simulation theorists argue that spectators might enjoy a horror movie and the resulting simulated emotions (i.e. fear) but would not enjoy them if generated by a real life situation. Wartenberg who co-authored "The philosophy of film" (Freeland et al 95) however expresses reservations about this approach, stating that "One problem facing the simulation theorist is explaining what it means for an emotion to be off-line. Whilst this is an intriguing metaphor, it is not clear that the simulation theorist can provide an adequate account to how we are to cash it out" (URL: Stanford Encyclopedia of Philosophy).

The “illusion theory” described by Anderson (Anderson 97) has evolved from cognitive science and should be regarded as a cognitive film theory. The concept is based on perceptual psychology and computational theory, and basically regards the film as a generative source of stimuli for the human brain to process. Signals such as motion perception, perspective, colors, textures or brightness/contrast are referred to as stimuli and are purposely assembled by the director. It is then the aim of the filmmaker to create in the spectator a certain illusion where characters or events are believed to be real. The stimuli are processed in the spectator’s brain and generate emotions. A common criticism of this approach is that if the emotions relate to beliefs generated by the movie for truly horrible or scary events, a spectator would not just sit quietly in a cinema but may run away, or otherwise act on the basis what he/she believes to be real (Frome 06).

The “thought theory” had been endorsed by Carroll (Carroll 90) and relates to the suggestion that spectators can express emotional reactions with regard to their own thoughts. In simple terms, the thoughts developed by a spectator whilst watching a movie (i.e. following the fate or situations of characters for instance) favors the generation of emotions in the spectator. The thought of something dramatic happening to a character with which the spectator identifies is enough for the generation of emotions. Though the term is not used, this approach could be related to empathy and how one can be emotionally affected by the fate of others. This approach can also be criticized for not actually providing details on the mechanisms generating emotions. In the same way that beliefs do not generate fully fledged emotional reactions, how do thoughts generate emotions from cinematic representations? How and why would the emotions prompted by thoughts differ from emotions generated by real situations?

In general, the different approaches presented in this section do not detail the internal mechanisms responsible for emotional reaction generation. It is however interesting to consider these theories and models as high-level approaches that could potentially be implemented if coupled with a lower-level emotion representation model.

4.3 Emotions in the actor

As the work presented in the previous section shows, understanding the flow of emotions in a dramatic context is essential in designing emotionally intense and compelling dramas. However, the consideration of emotion in drama should not be limited to emotion perception/generation from a spectator perspective, but should also include actors and the way in which emotions are expressed and communicated thorough their work.

The use of emotions has in this case a clear purpose; conveying emotional values and provoking the generation of emotional reactions in the spectator. Rather than feeling emotions without much control over them with the spectator, the actor is, in the majority of cases, in total control and emphasises and consciously expresses certain emotions in order to communicate them. Methods for doing this are well documented and have been empirically tested since the early days of acting. Since EN takes a character-based rather than a plot-based approach to storytelling, it is important to understand the implications of emotions from an actor's perspective. Several relevant theories and concepts are briefly described in this section. Such approaches could potentially be modelled in the agent's architecture, and be used for the design of purpose built agents that would act in a dramatic manner in the same way as an actor would.

Konstantin Stanislavski, a Russian theatre actor and director, created a system consisting of a mode of preparation and role conditioning for actors. This particular technique is commonly referred to, in the drama and theatre communities, as the “Stanislavski system” or “the system” (Stanislavski 24). It aimed to provide actors with a method that would allow them, through training, to control certain aspects of their performance that are often unconscious in real-life, such as emotions for instance. The system developed by Stanislavski requires an actor to investigate a role and approach the character from both a motivational and emotional point of view. Whilst such an approach is common practice today, Stanislavski pioneered the detailed discussion of the concept. The system supports the development of rich, complex and realistic characters in the eyes of the audience. Emotions are expressed not only by the dialogue but also by the actor’s body (i.e. the method of physical action). The system is a complex blend of training and methodology and it is difficult to define it with complete accuracy, as Milling and Ley indicate in their “modern theories of performances”, the system has been defined “in its different manifestations as an intensive process for production-preparation and rehearsal, or as an extended programme for student training” (Milling et al 01). It would be more accurate to view the “system” not as a single work but as a constantly evolving process that has been developed and refined over a number of years.

Confusion, however, often arises with Lee Strasberg’s “method acting” developed in the 1950s (Strasberg 90). This technique, like Stanislavsky’s system, aims to bring more realism to the actor’s performance, and focuses on both emotional and motivational interpretation of the characters. The way in which this is achieved depends not only on the form and techniques used in the actor’s training, but also on the extent to which the actor is identifying him/herself with the character.

The “Method”, as it is often called, consists of the actor drawing on their own personal experience, memories or emotions in order to express in the most realistic way the emotions of a character. The actor conditions him/herself emotionally, aiming to produce a more realistic performance and give a sense of realism to a scene, at least on the emotional level through the emotions expressed by the character. Many American actors have been renowned for using this technique, amongst them, Paul Newman, Al Pacino, Marylin Monroe, James Dean, Robert DeNiro, Steve McQueen and Dustin Hoffman to name a few.

Finally, it is important to mention Bertolt Brecht’s “Alienation effect” (Brecht 57). Originally inspired by a play from the Peking Opera, this concept is radically opposed to both the “Stanislavsky system” and Strasberg’s “method acting”. It presents an interesting counter argument on the importance of emotions in the actor’s performance. Translated from the German “Verfremdungseffekt”, Brecht’s theory is referred most commonly as the “alienation effect” but is also called, the “estrangement effect” or the “distancing effect”. This particular technique aims to distance the spectator from the narrative illusion in order to reflect on themes and concepts in a critical manner. The objective of this particular approach is to alienate the spectator by presenting well known concepts from a different perspective so they are perceived in an unfamiliar manner and reflected upon objectively. The spectator is therefore prevented from getting a sense of the characters’ emotions. According to Brecht’s work, the spectator’s qualities of criticism and objectivity should not be interfered with by emotional closeness and the illusion of reality. In order to achieve this aim, diverse techniques have been developed in order to break narrative immersion (i.e. exaggerated lighting, disruptive music or sound effects). The most common and characteristic technique is the one

where the actor regularly acknowledges the audience. It shows that the actor is not interpreting a role in the conventional sense of the term, but is also aware that he is being watched by an audience and should be delivering for that audience. This particular technique originated from the Chinese opera and is often referred to in western media cultures as “breaking the fourth wall”; the imaginary wall that actors build between themselves and the audience. Numerous film makers embraced Brecht’s ideology, Jean-Luc Godard (A bout de souffle 1960, Pierrot le fou 1965) and Ingmar Bergman (Persona 1966) presented arguably the most visible examples of this approach in their works.

The work presented in sections 4.2 and 4.3 underlines the importance of emotions in drama and shows that it is essential for actors to reflect on the characters’ emotions in order to establish enough believability for their characters to generate emotions in the user. This interconnection between dramatic display and emotions could suggest that emotions could be regarded as a substitute for dramatic value, a dramatic situation could be assessed with respect to the emotions it generates, and situations could be assessed dramatically via their emotional outcomes.

4.4 Emotion models

The theories and concepts described in the previous two sections present interesting ideas for implementing both actor/agent minds and overall story managers/facilitators. The real question to be answered in this chapter is not whether or not emotions should be used in the modelling of intelligent agents, as it is apparent that they should from the discussion carried out, but how and to what level of abstraction should it be done? The emotion models investigated in this section can

be used to answer this question. The last decade saw the behavioural AI community becoming increasingly interested in the emotion modelling research field. As a consequence of its involvement with a psychology-based domain, behavioural AI research has distanced itself from the more classical branches of the AI community. Mateas discusses this distinction between behavioural AI and classical AI in (Mateas 02).

Whilst it is not the aim of this chapter to describe emotion-based models to the same level of detail as narrative systems in chapter 3 and agent architecture in chapter 5, it is still essential to present a brief overview of this research field in order to lay the basis for the understanding of the systems described in chapter 5. This review of emotion models is divided in two distinct parts; appraisal-based and low-level models.

4.4.1 Appraisal models

Since emotion modeling is a very large research domain and appraisal-based theories account for an important part of it, it would be difficult to cover this domain in detail in this thesis. The approach undertaken is to present a brief history of emotion modeling, and refer to cognitive models that have actually been implemented and proved to be computationally relevant.

Emotions have been studied for a long time, and the concepts and theories developed over the years have to date played a very important role in the development of intelligent agent technology. Plato's definition of "Thumos" (Ancient Greek for passion) (Plato 360BC) was probably the first attempt at understanding the why and how of emotions. In his case, emotions (i.e. Fear and anger) were seen as a disruptive element to reasoning and rationality. Charles Darwin (Darwin 1872) later (1872), produced extensive empirical studies into how

human beings and animals use facial expressions to convey signals and express emotions. Cannon-Bard (1927) (Cannon 27) went on to suggest that emotions were essential and necessary for an individual to react to a stimulus. Emotions could be associated with various stimuli (e.g. Height) and a reaction would be based on the emotion experienced. Therefore, emotions had to be experienced for an individual to react to a stimulus. Izard later (1979) argued that facial expressions reflected emotions and were a component of naturally occurring emotion (Izard 79). Finally, Damasio's studies (1994) of a patient suffering from brain damage led to the identification of "somatic markers" and to the conclusion that emotions were involved in decision-making (Damasio 94).

It is generally accepted that cognitive modeling was first introduced in the works of Magda Arnold in the 1960s (Arnold 60) when she introduced the concept of appraisal. Her conception of appraisal was that of an unconscious mechanism where an individual would mentally appreciate the benefit or inconvenience of a particular situation. This would in turn generate emotions. Since then, a certain number of high profile theories have emerged. They include, to quote the most relevant, the works of Fridja (1986) (Frijda 86), Ekman (Ekman 92), Lazarus (Lazarus 91) and Scherer (Scherer et al 01). Whilst the AI community has shown a lot of interest in these models, they have yet to be implemented successfully within a computer-based framework. Considering the amount of work necessary, this is not a viable option for this thesis. However, two appraisal-based models have been successfully implemented and constitute the basis for computer-based appraisal systems. These are the emotions model developed by Lazarus (1991) (Lazarus 91) and the cognitive structure proposed by Ortony, Clore and Collins (OCC) (Ortony et al 88) (1988).

Lazarus (1991) (Lazarus 91) added to the general concept proposed by Arnold that a conscious consideration actually led to the generation of emotions. He also raised questions on how individuals “cope” with the generated emotions. The overall approach revolves around the fact that emotions and their variations, together with the environment where subjects are located, can affect emotion generation and judgment. Thus prompting different reactions and coping strategies depending on the personality of the subject. This particular appraisal system proposes that perceived events (i.e. as appraised) generate emotions. These emotions then influence actions carried out by an individual and the assessment of immediate future events. This appraisal mechanism therefore offers a dynamic emotional system that interacts with the action selection mechanism of the individual. This approach has been implemented in the EMA system (Marsella et al 06) as well as in FearNot! (Louchart et al 05(2)) and is described in detail in the next chapter.

The OCC has also been implemented in many systems, notably in Eliott’s “Affective Reasoner” (Eliott 92), the OZ (Bates 92) and VICTEC (Paiva et al 04) projects. Both projects are described in chapter 5. This approach is based on emotion types and is defined within a hierarchical taxonomic structure. Appraisal in OCC assesses events according to an individual’s goals, preferences/natural dispositions (attitudes) and morals/principles (standards). An individual will generate emotions depending on whether the event is perceived as good or bad. The 22 emotion types are generated according to a hierarchical structure and pre-emotion categories **[Table 4.4.1A]**. These categories can then be merged together in order for specific emotions to arise and emerge as dominant with respect to a particular event or situation. The resulting emotions are taken into account in the individual’s response.

Emotion category	**Emotion**
Fortunes- Of-Others	Happy-For
Fortunes - Of-Others	Gloating
Fortunes - Of-Others	Resentment
Fortunes - Of-Others	Pity
Prospect-based	Hope
Prospect-based	Fear
Prospect-based	Satisfaction
Prospect-based	Fears-confirmed
Prospect-based	Relief
Prospect-based	Disappointment
Well-Being	Joy
Well-Being	Distress
Attribution	Pride
Attribution	Shame
Attribution	Admiration
Attribution	Reproach
Attraction	Love
Attraction	Hate
Well-Being / Attribution - Compounds	Gratification
Well-Being / Attribution - Compounds	Remorse
Well-Being / Attribution - Compounds	Gratitude
Well-Being / Attribution - Compounds	Anger

Table 4.4.1A: The OCC 22 emotions (Ortony et al 88)

4.4.2 Low-level models

Since they not only aim to model emotions but also to incorporate elements such as motivations, personality or goals, the theories described in the previous section could be referred to as high-level emotion models. Low-level models are typically partly or totally non-cognitive, and generally regard emotion generation issues from a physiological point of view where arousal within an individual affects perception, attention, motivations and drives.

Canamero (Canamero 97) proposes a model where emotions are seen as modifiers of the individual's motivations, perception or attention. This is an agent-based model and has been designed in order to control intelligent agents and robots. Contrary to most of the other models mentioned in this chapter, this approach is non-

symbolic and emotions are not labeled. The agent senses the environment for pre-determined stimuli. Once identified and detected, these stimuli act on the agent activation mechanism, and depending on the intensity or importance of the stimuli perceived, it releases hormonal signals that in turn have effects on the agent's motivations/drives but also the way it perceives the environment and its level of attention.

Velasquez's Cathexis (Velasquez et al 97) on another hand is a different concept based on a model proposed by Izard (1993) (Izard 93). The approach is also motivated by the development of agent technology. It proposes the integration of drives and behaviors via emotional inputs, and considers emotion within the action decision mechanism. The model itself is quite complete and integrates both cognitive and non-cognitive emotion generators (elicitors) as well as a representation of moods in order to influence both the motivations and the behaviours of the agents. Like the model proposed by Canamero, Velasquez's model proposes an interesting alternative to the more commonly considered appraisal-based approaches regarding emotional arousal from a physiological-oriented perspective.

Whilst these models are relevant to this investigation, the level to which they are implemented might be too low for an author to relate to these models in a narrative framework. Appraisal-based model which operate at a symbolic level seem therefore more suitable for computational implementation within an interactive narrative project.

4.5 Theory of Mind and empathy

The work presented in sections 4.2 and 4.3 suggests that there is a strong link between drama and emotion in the sense that the author aims to assess the emotional

state of the spectator for the timing of dramatic events (Theory of Mind) and the spectator feels emotionally for the characters (empathy). The author pre-assesses the state of mind of the users (emotional mapping of the audience) when writing a dramatic performance. The aim is to take the audience on an emotional journey that includes surprise, fear, happiness or sadness depending on the particular genre of the script. In order to achieve this successfully and select the most suitable technique for a desired effect, the author needs to have a good idea of the spectators' state of mind. This is achieved by directing techniques such as lighting, colors, contrasts, camera angles, suggestive frames that would influence the spectators' overall state of mind so that they are mentally disposed to experience the effect desired.

In the interaction and the character-based approach taken in this thesis, it is essential to identify which element carries responsibility for making necessary dramatic decisions. The Theory of Mind (ToM) concept (Whiten 91), presents an interesting approach to the way decisions are made and could potentially contribute to the development of character decision mechanisms. ToM is believed to be an essential factor in human social interactions. It suggests that human decision making is influenced by our predictions of others' reactions to our actions. This acts through our ability to generate a mental representation of other people's states of mind and personalities and make decisions using our beliefs of what their reactions will be. We tend to interpret expressive behaviour such as language, facial expression, context, voice tone or gesture in order to establish a mental representation of the other. Based on this representation, we then adjust our decision-making process so we can ask the right question, take the most appropriate tone or position; basically we adjust ourselves to the other. However, this ability can also be used in a negative way, for instance helping to take advantage of someone else's

mental state. This is very common in school bullying for instance, where bullies have scored high at Theory of Mind tests, showing a better than average understanding of the mental state and perception of others (Paiva et al 04). This approach was studied in the VICTEC project (URL: Victec) where virtual agents were designed to encourage empathy via their expressive behaviours and decisions, through allowing the user to build a mental representation of their internal states and emotions.

Marsella also implemented this approach in two distinct computer science projects; PsychSim (Marsella et al 05) and the Emotion Evoking Game (EVG) (Wang et al 06). PsychSim aimed to "exploit the recursive modelling to allow agents to form complex attributions about others, enrich their messages to include the beliefs and goals of other agents" (Marsella et al 05). EVG is a different project that aimed to study emotions in video games players by generating situations so that users would experience a certain pattern of emotions.

Whilst this thesis is oriented toward the dramatic issue of interactive storytelling, rather than the generic social considerations of ToM, the idea of defining an action-decision mechanism based on both the individual and others could be extended to drama. The ToM approach could be incorporated into a character-based design where decisions could be made based not only on the intrinsic emotional state of an individual, but also on how they would affect others emotionally. Such a process would allow the character to make decisions on a dramatic basis (the amount of emotions internally generated for a given action determines its dramatic weight).

4.6 Conclusion

The main aim of this chapter was firstly to investigate the role of emotion in drama, in a narrative context, but also to look at how emotions could be represented and modelled with a view to possibly integrating such a model within a narrative framework.

Based on the investigation presented in sections 4.2 and 4.3, it is apparent that the role played by emotions in both the spectator's and the actor's perception of drama is significant and should be taken into account. As a result, the approach proposed in this thesis is to consider emotions as a substitute for dramatic value in an agent-based action selection mechanism. Whilst the different approaches discussed in sections 4.2 differ on how emotions are generated, they all agree that drama has an actual emotional impact on the viewer. From an emergent narrative point of view, it would be interesting to consider the selection of narrative actions according to their likely or predicted emotional impact. This would replace the subjectivity associated with the concept of dramatic value and elevating emotions by the quantifiable notion of emotional impact.

Emotion models and emotion-based systems must be taken into consideration for the implementation part of this work on the emergent narrative. Section 4.4 introduced a wide range of approaches and concepts that could potentially be implemented within current or developing agent technologies. Since technical work based on these models has not yet been covered, it is still too early to decide on a model for implementation. However, the overview presented in this chapter has clarified the way in which emotion modelling should be considered with the emergent narrative approach.

Both appraisal-based and low-level models are potentially interesting. Whilst the models proposed, for example, by Canamero (Canamero 97) or Velasquez (Velasquez et al 97) present interesting alternatives to the more commonly considered appraisal-based approaches. However, their implementation is carried out at a very low-level and this poses problems for their authoring in a narrative framework in the sense that these do not operate at a symbolic-level at which an author operates. It is therefore questionable if their consideration would be beneficial to this particular work. The emergent narrative approach is narrative-based and primarily focuses on the generation of drama and dramatic actions without any particular focus on the naturalism of the techniques and concepts involved in its realization. It is therefore not an issue to consider appraisal over low-level models as long as they allow for the selection of narrative actions based on emotional inputs. It is felt that the consideration of low-level models would result in a level of complexity that would not benefit the considerations of emotions in this project.

The concept of Theory of Mind should also be taken into consideration in Chapter 6 (Theoretical formulation) as it potentially offers an interesting and novel approach to develop autonomous agents with dramatic capabilities. It also supports the integration of an appraisal theory such as OCC (Ortony et al 88) in the way in which it was originally intended (i.e. assessment of emotions of others) rather than its current common use in computer science (i.e. general agent control mechanism).

Chapter 5 will focus on implemented emotion-based systems, and will consider them with respect to an emergent narrative concept in terms of practicality, model implementation and agent abilities.

Chapter 5

Synthetic character architectures

5.1 Introduction

The investigation undertaken in this thesis has, via the studies of narrative theories and systems, identified several important aspects of the design for an emergent narrative concept (EN). Previous chapters argue that established narrative concepts in the domains of narratology, theatre, cinema or literature cannot be applied within an interactive framework, and therefore articulation and management mechanisms should be sought in other domains.

Chapter 3 identified an agent-oriented framework as a suitable approach to the development of a character-based framework. Since the EN approach is based on character interactions, it is important that agents should simulate acting by carrying out dramatic actions. For this reason, this chapter focuses on agent architectures and their abilities to generate emotions and produce believable behaviour. These are the necessary elements an actor brings to character interpretation.

In order for a character-based drama to unfold without relying on a directing plot structure, a synthetic character should have the ability to interpret events in the same manner that a real world actor would (i.e. by feeling and reacting accordingly to situations). Such an approach to agent design would allow both the user and the synthetic agents to communicate on a common basis, and more importantly, in a way that is natural to the user, since emotions play a large part in the way people make

decisions. For this reason, this chapter investigates the potential for an agent architecture to support the user's "suspension of disbelief", which is an essential element in achieving believability.

In this chapter, architectures are also reviewed according to their planning mechanisms. Due to the changing nature of the story world the agent architecture for such a project must be able to operate dynamically. Special attention has been given, in this part of the thesis, to mechanisms supporting the continuous updating of world and/or agent states and to the ability of agents to modify their own goal structures or emotional status in response to changes in their environment.

Finally, this chapter reviews a representative selection of synthetic character architectures. The objective is to identify elements of an architecture for character/actor implementation. This review critically evaluates: TEATRIX, TOK (OZ project), QUAKEBOT, EMA and FAtiMA (FearNot!). They have been selected because of their contributions to four essential areas of affective agent architectures design (AAAD) - namely appraisal, emotion modelling, planning and action/goal selection mechanisms.

The discussion in this chapter assesses their potential in integrating the type of interactivity and affective representation required for a successful implementation of a character-based model.

5.2 TEATRIX (NIMIS project)

TEATRIX is particularly relevant to this thesis given that it was developed within a narrative framework. It aimed at developing creative storytelling skills in young children (4-8 years old) using a theatrically inspired approach. TEATRIX was a collaborative virtual environment developed under the NIMIS (Networked Interactive Media In Schools) EU project (Machado et al 00). The overall concept of

the application architecture (Machado et al 01), and aimed to develop a framework based on Vladimir Propp's narrative interpretation (Propp 28). Users were able to set up scenes, props and characters for each scenario. They could then initiate situations and interact within the story-world through the character they chose to direct. Characters could either act on the behalf of users (i.e. follow advice/orders or directions) or autonomously (i.e. deciding their own course of action) (Prada et al 00). It is the implementation of this autonomous function that is of particular relevance to this thesis.

Whilst Chapter 2 discussed the limitations of the Proppian model for an emergent narrative concept, the synthetic character architecture developed for TEATRIX is still relevant. TEATRIX implemented the notion of roles (i.e. the roles that the characters will play in the stories), personality, emotional profile and integration of emotional behaviour within the character's reasoning process (Machado et al 01). These concepts are essential if one is to simulate an actor and convey emotions and drama within a performance. **[Figure 5.2A]** shows a screenshot of the TEATRIX application.

Figure 5.2A: A scene from TEATRIX (Prada et al 00)

The TEATRIX collaborative distributed agent architecture allowed several children to work on the same story at the same time. The system was designed around "a server module owned by the child who started the story and several client modules owned by all the other children that have chosen to play the same story" (Machado et al 00(2)). Prada also pointed out that "a story character in TEATRIX is the conjunction of an actor and a role" (Prada et al 00). This approach to character consideration conforms to the EN vision of a user/participant and character/actor described in section 5.1. The agents are composed of five elements (mind, sensors, effectors, body and inventory) where the character's mind receives information from sensors and passes actions to effectors for execution and the character's body performs actions. On top of this, the agent's inventory keeps track of the character's belongings and uses this knowledge as pre-conditions for further character actions. This information flow is detailed below in **[Figure 5.2B]**.

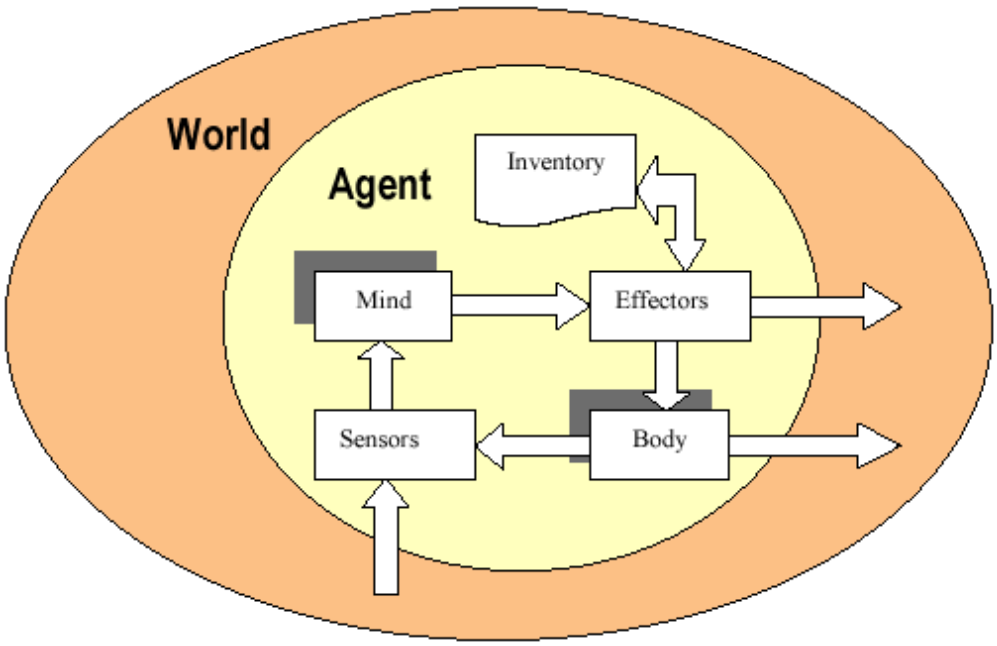


Figure 5.2B: TEATRIX agent architecture (Prada et al 00)

Finally, the architecture of the mind is also of great relevance, in the way that information flows between the agent and the world model and the way in which emotional reactions are produced and used in conjunction with the agent's own goals. Input via the sensors is filtered in order to determine its relevance to the character's set of goals and actions. This process also triggers an update in the world. This update is run in the emotional reaction module, so that consequent events can change the character's emotional state. Changes in the world model also trigger the goal management mechanism to run an update on the state of the character's goals based on the current version of the world model and the current emotional state of the agent. Finally, planning is performed taking into account "current goals, world state, actions that can be performed and the emotional state" (Prada et al 00).

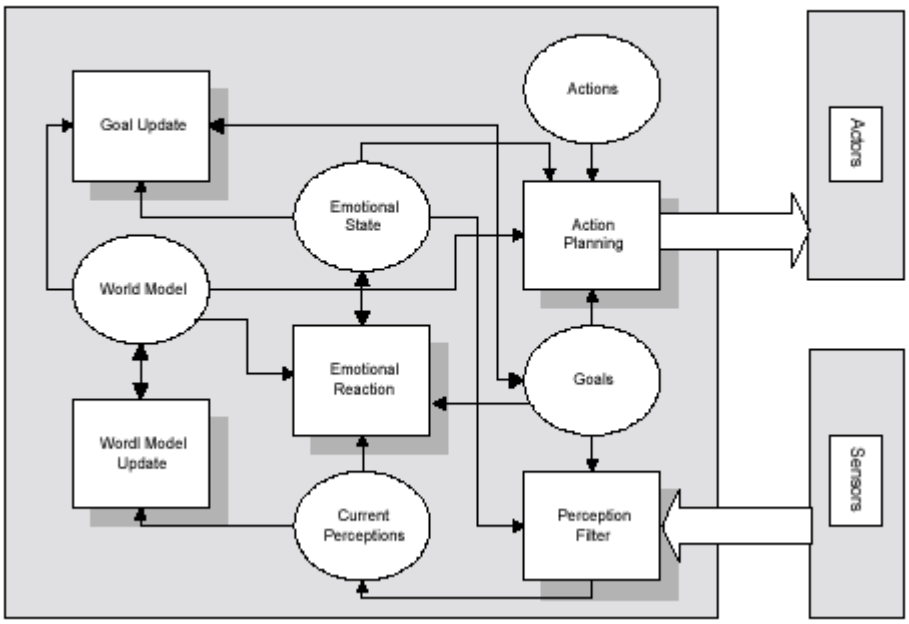


Figure 5.2C: TEATRIX mind architecture (Prada et al 00)

These mechanisms produce **[Figure 5.2C]** a dynamic system in which the agent's mind is constantly updated with changes in the world state as they happen and in which the agent builds its own representation of the world state.

However, the emotion model animating the characters in TEATRIX does not appear to be sufficiently rich for operating outside the scope of a Proppian model. The TEATRIX implementation seems only to incorporate a subset of the OCC (Ortony et al 88) basic emotions relevant to fairy or folk tales. It would be preferable to incorporate a much larger set of emotions and reactions in order to cover a wider range of actions in an emergent narrative system.

5.3 QUAKEBOT (John Laird – SOAR architecture)

The Quakebot application already referred to in Chapter 3 (IDA - Interactive Drama Architecture) is also of interest. Not only it is directly linked to the AI framework Soar (Laird et al 03), but it also covers an interesting anticipation mechanism potentially adaptable to drama. A QuakeBot character is able to predict other characters (i.e. players) actions. “Soar Quakebot was designed based on principles developed for controlling robots using Soar” (Laird et al 00). The Soar architecture presents a “theory of cognition embodied in a computational programming architecture” (URL: Soar1). “It is a general cognitive architecture for developing systems that exhibit intelligent behaviour. It has been used since 1983 and evolved through many different versions to where it is now, Soar version 8.6” (URL: Soar2).

The Soar Quakebot was designed to reproduce human-like tactical play for first-person-shooter (FPS) video games (Laird 00(2)). It is interesting the way that anticipation has been incorporated within the architecture. The Soar Quakebot would “create an internal representation that mimics what it thinks the enemy’s internal state is, based on its own observation of the enemy” (Laird 00(2)). This could be summarised by the following “What would I do if I was in this situation with that state of mind?” (Laird 00(2)). By building an internal representation of the enemy’s internal state, and applying its own tactical knowledge to the foreseen situation, the Soar Quakebot would second guess the intention of the enemy and be able to set up an ambush for instance, as described in detail in (Laird 00(2)). The concept is computationally straightforward. In order to apply such reasoning the agent would need, in principle, to project a basic action decision mechanism onto a fictive situation and report the result of this operation to its own more complex and developed action-decision system. Whilst this has been successfully implemented in

the case of the Soar Quakebot for a first-Person-Shooter (tactical operations), it would be interesting to investigate the suitability of such an approach to the particular contexts of dramatisation and action-selection processes based on dramatic interests rather than tactics. In the context of an EN model, an agent, rather than selecting actions based on its own emotional state and plans, could potentially foresee the emotional impact its actions would have on other characters and select them appropriately. Such an agent would not only be aware of its own actions and goals, but also of the dramatic impact of its actions on the environment.

This approach supports a key issue in EN. For an emergent narrative to be successful, the actions carried out by characters must carry a minimum level of dramatic intensity if they are to be seen as potentially interesting by fellow characters and users. The anticipation mechanism described by John Laird in the Soar Quakebot could potentially ensure that characters choose to execute actions that carry a potentially high dramatic impact rather than possibly insignificant actions.

5.4 EMA (Marsella and Gratch)

EMA (**EM**otion and **A**daptation) is a computational model developed by Jonathan Gratch and Stacy Marsella at USC (University of South California – USA). It applies a general computational framework of appraisal and coping mechanisms that aims to develop autonomous agents with life-like behaviour. It has been designed as a computational model of appraisal and action. The system generates a causal representation of characters and their environment, and interprets this relationship for goals and actions decision making. This is constantly subjected to changes (real-time) from a wide set of appraisal variables (i.e. perspective, desirability, likelihood, causal attribution, temporal status, controllability and changeability). **[Figure 5.4A]**

illustrates the connections between the different components of the system; namely, environment, causal interpretations, appraisal, coping, planning and beliefs.

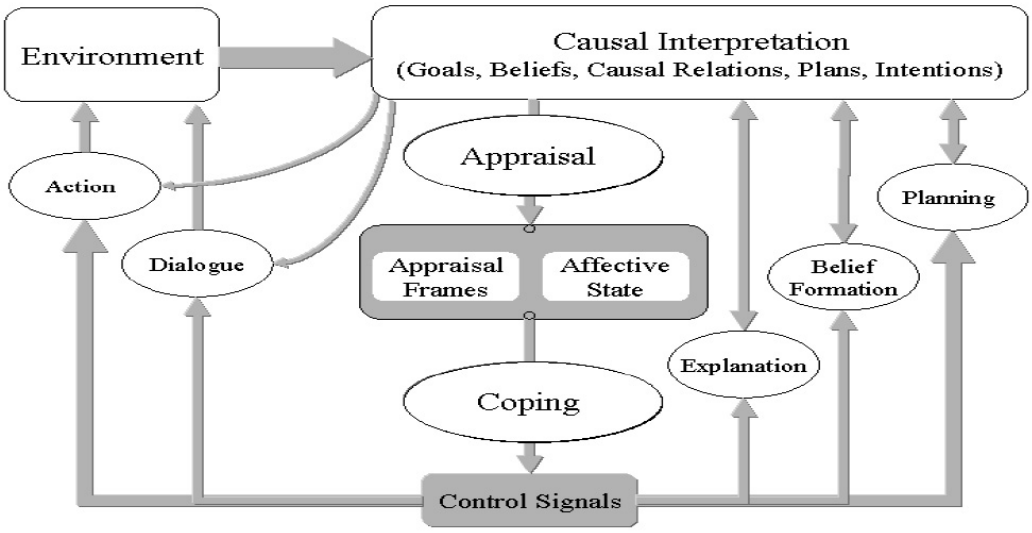


Figure 5.4A: The EMA architecture (Gratch et al 04)

[Figure 5.4A] illustrates how causal interpretation of the agent's relationships with the environment is subjected to changes from other components (beliefs, planning and explanation). It also shows the cycle of appraisal and underlines the dynamism of the overall architecture.

Causal representations are developed for decision-theoretic planning and also feature representations of both intentions and beliefs (Marsella et al 06). This approach allows for the appraisal processes to be processed quickly as the agent's beliefs, intentions and plans are uniformly represented within the system (Marsella et al 06). The uniformity of this approach also allows for both reactive and deliberative outputs to be integrated in the agent representation. Since the agent's causal representation is constantly updated, any decision made by the agent always reflects on its current emotional state, goals, beliefs, intentions, plans and causal relations.

In this system the appraisal of events is conducted according to the cognitive structure of emotions proposed by Ortony et al (OCC) (Ortony et al 88) with the coping mechanism of EMA integrated within the appraisal process. This allows coping to relate to the agent's causal interpretation of the world environment and determine its reaction to appraised events.

This work is relevant because it enables agents to make decisions affectively and to organise their plans and tasks in regard to their emotional states. An architecture based on a cognitive approach to emotions could lead the way to the development of relationships between the different characters and users of a virtual interactive drama.

Such an architecture technically underpins the argument presented in this thesis that affectively-based action selection mechanisms can reflect character actions, and therefore produce coherent and consistent characters. In turn, based on the coherence of the character's decisions and apparent goals, characters would appear believable to an intervening user (c.f. Chapter 4). This would support the hypothesis of character-based interactive storytelling in which character's decisions are coherent with character definitions and where characterisation (in the dramatic sense) can therefore be achieved. The EMA architecture presents potential technical solutions to characterisation (i.e. internal agent representation and affectively driven action-selection mechanisms) that increases the feasibility and relevance of an agent-driven narrative approach.

5.5 The TOK architecture (The OZ project)

The TOK architecture is an intelligent agent architecture that was developed within the OZ project in the early 90s. This project is widely considered as a landmark in

the AI and agent research area and was funded and developed at Carnegie Mellon University (USA). It aimed to develop an agent architecture that would support reactivity, goals, emotions and social behaviour (Bates et al 94). The TOK architecture was part of a larger piece of work of generating compelling simulated worlds supporting the "suspension of disbelief" already mentioned. For this reason, its design incorporated natural language analysis and generation.

The primary capabilities of the Oz agent architecture were "perception, reactivity, goal-directed behaviour, emotion, social behaviour, natural language analysis and natural language generation" (Bates et al 94). Details of the TOK architecture are shown below in **[Figure 5.5A]**. The two main features were the emotion (Em) and action/selection (Hap) modules. This architecture is comparable to the one proposed by Blumberg in the mid-90s (Blumberg 95) and is essentially reactive and behavioural.

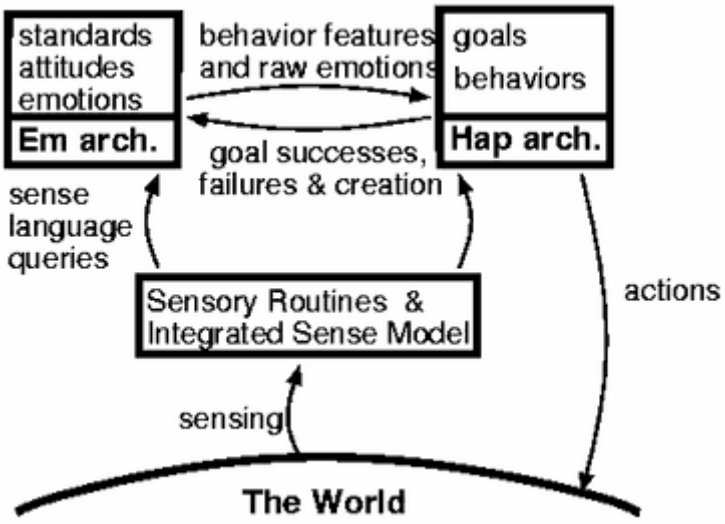


Figure 5.5A: The TOK architecture (Bates et al 94)

The Oz agent follows a process common to autonomous agents in robotics. It constantly executes a three-step loop: It first senses the world through their perception modules (i.e. sensory routines and integrated sense model (ISM)); then

reflects on its actions (based on perception, current goals, emotional state, behaviour) and finally act. The agents are designed to learn and start with an empty ISM, they collect information by interacting. Although it might look like they are planning their next move, the HAP module (i.e. action decision mechanism) selects between a static set of actions representing a plan for different goals. However, this does not constitute planning per se as pointed out by Bates; “Goals do not characterise world states to accomplish and HAP does not do explicit planning” (Bates et al 94). The approach to goals and plans in the system is to select and manage “a tree of alternating layers of goals and plans that represents HAP’s current execution state”. They are stored in what is called the Active Plan Tree or APT.

Although the structure of agents is of great interest to this thesis, the way in which emotions are modelled is of even greater interest. The overall emotional and social aspects of the agents are implemented following the appraisal system for emotions (i.e. commonly referred to as the OCC) developed by Ortony et al (Ortony et al 88). The TOK module (Em) generates emotions from a cognitive perspective: actions and events are appraised and generate emotions that change the emotional state of the agent dynamically. For instance, a goal failing has a negative effect on an agent (sadness), in turn; the (Em) module processes the information and updates the emotional state of the agent, possibly altering the selected set of plans for the next action to be performed. Some of the relationships between emotions and plans and actions are shown in **[Table 5.5B]**.

EMOTION	CAUSE
Joy	Goal success (*)
Distress	Goal failure (*)
Hope	Prospect of goal success (*)
Fear	Prospect of goal failure (*)
Pride	Action of self approved according to standards
Shame	Action of self disapproved according to standards
Admiration	Action of other approved according to standards
Reproach	Action of other disapproved according to standards
Love	Attention to liked object
Hate	Attention to disliked object
Gratification	Action of self causes joy and pride
Gratitude	Action of other causes joy and admiration
Remorse	Action of self causes distress and shame
Anger	Action of other causes distress and reproach

(*) Denotes difference from OCC model

Table 5.5B: Emotion – Causes relationships (TOK architecture) (Bates et al 94)

By implementing the OCC model, the TOK architecture generates and manages an interesting range of emotions and develops a certain level of believability in the Oz characters, from the way they emotionally respond to events and their behaviour in general. The (Em) module also integrates a decay function so that emotions fade with time. Such a function also reinforces believability in the characters, because this is the way we operate in our everyday life, and it is the type of implicit behaviour we would expect agents to display.

The TOK architecture is of particular interest for the development of the emergent narrative concept given that it was primarily designed with the concept of character believability in mind. Since it has developed into an agent framework that supports the user's "suspension of disbelief", the TOK architecture could be relevant to the EN concept as both approaches rely on the user interacting and identifying with characters, both on a cognitive and emotional level. As shown in both the MRE project (EMA architecture) and the TOK architecture, a cognitive approach to

emotions (i.e. OCC) appears to be particularly suited to computational implementation.

5.6 FearNot! - FAtiMA (VICTEC project)

The FearNot! agent architecture (Fun with Empathic Agents to Reach Novel Outcomes in Teaching) has been developed within the EU funded VICTEC (Virtual ICT with Empathic Characters) project and is the most recent architecture to date (VICTEC). The project dealt with PSE (Personal and Social Education) issues such as bullying from an agent-based perspective. It also aimed to develop social agents or characters with which users could interact and build empathic relationships. There are many common aspects between the VICTEC project and the emergent narrative concept presented in this thesis. To a certain extent, the agent architecture developed for VICTEC reflects the need for the emotionally driven agents required by the emergent narrative approach. Since VICTEC is the most recent work presented, it reuses several concepts developed in other work.

The agent architecture used in the FearNot! Demonstrator (FAtiMA) (Dias et al 05) is shown in **[Figure 5.6]**. Their behaviours, rather than being generated by a conventional planner are primordially influenced by their emotional state and primarily personality. Their emotional status affects their drives, motivations, priorities and relationships. FAtiMA provides two distinct levels in both its appraisal and coping mechanisms. The reactive level provides a fast mechanism to appraise and react to a given event, whilst the deliberative level takes longer to react but allows a much more complex and rich behaviour (Louchart et al 05(2)).

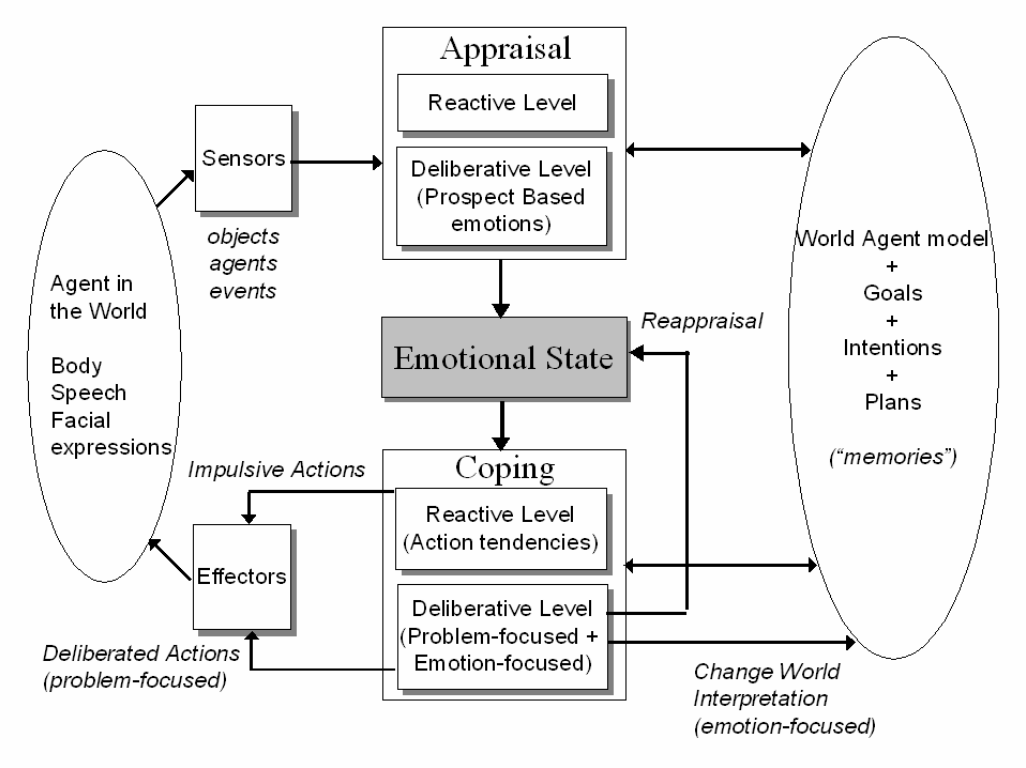


Figure 5.6A: The FAtiMA architecture (Dias et al 05)

The emotion definition adopted for the FAtiMA architecture is again the OCC (Ortony et al 88) and is based on a valenced (good or bad) reaction to an event. The 22 OCC emotion types have been implemented within the FAtiMA architecture. Similarly to the EMA architecture, that developed for the VICTEC project applies both emotionally focused and action focused coping in planning processes (Dias et al 05, Louchart et al 05(2), Marsella et al 03).

As shown in **[Figure 5.6A]**, the appraisal mechanism is composed of two distinct layers. The reactive layer appraisal is handled by a set of emotional reaction rules, based on Elliot's Construal Theory (Elliot 92). A reaction rule consists of an event that triggers the rule and values for OCC appraisal variables affected by the event (desirability, desirability for other, praiseworthiness, etc). The deliberative layer is responsible for appraising events according to the character's goals, thus

generating prospect-based emotions like hope and fear. These emotions guide and influence the deliberative coping mechanism.

The action selection process is composed, like the appraisal mechanism of both reactive and deliberative levels. The reactive layer consists of a set of action rules: each contains a set of preconditions that must be true in order to execute the action and an eliciting emotion that triggers this particular action. The core of the coping or conceptual layer is built up according to a partially ordered continuous planner (Russell et al 95). Once the appraisal process is completed, the planner selects the currently most intense intention, which corresponds to the goal generating the most intense fear or hope emotion. The selected intention becomes the target goal for the planner to achieve. More than one plan may be generated and the planner must select one in order to continue planning or execution. As soon the selected plan is brought into focus it generates hope/fear emotions, including emotions caused by action threats to interest goals. Unlike other planners, the FAtiMA planner can also use emotion-focused strategies to drop an unlikely plan, to improve a plan or to resolve a flaw. The resulting plan is stored with the intention and can be pursued later on.

The FAtiMA agent architecture features an affectively driven planning and coping system and could offer a useful test platform for the computational implementation of characters for an emergent narrative concept. Since such an architecture produces agents that are emotionally driven, any significant interaction with a user or another agent will result in the alteration of the agent's emotional state. Since the agent makes decisions based on that emotional state, this potentially affects its perception of actions and alters the probability of plan success and the resulting feelings of hope and fear. This, in turn, influences the actions selected for

execution by the agent and allows for the unfolding of narratives different in form and content (i.e. according to their context) without the need for scripting them.

5.7 Conclusion

The discussions presented in this chapter have contributed to the identification of several elements that could potentially contribute to the implementation of an affectively driven agent architecture fitting the requirements of the EN concept discussed in this thesis. **[Table 5.7A]** shows these elements in relation to the research questions of Chapter 1.

Interrogations	Agent approach
Can autonomous agents participate in an active manner to character/role-based storytelling?	**TEATRIX** with its strong notion of character demonstrates that character-based storytelling can be achieved via autonomous intelligent agents. This is achieved in **TEATRIX** by regarding the character as an actor with an agent simulating the acting role autonomously.
Can the dramatic weight of an interactive story be carried out by the characters/agents?	There is a strong probability that the tactical anticipation mechanism proposed by Laird could be adapted to drama and relate to some dramatic evaluation criteria. An anticipation mechanism "a la" **QuakeBot** could provide agents the necessary information for making dramatically relevant choices within a story experience.
Can agent technology provide technical solutions for the simulation of a character's emotions? **Can agents interpret a character role so that they achieve believability?**	**EMA, FAtiMA** and to a lesser extent **TOK** have demonstrated that current agent technology can support affectively driven action/selection mechanisms and that an agent can organize plans and tasks in regard to emotional states. Therefore insuring that an agent is making decisions according to its emotions and achieve believability.

Table 5.7A: EN hypothesis open research questions

Since it is the most recent architecture to date, and because of its involvement with EN development, the FAtiMA architecture appears to be the most suitable for experiments in this thesis. It has the potential to be instrumental in proving the validity of the emergent narrative concept. However, changes must be implemented for this to be possible. It is also necessary to integrate additional functionality relative to some of the architectures described in this chapter. As identified in this chapter, the anticipation mechanism described in the QuakeBot system represents the

basis for a novel distributed story management system based on the dramatic assessment of actions for decision making.

Chapter 6

Theoretical formulation

> When I was very young, I was already a fabulador. I loved to give my own version of stories that everybody already knew. When I got out of a movie with my sisters, I retold them the whole story. In general they liked my version better than the one they had seen.
>
> -*Pedro Almoldovar*

6.1 Introduction – Methodology

The investigation conducted in previous chapters suggests that there is a mismatch between existing narrative theories and the requirements of interactive drama (ID) (c.f. chapter 2 and 3). Whilst interactive narratives are complex and challenging both in their conceptualisation and implementation, there are no commonly accepted definitions or methodology for their development. Furthermore, the interactive factor has rarely been considered or applied in traditional dramatic forms. This raises two critical questions:

- How can a story fit within an interactive framework?
- How can a plot unfold if the user is allowed to perform plot-meaningful actions?

This chapter aims at identifying all the necessary concepts for the theoretical formulation of an Emergent Narrative theory.

Since theories are composed of concepts and relationships, it is essential in this chapter to identify those relevant to the definition and justification of the EN approach undertaken in this thesis. In considering a theory, concepts generally come from existing theories, or are generalised across instances derived from practical applications.

The investigation carried out in Chapter 2 suggests that narrative theories can only make a limited contribution to EN since they do not consider interactivity in their formulation. There are, however, several important concepts that should be taken into account in this chapter:

- **Dramatis Personae** - The Dramatis personae described by Propp (Propp 28) is directly relevant to the EN formulation as it translates as "the persons of the drama" (in Latin) and refers to the active characters in a dramatic enactment. The dramatis personae are not central in most narrative theories as the plot structure is generally the focus of attention. However, since this thesis argues for a character-based consideration of ID (c.f. Chapter 3), the dramatis personae should be regarded as a prominent concept in the EN theory.
- **Story/Fabula** – This is particularly relevant to the EN formulation as it refers to the complete set of events making up a narrative and reflects what has in effect happened. It differs from the plot as it does not relate to any dramatic articulation or ordering, but is comprised of the action/event content of a drama. The function of this concept within the EN however differs from its commonly acknowledged role in other narrative theories and should therefore be addressed in this chapter.

- **Sjuzet/Discourse (plot)** - This is also a concept that should be considered in this chapter, as the integration of a character-based narrative approach affects both its role and its importance within an interactive narrative framework.
- **Internal ontological interactivity** - Interactivity, as a concept, should also be discussed in the sense that interactivity can be interpreted differently (Louchart et al 04(2)) and carry several meanings. It can be seen as a creative experience where the user participates in the conception of interactive drama and is therefore part of an authorial concept (Silva et al 03). On the other hand, it can also be regarded as a means to transfer character and dramatic responsibilities to the user and allow for the development of immersive experiences. The internal ontological interactivity identified by Ryan (Ryan 05) should be identified as an important concept for the EN formulation as it refers to non-deterministic story interactions for the generation of stories in real-time from the co-operation between both users and the system.

The investigations conducted in previous chapters (c.f. Chapters 3, 4, 5) answered several important questions and contributed to the identification of elements that should be categorised under the following EN concepts:

- **Interventionist user** – Existing narrative systems have shown that an interactive drama can be articulated around a user's decisions and actions (e.g. Façade (Mateas et al 05)). This is particularly relevant in EN in the sense that the user, via their character plays a central role in a story experience. These decisions/actions should be taken into account as they affect the narrative unfolding.
- **Dynamic Story Environment (DSE)** – The concept of a DSE refers herein to a story environment reactive to an interventionist user. This is important in

the sense that a continuous planning functionality would allow for managing story contexts accurately by keeping track of what has been happening within a story and providing decisions adapted to the story and the interventions of the user. This concept should be discussed in this chapter as its conception within EN is different from the planning implementations discussed in Chapter 3.

- **Affectively Driven Characterisation (ADC)** - Chapter 4 has demonstrated the importance of emotions in characterisation for both the spectator and the actor. In a character-based framework such as the EN approach, it is essential that characters act their roles emotionally in order to be believable to the user and to bring out their personalities. Emotions are generally not considered explicitly within narrative theories or systems but play an important part in narrative practices such as films or novels. Considering the importance of emotions in characterisation (c.f. Chapter 4), this concept is particularly relevant to the EN as characterisation represent the core of the narrative approach.
- **Storification –** This term, coined by Aylett (Aylett 00) refers to the continuous activity of a narrative participant in building a mental model and developing and testing expectations about the story's outcome and the character's present and future motivations, roles and emotions as the story unfolds in real-time. Whilst this concept has not been described yet in this thesis, it is relevant to Chapter 4 on emotions and the communication of emotions and intentions (c.f. Chapter 4 section 4.2). It is an important novel concept (with respect to interactive storytelling) that is entirely relevant to the

EN as it concerns the activity of a user participant during the unfolding of a drama.

Whilst the work carried out in Chapters 1 to 5 has allowed for the identification of several important concepts, it has not provided elements relevant to story management and the overall general articulation of character-based interactive narratives. It is therefore essential to investigate instances of both interactivity and storytelling. Section 6.2 investigates interactive media such as Interactive theatre, Role Playing Games (RPGs) and Video games in order to define a complete set of relevant concepts to the EN. Finally, section 6.4 presents the formulation of the EN theory and describes in detail its concepts and relationships.

6.2 Instances

Since the elements allowing for interactivity seem to be positioned outside of conventional thinking (c.f. Chapter 2), it is apparent that the investigation presented in this thesis should be oriented towards alternative narrative forms with a particular focus on their articulation. This includes the study of interactive theatre, RPGs and video games.

6.2.1 Interactive theatre

Interactive theatre (IT) should be regarded, in this thesis, as a generic term for participative narrative forms and includes several practices.

- Street theatre (Izzo 97) which consists of actors performing their characters from within a crowd and directly interacting with their audience.
- Boal's forum theatre (Boal 79) is a variant where the interactions between performers and spectators determine the decisions made by the actors and therefore the unfolding of the play.

- Persuasive games (URL:BlastTheory) are theatrical practices where a user/audience is immersed in real-life sceneries and is driven to interact with strangers, actors or online players as part of the making of an interactive experience.

These are particularly relevant to the EN formulation in the sense that they unfold in real-time with the collaboration of intervening users. In IT, the actors are usually given a certain amount of information interactively by the audience and then act "in character"; applying this material creatively. A narrative emerges through the interaction between the different actors, who may themselves be advised by a part of the audience. The creation and design process are accurately illustrated in (Izzo 97). A more structured version of this approach can be seen in Forum Theatre (Boal 00). This allows sections of the audience to halt the action in order to provide new guidance to an actor, or allows an actor to halt if they cannot continue in role without further information. Boal coined the term 'spectACTOR' for the role played by audience members in this process to emphasise the difference from passive reception.

Persuasive games such as the ones conducted by Brighton-based interactive theatre company Blast Theory (URL:BlastTheory) (i.e. "Uncle Roy all around you" or "Can you see me now") operates in similar fashion and integrate audience members within the interactive experience so that their decisions and actions affect the narrative unfolding.

Interactive Theatre is generally character-based and story management is often assumed by the actors themselves. In many cases, the actors share the responsibility of managing the unfolding of the narrative experience. Whilst this does not comply with the narrative theories presented in Chapter 2, it introduces the

concept of **Distributed Story Management** to interactive storytelling. This concept is relevant to the EN formulation as it aims to manage interventions from interacting users within the unfolding of narrative experiences in real-time.

6.2.2 Role Playing Games (RPGs)

Role Playing Games (RPGs) are interactive and participative forms in which players assume the roles of characters and create narratives collaboratively under the supervision of a Game-Master (GM). The GM aims at providing a meaningful and interesting narrative experience to the players (i.e. the party) and its role is to control the flow and content of the experience. The actions of characters are determined by the participants and are based on the characters' attributes.

The study of RPGs aims to contribute to this thesis by identifying mechanisms that bring together plot (sujzet) and the level of freedom offered to the user (i.e. space, time and interaction). Their interactive character-based approach differs both from the classical Aristotelian theory (Aristotle 330BC) and the analytical models proposed by French Structuralists ((Barthes 66), (Todorov 66)). Three different types of RPGs were considered in this investigation; Board, Conflict and Live RPGs.

- Board RPG is played with fictive characters, sometimes these are represented by board-sized models, and the game is normally organised into campaigns. The game is composed of sessions (the number varies according to the size of the campaign) and usually involves a quest with a group of largely co-operating characters. The interest of this genre lies in its episodic nature and the way it handles narrative events and character development.

- Conflicting RPG is a variant played with conflicting character goals and personalities over a short period in a single session, and is of interest for its management of narrative tension and narrative set up.
- Live RPG (LARP) is played in the real world and players act out their actions instead of describing them. LARPs are relevant for their management of narrative on a real-time basis.

6.2.2.1 Empirical investigation

Although RPGs can be used for pedagogical purposes (URL: Utbildning), they mainly aim towards entertainment and, despite some relevant research work (Tyschen et al 05), their investigation is made difficult by the paucity of scholarly resources available. There is also a wide range of games and mechanisms for which it is difficult to produce comprehensive definitions of types and categories. The selected approach for this study was empirical and aimed at identifying narrative patterns, elements or factors influencing the creation, development and unfolding of dramatic narratives and stories. The success of such an approach depends heavily on the quality and level of expertise of the expert involved: the results displayed in this thesis are based on knowledge elicitation sessions conducted with experienced RPG Game-Masters and writers (including the 2001 World Champion of Ultra Modern World Team Championships) over a 12 month period. Three experts have been interviewed with a total of seven knowledge elicitation sessions in all, each session lasting three hours. The experts were recruited with respects to their knowledge to board, conflicting and live RPGs. The elicitation sessions were focused on the narrative controls exercised by the Game-Master within a game session. The overall Game-Master elicitation program sessions were repartitioned as follow:

- Board RPGs (4 sessions)

- Conflicting RPGs (1 session)
- Live RPGs (2 sessions)

The repartition presented here is reflective of the Game-Master level of activity within a game session.

Knowledge acquisition is known to be a difficult and time-consuming activity, to the extent of being a bottleneck in knowledge-based system construction (Feigenbaum 84), such that the application of professional tools and a known methodology is very desirable. Empiricom Ltd (URL:EmpiricomLtd) made their KAT™ Builder software (Butler Group 01), as well as essential training, available to us for this study via utilisation of the KAT™ Technique and KAT™ Builder software. The process known as "Knowledge Elicitation" is that of acquiring tacit knowledge from a human expert and putting that knowledge into a form which is computable, that is, a format suitable for use by a computer system. Empiricom's Knowledge Acquisition Technique (KAT™) applies the logical formalisation of the philosopher Karl Popper's "falsificationism" (Popper 59). Essentially, it states that the most efficient way to address a problem is not to try to find all of the conditions that must be true for a hypothesis to hold, but rather seek out only the evidence which would disprove a hypothesis. Since one only needs one piece of counter-evidence in order to disprove a hypothesis (as opposed to the almost infinite number that is required to prove one) this is quick, efficient and also requires much less computable code.

The process of elicitation carried out in the empirical study of Game-Masters was comprised of the following stages:

- An introduction to the EN concept and the research involved

- An introduction and high level presentation of the knowledge elicitation technique used in the session – so that the experts can actively participate in the conduct of the knowledge elicitation session
- Identification of overall target questions – this phase aimed at identifying the most basic and essential questions to the process of Game-Mastering in order to apply the falsification concept
- Task and action identification as part of the elicitation process
- Knowledge elicitation session summary to expert – phase targeted at checking the completeness of the analysis
- Extraction of rules and discussion with expert

Finally, in order to ensure that the results obtained were conform to the expert's knowledge, the experts were invited to actively participate at the construction of the knowledge elicitation tree and worked together the interviewer on the same computer screen.

6.2.2.2 Study results

This section discusses the results of the knowledge elicitation exercise; the rules assembled from these sessions are available in **[Appendix E].**

- **Creating a campaign**

This is a collaborative process where the characters, as well as the worlds and environments in which the campaign is set, are developed in common accord between the Game-Master and the players. Character definitions include details such as histories, activities, work, physical characteristics or eating habits. Environments and worlds are defined with the same level of detail. This laborious but highly participative creation process allows the Games Master to prepare the campaign

episodes with a good understanding and knowledge of the different characters and worlds involved. This favours the delivery of a highly flexible narrative structure, potentially challenging all the different protagonists of the party.

This creation process illustrates important differences between participative and non-participative structures. Character or role-based approaches, such as the one undertaken by RPGs, aim at a relatively equal sharing of actions, interactions and narrative developments between characters. Each character develops its own story, mainly through interactions with other characters, non-player characters (NPC) or challenges proposed by the Game-master. This results in increasing the number of possible scenarios by a factor depending on the number of characters involved in the campaign. It also gives the user a broader choice regarding the type of character they are to be involved with. As character development itself is a permanent goal, in so far as this is key to retaining the interest of the player, and requires their constant attention which is persistently mobilised, keeping the user's interest at a satisfying level. While plot-based structures such as the one proposed by Propp (Propp 28) or Campbell (Campbell 49) (c.f. Chapter 2) concentrate on potentially decisive plot events or actions, RPGs address the importance of roles in narrative structures by providing the user with a constant object of interest, the character and its development.

Whilst the Fabula itself still operates as within the boundaries of conventional traditional narrative media (Cinema, Comics), the formulation of the discourse differs greatly in order to accommodate user/player interest and interactivity. RPGs present multiple discourses unique to the experience of each player. These individual discourses reflect the interventions, decisions and actions of a player along with other story elements with which he/she has been exposed. This

concept is not represented in traditional narrative theories and due to its important function in RPGs (interest / interactivity); it should therefore be considered in the formulation of the EN theory. This concept is referred to, in this thesis, as the Multiplicity of Discourse.

- **The function of encounters**

During the course of the campaign, RPG players are confronted with a certain number of encounters, distributed in time and space by the Game-Master as a source of challenging and interesting activities for the party. The Game-Master expects that the encounters specifically created for an episode or a session, if wisely distributed, will trigger actions, reactions, discussions or decisions from the party in such a way that an anticipated plot will unfold. This plot however has a hypothetical aspect since what actually happens is the direct result of the party's generated reactions to the different encounters. Thus to a large extent RPGs are encounter-driven rather than directly plot-driven. Section 6.2.2.3 below develops the role of the Game-Master in more detail, his or her influences on the overall plot and his or her actions to ensure a dramatically satisfying narrative. There are generally five different types of encounter at the disposition of the Game-Master as shown in **[Table 6.2.2.2A]**. Their presence in any game is, however, dependent on the genres and themes of the campaign and its specific settings.

Name	Content	Purpose
Descriptive	Game-master describes scene to players; makes announcements; states rules; describes functionality	Substitutes for lack of direct player perception of environment and for attentional focus
Social	NPC (non-player character) voluntarily communicates information or specific message to particular player in a social context	Help players identify goals, steers players in direction desired by Game-master
Information-gathering	NPC assesses state of player knowledge for gaps; provides information or clue only if specifically asked. Documents or other media can be used instead of an NPC	To help players who cannot solve a puzzle, meet a goal or progress
Problem-solving	NPC confronts player with puzzle or problem; some puzzles (e.g combination locks) may not require an NPC	Gate-keeper of resource needed for further progress which is released on solution of puzzle
Combat	NPCs for action encounters – battles, fighting	Repercussions on the members of the party's health state, weapon, power, strategy etc.

Table 6.2.2.2A: RPG encounter types

Encounters can be used by the Games Master to shape and pace the dramatic unfolding of the narrative as well as presenting the main source of entertainment to the players, and embodying key events in the construction of the plot. Their smooth orchestration by the Game-Master is critical in ensuring the players participate in interesting stories and interactions with each other, and also helps them in achieving a personal level of satisfaction around character development and overall plot. The role of the Game-Master is crucial to the creation, development and unfolding of an RPG campaign.

Encounters are used in RPGs to bring interesting narrative information to the party or communicate important campaign details. They are also used to trigger character activities or interventions. It is, therefore, unknown to the GM how the players will react to encounters and what course of action they will undertake. As a result of this, the plot (Sjuzet) is provisional and hypothetical, as it cannot be predicted with any degree of accuracy what the turn of events will be. The concept of **Hypothetical plot** is key to the EN formulation as it allows for narrative flexibility in an effort to accommodate interactivity.

- **Narrative control**

Although board RPG is directly relevant to this investigation in terms of character development and the handling of narrative events, it has little to contribute as far as narrative controls are concerned. Conflicting RPG and Live RPG however, distinguish between narrative controls that occur before the RPG game session and those that occur during the game session. In both cases, most of the narrative controls are defined and set up prior to the game taking place, emphasising the idea of the narrative as a hypothesis based on the types and personalities of the characters, their roles and the nature of the environment that surrounds them. The narrative control over the game's set-up is limited to the definition of the environment, tasks and roles. As with board RPGs, since there is no way for the game writers to predict with accuracy the players' state of minds or histories prior to pre-designed narrative events, it is virtually impossible to guarantee how they will affect the players. The plot is highly provisional and its meaningfulness is almost totally dependent on the way the character roles have been written. Such an approach encourages the development of sub-plots and individual or relatively small group storylines. The design generally consists of a hypothetical storyline composed of several hypothetical plot elements, each of which involves several groups of a number of characters. Plot elements should be inter-related with at least one other plot element, their interaction ultimately defining the storyline of the game session **[Figure 6.2.2.2B]**.

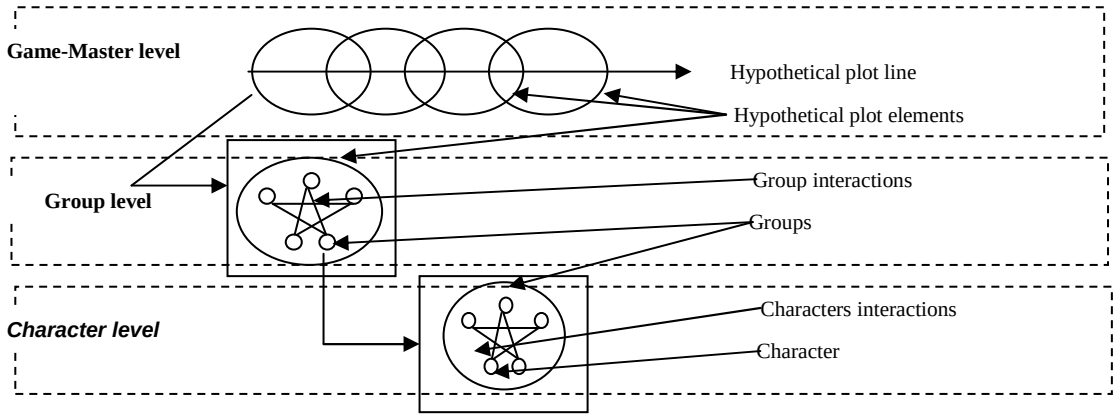


Figure 6.2.2.2B: Storyline decomposition for interactive participative narratives

Since there are inevitably a large number of events that occur, but that are not predicted or anticipated by the authors, conflicting and Live RPGs generally conclude with a debriefing session at the end of the game. Here each player describes their individual Fabula, along with their understanding of the overall game plot (Sjuzet) to the other players. This session helps individuals to understand the role that they played, either consciously or unconsciously, in the unfolding of the game narrative, and the reasons for other players' behaviours. Whilst **Narrative Debrief** (ND) allows players to refine and complete their understanding of the Fabula, it is the element that links players' experiences together and is integral to the overall experience. For these reasons, it should be regarded as an important concept for the formulation of the EN theory as this thesis regards interactive drama as a narrative experience between characters and users and between users themselves.

The interventions from the Game-Master during the game session are therefore limited in the following actions:

1. **The timing and unfolding of narrative and dramatic events**
2. **The use of dedicated agents acting for the interest of the dramatic unfolding. They answer to directives emitted by the Game-Master.**

6.2.2.3 The role of the Game Master

The Game-Master has two major responsibilities in the unfolding of an RPG. First is the technical duty to ensure that the story is moving forward. Second is the moral duty to build, produce and orchestrate an interesting and enjoyable experience for the players. Each may trigger a different set of actions by the Game-Master.

- **Ensuring the progress of the story**

This is achieved in the main through a wise use of the different encounters available to the Game-Master. However, due to the hypothetical nature of the plot and its encounters, players can misread hints or clues or deliberately decide to act against or engage themselves in a different direction than the one anticipated or expected by the Game-Master. For this reason, the episode's encounters, framing a hypothetical scenario, are written as the campaign unfolds rather than completely upfront, and develop from session to session. However a Game-Master may dynamically introduce specific actions if the delivery of an interesting story or their control over the overall narrative seems threatened. Interventions are generally caused either by players taking longer than expected in dealing with encounters, or by the story branching in an unexpected manner. Some of the actions that can be taken when players take longer than expected in a particular encounter can be seen in **[Table 6.2.2.3A]**.

Encounter type	Possible actions
Descriptive	Short and unambiguous answers to player question
Social	NPC actively closes conversation Extract player from unexpected conversation NPC initiates expected conversation Information-gathering encounter introduced
Combat	Weaken or withdraw enemy Give players line of retreat
Problem-solving	NPC provides hint Game-Master provides hint (last resort)

Table 6.2.2.3A: Actions when players are taking longer than expected

Intervention can prove more critical when an unexpected branching of the story occurs. This highlights the need for the Game-Master to be well prepared and flexible regarding the plot and illustrates its provisional nature. Branching may occur when the party incorrectly determines their role and what is expected from them, pursues future plot events omitting essential encounters or attempts to reinvent themselves. The Game-Master first assesses the potential value of new resulting sub-plots for the party, decides whether or not this allows the campaign to continue, and if not takes appropriate action. **[Table 6.2.2.3B]** includes some of the large number of actions that may be taken in the face of unexpected branching.

Some possible actions
Provide ‘blank’ encounters
NPC provides hint
Provide insurmountable obstacle
Force next encounter
Break session to rework plot
Negotiate as Game-Master with individual character

Table 6.2.2.3B: Dealing with unexpected branching

As a practical rule, the intervention of the Game Master is generally indirect as far as players are concerned. Direct negotiations between the Game Master and players only occurs in extreme cases when a player is acting “out of character“ or

threatening the overall experience for other players. This concept of **Indirect Story Managment** (ISM) is particularly relevant to the EN formulation, as direct intervention from a story managing functionality could affect user immersion.

However, there are cases when ISM is not possible, and when direct intervention is required. It is then important that the Game-Master monitors players' behaviours both in and out of character, and decides on corrective measures if it appears that certain players are not enjoying the game. They generally involve NPCs and those specific characters in more action and interaction, but in the majority of cases, it is the Game-Master's responsibility to discuss the situation with the player, generally out of character. The most common signs that such actions are needed are where a character is not interacting or is not attentive, although he is involved in a situation; where a character knows what he should be doing but is looking for something else to do; or finally, where a character is behaving in a suicidal way and knows exactly the consequences of these actions.

- **Ensuring the satisfaction of the party**

In entertainment of nearly any form, there is always at some stage the idea of the targeted audience in the minds of theatre directors, novelists or film directors/ screenplay writers. The same could be said of the Game-Master even though the common values of theatre, novel and cinema do not obviously apply to a participative narrative form such as RPG. What matters for a spectator might not match the priorities of a character in a participative environment.

Although RPG players have a good idea of the overall story in which they are involved, they are more concerned by the development of their characters and their focus is situated at a fairly low level within the overall story, the individual level. The spectator generally follows a story globally, and functions at a higher level of

abstraction than the RPG player. Moreover a film director / screenplay writer or a novelist generally produces a film or writes a book for a generic audience, whilst the Game-Master is expected to consider specific individuals so as to deliver an interesting and enjoyable experience to trusting players.

This outlook on storytelling differs from traditional theoretical approaches on narrative in the sense that it regards the overall Fabula from the perspective of its different protagonists. This practice introduces the concept of **Story Surface** that consists of all individual characters (dramatis personae) Fabulae in a drama. This concept is key in formulating the EN theory as it favours interactions over a pre-determined plot (Sjuzet).

6.2.3 Video Games

Outside of the ongoing Narratologist versus Ludologist debate discussed in Chapter 2, video gaming and digital entertainment present a strong potential for interactive dramas. The video games industry has successfully demonstrated over the past two decades that virtual characters, virtual worlds/environments and even societies can reach and entertain large populations while games companies have developed a range of applications, domains and genres.

Driven by commercial obligations, the game industry has however relied heavily on technical and computational progress to justify the release of new products (i.e. improved graphics, wider environments). More often than not, direct action has been prioritised in regard to any narrative element and consequently, the current representation of narrative in today's video games has become a means of invoking action sequences rather than relating to the story experience of the player. Game-play is too often irrelevant to the unfolding of stories in the game's graphical world, with narrative aspects relegated to decorative back story or only developed

through non-interactive cut scenes. Games have very little to offer to those not interested in puzzle solving, strategic planning and motor-based challenges such as dexterity or hand-eye coordination. In their commercial form, video games clearly demonstrate technical potential in exploiting an interactive concept graphically and could deliver the types of immersive environments necessary for interactive dramas. However, the way narrative content is articulated does not relate to the development of interactive narratives, as narrative elements are perceived as elements justifying action scenes or situations. For these reasons, video games do not provide practical elements or concepts for the formulation of an EN theory.

6.3 Theoretical Formulation

An important part of the work carried out in this thesis was to research interactive media, classical narrative theories and practices in order to propose a formal formulation of the EN theory. The methodology adopted herein is to takes into account the main narrative elements and concepts identified in this chapter **[Table 6.3A]** and address / (re)define them with respects to the EN vision described in Chapter 1.

Concept	Origin
Dramatis Personae	Theoretical
Fabula / Story	Theoretical
Sjuzet / Discourse	Theoretical
Internal ontological interactivity	Theoretical
Interventionist user	Narrative systems
Dynamic Story Environment (DSE)	Narrative systems
Affectively Driven Characterisation (ADC)	Emotions
Storification	Emotions
Distributed Story Management	RPGs
Multiplicity of Discourses	RPGs
Hypothetical plot	RPGs
Narrative Debrief	RPGs
Indirect Story Management (ISM)	RPGs
Story Surface	RPGs

Table 6.3A: EN relevant concepts and origins

6.3.1 Dramatis Personae

The EN approach is character-based and relies heavily upon characterisation (i.e. character definitions, acting, behaviour and communication). As opposed to most narrative theories where characters do not represent the core of the discussion, the EN approach places the Dramatis Personae at the centre of its articulation. In the EN, the user is regarded as a participant and is expected to interact, via a character, with the other members of the Dramatis Personae; generating interactions and participating in the unfolding of the narrative experience. In the tradition of RPGs, the user in an EN scenario is expected to endorse a role and act it out through interactions with other characters (autonomous agents or users).

The EN also argues for non-player characters to be accountable for the dramatic intensity of the overall story experience. This responsibility should be assumed by the characters as they are ultimately the ones carrying out meaningful or dramatic actions. Since the characters are still carrying out character specific actions within their roles, their interventions are therefore more likely to be perceived as

believable by the users as these can be attributed to goals or motivations. A Game Master or overall authoring system that would order particular characters to perform certain tasks for dramatic purposes would always run the risk of triggering inappropriate or "out of character actions" that could potentially damage the believability of the overall experience.

Characters should be given the ability to assess the situation and autonomously decide upon actions that would either invite the user to participate, or provoke the strongest reactions amongst other characters or the user in order to generate dramatic tension and/or effect.

The role and responsibilities of the characters (i.e. non-playing characters) in an emergent narrative story experience should consist of the following:

1. **Carry out role (i.e. goals, motivations, actions)**
2. **Assume pre-determined story control responsibilities dictated by the Game Master (e.g. giving out information, awakening monsters etc.)**
3. **Act in the best interest of the story experience rather than on a personal level**

6.3.2 Fabula-Story / Sjuzet-Discourse

It seems that once interactivity is involved, the discourse becomes plural. Most of the different approaches studied in recent years (i.e. branching, emergent) deal with multiple discourses. In the case of branching systems, the discourses potentially displayed are instances/variations of a given discourse, while in emergent concepts, they results from the associations of Fabulae at character level.

The EN approach differs from classic narrative theories in the sense that whilst there is an overall Fabula that is generated by character interactions, only a subset is common to all characters. Each character experiences its unique Fabula

composed of a common set of narrative elements and its own interactions with other characters.

This distinction between multiple Fabulae and Discourses is important as it differentiates the EN from other narrative media such as Cinema, Theatre or Novels. Whilst multiple storylines are common in these media, they are presented at the Discourse level, which means that character Fabulae are arranged and presented in order to fit within a certain discourse (plot). In participating approaches such as EN, multiple storylines exist at the Fabula level independently of an overall Discourse. Therefore each character experiences a Fabula that consits of its actions and decisions. Whilst the discourse level is not explicitly represented in this approach, its function is played out in the imagination of the user (i.e. Storification process). Although the general format of beginning, middle and end should be respected in principle since everything has to start somewhere and something has to determine the end, the EN approach favours the Fabula of individual characters (i.e. actions, paths) over the overall discourse.

The definition of what makes a story needs to be extended and broadened in the face of interactivity, as it is essential to distinguish between individual Fabulae arising from the dynamic process of experiencing, and an overall static Discourse. Since the Fabula is concerned with the experience of the character rather than an ‘objective’ spectator’s view, it then becomes a process in which a character is involved and which it helps to sustain rather than an artefact being presented. The Discourse-based perspective can be seen as a means of dynamically monitoring the depth, meaning and context of the process rather than controlling what actually happens. This requires the Discourse to be thought of at multiple levels of abstraction (Aylett 99) with the higher levels forming narrative waypoints, and the

lower levels left to character activity. For instance, Games such as the Medal of Honour or Call of Duty series already make use of a concept of plot hierarchy. Set in our real-world history, the game experience combines events that have really happened, and for which the outcome cannot be changed, by game-play with the ability of the player to act freely within this framework. The high-level discourse generates interesting and contextually correct events, which constrain the user's actions whilst not interfering with their freedom of movement within the story world. **An EN experience is therefore composed of two distinct narrative elements that should be considered in the following order of priority:**

1. **Fabula**
    a. **Character actions and decisions must be made in accordance with a precise and accurate goal, motivation descriptions and personality (i.e. emotions).**
    b. **The character must be developed to fit the world environment of the overall theme of the experience. It can have some ramifications to certain events of the overall discourse (i.e. goal activation, motivation change).**
2. **Overall Discourse**
    a. **This is unfolding in parallel to the character's existences. It should be regarded as a support tool (i.e. depth, meaning, and context) generator of exogenous events relevant or not to the character's experience (i.e. causes and consequences of actions).**

6.3.3 Multiplicity of Discourses / Storification

Whilst the EN approach favours Fabula over an overall discourse, it does not however mean that no form of discourses should be considered. The previous section (c.f. 6.3.2) showed that certain discourses can and should be in use within an EN scenario. In order to clarify this argument, it is important to understand the different types of discourse present in interactive narrative.

- **The discourse of the author**

The discourse of the author in an EN scenario differs noticeably from its counterparts in most traditional narrative media. The character approach presented in this thesis greatly affects the conventional conception of discourse in the sense that interactions from characters dictate the way a narrative unfolds, rendering the discourse of the author hypothetical. It is therefore necessary to regard the discourse as either an overall dynamic and flexible theme or a support tool for character interactions as described in section 6.3.2.

The conventional discourse consideration as seen in Cinema, Theatre or literature does not apply to the EN theory as it conflicts with the concept of a character-based approach (c.f. Chapter 2).

- **The discourse of the spectator; the discourse of the user participant**

In most narrative approaches and theories, the discourse of the spectator reflects the discourse of the author as it aims to communicate the vision of the author to its audience. However, since the EN theory is oriented towards the participant, there are no mechanisms in place that will guarantee a coherent and engaging discourse for the spectator.

- **Storification, the discourse of the user participant**

In the case of a user participant, the discourse function is instead undertaken by the participant as part of the storification process. The participant continuously builds its own discourse from the Fabula based on its own perception of events and understanding of what has happened through interactions and exogenous events.

In conventional narrative forms the engagement of the user is reported indirectly by applause or even global sales; in a participative form it is basic to narrative development. Although one can and should analyse signs of enjoyment or immersion of users via their behaviours, level of activity or response within a performance, essential information for the evaluation of such a narrative approach still remains undisclosed and only known to the users. Some can be retrieved through the use of post-performance questionnaires but the subjective story-as-experienced may remain permanently hidden. A feature of live role-play is the debrief at the end, in which the multiple story experiences of the participants are shared and integrated through the appreciation of larger-scale causal chains than those an individual has directly experienced.

Storification (Aylett 00) is a term that defines the continuous activity of a narrative participant in building a mental picture and developing and testing expectations about the story's outcome and the character's present and future motivations, roles and emotions as the story unfolds in real-time.

What separates this process from the variant present in spectating is the situated position of the participant – more limited in terms of global understanding, but richer in terms of ability to act. In the current absence of non-invasive and reliable mechanisms for estimating user emotional state, one can fall back on monitoring external signs of non-commitment, as seen in RPGs where the GM

constantly tracks the user's activity or behaviour (i.e. suicidal behaviour, lack of activity, clear lack of interest, lack of attention) in order to assess his/her internal state with respect to the performance. Theatre, cinema and literature have shown that the user's internal emotional state can be manipulated to a certain extent via purposely misguiding hints or indications creating the right frame of mind for a particular effect (i.e. suspense, twist, or surprise).

This concept (Storification) is important, in the context of EN, because it directly impacts on both the authoring and narrative management in real time. Since the drama intensity is not controlled in the EN by a dominant plot (Sjuzet), it is left to the user to understand other character actions or events in order to figure out a discourse for the experience. It is therefore important that events and actions take this into account and provide material or information that would contribute to the user's storification of the experience.

The EN theoretical formulation has the following position on discourse:

1. **The discourse of the author is hypothetical and therefore highly flexible. It is necessary for the author to think in terms of interactions and character roles rather than overall discourse.**
2. **The discourse of the spectator is not directly represented in the EN approach and is substituted by the discourse of the participant – the storification process.**
3. **Actions and events must be defined in a way that they support the user's storification process (i.e. additional information, material).**

6.3.4 Story Surface

The concept of the story surface is essential to the overall EN approach in the sense that it re-defines to a certain extent the definition of story environment. Most conventional narrative forms defined the story environment with respect to the narrative discourse. Therefore, the world of a given story is limited to certain characters, environments and specific actions carried out by the dramatis personae.

These approaches are restrictive in the sense that the story environment's function is to provide narrative elements or motivations for a given discourse. The EN approach departs from conventional thinking by regarding the story environment as a space or landscape accross which each character journeys and creates its own Fabula. Rather than limiting the story surface to a particular discourse, it is a space that comprises all the possible paths for each character of the dramatis personae. Whilst this concept is yet to be finalised in terms of visualisation or representation, it is inherent to the EN approach as this could be used in future developments, providing the identification of relevant dimensions, as a tool for the real-time articulation of interactive drama.

The EN approach considers the story environment as whole - the Story Surface.

6.3.5 Interactivity / Dynamic Story Environment

The EN approach formulated in this thesis is essentially dynamic and based on various types of interactions:

- User to character
- Character to character
- User to environment

- Character to environment

This thesis identified in Chapter 2 that user interaction is mainly based on the internal ontological interactivity described by Ryan (Ryan 05), and that the user interacts with characters in real-time and generates Fabulae in a non-deterministic fashion. This approach to interactivity fits particularly well with the concept of hypothetical plot advanced in this Chapter. In the EN approach, since the Sjuzet (plot) articulation is at best hypothetical, it is important to develop a particular narrative articulation that complies with non-deterministic Fabulae. The overall Sjuzet (plot) articulation model discussed in this section could be regarded as a "back-stories, role allocation, interaction, debriefing" type format.

There are several levels of action and interaction in the EN model discussed herein. There is a high level that corresponds to the role played by the Game-Master in RPGs, a medium level that is fulfilled by the different characters' actions and interactions and a low level composed of narrative events, different types of environment and attracting and repelling narrative elements. The originality regarding this type of interactive and participative design is that there is no runtime controlling or communication between the high and medium levels[3]. The Game-Master does not communicate directly with the players or characters but tries to influence (or not as the case may be) their decisions and actions through the lower level of the system, based on hypotheses concerning how characters and players would react to changes on the low narrative level. Such a distinction can only be envisaged in interactive media and cannot be formulated within classical narrative approaches **[Figure 6.3.5A]**.

[3] The starting goals and action repertoires are determined by the author as is their initial position and situation in the world.

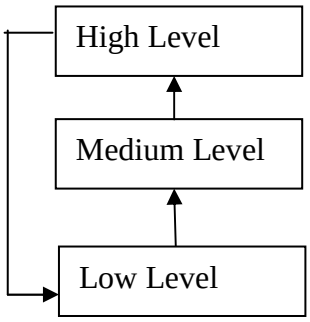


Figure 6.3.5A Interactive participative flow

This particular approach fits with the concept of Dynamic Story Environment described earlier in this chapter, in the sense that the high level end of participation monitors the actions and performances of characters towards each others and the environment and intervenes when necessary. By not interacting directly with the characters but with the low-level environment only, the Game-Master does not break the user's immersion in his/her Fabula and dynamically shapes the story environment to suit identified narrative directions. Since there is no direct interaction between Game-Master and users, the Sjuzet (plot) is still hypothetical, as nothing can guarantee that users will react in any expected manner.

Since the EN approach also stresses the importance of other characters in carrying out meaningful and interesting actions as the primary source for the generation of the character Fabula, it is necessary for the author of an EN scenario to achieve a synergy between Non-Player characters, user characters and environments. Characters and environments must therefore be developed such that they support large amounts of interactions in an interesting manner. This is achieved by developing rich characters specifically defined for interactions. These are based on a collection of techniques taken from interactive theatre, RPGs and video games and are described in detail in Chapter 7.

The EN theoretical formulation considers interactivity according to the followings:

1. **Interactions are non-deterministic and unfold in real-time**
2. **The overall format is that of "back-stories, role allocation, interaction, debriefing"**
3. **The Game-Master does not interact directly with the characters but with the environment in a dynamic manner, unlike Façade where the drama manager interacts directly with the characters**
4. **The characters interact with each other and the environment**
5. **Both characters and environments are defined so as to support interactions (c.f. Chapter 7)**

6.3.6 Story Management

Story or drama management is typically where the crunch takes place in interactive narrative. The role of a manager in the application of conventional narrative theory is to keep the overall story 'on track' in the face of user actions. The implication of the arguments advanced so far is that in the EN, the drama manager should not focus attention on the quality and meaning of an overall discourse but on the quality of the Fabulae experienced by the different characters (i.e. user, other agents), so that 'staying on track' is no longer an objective.

This requires the development of metrics of performance quality, but since these should be formulated from the point of view of the different characters, the idea of a distributed story manager within different agents in the world environment is a very natural one.

By equipping characters with an extended action-selection process, in which choice of action is influenced by performance considerations as well as the more usual one of goals and affective state, management would execute below the surface of the visible story and would not disturb the feeling of immersion the EN approach aims at protecting. Global management would then be confined to events exogenous to the characters: entrances, exits, the outcome of unpredictable physical actions (in

the absence of comprehensive – and computationally expensive – virtual physics) and, in RPG terms, 'wandering monsters'. Since most of the performance design is directly imputable to the harmonious definition of both the world environment and the characters, as in its RPG counterpart, the role of the drama manager in the EN approach is one of policing the boundaries of character roles and introducing situations and narrative events when required **[Figure 6.3.6A]**.

The drama manager should then act according to a set of rules directly extracted from RPG practices. These rules are to be distributed within the character's personalities and goals, and triggered appropriately when the performance requires them.

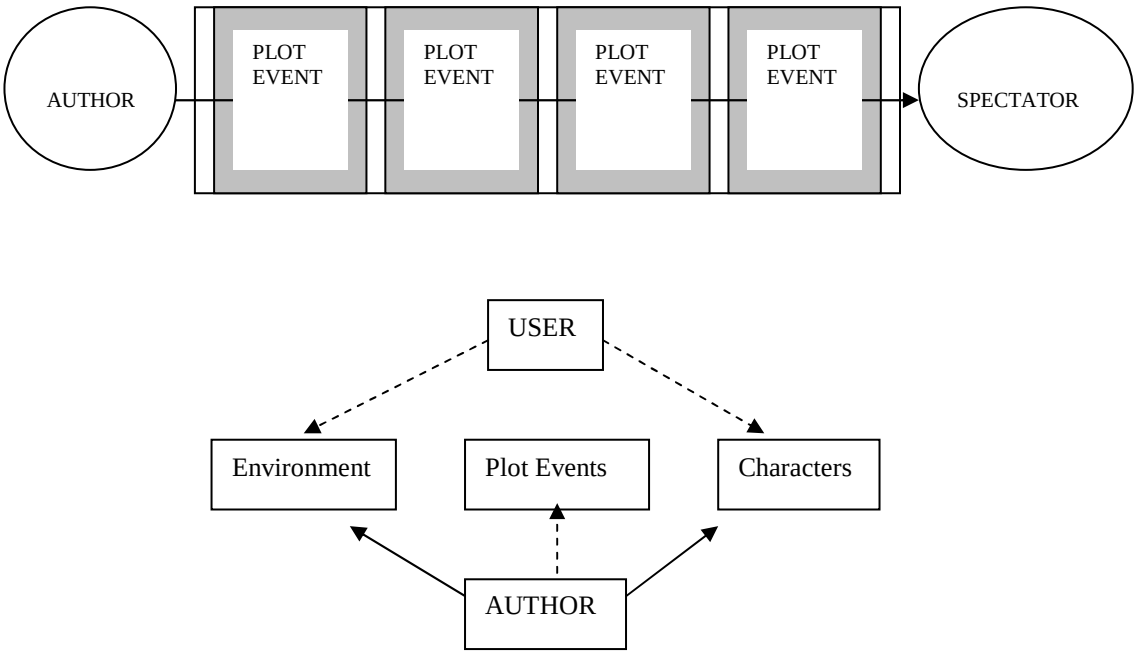


Figure 6.3.6A: The emergent narrative articulation

The story management of an emergent narrative story experience should consist at run-time of the following:

1. **Dynamic triggering of pre-determined narrative events when the situation requires them (i.e. exogenous events, environment events)**

2. **Distribution of character triggers within the collaborating cast (i.e. non-playing characters) for distributed ad-hoc story management**

6.3.7 Affectively Driven Characterisation

Considering the importance of emotions in characterisation (c.f. Chapter 4), this concept is an integral part of the EN formulation as characterisation determines the actions and decisions of characters and therefore their behaviours. This chapter has also shown that whilst character believability depends on the adequacy of a character's behaviour, this is also conditioned by emotions and the emotional approach involved in the design of the character.

Based on the investigation conducted in Chapter 4, the EN formulation argues for an agent-based approach where non-player characters are affectively driven autonomous agents. These agents must be able to assess situations and interactions with other agents or users and react in an adequate manner so that they can display and/or fulfil their goals, motivations and personalities. The appraisal-based emotion theories described in previous chapters are particularly adequate for this type of design and should therefore be regarded as the approach to follow for the design of affectively driven characters for an EN scenario.

Non-Player characterisation in the EN formulation must fulfill the following requirements:

1. **Affectively driven characterisation**
2. **Non-Player characters should be interpreted by autonomous agents**
3. **The appraisal-based models presented in Chapter 4 are particularly well suited for the implementation of affectively driven characters**

6.4 Conclusion

This chapter presented elements towards a theory of Emergent Narrative based on knowledge acquired in previous chapters and taking account of interactive practices. The theoretical formulation presented argues for the consideration of an emergent narrative application where a user could engage with a story environment (i.e. sets, characters, props etc.) whilst not being constrained by an imposed and inflexible plot structure. This approach has been summarised in **[Table 6.4A]** overleaf.

Element 1	The story must be perceived as a process, in a dynamic rather than a static way.
Element 2	The Sjuzet (plot) is hypothetical. It is composed of interrelated hypothetical plot elements.
Element 3	Plot events are written before performance, certain types (e.g. way points) can be controlled by the drama manager.
Element 4	Narrative authoring is done before rather than during the performance.
Element 5	Character Fabulae are created as the different characters interact with each other, in real-time.
Element 6	Environments and props must be complementary to the hypothetical plot or plot elements.
Element 7	Characters are written for interaction, implying rich, deep and emotionally engaging traits
Element 8	The user is considered as a participant in the performance rather than a spectator or author
Element 9	The user should be encouraged to act in role.
Element 10	The user(s) engagement and interest are the only reasons for the performance to take place
Element 11	Character actions and decisions must be developed to fit the world environment.
Element 12	The overall discourse should be regarded as a support tool (i.e. depth, meaning, and context) generator of exogenous events relevant or not to the character's experience (i.e. causes and consequences of actions). It should be run in parallel to the character's Fabula
Element 13	The characters of the drama must be described in depth and their role must be clearly defined.
Element 14	Meta-roles must be attributed to certain characters in order to act as regulator (distributed story management) during run-time.
Element 15	The character's reactions (i.e. motivations, goals) must be created with regards to certain important potential story elements (i.e. storyline, other character's actions).
Element 16	The user's responsibility should be limited to assuming a character's motivations, goals and desires, the quest for the fulfilment of these aims and the ability to make decisions "in role".
Element 17	The character's role is to carry out a role, assume pre-determined story control responsibilities and act in the best interest of the story experience.
Element 18	The story manager's responsibility is to trigger pre-determined events between non-player characters when required.

Table 6.4A Elements from the emergent narrative theoretical formulation

Chapter 7

Scenario development and implementation

7.1 Introduction – scope of actions

The conception of emergent narrative is a complex task that is dependent on the quality and amount of its content. The availability of relevant content for each character allows them to behave accordingly within the context of a particular Fabula. This requires the development of a rich story world and rich character action repertoires. This creative aspect of the overall EN development is both time consuming and artistic rather than a technical task per se. For this reason, the implementation has been oriented towards the most basic element of scenario development, character definition and to the most vital technical elements of the agent action-selection mechanisms. The implementation is therefore composed of two distinct sets of work; the characters, environment and overall scenario development, and the task of implementing a novel agent action selection-mechanism conforming to the ideas discussed in Chapter 6.

The decision to focus the implementation on these particular areas is based on their potential contributions in bringing answers to the following questions:

1. **Can a scenario with no pre-authored plot provide a viable answer to the narrative paradox?**
2. **Can an agent action-selection mechanism select actions that are dramatically interesting and therefore sustain the dramatic weight of a story via its characters rather than its plot structure?**

On the basis of the implementation described herein and its evaluation, parts of the theory will be validated, and the groundwork will be laid for a more complete implementation of the EN concept. From a technical perspective, since the characters are autonomous and not scripted, they adequately represent a user playing in role in a scenario. This allows for the development of a testing platform without the overhead of incorporating a natural language system and graphics for the user.

Finally, since the VICTEC (URL:Victec) project has been oriented towards the idea of emergence and emergent narrative, the implemented work presented in this thesis has been developed using the FAtiMA (FearNot!) agent framework described in Chapter 3. The language used in configuring the agents for the system is Extensible Markup Language (XML) and the language used to develop the internal reasoning system of the agents is JAVA by Sun Microsystems.

7.2 Scenario development

7.2.1 Environment and character development

The development of scenarios focuses on character rather than the overall story. As opposed to conventional storytelling where the character serves the purpose of the story, the character develops and unfolds the story in an EN scenario. The environment design and other narrative events are created in order to favour character interactions and story development. The approach followed in this thesis regroups character and environment creation techniques borrowed from a range of different artistic and entertainment practices (cf. Chapter 6). Whilst characters created for plot-based storytelling are defined in order to serve a story in a way that matches the author’s vision; the definition of a character for interactive and

participative applications is richer since it has to cover more potential situations than just those envisaged by the author for a particular plot.

Environment elements	Origin
Back story	**(RPG/Conflict RPG/Video games)**
World definition	**(RPG/Conflict RPG/Video games)**
World maps	**(RPG/Conflict RPG/Video games)**
Character elements	Origin
Physical characteristics, general information:	
Biography:	**(RPG/Conflict RPG)**
Personality traits:	**(Video Games) (Freeman03)**
Quirks:	**(Video Games) (Freeman03)**
Priorities:	**(RPG/Conflict RPG)**
How the character helps to define, belongs to the environment?	**(Interactive theatre) (Izzo97)**
How the character chooses to be in the environment, what are its objectives?	**(Interactive theatre) (Izzo97)**
Occupation:	**(Interactive theatre) (Izzo97)**
Passion:	**(Interactive theatre) (Izzo97)**
Origin of passion:	**(Interactive theatre) (Izzo97)**
Foible:	**(Interactive theatre) (Izzo97)**
Virtues:	**(Interactive theatre) (Izzo97)**
Constraints:	**(RPG/Conflict RPG)**
Layer cakes (relationships states):	**(Video Games) (Freeman03)**
Character deepening elements:	**(Video Games) (Freeman03)**
Chemistry NPC to NPC:	**(Video Games) (Freeman03)**

Table 7.2A: Character and environment definition templates

The character and environment definition proposed in this work regroups elements from interactive theatre, role-playing games (RPGs) and video-games. **[Table 7.2A]**, above, illustrates these different elements and their origins for both environment and character design.

The scenario developed for this thesis reflects the investigations on role playing games discussed in Chapter 6. Since the aim of this work is to assess the validity of the EN concept, it is important that the scenario is developed such that it allows for the evaluation of agents action-selection mechanisms with respect to dramatisation. This however implies certain requirements on the length and intensity of the virtual drama. On the one hand, a relatively short scenario is required so that it can be assessed rapidly and thus favour a large number of test subjects. However, it

is equally as important that it supports a high level of dramatisation through characterisation in order to reflect the EN's character-based approach.

The scenario developed for this thesis was therefore based on the conflicting role-playing games (RPG) model described in Chapter 6. These games are generally quest–based RPGs played within a single game session where the intensity of the dramatisation is embedded within the goals and motivations of highly conflicting characters. This approach fits the needs for evaluating character action-selection mechanisms as dramatic intensity is directly dependent on the actions carried out by the characters. The entire scenario for this implementation has been included in this thesis in **[Appendix F]** (environment elements) and **[Appendix G]** (character elements).

7.2.2 Scenario implementation method

The scenario development consisted of implementing the agents and the Game-Master (GM) within a modified text-based version of the FAtiMA software so that extraneous factors (immersion, interaction modality, graphics, sounds) do not play a role in the users' judgment. Several versions of the GM and agents were implemented. These will be subject to a comparative analysis in Chapter 8. Whilst its actions, goals and motivations are different (oriented towards event management and outcomes), the GM operates the same action-selection mechanism as the other agents in the simulation, and features the same architecture as other intelligent agents developed in the scenario.

The implementation method followed for the scenario is not dissimilar to the development method used in organic IMPROV. The basic principle is to give characters a certain amount of information about themselves (i.e. temperament, objectives, goals, reaction tendencies, etc.) and to immerse them into a given

situation. Their reactions “in character” will then be used as the backbone for future production, or will help in highlighting weaknesses in the definition of characters.

The approach followed in this thesis was to implement the characters together with their different skills, emotional setups, personalities, action tendencies, goals and emotional reactions, and to run simulations of the interaction in order to observe areas in the character definition in need of further development. This approach is “organic” in the sense that the reactions generated by the characters result directly from their dramatic personae and in turn impact the characters’ goals, motivations and emotional state. The advantage of this approach is that, by selecting actions autonomously, with regard to their internal motivations and character, the virtual agents in an EN application cannot take “out of context” actions and therefore do not require an action managing functionality to prevent this from happening. The development process is illustrated below in **[Figure 7.2.2A]**.

For interactive drama, the author assigns one particular character to the user and runs various simulations in order to replicate the different choices made by the user. These decisions are known to the author, since the overall application is based on role-play, and therefore the actions undertaken by the user are those of the character they are playing, and must reflect the character’s persona. For each potential choice made by the user, a simulation is run and the other characters are developed with regard to their own personae in order to take the story forward from that point.

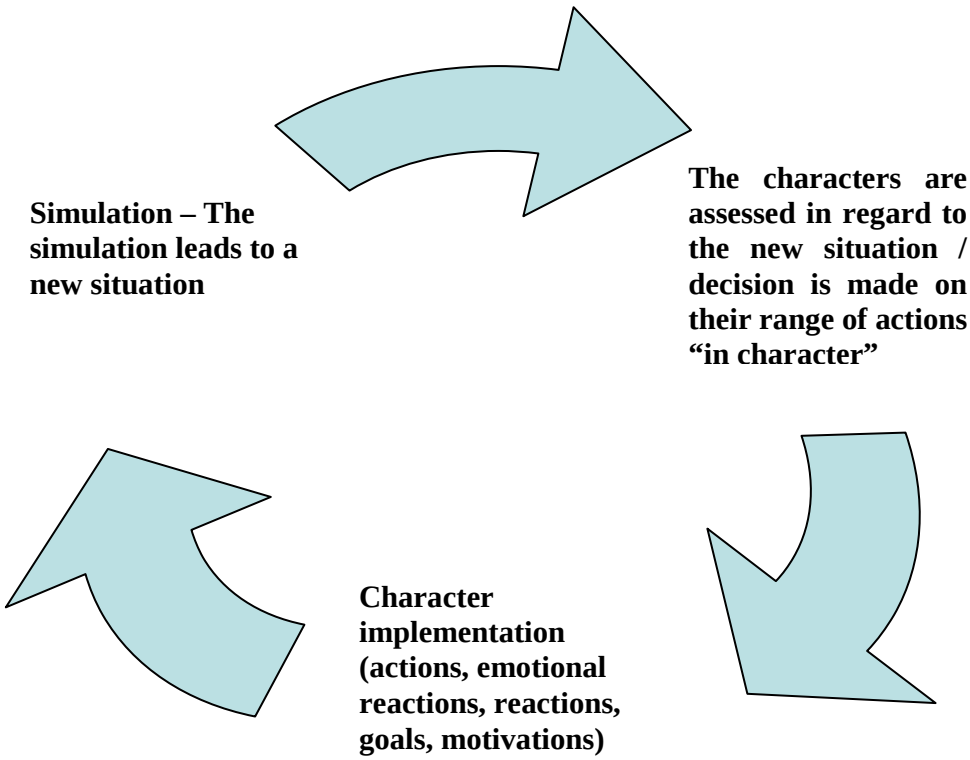


Figure 7.2.2A: Scenario implementation cycle – non-interactive design

From a more theoretical stance, the argument highlighted briefly in this section is that the range of actions available for each character represents the Fabula boundaries of a scenario. An analogy would be to compare the scenario content to a narrative surface on which the users travel. Their decisions influence the path they follow, and subsequently the unfolding of the Fabula. The discourse, at character level, should therefore reflect on the complexity of their experience. This approach is not dissimilar to Barthes' (Barthes 66) views on complexity and integration of narrative units in stories. In his structural analysis, he considered complexity in a text in relation to an organisational or flow chart allowing travelling back and forth between narrative elements. The integration of narrative units, in this approach, is the element allowing for the development of meaning within the text (i.e. "Isotopie" in the text (Barthes 66), (Greimas 66)).

The exercise of authoring EN could be perceived as the integration of small narrative units into an overall story surface that aims to facilitate the development of narrative sequences, and contribute to the overall significance of discourses (i.e. by building bridges between non-connected narrative elements). The scenario implementation cycle is illustrated below in **[Figure 7.2.2B]**.

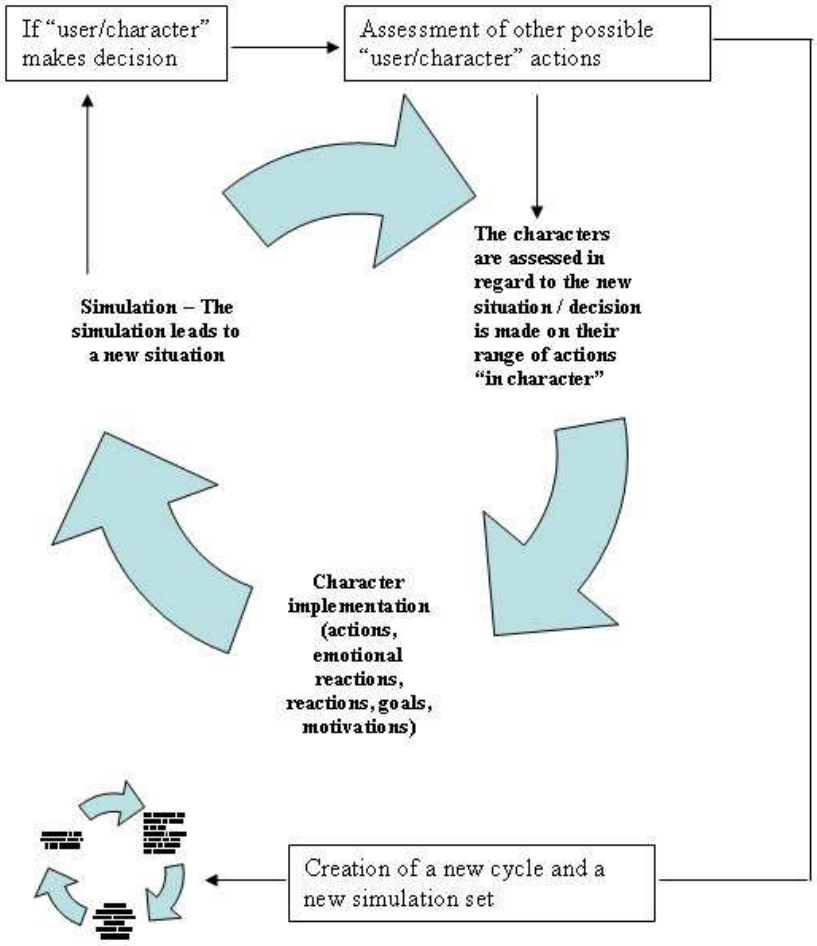


Figure 7.2.2B: Scenario implementation cycle – interactive design

7.2.3 Agent components

The characters (intelligent agents) have been developed using XML code which was defined for the VICTEC project (URL:VICTEC). This is composed of several

components that configure the scenario's characters. The characters have therefore been defined in XML representing the following:

- Personality
- Emotional reactions
- Goals
- Action tendencies

This section briefly describes the functionality of each of these components and illustrates the way they are set up in the system.

7.2.3.1 Personality

The personality of the character is expressed through the way it deals with emotions defined by types, thresholds and decays, that is, its emotional properties. The FAtiMA (Dias et al 05) (cf. Chapter 3) agent architecture proposes a direct implementation of the OCC appraisal theory (Ortony et al 88) where the emotion threshold refers to how easy or difficult it is to trigger a particular emotion in a character. The emotion decay refers to the length of time it takes for a character to return to a neutral state after experiencing a particular emotion. For instance, a character whose definition is fearful would be set up with a very low threshold for fear, such that it will experience that emotion easily; and with a low decay level – such that it will experience fear for a long period of time. The character's emotion profile influences the way it feels in response to events and actions and therefore its decision making process. Personality is also therefore emergent in this approach. **[Table 7.2.3.1]** shows a character configuration in the scenario developed for the implementation. The listed emotions are those of the OCC model of cognitive appraisal. The personality configuration of all the agents developed for the scenario

has been included in this thesis in **[Appendix H]** (Character personality configurations).

Emotion	Threshold	Decay
Love	3	7
Hate	5	5
Hope	8	3
Fear	3	7
Satisfaction	5	5
Relief	4	4
Fears-Confirmed	5	5
Disappointment	3	5
Joy	3	5
Distress	3	5
Happy-for	4	5
Pity	4	6
Resentment	4	5
Gloating	5	5
Pride	3	7
Shame	3	7
Gratification	2	6
Remorse	3	6
Admiration	3	7
Reproach	3	7
Gratitude	7	7
Anger	4	8

Table 7.2.3.1 A: Example of a character personality configuration

7.2.3.2 Emotional reactions

The emotional reaction configuration is a set of pre-determined reactions acting on the affective system of the agent with regard to particular events. Every single action (i.e. dialogue or physical) is parsed into the agent in the form of an event, thus the agent does not perceive the world as such, but as a series of events for which it can express a certain range of emotions. The emotional reactions are configured according to the character's defined personality and are created for significant likely events. Whilst there is no point in creating an emotional reaction for every single action in a scenario, it is sensible to create emotional reactions for events such as

being physically pushed, insulted or shouted at when configuring, for instance, the agent playing the role of a victim in a bullying scenario.

An emotional reaction is defined according to several parameters and relates to a particular event. These parameters are described in **[Table 7.2.3.2A]**.

Parameters	Definition
Desirability	How desirable or not desirable the event is for the agent
Desirability for other	How much the character thinks the event is desirable or undesirable for the other character specified in the emotional reaction
Like	This parameter refers to an object and specifies how much the agent likes or dislikes the object
Praiseworthiness	How is the agent assessing the event in regard to its standards? Is the event praiseworthy or blameworthy?

Table 7.2.3.2 A: Parameters for emotional reaction configurations

The characters emotional reactions are configured according to an event as illustrated below in **[Figure 7.2.3.2 A].** In this example, the emotional reaction for this event is defined so that the character to which the action (i.e. order to explore the temple) is directed towards (i.e. SELF) sees its emotional state modified according to the parameters parsed by the emotional reaction definition.

```
<EmotionalReaction Like=”6” desirabilityForOther=”3” desirability="8" praiseworthiness="6">
 <Event  subject="Radsinsky" action="OrderExploreTemple" target="SELF" />
                                                    </EmotionalReaction>
```

Figure 7.2.3.2 A: An example of emotional reaction configuration

7.2.3.3 Goals

Goals are defined in two distinct files in the configuration process - the goal library and the agent configuration file. The reason for this distinction is that a goal in the

library may be used by more that one agent. There are two different types of goal implemented in FAtiMA, both of which are part of the OCC model (Ortony et al 88): Active pursuit goals (i.e. the characters actively try to achieve them – e.g. going to an appointment), and Interest goals (i.e. the character has the goals but does not actively pursue them – e.g. avoiding getting hurt).

The goal itself is defined in an overall goal library file and is configured according to a set of pre-conditions, success conditions and failure conditions. The goal is first named and its target identified as a property in the pre-conditions section, along with events triggering the goal activation. Since FAtiMA includes a generic STRIPS-derived planner, the success condition of the goal is defined as an event and the planner processes all the necessary steps in order to reach it. It is also possible to implement a failure condition so that the goal can be abandoned at execution time if contradictory events have been triggered. For instance, if a character is pursuing the goal of opening a door and another character opens that door, it is sensible to include in the “open the door” goal a failure condition that would allow that goal to be dropped if the door is opened either by the agent itself or another agent. **[Figure 7.2.3.3A]** shows below the definition of a goal in the goal library.

```
<ActivePursuitGoal name="IG-LeadExplorationTemple([target])">

<PreConditions>
<Property name="?[target]" operator="=" value="Party" />
<Property name="?EVENT([SELF],OrderExploreTemple,[target])" operator="=" value="True" />
</PreConditions>

<SucessConditions>
<Property name="?EVENT([SELF],ExploringTemple,[target])" operator="=" value="True" />
</SucessConditions>

</ActivePursuitGoal>
```

Figure 7.2.3.3A: An example of a goal definition in the goal library

Another action in configuring goals for agents is to apply them to the characters. Goals from the goal library are only attributed to a character once they are referenced by the main character configuration file (i.e. the same file where the character's emotional reactions, personality and action tendencies are specified). Goals have two associated parameters, the importance of their success and the importance of their failure. This mechanism allows the prioritisation of goals in the agent's mind and plays a determining role in the agent making the decision to follow one goal rather than another when two goals are available for execution. **[Figure 7.2.3.3B]** shows an example of goal attribution to a character.

```
<Goal name="IG-LeadExplorationTemple([target])" importanceOfSucess="8"
importanceOfFailure="10" />
```

Figure 7.2.3.3B: An example of goal attribution

7.2.3.4 Action tendencies

Action tendencies are another essential element in configuring agents, especially in relation to EN. Action tendencies are emotional triggers that influence an agent when deciding on an action. Certain actions are triggered when an agent reaches a certain level for a particular emotion. For instance, an agent could decide to physically

attack another agent if its anger level reaches a certain point, in the same way a human being would. Whilst this approach is simplistic compared to real life, it is convenient when replicating agents that must behave as actors. It allows for the author to insert potentially important narrative elements by way of emotional triggering via the characters. Action tendencies are defined in a similar way to emotional reactions, apart from the fact that they refer to elicited emotions that act as triggers for an action reaction. Similarly to emotional reactions, action tendencies feature pre-conditions. These can be used in order to prevent reactions from being repeated (i.e. for as long as the emotion is felt by the agent) whilst timing is another device used in FAtiMA to prevent this from happening. The eliciting emotion is related to the cause event and acts as a trigger. The example below **[Figure 7.2.3.4A]** shows the action of re-affirming a role when an agent expresses the reproach emotion at a minimum level of 1 (on a scale varying between -10 and 10) towards another agent protesting a decision.

```
<ActionTendency action="AffirmRoles([Subject])">
<Preconditions>
<Property name="?EVENT(Camberra,RemindStatus,Party)" operator="=" value="True" />
</Preconditions>
<ElicitingEmotion type="Reproach" minIntensity="1">
<CauseEvent subject="Camberra" action="ProtestTempleDestruction" target="SELF" />
</ElicitingEmotion>
</ActionTendency>
```

Figure 7.2.3.4A: An example of an action tendency

7.3 Agent implementation

The agent implementation work for this application concerns the technical development of a novel agent action-selection mechanism for dramatic purposes that conforms to the theory presented in Chapter 6. This section first describes the implementation strategy for an action-selection mechanism that fulfils the EN theory

requirements, and then focuses on the details of the technical work necessary to develop it.

7.3.1 Implementation strategy

Creating an agent action-selection mechanism that selects interesting and dramatic actions is not only a complex task but also a very subjective one.

1. **What constitutes a dramatic and interesting action that is quantifiable?**
2. **To whom and to what degree, must this action be interesting?**

The goal of this thesis is to develop, via an appropriate agent action-selection mechanism, the link between dramatic interest and emotional impact. The character would not take on an action solely based on its motivations and goals, but also on the emotional impact this action can cause to either the character itself or to other characters in the scenario. This approach exploits the hypothesis proposed in Chapter 4 that the emotional impact of an action could be associated with dramatic impact, and could be used as a substitute for dramatic value. It also conforms to the EN theory presented in Chapter 6, and allows the characters to conjointly assume in a distributive manner the dramatic weight of an unfolding story without relying on a plot structure.

The strategic decision made for the implementation of such a concept is to develop a novel agent action-selection mechanism featuring a double appraisal cycle, as opposed to the single appraisal system featured in other appraisal-based agent architectures. The agent first appraises events as in any conventional appraisal-based system, but resolves decision conflicts by running another appraisal cycle in parallel, where the set of possible actions is assessed according to the potential emotional impact of each action. Rather than selecting the action with the highest value for the character state after appraisal, the one with the highest emotional impact is chosen.

This modifies FAtiMA, and has been implemented in three distinct phases. This is referred to in this thesis as a double appraisal or re-appraisal action-selection mechanism and takes place at the coping level in an appraisal-based architecture.

A benchmark version of the scenario was developed within the original FAtiMA using the standard agent action-selection mechanism. It aimed to establish a reference point for assessing later iterations of the system and served as a basis for comparative analysis between those different versions. In this benchmark version, the agent appraises events with respect to its own emotional state, emotional reactions, goals, priorities, motivations and action repertoire. Once the appraisal process is concluded, the agent selects an action at coping level from the resulting set of possible actions. An action is selected using the intensity of the proposed action, picking the one with the highest intensity. **[Figure 7.3.1A]** shows the appraisal process controlling the agent mind in the original version of FAtiMA.

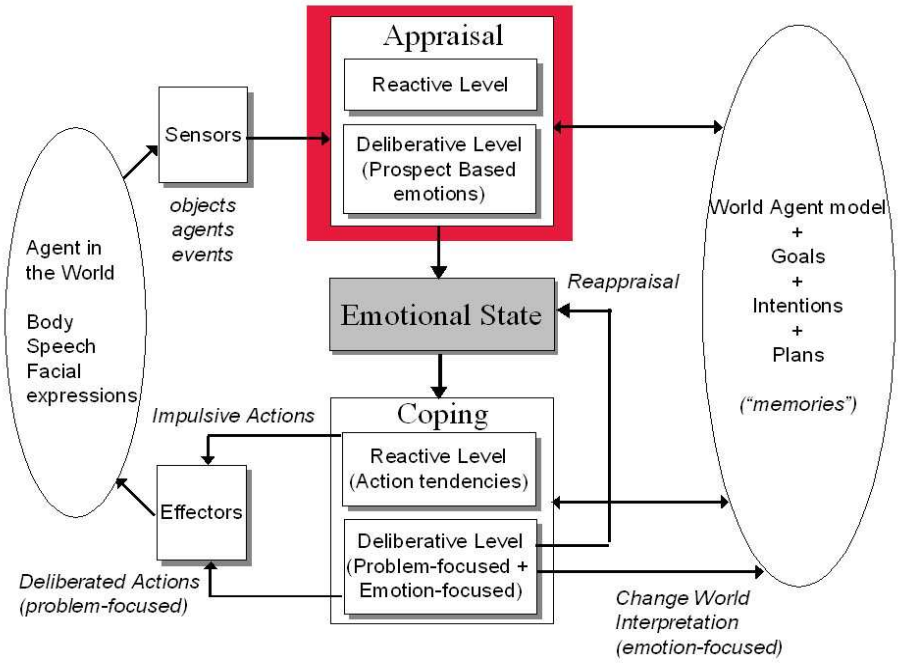


Figure 7.3.1A: Original agent action-selection system (appraisal)

The second implementation (Double Appraisal) [DA] features a modified action-selection mechanism in which the agent makes decisions based not only on its emotions and goals, but also on the emotional impact the action would have if directed at itself. This iteration of the action selection mechanism adds another invocation of the appraisal process and re-appraises potential actions according to the agent's own set of emotional reactions. The approach draws on the "Theory of Mind" concept (Whiten 91) referred to in Chapter 4. The agent uses its own set of values and references to assess how an action is perceived by others in order to make a choice between two or more competing potential actions. Because the agent applies its own set of values to assess the emotional impact of an action, the decision is made as if the action was directed towards the agent itself. Since goals are expressed in FAtiMA through actions, this modification also impacts the goal management of the agent. In order not to affect the actual emotional state of the agent, this re-appraisal cycle is executed in parallel to the agent "appraisal-coping" cycle and takes place within a second instance of the agent's mind that is not connected with the agent's running emotional state. **[Figure 7.3.1B]** illustrates the process of re-appraisal in the agent mind.

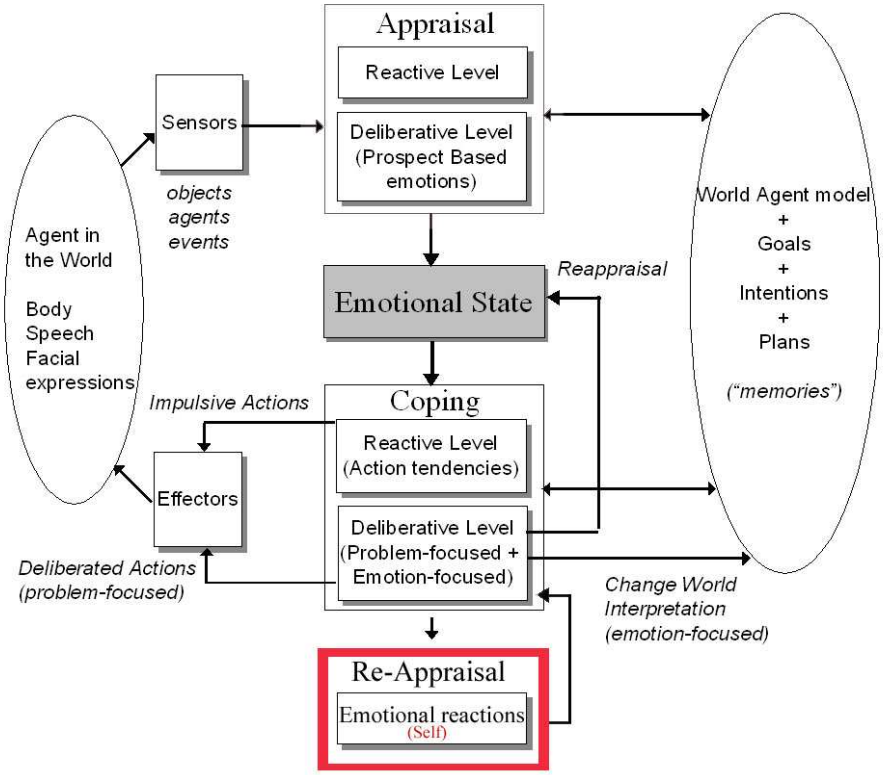


Figure 7.3.1B: First iteration of agent action-selection system

The third version of the implementation (Double Appraisal with Modelling) [DAM] adds another dimension to the re-appraisal approach by actually conducting the re-appraisal with respect to a representation of the emotional reaction sets of all the agents present in the scenario. This third iteration of the software aims to select the action that would have the highest overall emotional impact on any character present within the scenario. It considers the impact of actions on each character and picks the one that scores the highest value for some character in the scene.

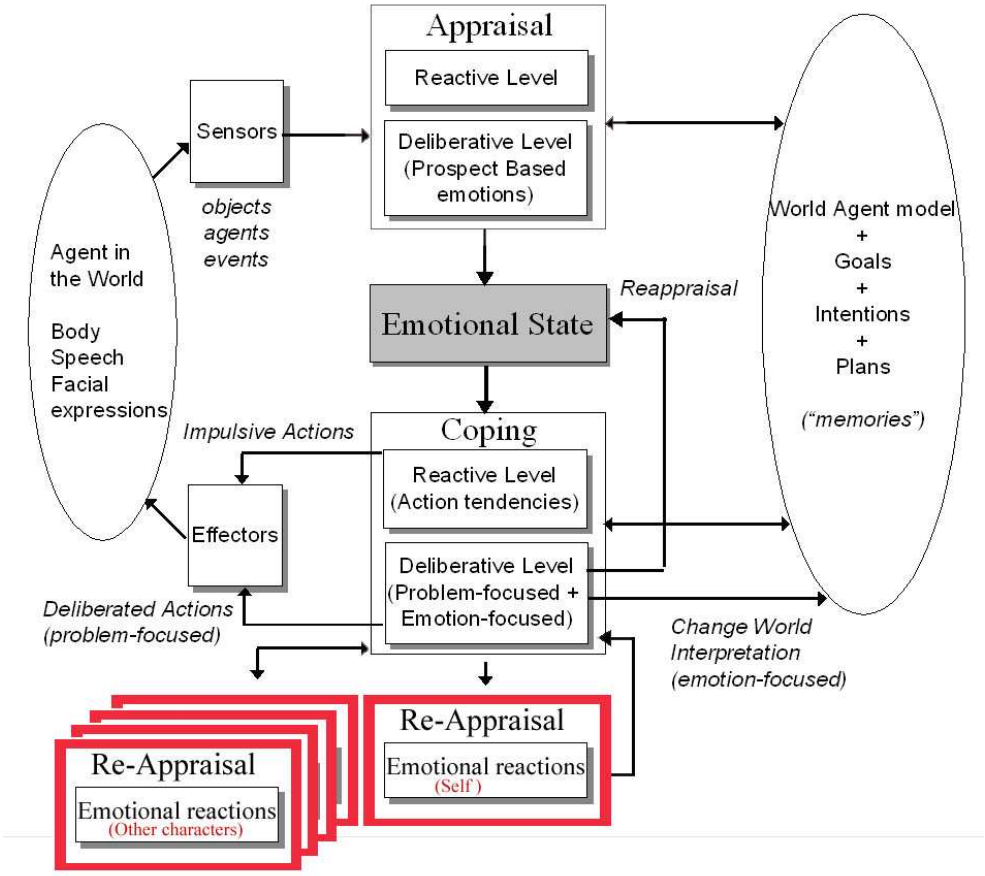


Figure 7.3.1C: Second iteration of agent action-selection system

Finally, each implementation (DA/DAM) presents two versions; one where the set of pre-selected actions for contention for re-appraisal is limited to a small amount of actions (i.e. three) and another one where it is significantly larger (i.e. nine). These pre-selected actions represent a set of feasible actions ranked in an array list (valued action set) as it seems possible that the number of actions considered might affect the outcome of action-selection. Whilst a larger set also imposes a higher computational burden, this versioning approach aims at studying if the range of actions sent for re-appraisal influences the decisions made by the agent.

7.3.2 Technical implementation

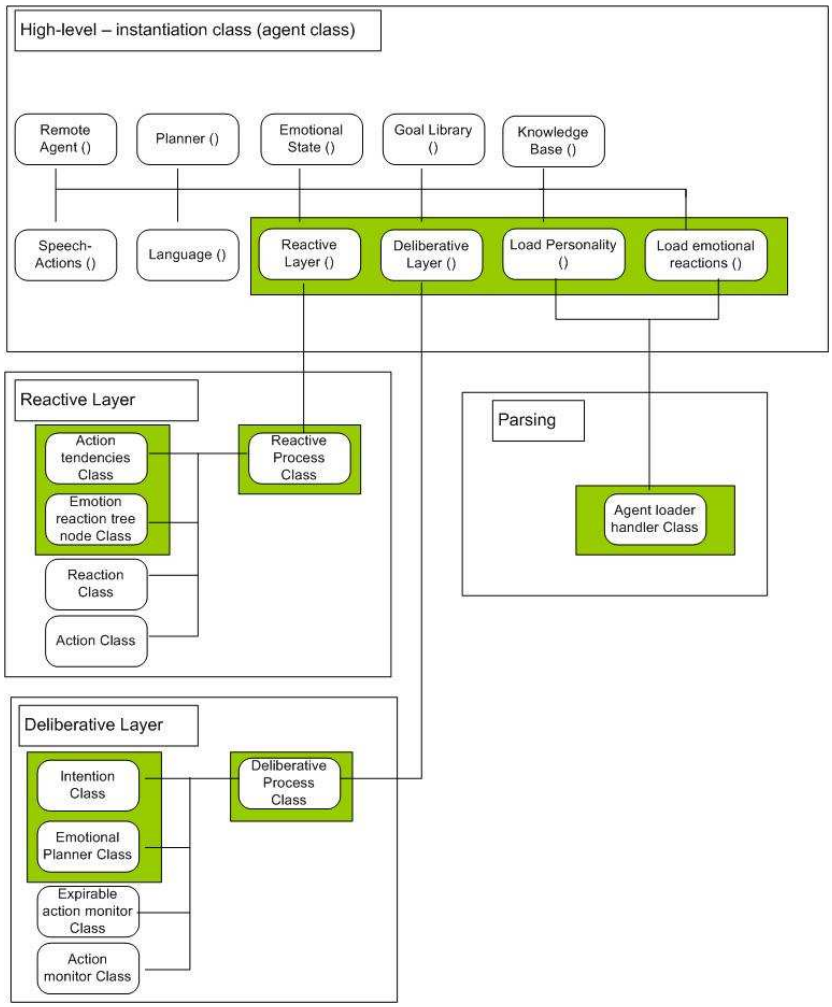
From a technical perspective, the double appraisal cycle developed in the agent mind requires changes within several areas of the cognitive appraisal system. In this

section, the original action selection mechanism (i.e. original FAtiMA) is firstly described in detail, then the iterations discussed in this section are presented and illustrated.

7.3.2.1 FAtiMA original action selection mechanism

FAtiMA (Dias et al 05) implements the OCC model (Ortony et al 88) alongside the coping mechanism of Lazarus (Lazarus 91) and is composed of many elements relating to both this cognitive appraisal theory (appraisal, emotion generation, goal library, emotional states, coping mechanisms, etc.) and the agent framework within which the agent minds are implemented (information parsing, loaders, etc.). Much of this is outside the scope of the changes made and a full class diagram is therefore omitted. **[Figure 7.3.2.1A]** represents a partial class diagram of the system focusing on the areas controlling the appraisal and coping processes of the agent cognitive system. The areas highlighted in this diagram represent the parts of the system where the appraisal and coping mechanisms are implemented and where the changes discussed in this section have been made.

The main body of the architecture is the agent class where the essential elements of the system are instantiated. Amongst these elements, the method “load personality” attributes an agent role and name to an emotional state, a goal library, a knowledge base and other components of an agent’s mind. The method “load emotional reactions” has been implemented in order to support the emergent narrative iterations of the software and will be described later in this section. Both methods refer to the “agent loader handler” class that processes the parsed information and creates the objects invoked in the loader handler.



Key: Green highlight indicates classes that have been modified

Figure 7.3.2.1A: Partial class diagram of the appraisal coping process

The reactive layer is composed of elements whose function is to assess events and select emotional reaction within the system. The "Reactive process" is the main class of the reactive layer and carries out the appraisal of events perceived by the agent according to the agent's emotional reactions. This appraisal is conducted using the "emotional reaction tree node" class via a matching mechanism that checks if an emotional reaction has been defined with regard to the event appraised. The end result of this operation is the creation of a reaction to a particular event that, together with the event, will constitute the parameters for the generation of emotions that are attributed to this particular event. Finally, at coping level, the "action tendencies"

class, using the emotions generated, checks if there are any actions that match both the event appraised and the resulting emotional state of the agent. In case of conflict between two or more actions (i.e. all fulfilling the selecting conditions), the action selected is the action that possesses the overall highest intensity (i.e. highest intensity amongst the generated emotions). **[Figure 7.3.2.1B]** illustrates in a simplified diagram the appraisal and coping mechanisms in the reactive layer in relation to the different classes and methods involved in the process.

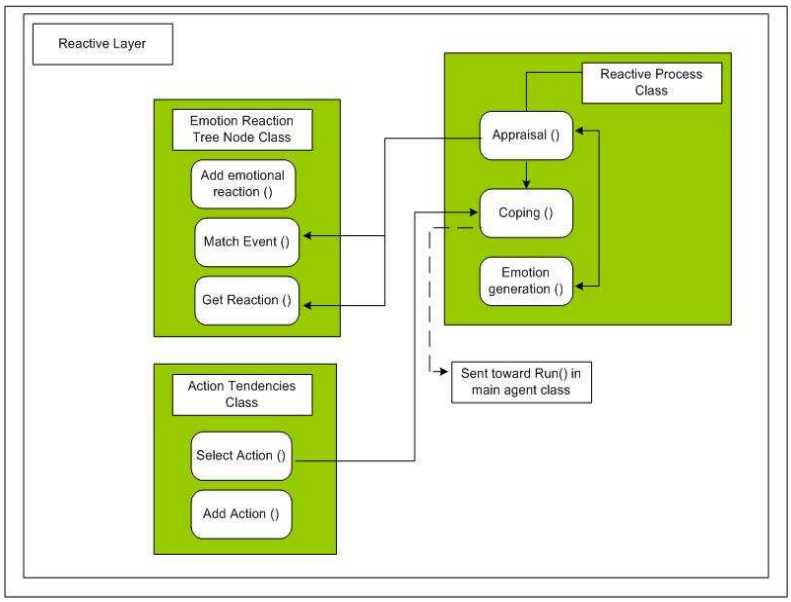


Figure 7.3.2.1B: Reactive layer action selection process

Deliberative and reactive layers share a similar design approach and function in a similar fashion. The appraisal mechanism in the deliberative layer is slightly more complex than that in the reactive part of the agent architecture, in the sense that it deals with cognitive reasoning as opposed to a simple matching process as seen in the reactive layer. Events are appraised and actions are monitored but the system conducts more operations in the overall process. Since this part of the appraisal concerns the cognitive mechanism, the system does not generate emotions or look for emotional reactions as it does in the reactive layer, but monitors actions and events with regard to the goals and plans of the agent.

The perception of an event generates a series of checks that updates the agent's representation of its goals, plans and triggers the selection of intentions. An intention is created when a goal becomes active and represents the intention of the agent to achieve a particular goal. Each intention is specific to a goal. An event or action has an associated probability for its occurrence and effects. The appraisal process assesses these and updates the probabilities of actions, then checks for their presence in any running plan, in which case an update on the state of the plan is carried out. Goal pre-conditions are then checked for activation, and the emotional planner is called for the generation and selection of intentions relating to the agent's overall goal structure. The emotional planner is located in the deliberative layer of the architecture and refers to the generation of prospect-based emotions (i.e. Hope and Fear). Aylett explains in (Aylett et al 06) that these emotions "specifically relate to future events – either to those congruent with the agent's goals (hope) or threatening those goals (fear), they offer a specific interface between the affective system and the planning component of coping behaviour". Intentions can be associated with active goals, that is to say goals whose pre-conditions are fulfilled and eligible for activation. At coping level, the planner selects the most relevant intention for execution. In a similar fashion to the action selection mechanism of the reactive layer, the intention with the highest intensity is selected and processed.

Finally, the intention selected is sent back to the emotional planner in order to generate a plan for its fulfilment and the first step to be executed in the plan is determined. The resulting (event) action is then retrieved from the emotional planner by the coping mechanism and parsed into the run cycle within the main agent class in the system. **[Figure 7.3.2.1C]** illustrates the appraisal and coping mechanism at the cognitive level in the deliberative layer of the architecture.

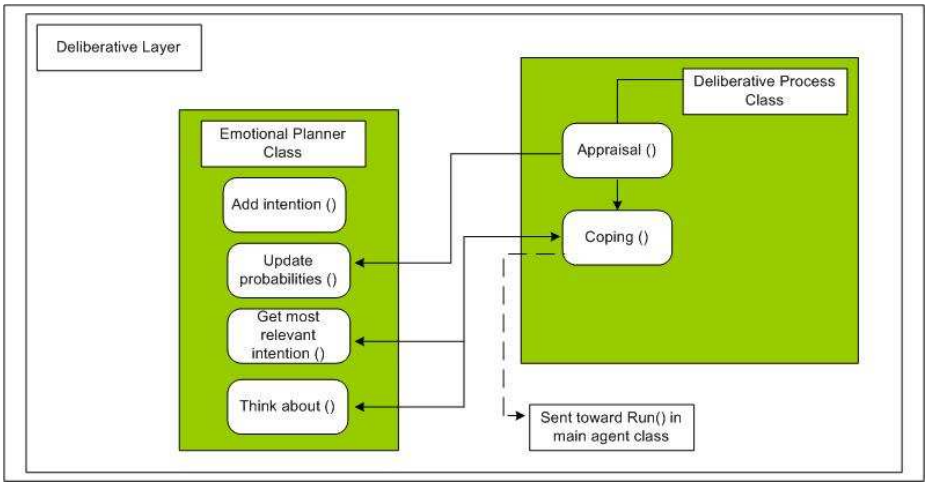


Figure 7.3.2.1C: Deliberative layer action selection process

Both reactive and deliberative systems communicate with the run cycle of the system and send data within each cycle, whether an event or a null statement. The action that is sent first, both by the deliberative or the reactive mechanism, gets priority and is executed by the system. Such an approach allows for the modelling of emotional reactions similar to those humans experience in real-life, since an emotional reaction can precede a well structured plan in the same way as people can "act before they think" and take decisions purely based on their current emotional state. Such a phenomenon is often described as taking a decision in the "heat of the moment", meaning that the emotions of an individual have overruled their cognitive reasoning.

7.3.2.2 Emergent narrative iterations (double appraisal)

As described in section 7.3.1, the main technical contribution of this work consists of the integration of a second appraisal cycle within the already implemented action-selection mechanism. Whilst two separate changes have been implemented in the original action selection mechanism, both aim to integrate the second appraisal cycle referred to in this section within the actual coping mechanism of both reactive and deliberative layers.

In doing this, the range of actions or intentions eligible for selection has been widened, thus necessitating change within both the emotional planner and the action tendencies classes, including the creation of new objects able to store several elements simultaneously, in so as to examine more than one element (i.e. actions in the reactive layer and intentions in the deliberative layer) in the second appraisal cycle. This extension of the range of actions eligible for selection is essential to the integration of the EN theory within FAtiMA. In the original design, only one element was considered for execution (i.e. the one with the highest intensity). In order to incorporate dramatic considerations into the overall action selection system, the range of elements eligible for selection has been widened so that potentially interesting elements are not discarded purely due to their initial associated intensities. For this reason several new parameters have been included within both the reactive (valued action set class) and deliberative (intention set class) layers in order to fulfil these needs. The following sections describe the two implementations.

7.3.2.2.1 [DA] (Double Appraisal versions 1/2)

DA reappraises a set of valid and eligible elements selected by the first appraisal cycle with regard to their potential emotional impact.

In DA, the agent reconsiders its choice of action/intention with reference to the emotional impact if the action or emotion was directed to itself. Thus for an action such as hitting another agent, it would assess the emotional impact based on how it would react emotionally to being hit by another agent. An intention is re-appraised based on the plan to achieve it. Here the action re-appraised as an event is the one that satisfies the relevant goal via its post-condition definition.

From a reactive perspective, the initial appraisal process conducted by the agent is the same as in the original action selection system, the event is matched to

the agent's emotional state and emotions are generated in response. The coping mechanism however, instead of assessing the action with the highest intensity, accesses a set of valued actions composed of the three (or nine, depending on the version) actions eligible for selection with the highest intensity. From then on, the coping mechanism instantiates a copy of the agent's emotional state and assesses selected actions within an event template where the target of the event is the agent itself. Re-appraisal is then conducted on this event within the agent's duplicated emotional state so as not to affect the run-time emotional state of the agent. As a result of this re-appraisal, still within the instantiated emotional state, emotions are generated and the value of the strongest emotion generated determines the value of the emotional impact for the re-appraised event. This value is accessed by the coping system through the instantiated emotional state (via the get emotional impact method) once the action appraisal has been completed. At the end of the cycle, the instantiated emotional state and event pool are reset for the re-appraisal of the next selected action. The cycle is run until all actions selected in the valued action array list have been re-appraised. The system then selects the action whose emotional impact is the strongest.

[Figure 7.3.2.2.1A] below, illustrates in a partial diagram the functioning of the reactive process for Versions 1 and 2 of DA.

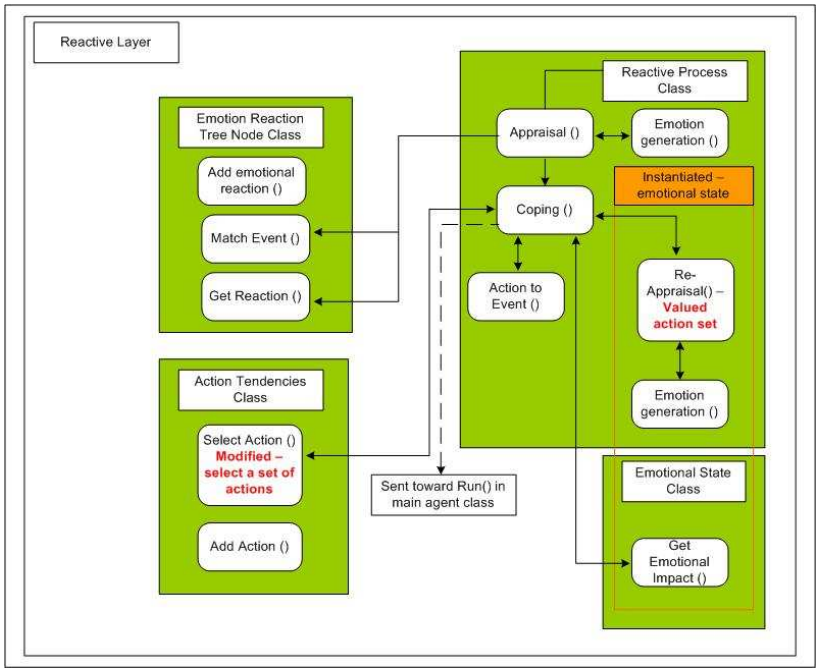


Figure 7.3.2.2.1A: Reactive layer DA

From a deliberative perspective, the system acts in a similar fashion. It takes into account a larger set of intentions than in the initial design, formats them into events as seen in the reactive process, and reappraises them within an instance of the agent's emotional state. In this case, the event appraised is modelled on the success condition of an intention (i.e. an action). An emotion-generation functionality has been implemented within the deliberative layer in order to assess the emotional impact of intentions on the agent. This functionality is based on that used in the reactive layer and aims to measure the emotional impact of an event on the emotional state of the agent – i.e. emotional impact**. [Figure 7.3.2.2.1B]** shows a diagram of the deliberative process for versions 1 and 2 of DA.

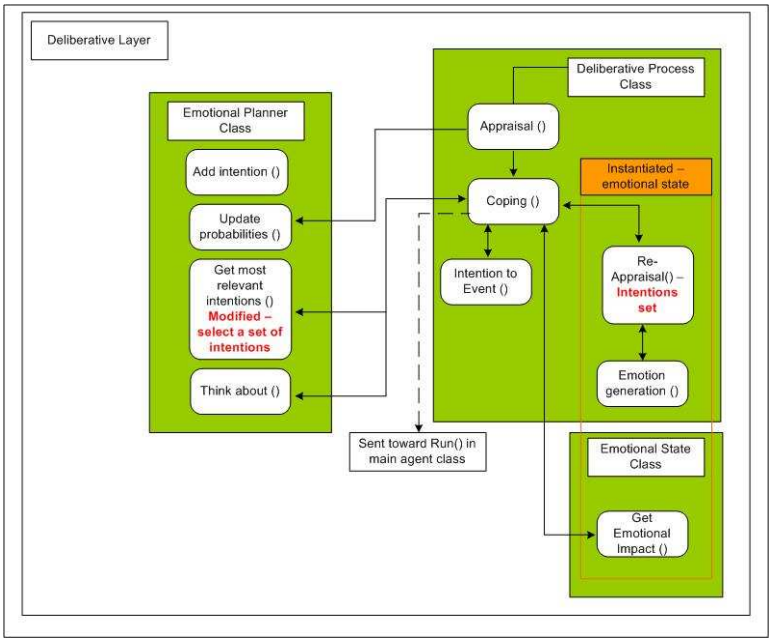


Figure 7.3.2.2.1B: Deliberative layer DA

7.3.2.2.2 [DAM] (Double Appraisal with Modelling versions 1/2)

DAM is based on the same principle as DA, but applies the re-appraisal mechanism to a different target. Rather than assessing an action or intention with regard to the agent's own set of emotional reactions and goals, it is carried out for all the agents present in the scenario. Therefore, an action is not assessed on its emotional impact on the agent, but on the single highest emotional impact generated for any of the agents involved in the scenario. This implementation, whilst important from an evaluation and theoretical point of view, is technically little different from DA. The principles and overall flow of data is the same as in DA; the only major change carried out is that of integrating as many re-appraisal cycles as there are agents into the coping system. The issue with this approach is to generate and load representations of the other agents' emotional states in order to assess elements on the basis of the other agents' emotional set up. This task has been carried out in both reactive and deliberative process classes by altering their definitions in order to include an additional set of parameters, the other agents' emotional state. **[Figure**

7.3.2.2.2A] and **[Figure 7.3.2.2.2B]** present modified diagrams of the implementation and highlight the differences between the two processes.

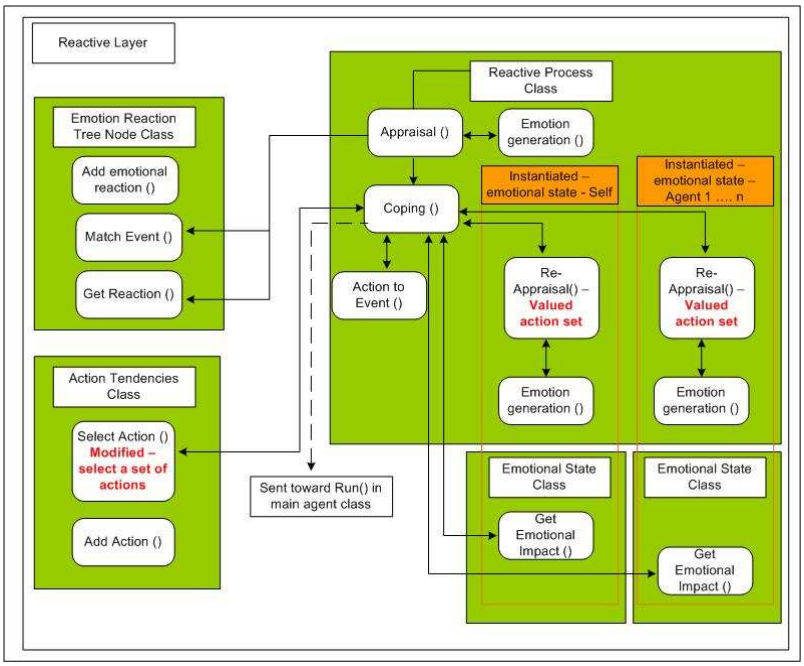


Figure 7.3.2.2.2A: Reactive layer DAM

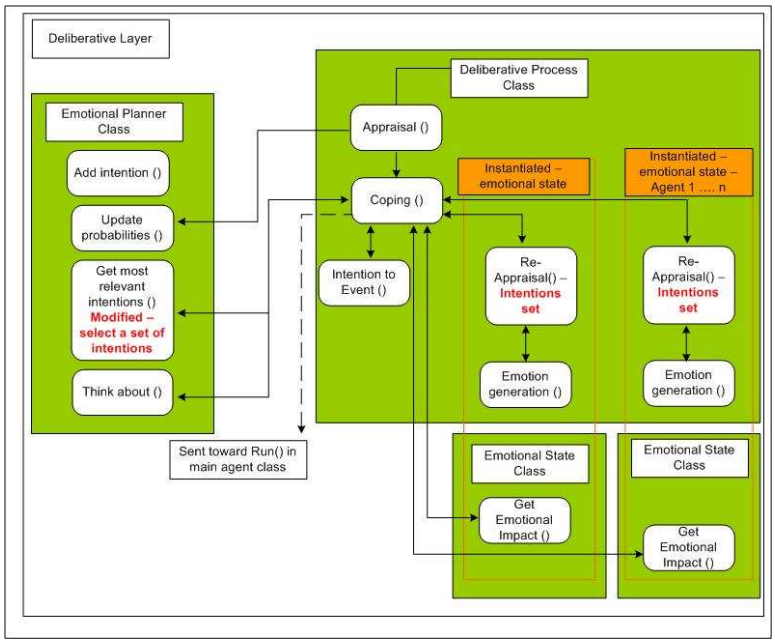


Figure 7.3.2.2.2B: Deliberative layer DAM

7.4 Conclusion

This chapter describes the first steps towards implementing the EN theory developed in this thesis. The implementation has been divided into two distinct

sections - scenario/character definitions and integration; and the more technical development of a double appraisal cycle within the agent action selection mechanism. These approaches are complementary: the scenario development directly applies elements of the theory (i.e. character definition, conflicting personalities and objectives) in a straightforward manner and is geared towards the content aspect of the concept, whilst the technical integration aims towards its articulation and provides computational solutions to the development of such a system.

The implementation described in this chapter has been designed to support the evaluation of essential elements of the theory, and must therefore be seen as an initial attempt to prove the validity of the concept rather than as a working application. The elements of the two different implementations are essential to the theory and, if proved successful, will lay the foundation for further work and a more complete implementation of the emergent narrative concept outside of this thesis. **[Appendix I]** illustrates the coding of the double appraisal mechanism implemented in this thesis.

Chapter 8 describes the overall evaluation approach in detail, and presents results of an extensive survey conducted in order to prove the validity of the EN approach.

Chapter 8

Experiments and results

8.1 Introduction

This chapter discusses the evaluation and results of the thesis' implementation work. It aims at evaluating the impact on stories of the double appraisal implementations (DA/DAM) described in Chapter 7. The key question to consider is do these implementations contribute to make a story more interesting?

The evaluation of generative narrative is known to be very difficult and there is no agreed approach to doing so (Knickmeyer et al 05). The subjective nature of storytelling is a major issue for the design of efficient and reliable evaluation procedures. Evaluating applications based on satisfaction and user experience is very different from the usual task oriented evaluation designs and is therefore still very much an open research question (Knickmeyer et al 05).

Riedl and Young (Riedl et al 05 (2)) approached the evaluation problem from a different perspective, and looked at analysing the believability of characters as a criteria for a successful narrative. Their approach is that for a story to be successful it must have emotional impact on an audience. Therefore, the characters must act in a believable way; their decisions must make sense with respect to the character interpreted. Whilst this approach is sensible for a story engine working within a plot-based approach to generate stories, it does not appear to be particularly appropriate when actions are taken by the characters themselves in line with their moods,

emotions, goals and personalities. One might argue that the actions carried out by the agents are bound to be believable within the characters being interpreted since there is no external mechanism intervening in the action decision mechanism that could force the choice of an action upon them.

Another issue arises from the emergent nature of the storytelling form. Depending on the agents' minds, moods and emotions, a story might not unfold in the same way twice, making a direct comparative analysis difficult. The EN approach is character-based and is aimed at participation rather than spectating. It is essential to devise an evaluation framework that primarily focuses on the characters' decisions and behaviour, rather than the overall discourse.

However, the nature of the work presented herein requires the evaluation to consider both spectators and participating users, as it is necessary in this research work to define common ground for comparison data. Therefore, combining a participant/spectator perspective in evaluation supports a direct comparison of data from both participant and spectator users. Parallels can then be drawn between different stories with respect to their participative nature or levels of appreciation.

Therefore, the approach presented in this chapter aims to conduct a direct comparative analysis between the different implementations described in Chapter 6. It first relates to both the evaluation set and the methodology, and then presents concluding results on the efficiencies of the different iterations of the software produced.

8.2 Evaluation Methodology

Since conventional software evaluations (i.e. performance, usability or even functionality) would not help to establish whether or not the double appraisal approach is improving the dramatization of a story within an agent framework, a

similar approach to that commonly used in cinema has been designed for this evaluation. It is standard practice in the movie industry to test alternative endings, plot elements, characters or even movie photography at postproduction level. Different versions of a feature are shown to test audiences and detailed evaluations and analysis are conducted in order to help make decisions about the use of certain characters, types of photography or important plot or story elements.

Since this evaluation aims to assess the quality of the stories generated by the system from the perspective of both interactive users and spectators/readers, it is necessary to carry out the evaluation of both within a common format so that extraneous factors do not play a role in the users' judgment. For this reason, stories have been reduced to a text form to avoid graphic quality or specific user interaction modalities influencing the outcome. The experimental setup for this evaluation was to record the interactions between autonomous characters so that emergent stories were generated by the software itself. These stories were then presented to a test-audience whose reactions, dramatic perceptions and judgment of dramatic intensity were documented with respect to character-based actions and plot events. The evaluation was then conducted from both spectator and participant perspectives. Spectators completed the evaluation by assessing generated stories; whilst participants influenced the development of stories by playing a role and making character decisions.

The evaluation plan designed for this application was composed of 5 different tests that aimed towards assessing the dramatic values of the stories generated by the system. The first two tests (T1, T2) assess stories from a spectator perspective by presenting the user with a set of stories and asking them to mark and rank them by order of preference. Although T1 and T2 display the same stories to

their test audience, these are slightly modified in T2 so that all stories contain the same amount of actions and therefore are of equal length. **[Appendix J]** illustrates the process of lengthening stories. This is to establish whether the length of stories plays a role in the marking or ranking by the user. The actions used to lengthen the stories did not influence the appreciation of stories as none of them were reported as being either interesting or meaningful. The final three tests (T3, T4 and T5) aimed to assess stories from a participative perspective and presented the users with a role to play by making decisions for the game-master (T3) and one character (T4, T5) in every cycle. Their decisions influenced the outcome of the overall story, therefore allowing users to determine, from their decisions, the story they experienced. These stories, like their counterparts in T1 and T2 are then marked by the user. When the marking/ranking has been executed, the users are given information about the characters' motivations and are asked, via a questionnaire, about the decisions they made with respect to this information. This part of the evaluation is similar to the de-briefing session common in Role-Playing Games (RPGs). This session consists of presenting the user with detailed information on characters' motivations, objectives, background information, active goals and personality types. A questionnaire example is available in **[Appendix K]**. The evaluation methodology has been designed in order to achieve the aims summarized in **[Table 8.2A]**.

Aim	Description
1	Determine which story is judged most interesting by the test audience (spectators)
2	Determine if the length of the story is a factor in determining its dramatic factor and general level of interest
3	Rate the meaningfulness/interest of agents and game-master actions/decisions from a spectator perspective
4	Determine whether a better understanding of the characters and roles would influence the ranking and marking of stories
5	Determine which story would be generated by the user if given authorial powers
6	Determine which story is judged most interesting by the test audience (interactive users)

Table 8.2A: Evaluation aims

The evaluation conducted in this thesis firstly aims at assessing the intrinsic quality of the stories generated by the different agent implementations (i.e. **[Table 8.2A]**), and secondly aims to assess a number of other factors that could have influenced the results obtained in the evaluation. There are many factors that can impact one's appreciation of a given story. As discussed earlier in this section, the stories presented to test users were all formatted into simple text so as to nullify the influence of extraneous factors such as graphic appeal, immersion, presence, sound, ambience, lighting or interactive controls or mechanisms. However, it was not possible to nullify or minimize a number of other factors such that they could not influence the results obtained. These factors have been summarized below in **[Table 8.2B]** and their influences on the results of this evaluation are discussed in detail in section 8.4.5.

Extraneous factors	Description
Gender	The importance of gender should not be underestimated in a study such as the one carried out in this thesis. Storytelling is highly subjective and one cannot assume that stories are equally appreciated depending on the gender of the test subject.
Story length	Story length as a factor can have an influence on the appreciation of a story. It is therefore important in this study to determine if it has been an effect in the study presented in this chapter and if so to what extent.
Interactivity	Interactivity in this particular evaluation refers to the possibility given to test users to make decisions for a character. Due to the importance given to the character in the EN, it is important to assess if this type of interactivity influences the decisions and story appreciation of a test audience.
Action influence	The nature of drama is such that some actions will always be regarded as of more dramatic interest than others. It is important with respect to this evaluation to ensure that the dramatic perception of particular actions do not influence story appreciation so as to reduce the significance of the evaluation results.
Experience	The experience of the test-audience should also be regarded as an extraneous factor in story appreciation as familiarity (concept knowledge, references,) within a certain style or genre can affect how much a story is appreciated or not. In the case of this evaluation, all the members of the test audience with a narrative background or with a strong activity in the domains of video-gaming or Role-Playing Games have been classified as experts.

Table 8.2B: Evaluation extraneous factors

8.3 Evaluation set

In this evaluation, the original FearNot! agent framework without any double appraisal has been used as a benchmark against which the implementations DA and DAM have been compared. The scenarios are composed of interacting agents who act a role and have their own personalities and goals, and a Game-Master whose aim is to provide narrative events and make decisions about the world environment (outcome of physical actions, entry of new characters, removal of characters, etc). In this implementation, the role of the Game-Master is played by a disembodied agent dedicated to story management. Like the actors, the Game-Master agent has been extended by DA and then by DAM. The combinations of different types of agents and Game-Masters resulted in 25 simulations.

These simulations were all run with identical configuration setups and produced different story-variations of the same scenario with identical configuration set ups. The stories were determined by their contents and outcomes, and since a large number of stories were either identical or very similar, these were regrouped together and the simulation plan resulted in the generation of 5 story variations. These stories were all distinct from each other as they either presented a different sequence of events or outcome.

The scenario evaluated is a quest type story involving 6 characters on an exploration mission. **[Table 8.3A]** illustrates one of the stories (Story 1) generated by the system. The 5 different stories generated are available in **[Appendix L]** along with a graphical representation in **[Appendix M]**.

Agent	Speech actions[§]
Colonel	Let's be clear about what we are all about to do! No one has ever been down there! Our intelligence reported this site has a potential threat to our land security! We all know why we are here today! The technology possibly hidden in there is all that matters to us. In the unlikely event of an encounter of any type, we are to wipe this place down and make sure no one or nothing ever come out of this temple! Dead or alive!
Colonel	God bless you all. Military personnel in formation, others behind me, keep an eye for traps, and loose sight of each other. All right, let's go!
The party	Following your order Sir!
Sergeant	Colonel! Here! Here come here. I have something odd here; it looks like a metal door with strange writings on top of it!
Colonel	Professor! Are these hieroglyphs there above the door say anything of what might be behind it?
Professor	Hum Yes Colonel!, Well, this is strange, these do not appear to be conventional hieroglyphs! There are actually two sets of text there. One that can be interpreted as a death threat to any mortal disturbing the lizard gods, no idea whose these can be! The other one although looks like Egyptian hieroglyphs contains many symbols I have never encountered and does not make any sense to me I am afraid!
Colonel	Ok, Everybody step back! We are going to blow this one up and see what it is hiding. Bellini, McLean hold assault position!
Professor	Colonel, this temple is thousands of years old, this door is magnificent and such artefact has never been discovered before! Surely we can't just blow it up, we need to find a way to open it or leave it as it is. This is an archaeological wonder!
Colonel	I am not sure you are getting the whole picture there Professor! Right here and right now I am in charge! You do what I tell you to do when I tell you to do it!
Colonel	Destroys the door and the door opens

Table 8.3A: An example of a generated story (Story 1)

[§] Note that each row in **[Table 8.3A]** represents one character speech action

[Table 8.3B] shows the distribution of story variations across different simulations. It also includes different versions of the GM. For the purpose of this evaluation, different versions of the GM (i.e. DA, DAM) were also implemented, similarly to the process for characters, in order to test the validity of both DA and DAM for an agent playing the GM role.

<table>
<tr><th></th><th>GM Original</th><th>GM DA(1)</th><th>GM DA(2)[4]</th><th>GM DAM(1)</th><th>GM DAM(2)[4]</th></tr>
<tr><td>FAtiMA Original</td><td colspan="3">S1 S2 S3
Story 1</td><td colspan="2">S4 S5
Story 2</td></tr>
<tr><td>FAtiMA DA(1)</td><td>S6</td><td>S7</td><td>S8</td><td>S9</td><td>S10</td></tr>
<tr><td>FAtiMA DA(2)[4]</td><td>S11</td><td>S12
Story 3</td><td>S13</td><td>S14
Story 4</td><td>S15</td></tr>
<tr><td>FAtiMA DAM(1)</td><td>S16</td><td>S17</td><td>S18</td><td>S19</td><td>S20</td></tr>
<tr><td>FAtiMA DAM(2)**</td><td>S21</td><td>S22</td><td>S23</td><td>S24
Story 5</td><td>S25</td></tr>
</table>

Table 8.3B: Simulation cases and story distribution

8.4 Results

The evaluation has been carried out on a total of 46 subjects with a 68 – 32 ratio between males (68.1%) and females (31.9%). Participants **[Table 8.4A]** were recruited via a number of methods, including using the network of contacts available from the development of the research as well as gaming communities and societies who expressed an interest when initially approached.

[4] Note that both implementations have two entries in **[Table 8.3B]** since they present two slightly different versions (i.e. small and high ranges of pre-selected eligible actions (cf. Chapter 7)). The same versioning design applies to the different implementations of the game-master (i.e. GM Original, GM DA(1/2), GM DAM(1/2)).

	Male	**Female**	**Total**
Interactive	22	8	30
Non-interactive	10	6	16
Experts	10	1	11
Non-Experts	22	13	35

Table 8.4A: Participants distribution

As previously discussed in this chapter, the evaluation of studies is an open research question. To date, very little has been done in order to assess the intrinsic quality of a story, much of the evaluation work for interactive storytelling systems has been oriented towards character believability or user interest in replaying stories. This study shows an interest towards statistical significance as it aims to provide results upon which a comparison can be made with other work in the discipline. Several methods have been taken into consideration for this study, these are summarised below in **[Table 8.4A]**.

Method	**Description**
Wilcoxon Mann-Whitney Test	A non-parametric test for the comparison of two populations. It is often applied when the observation data are constituted of ranks.
Kruskal-Wallis Test	This is an extention of the Wilcoxon Mann-Whitney test in the sense that it follows a similar approach, but has been designed to be applied to three or more sample as opposed to only two.
One way - ANOVA	One way- Anova aims at testing differences in means in a sample in order to determine its statistical relevance. It is based on the comparison of variance in samples and is used to test the differences in three or more independent groups.

Table 8.4B: Statistical methods

There are several factors to take into account when selecting a method for statistical significance. In the case of this particular study, non-parametric methods such as the Wilcoxon Mann-Whitney and Kruskall-Wallis tests could have been considered, on the basis that they aim to assess the statistical relevance of results in small batch samples and where parameters for study have yet to be identified.

However, in order to provide more flexibility to the user for marking its appreciation, it was decided to mark stories on a 10 point scale. Since parametric statistics are statistically more powerful than their non-parametric counterparts and that the one way ANOVA approach is generally suitable to tests where data range are superior to 5, the ANOVA method was therefore selected for this study. It was also assumed that the differences between samples are normally distributed.

Results have been subject to an analysis of variance (ANOVA) and are statistically significant to a 0.1 range[††] within the evaluation test batches. The probability of insignificance (p) and degree of significance (%R) are indicated for each result. All the results obtained through evaluation for this thesis are available in **[Appendix N]**.

The results section is structured so it first investigates research questions with respect to the hypothesis advanced in this thesis, before taking into consideration other factors such as story length, gender, action impact and knowledge.

8.4.1 Research questions

As with every evaluation process, it is essential to identify pointers that would indicate whether or not a given hypothesis possesses some tangible truth. In the case of this evaluation, we have identified a series of questions **[Table 8.4.1A]** that require answering positively in order to demonstrate the validity of our approach. This list is not exhaustive by any means and focuses on the main aspects of the double appraisal theory (i.e. Dramatic efficiency, and comparison of the two implementations).

[††] Note that the 0.1 range is a non standard statistical measure. However this approach suited the work carried out in this thesis.

Research questions	Expected outcomes
(Q1) Does a double appraisal mechanism generate stories that are dramatically more interesting than if generated by a simple appraisal mechanism?	**(P1)** Story 1 (original FAtiMA) should rank and score lower than stories 2,3,4,5 (generated via double appraisal)
(Q2) Is an implementation considering the emotions of all characters better at generating interesting stories than one only considering one character (self)?	**(P2)** Based on our assumption than DAM is potentially more complete than DA, Story 4 should score lower than Story 5.
(Q3) Has the DAM implementation produced the best overall story (i.e. better stories than both DA and the original FAtiMA)?	**(P3)** Story 5 should score high on dramatic marking since it incorporate a double appraisal mechanism that takes into consideration all the characters of the scenario for both agents and game-master.

Table 8.4.1A: Research questions and expected outcomes

8.4.2 Q1

The overall story ranking (before debriefing) shown below in **[Figure 8.4.2A]** contributes to answering Q1. These results derive from T1 and T2 and reflect a spectator's perspective on the ranking of our 5 stories. Whilst it shows a high ranking for story 3 (discussed later in this section), it also shows a poor ranking for story 1.

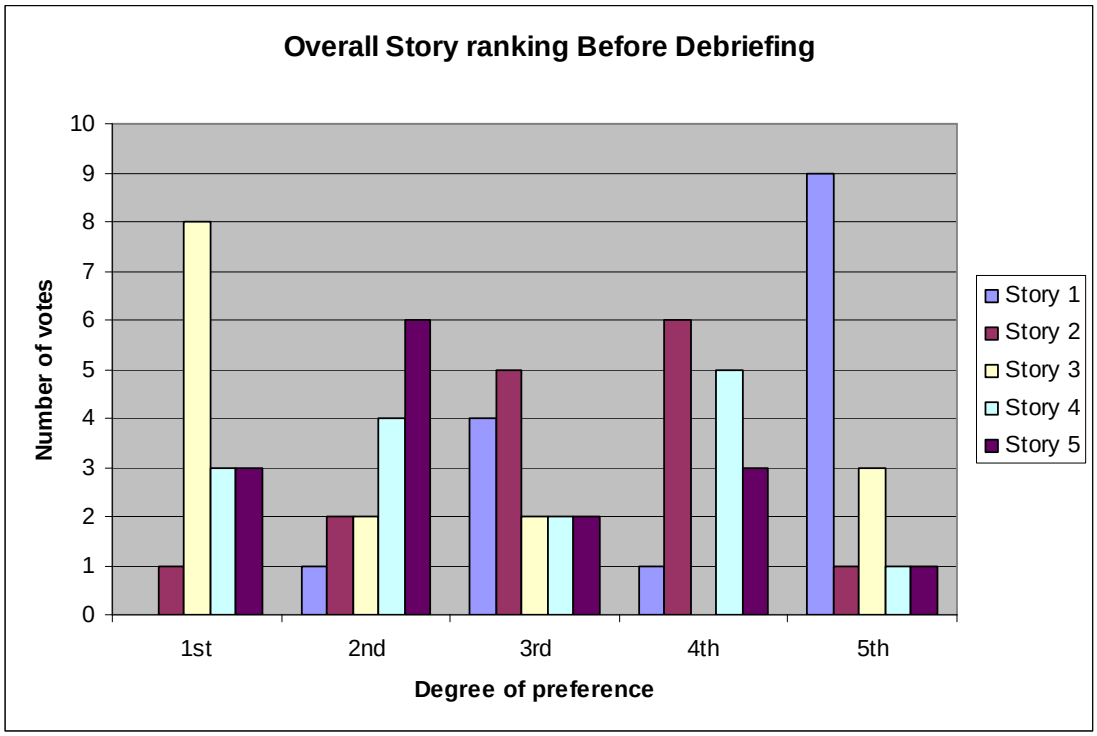


Figure 8.4.2A: Overall Story ranking before debriefing (Population 15 – M(9)/F(6))

The story generated by the original single appraisal mechanism (Story 1) did not perform well in the spectator ranking, and has been perceived as the worst story of the test batch. This trend is also confirmed in **[Figure 8.4.2B]** (p = 0.00061/ 99.39 %R) where individual story rankings have been translated into values in order to achieve a clearer picture of a story performance (averaging). This diagram shows to what extent Story 1 has been negatively perceived by spectator/reader users. Note also that there are no significant differences in performance for Story 1 between pre and post debriefing markings by users.

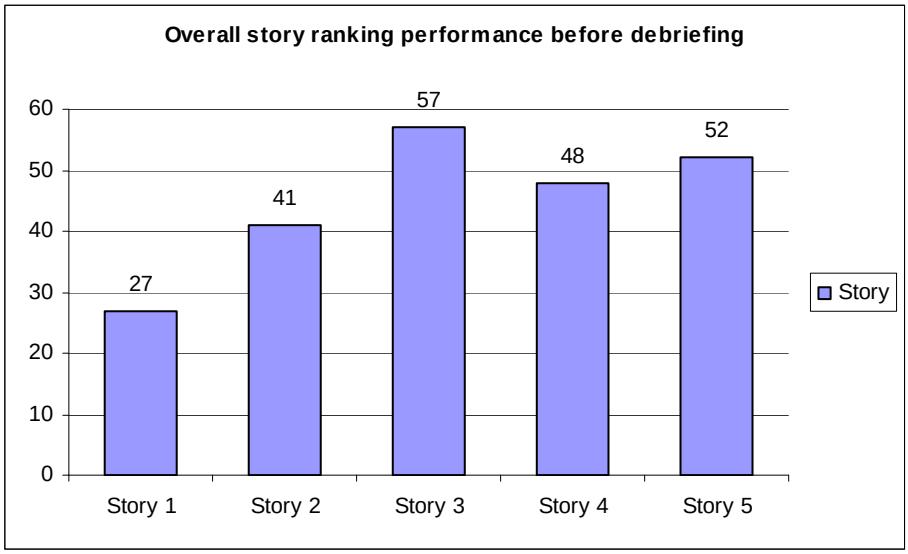


Figure 8.4.2B: Overall Story ranking (points table) (Population 15 – M(9)/F(6))

The results indicate clearly that the single appraisal-based implementation (SA) scores lower than its double appraisal-based counterparts (DA/DAM). On the other hand, it is also interesting to note that whilst the second DAM of the game-master generated a different story (Story 2) than the original SA-based approach (Story 1), its counterpart in DA still resulted in Story 1. The two stories using the SA-based agents (Story 1 and Story 2) also score significantly lower than agents fitted with either DA (Story 3 and 4) or DAM (Story 3, 4 and 5).

8.4.3 Q2

The evaluation results also show that agents or game-masters conforming to DAM tend to score higher than the ones conforming to DA. **[Figure 8.4.2B]** demonstrates this by showing that Story 2 (game-master DAM) scores better than Story 1 (game-master DA).

Conversely, **[Table 8.2B]** shows that there are no major changes in the actions of the agents unless they are interacting with a game-master of type DA. A distinction between the two implementations can, however, still be seen in the performance of stories 4 and 5. These stories feature the same version of the game-master DAM, but contain agents of the two different implementation types (DA= Story 4 and DAM = Story 5]).

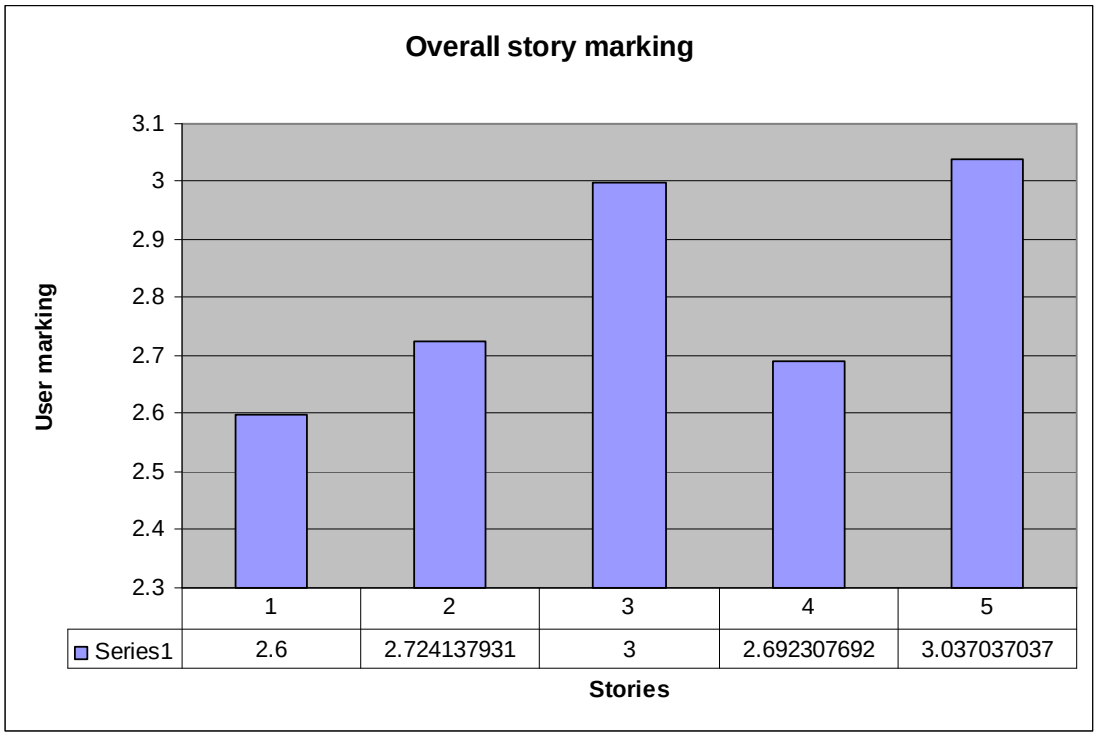


Figure 8.4.3A: Overall Story marking (Population 46 – M(32)/F(14))

Both **[Figure 8.4.2A]** and **[Figure 8.4.2B]** show that overall, Story 5 outperformed Story 4 in the spectator/reader user ranking. This is further confirmed

in **[Figure 8.4.3A]** (p = 0.0917/ 90.83 %R) where the overall marking by all users (i.e. spectator/reader and interactive user) shows a net difference of appreciation between Story 4 and 5 in favour of the latter.

8.4.4 Q3

The results relating to Q3 are interesting, because two opposing claims could be made in relation to the results.

- **Claim 1**: **[Figure 8.4.2B]** seems to indicate a better performance and appreciation of Story 3 over Story 5.
- **Claim 2**: **[Figure 8.4.3A]** shows that Story 5 is the preferred story from a marking perspective.

These results do not, in isolation, allow this thesis to claim that, considering the EI of actions on all characters, a double appraisal system of DAM type generates stories that are more interesting over DA types (Q2) or all types (Original FAtiMA and DA) (Q3). It is necessary to focus on the nature of the tests performed in order to gain a clearer idea of the validity of each claim. Claim 1 is based on spectator/reader user types, whilst Claim 2 relies on interactive users. It is important to consider the results for both perspectives (i.e. spectator/reader and interactive user) in order to assess the validity of each claim.

[Figure 8.4.4A] (p = 0.0068/ 99.32 %R) shows the overall story marking for non-participant users (Spectator/reader). It confirms, to a certain extent, the results observed in **[Figure 8.4.2B]** (Story 3 ranked better than Story 5) shows that Story 5 is not the story receiving the higher marks. It therefore contributes negatively to the hypothesis that a double-appraisal mechanism, which considers all the characters in a given scenario, performs better than both the self-centred and single appraisal mechanisms.

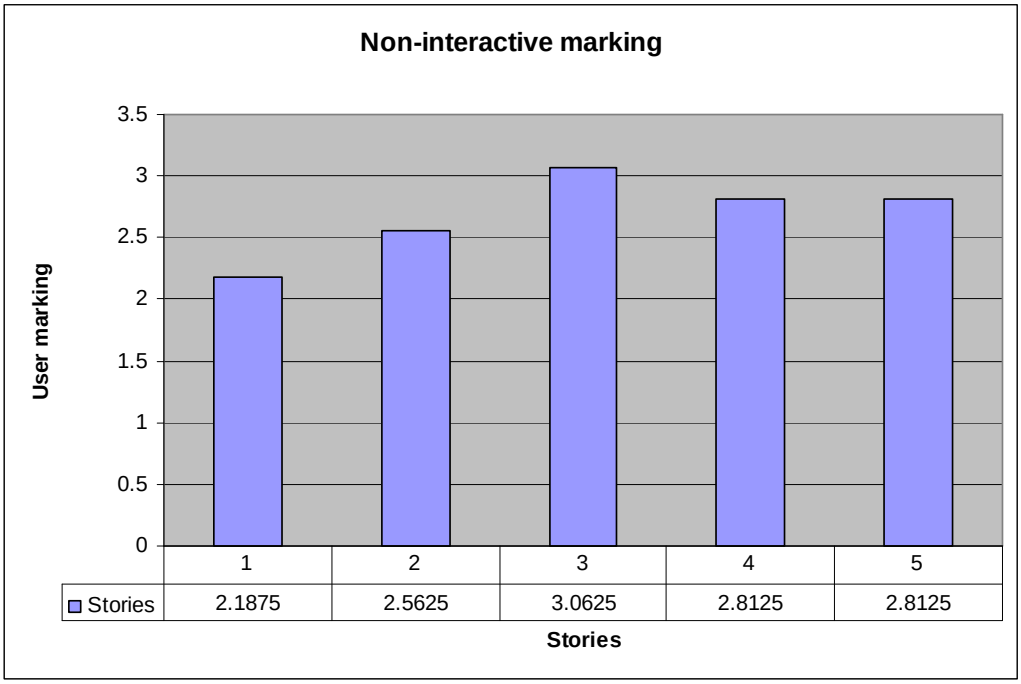


Figure 8.4.4A: Non interactive story marking (Population 16 – M(10)/F(6))

On the other hand, **[Figure 8.4.4B]** (p = 0.0185/ 98.15 %R) presents a different outcome showing a slight marking advantage for Story 5 over the rest of the stories from interactive users.

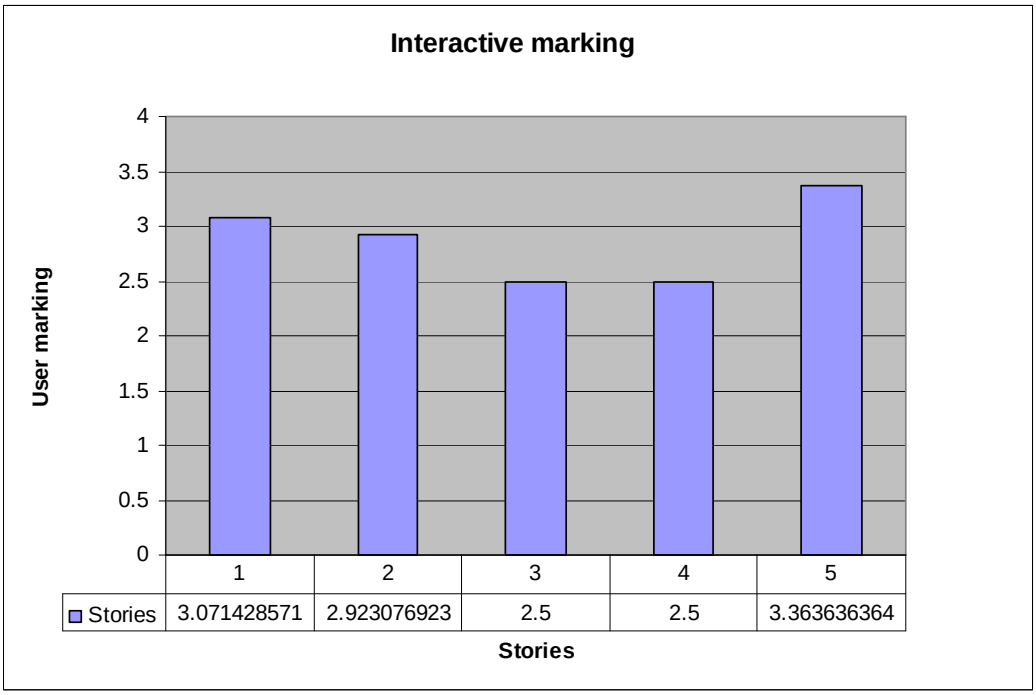


Figure 8.4.4B: Interactive story marking (Population 30 – M(22)/F(8))

It is also interesting to note in **[Figure 8.4.4B]** the high marking performance of Story 1. This reinforces some of the claims of (Aylett et al 03) that an emergent narrative may not be perceived to be as interesting from a spectator/reader perspective as it would be from an interactive perspective. In relation to Q3, given the aim of this work is to produce an interactive emergent narrative, the consideration of Claim 2 is rather more significant as a result than Claim 1.

8.4.5 Other factor considerations

Whilst the results presented in the sections above support the double-appraisal system hypothesis advanced in this thesis, it is also important to consider factors that could affect the results presented above. The elements taken into account in this evaluation are the length and the action content of the stories presented to the user for marking and ranking. For instance, does the high dramatic impact of one specific action (e.g. killing another character) always make the story that contains this action dramatic? Since the evaluation is conducted using a text-based application, actions, story length, gender and knowledge are elements from which a user could assess the dramatic qualities of a story.

8.4.5.1 Effects of story length

The length of a story is an important factor as people could tend to mark up a story just because it is longer. Section 8.2 described the evaluation methodology and highlighted the differences between tests 1 and 2 (T1, T2). In T1, the stories are presented as output and as a result have different lengths. In terms of the number of actions contained in these stories, certain are significantly shorter than others. For instance, Story 1 contains 20 actions and Story 5 28. In T2, Stories were extended so as to display the same number of actions as the longest story (i.e. Story 5). For

instance, Story 1 was extended from 20 actions to 28 so as to show the same number of actions as Story 5. Therefore, by comparing the results for T1 and T2, one can assess accurately the influence of length on overall results (i.e. used in sections 8.4.2, 8.4.3 and 8.4.4). It is important for stories in T2 to all display the same length, but it is also important that the actions added to the original stories in order to achieve this are insignificant in the unfolding of the stories. Since none of these actions were assessed as meaningful or dramatic by any of the test subjects, we therefore argue that they had no dramatic impact on the stories evaluated by the users. There were no significant distinctions between results from the pre and post debriefing and, as such, this section is illustrated with results from the pre-debriefing sessions. Evaluations showed significantly different results in story ranking. **[Figure 8.4.5.1A]** below, clearly indicates that Story 3 is regarded as the favourite story in T1 but has no vote at all for second position. Story 5, however, displays a certain regularity in its rating in positions 1, 2 and 4.

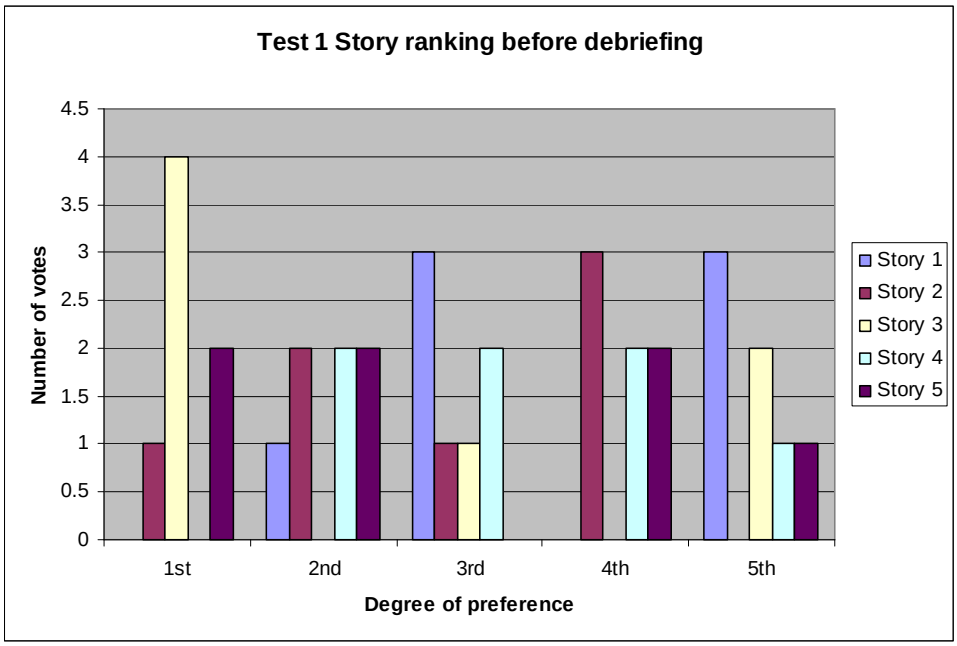


Figure 8.4.5.1A: T1 Story ranking before debriefing (Population 7 – M(4)/F(3))

T2 shows a different picture in **[Figure 8.4.5.1B]** as Story 3 shares the first position with Story 4 but also has votes for second position. Story 5 does not display the same regularity as in T1, and achieved a greater number of votes in second position than it did in T1. This is interesting as it suggests that the length of stories has played a role in the way test-subjects perceived and assessed stories.

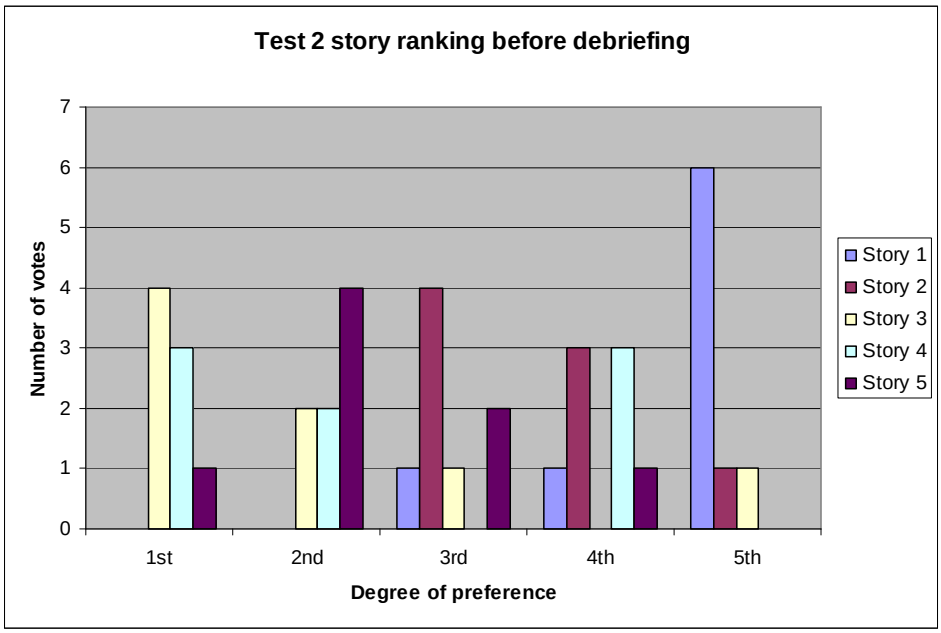


Figure 8.4.5.1B: T2 Story ranking before debriefing (Population 8 – M(5)/F(3))

Therefore, whilst the story ranking distribution seems to indicate that length could have influenced the results of this evaluation; this is not reinforced when consulting story rankings from a table perspective. The table perspective transcribed ranking data into a point table in order to assess the overall appreciation of a story. Point distribution was made with respect to ranking order (i.e. 5 points for first, 4 for second, etc.). With the notable exception of Story 4, which is better represented in T2 than in T1, **[Figure 8.4.5.1C]** presents a similar picture and indicates that in both T1 and T2 Story 3 is the overall preferred story, closely followed by Stories 5 and 4, whilst Story 1 is largely considered as the worst story of the set. The ranking trend is therefore similar between T1 and T2. Note that the difference in values between T1

and T2 is due to a different number of test subjects, and therefore does not reflect directly on the ranking of the stories.

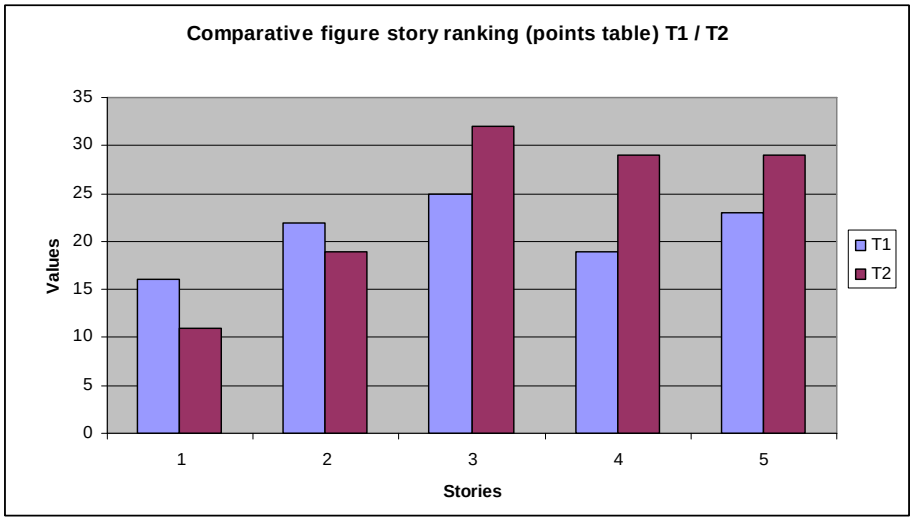


Figure 8.4.5.1C: Comparative story ranking figure (points table) T1 / T2

However, the study of story marking **[Figure 8.4.5.1D]** also displays the influence of length on the appreciation of stories. Whilst this is not significant in the results presented in previous sections (e.g. Story 1 is still in both cases (T1 and T2) the least preferred story), it is important to acknowledge this and take it into consideration.

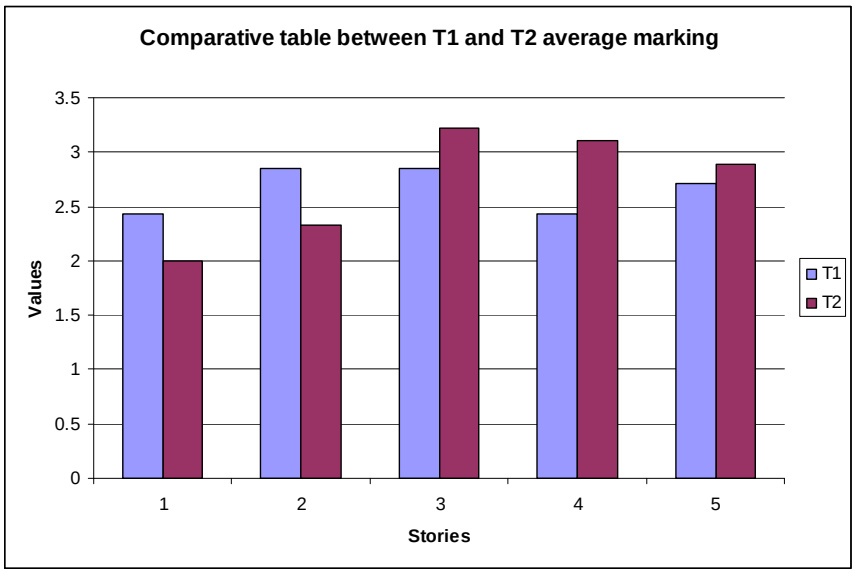


Figure 8.4.5.1D: Comparative story marking T1 / T2

Therefore, as far as this evaluation is concerned, it has been established that story length does influence the user's story appreciation. However, since the overall marking and ranking for non-interactive tests reflect the trends set in T2 (i.e. similar story point distribution trend **[Figure 8.4.5.1C]**), one can deduce that its impact on the results presented in this thesis is limited to the point of being insignificant. Story length has not affected the overall marking and ranking trends observed in T2 and, since the added actions were neither meaningful nor dramatically interesting they have not affected the relevance of action marking either.

8.4.5.2 Action influence

Since test users have marked and ranked stories based on their content and the actions they contain, it is therefore essential to assess whether or not actions with high dramatic impact always make a story that contains this dramatic.

Section 8.4.3 deduced that Story 5 was the most successful story and therefore supported the hypothesis of a double-appraisal approach. In order to validate these results, this section studies the action content of Story 5, and tries to determine if any particular action affected user marking, and consequently the results presented in this chapter.

[Figure 8.4.5.2A] illustrates the distribution of actions rated by users with regard to Story 5 (meaningfulness) and **[Figure 8.4.5.2B]** indicates how dramatic this story is perceived as being (Average Meaningful Rating = av.M and Average Dramatic Rating = av.D).

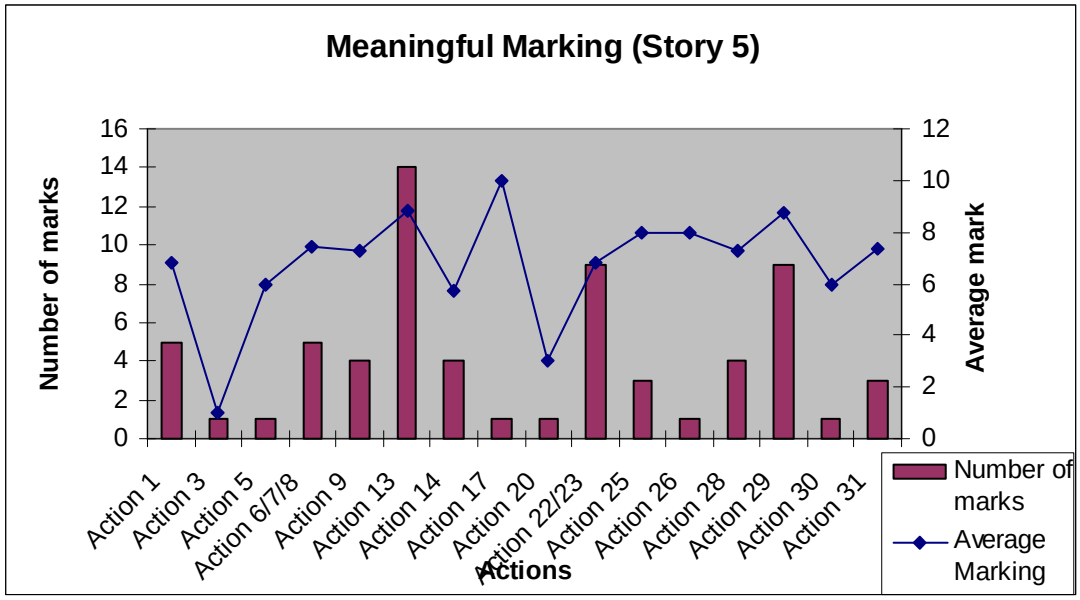


Figure 8.4.5.2A: Meaningful Marking Story 5

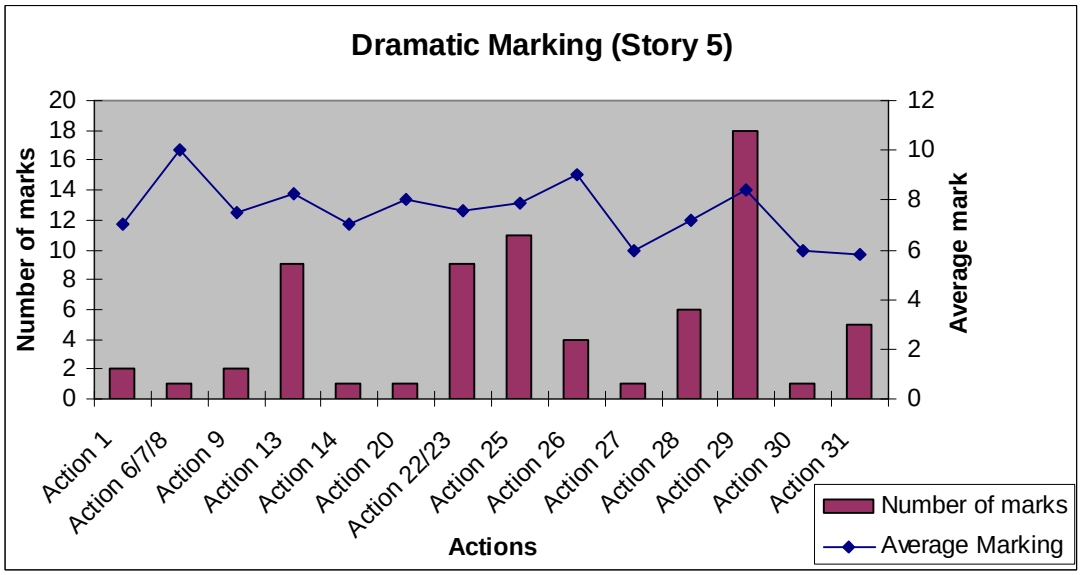


Figure 8.4.5.2B: Dramatic Marking Story 5

These figures show that the 3 most *meaningful* actions for users are, in order of importance: Action 17 (10av.M (Door opens)), action 13 (8.85av.M (Doctor awakes gods)) and action 29 (8.77av.M (Colonel shoots Doctor)). However, in order to gain a representative picture of the overall action marking, it is appropriate to discard action 17 as an isolated case as only one test subject marked this action, and consider action 25 (8av.M (Statues are animated)) instead as this action is

statistically more representative of the test batches collected as it has been marked by several test subjects. The actions regarded as the most *dramatic* are, discarding action 6/7/8 (10av.D (Discover the door)) as an isolated case (same reason as action 17), action 26 (9av.D (Colonel Orders to fire)), action 29 and action 20 (8av.D (Professor Protest against the destruction of the door)).

The study of action marking shows that, with the exception of action 29, no particular action can be singled out as explaining the success of Story 5 over other stories:

- Actions 13 and 25 have been rated as meaningful and dramatic in Story 5; however, whilst they also perform well in Story 4 (8.15av.D) (the only other story where they occurred), they cannot be used to explain the performance of Story 5, as Story 4 is ranked third in overall story ranking.
- Action 26 features well in dramatic markings in Story 5, but is not a major player in Story 4.
- Action 20 is also represented in Story 1 and 2. Whilst it performs well in Story 2 (8av.D), its performance in Story 1 (6.5av.D) is relatively average.

Action 29 only occurs in Story 5 and is relatively meaningful and dramatic (i.e. the action of killing another character is important to the drama). It is however difficult to single it out as the reason why Story 5 is more appreciated than others, as several other actions have performed similarly or better in other stories **[Table 8.4.5.2C]**.

Action	Average Marking	Story
Action 22/23	8.86 av.M	Story 2
Action 1	9.av.M	Story 2
Action 16	8.71 av.M	Story 3
Action 17	8.5 av.D	Story 3
Action 27	9.2 av.M	Story 4
Action 13	8.85 av.M	Story 5
Action 26	9 av.D	Story 5

Table 8.4.5.2C: Other actions performing strongly

[Figure 8.4.5.2D] compares these other actions with action 29 in both non-interactive and interactive tests in order to identify whether or not action 29 is intrinsically more dramatic or meaningful than others.

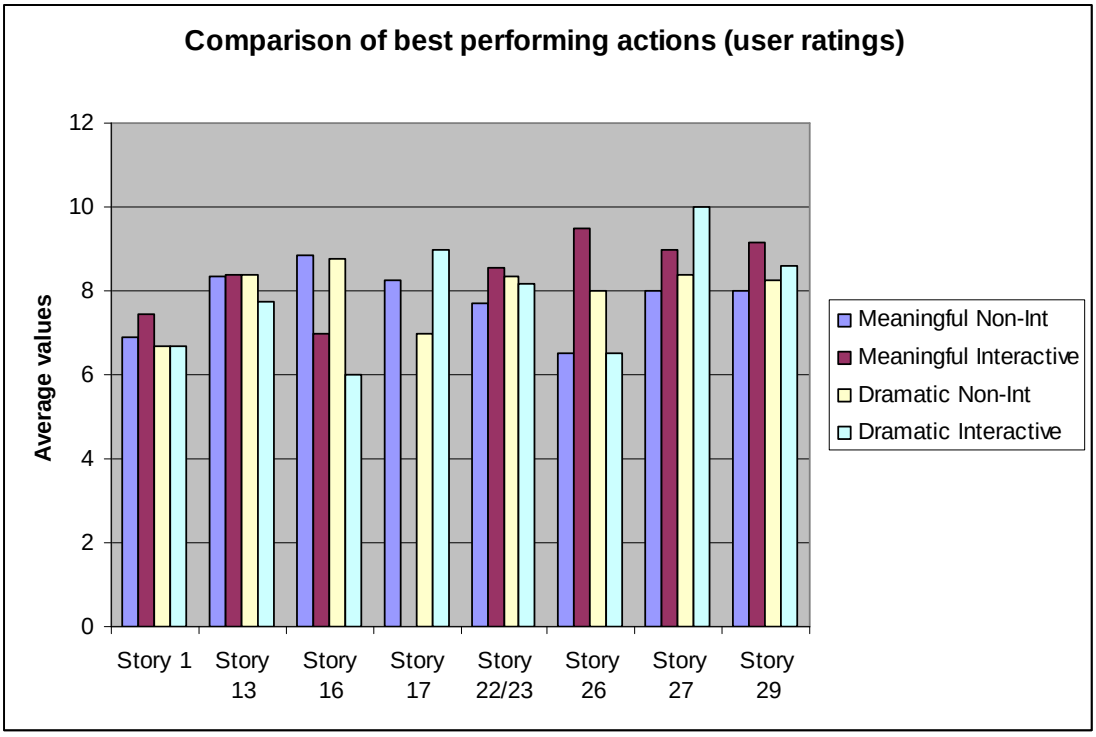


Table 8.4.5.2D: Best performing action comparison

Whilst action 29 has a strong intrinsic value in terms of meaningfulness and dramatic interest, it does not score the strongest average value in either the Meaningful (Non-interactive, Interactive) or the Dramatic interest (Non-interactive, Interactive) categories. The fact that it scores by a small margin the second best

average value for the Meaningful (Interactive) category does not allow us to regard action 29 as the sole reason why Story 5 is preferred to others.

Since the overall hypothesis of double-appraisal is that emotions can be used as a surrogate for dramatic context, a user engaged in a story will certainly care more for his/her actions and probably rate them higher than other character's actions. The same also applies if a user feels empathy towards other characters, the events or actions affecting this particular character would have more value to the user than those affecting other characters. Therefore, the apparent success of Story 5 is not likely to be found in the intrinsic dramatic value of its action content (e.g. action 29) but in the emotional context in which these actions have been perceived by both spectators and interactive users.

8.4.6 Gender consideration

The data analysis carried out in this thesis has also showed that stories are appreciated differently depending on the gender of the story recipient. **[Figure 8.4.6A]** shows the overall marking of stories based on the gender of test subjects. A first observation is that stories have been marked differently by both men and women. The female average markings in stories 1 and 4 are slightly superior to their male counterparts, and vice versa for Stories 2, 3 and 5.

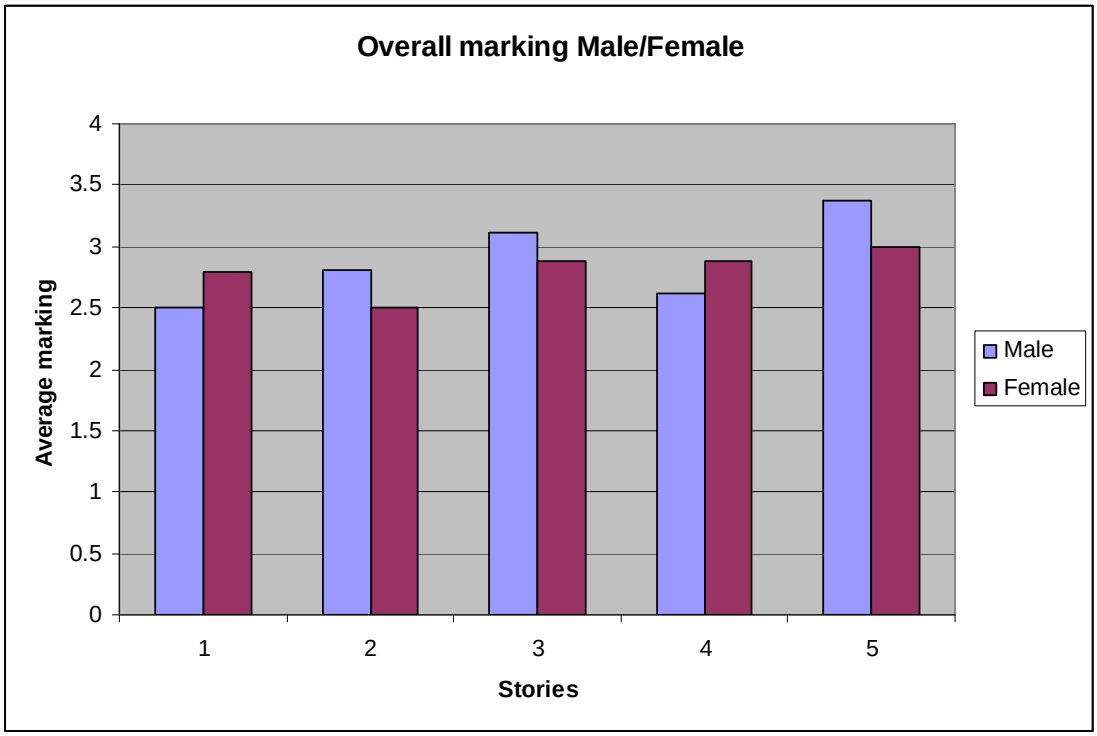


Figure 8.4.6A: Overall story marking Male/Female

Story ranking presents similar results as **[Figure 8.4.6B]** shows.

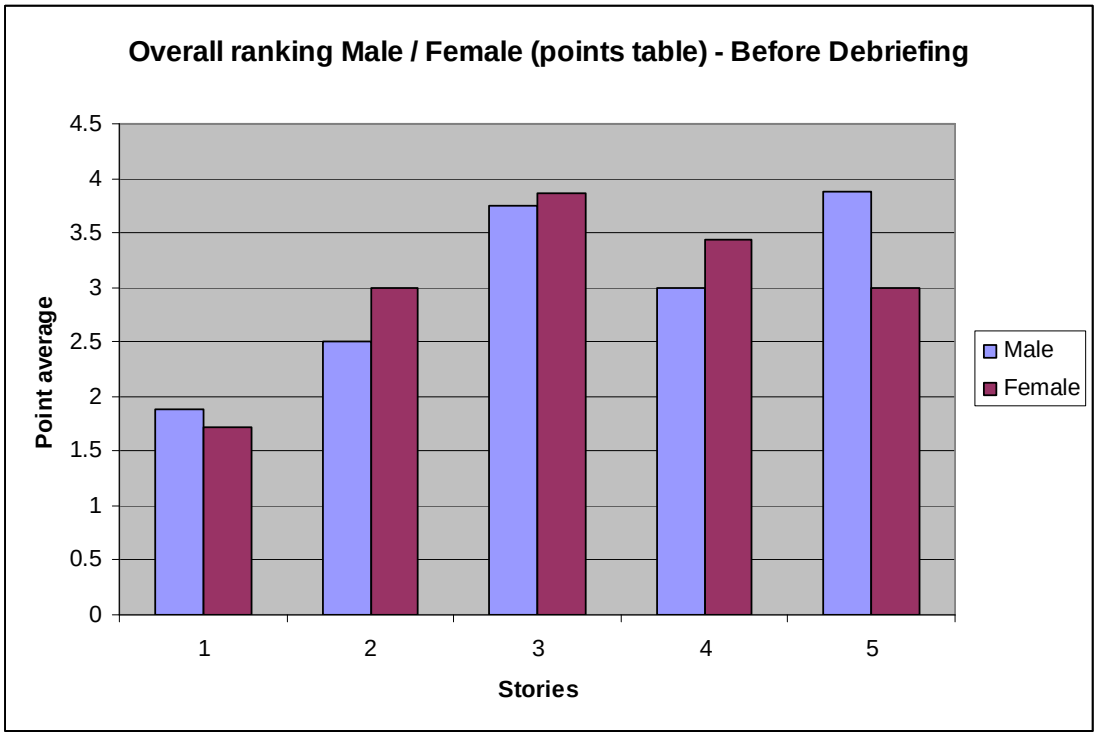


Figure 8.4.6B: Overall story ranking Male/Female before debriefing

Males ranked stories 5 and 3 as their preferred stories and Story 1 as their least preferred. Women, on another hand regarded stories 3 and 4 as their preferred stories while still considering Story 1 as the poorest story. However, the story ranking between men and women is more significantly different once the debriefing has been conducted as **[Figure 8.4.6C]** indicates. Males have harmonised their story ranking down (in intensity) with Story 5 as the preferred story and Story 1 as the least preferred one. Women, on another hand have harmonised their story ranking up (in intensity), with Story 3 as their favourite and 2 as their least favourite. Whilst the female marking in **[Figure 8.4.6C]** could be regarded as a challenge to the double-appraisal approach, it is important to acknowledge that the results displayed do not provide the marking repartition between interactive and non-interactive marking and are therefore non conclusive as to the efficiency of the double appraisal approach.

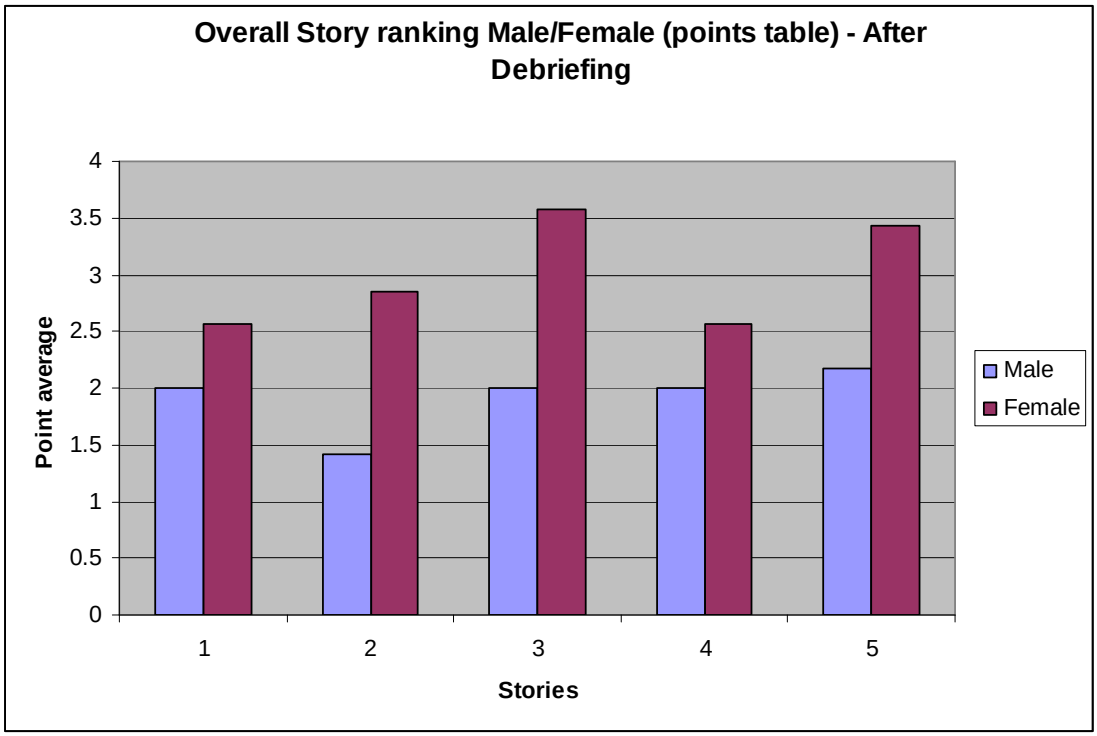


Figure 8.4.6C: Overall story ranking Male/Female after debriefing

Gender differentiation is also observed when comparing interactive and non-interactive story marking. **[Figure 8.4.6D]** shows that the non-interactive marking of

stories follows a similar pattern to the overall marking illustrated in **[Figure 8.4.6A]**. However, the interactive marking of stories shows significant differences.

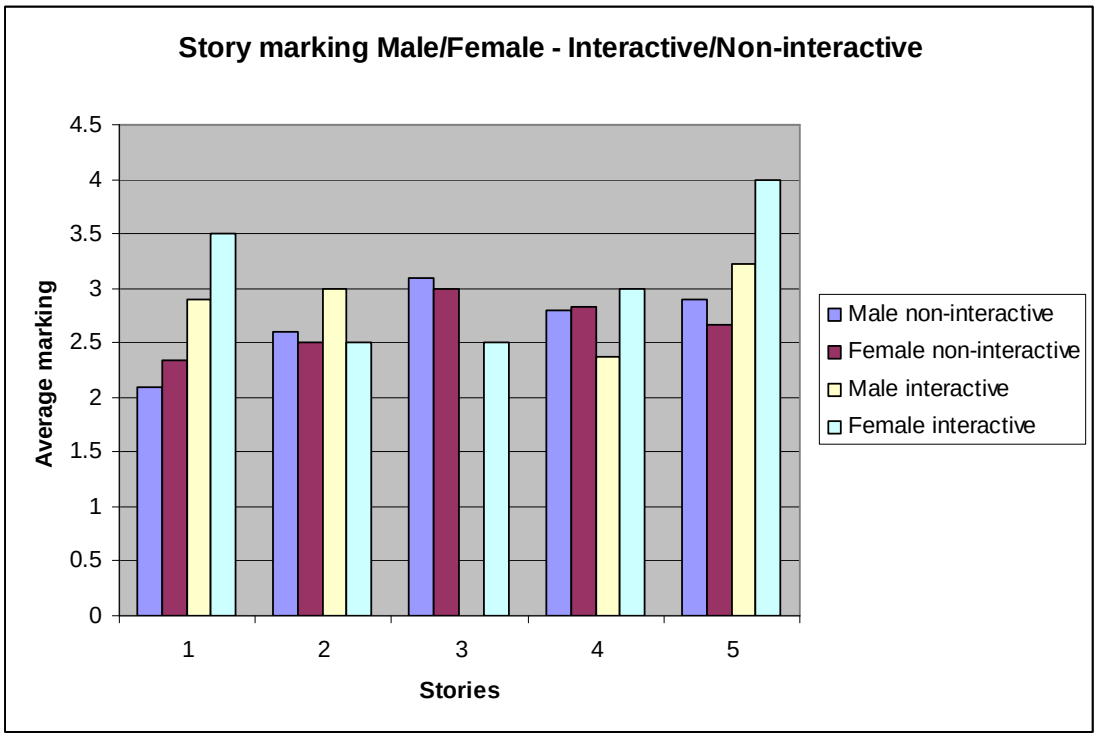


Figure 8.4.6D: Non-interactive and interactive story marking Male/Female

Whilst story 5 is the preferred story in terms of interactivity for both women and men, their intensity varies and women felt more strongly about Stories 5, 1 and 4 than their male counterparts. On another hand, men rated Story 2 higher than women.

The results presented in this section suggest that for the test subjects who participated in this evaluation, women and men appreciated stories differently and expressed their appreciation at a different level of intensity, with women marking stories higher than men. Women also reacted more strongly to interaction than men did. It is, however, difficult to assess the significance of these results as a general rule for story appreciation as it also depends on the genres assessed and the level of exposure of the subject to a particular genre. For instance, on a speculative note, men might have marked the stories down in intensity due to a possibly higher exposure to

the science-fiction genre. They would, therefore, have a large range of narrative experiences in this field to compare the evaluation stories to, and give a good assessment of the intrinsic quality of the stories. On another hand, women, generally believed not to be attracted by this particular genre, could have marked the stories up based on the relative novelty of the concepts to them. Further studies (outside of the scope of this project) will have to be conducted on different genres in order to identify precisely the reasons for the phenomenon observed.

8.4.7 Expert evaluation

The results presented in this section analyse and compare data from expert and non-expert users. In this evaluation, experts were identified as test subjects researching in fields requiring comprehensive knowledge of narrative theory and/or practice and experienced players (video-games, RPGs).

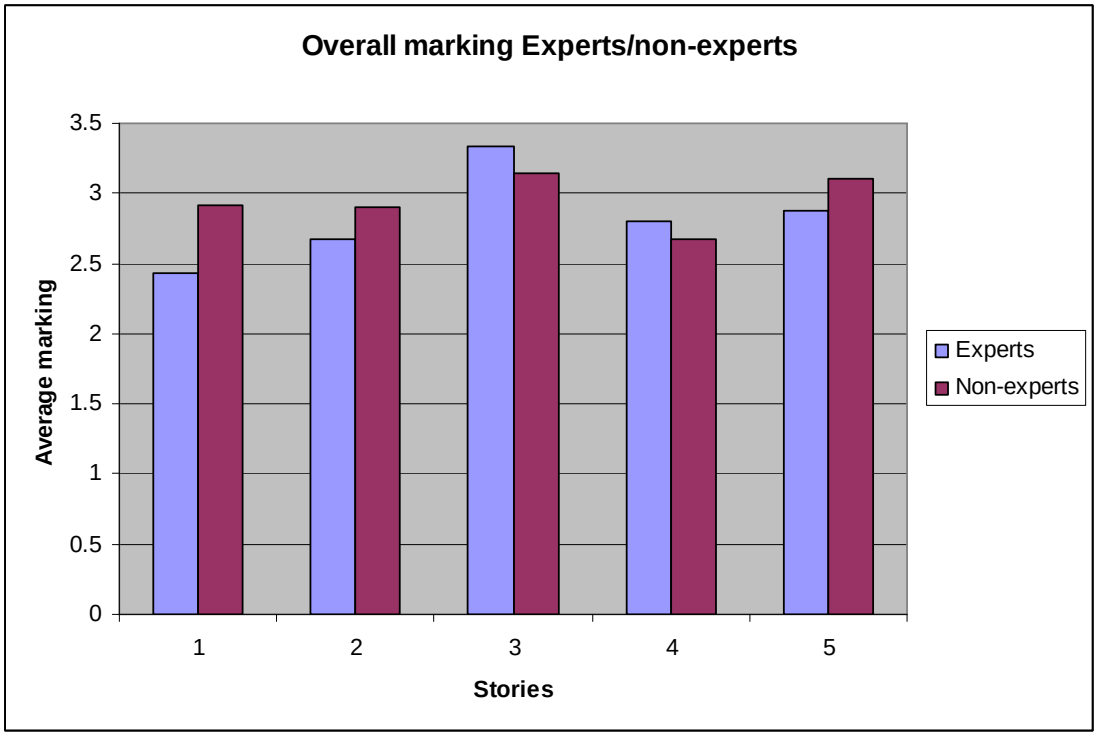


Figure 8.4.7A: Overall marking Experts – Non-Experts (Population 46 – E(11)/NE(35))

[Figure 8.4.7A] shows that on the overall marking of stories, experts and non-experts followed a similar marking pattern. This is also the case in **[Figure 8.4.7B]** where the marking trend for stories 1,2,4 and 5 is similar for both categories for interactive and non-interactive markings. Story 3 was not interactively assessed by experts in the evaluation, and should therefore not be taken into consideration in this section. Conversely, their assessments differ in intensity but do not seem to lead to any significant conclusions.

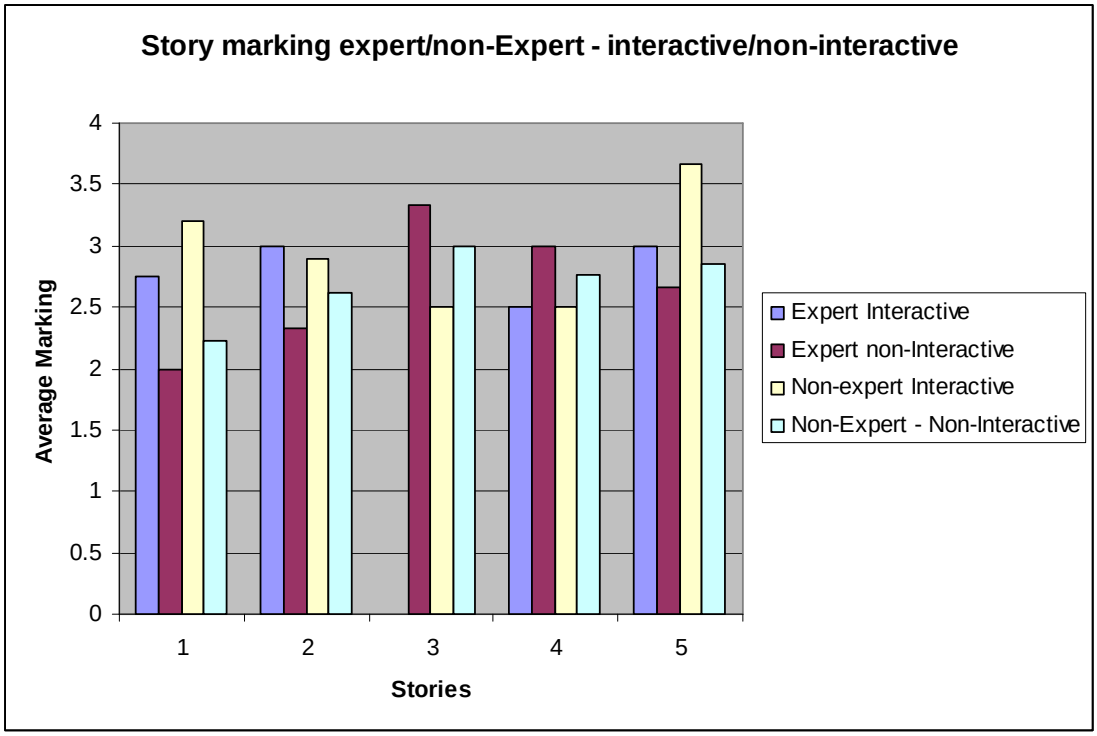


Figure 8.4.7B: Overall marking Experts/Non-Experts – Interactive/Non-interactive

8.4.8 Interactivity

[Figure 7.4.8A] shows some significant differences in marking stories based on whether or not the unfolding of the narrative was interactive or passive. Stories 1, 2 and 5 benefited from interactivity, and present interactive markings that are significantly higher than their non-interactive counterparts. On the other hand, stories 3 and 4 display the inverse trend and their non-interactive markings are higher than

interactive markings. Story 3 presents the best average in non-interactive marking, but only scores joint fourth in interactive marking. Story 5 presents the third best average in non-interactive marking but is first in interactive marking.

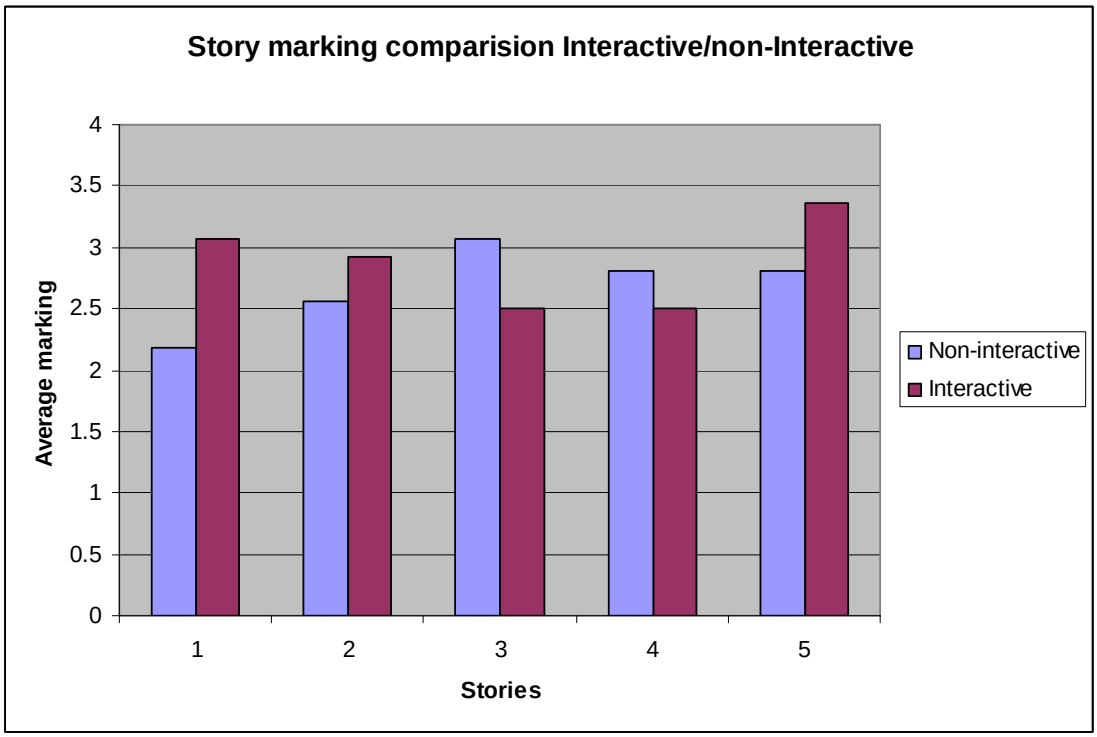


Figure 8.4.8A: Overall story marking – Interactive/Non-interactive

Whilst this evaluation cannot conclude the reasons for these results, they do however support the EN hypothesis that spectating and participating narratives are two different experiences that are regarded differently depending on the role and activity of the user. The results presented in this section could support the argument that the decisions made by a participating user are valued more highly than those made by other characters. However, further studies are required if one is to validate such an argument, and identify the elements that motivate participants and spectators to regard narrative content differently.

8.5 Conclusions

The evaluation conducted has produced results that support the overall hypothesis and validity of both the Emergent Narrative approach as a narrative concept, and its technical implementation through state-of-the-art agent technology (i.e. Double appraisal). This chapter demonstrates that synthetic characters can be enhanced to perform as actors rather than merely acting in role by carrying out a second appraisal of their projected actions. Results have been presented showing that extending an emotionally-driven agent architecture (FAtiMA), which has already been applied to the creation of emergent narratives (FearNot!), has a positive impact on the perceived dramatic values of the generated stories.

Whilst the two implementations had different effects in generating dramatic interest for the user as spectator/reader and as interactive user, they still produced simulations that scored higher than the original single appraisal-based architecture. On the basis of a direct comparison between the two different implementations carried out, DAM, which considered the emotions of all of other characters in a scenario in order to make dramatic choices, scored consistently higher than the more self-focused DA. This leads to the conclusion that DAM possesses a stronger dramatic potential than DA. Finally, when comparing user marking for all stories, Story 5, which features DAM in both its agents and game-master architectures, scored the highest overall mark, and was considered as the most interesting story experienced by interactive users.

These results establish that narrative control can be exercised at character level in a distributive manner and through local decision-making with satisfying results as long as the agents (i.e. characters) are provided with a mechanism that allows them to assess the emotional consequences of their actions on others.

Whilst there is a limited amount of evidence and more empirical work needs to be carried out, the results presented in Chapter 8 suggest that:

1. A double appraisal mechanism can contribute in generating stories dramatically more interesting than if generated by a simple appraisal mechanism.
2. An implementation considering the emotions of all characters is better at generating interesting stories than one only considering one character (self).
3. The consideration of all characters in a double appraisal contributes in generating more interesting stories overall.
4. Story length has an impact on the way an Emergent Narrative is perceived by a user.
5. There are differences in the way that stories are appreciated by different genders. However, this particular argument requires further study and should be investigated with regard to several narrative genres as opposed to a single one (i.e. science-fiction).
6. Stories are appreciated differently by users depending on their roles (i.e. spectator or participant).

Chapter 9

Conclusions and future work

> This is not the end. It is not even the beginning of the end. But it is, perhaps, the end of the beginning.
>
> -*Winston Churchill*

9.1 Conclusions

The work presented herein supports the validity of the Emergent Narrative (EN) hypothesis introduced in Chapter 1. It revisited the concepts of both users and authors in the face of interactivity, and proposed a theoretical approach, the main objective of which is the reconciliation of narratives and interactivity in virtual environments. The EN hypothesis consists, therefore, of a theoretical framework for the development of interactive narrative whilst solving the narrative paradox described in Chapter 1.

This work underlines the importance of interactivity over plot in interactive narratives. It shows that current narrative considerations have not been thought through with respect to interactivity, and are therefore difficult to articulate with an interactive user. On another hand, interactive practices such as Role Playing Games (RPGs) or interactive theatre show that narrative content can be reconciled to interactivity within an appropriate framework. The theoretical work of this thesis argues for character-based narratives where the story is regarded as an interactive

process, as opposed to the common artefact view of most narrative theories. It has also been formulated generically so that it does not only apply to interactive narratives in virtual environments, but also to other media.

On a technical note, part of the EN theory has also been implemented. A fundamental element, a distributive narrative management (c.f. Chapter 6) has been modelled within a novel approach to appraisal theories. This thesis introduces a double appraisal theory where the character does not select actions on the basis of their intrinsic values but on their potential dramatic impact (cf. Chapter 7). The character in this implementation makes decisions with respect to their impact on self and others. Such an approach is based upon the study of the relationship between drama and emotions, discussed in Chapter 4. This investigation of emotional models and drama techniques suggested that emotions could be used as a surrogate for dramatic intensity, thus allowing for the dramatic assessment of decisions according to their emotional impact.

This is confirmed by the evaluation results presented in Chapter 8; stories created with the double-appraisal implementation have scored better than other stories not featuring this particular action-selection mechanism.

9.2 Contributions

Chapter 1 identified a set of primary and secondary contributions to knowledge. These have been achieved in the completion of this thesis and are described in sections (9.2.1, 9.2.2).

9.2.1 Primary contributions

The first of these is the formulation of a novel character-based theory for interactive narratives, Emergent Narrative (EN). It proposes a theoretical solution to the

problem of reconciliation between interactivity and narratives (i.e. narrative paradox) in virtual environments and character interactive drama in general. The theoretical work described in this thesis examines interactive narrative and its components (i.e. author, user, plot, characters, interactivity, story, roles). The EN theory advanced is also novel in that it radically re-thinks user and author roles within narrative frameworks and questions the prevalence of story plots over user experiences, therefore arguing for a greater consideration of interactivity over narratives. The EN theory should be regarded, within the particular context of interactive narrative, as a theoretical work arguing for a character-based approach to narrative. The process view of storytelling proposed in this thesis should be regarded as a clear departure from the plot-based approaches proposed by Aristotle himself and other Aristotelian theorists.

The second primary contribution concerns the definition of a novel story management approach that draws on interactive practices rather than non-interactive theoretical approaches. This has been achieved through the design and implementation of a novel agent architecture action-selection mechanism. The "Double-Appraisal" (DA) approach is an affectively driven action-selection mechanism that exploits the close relationship between emotions and drama in order to generate dramatically interesting events. The DA approach also introduces a novel distributive drama management system (i.e. shared by the characters) to enable interactive storytelling. It practically links for the first time cognitive appraisal modelling to specific narrative functions and drama (i.e. dramatic action-selection mechanism). It is also the first mechanism developed to specifically integrate bottom-up emergent structures within a character-based narrative framework.

9.2.2 Secondary contributions

Secondary contributions have also been made to the development of novel practical processes for the authoring of Emergent Narratives. The authoring process described in Chapter 6 could be regarded as the basis for a novel authoring methodology for bottom-up narrative structures. The work carried out in this thesis has also contributed to the development of a novel evaluation methodology for emergent narrative and interactive storytelling systems. Other contributions to knowledge concern:

- The development of a scenario and content elements for an emergent narrative application, as described in section 7.2. This section also laid the basis for an authoring methodology on character and environment development for EN.
- The results of experiments on story appreciation (i.e. marking, ranking) from real users as described in Chapter 6.

9.3 Critical evaluation

The work presented in this thesis has contributed to knowledge in a number of areas (cf. section 9.2). However, it is essential with every piece of investigative work to reflect objectively on the way in which it has been conducted. Like most ambitious projects, this thesis was not exempt from problems and issues, and lessons have been learnt in terms of both project management and research methodology.

Whilst not critical in the evaluation of double appraisal to assess a fully interactive immersive application, the development of such software was not possible for several reasons. The decision was made that technical implementation would rely on the state-of-the-art agent architecture developed for the VICTEC

project. Although this decision supported a focus on character action-selection mechanisms and led to the development of double-appraisal without draining resources on developing other parts of agent architecture design, there were also some disadvantages. Due to the research nature of the VICTEC project and the still in-development status of FAtiMA, its agent architecture, the technical implementation relied heavily on the success of the VICTEC project and its ability to deliver technical content within expected deadlines. Consequently, delays in delivering VICTEC's technical input similarly affected this investigation at the implementation stage. Whilst this decision proved to be successful, it also presented risks that were under-estimated at the time the decision was made. A better decision might have been to pursue the FAtiMA iteration option whilst also recognising the necessity for rapid prototyping and the development of low-fidelity software for testing purposes.

Prototyping would also have allowed for intensive and practical testing of interactive material in conjunction with studying interactivity. It would have certainly allowed this investigation to identify the dominant role of interactions over narratives more quickly, and produced an earlier implementation. This would have allowed more time for the evaluation and testing phase. Although the evaluation presented in Chapter 8 is large by computer science standards (47 test subjects), early prototyping would have permitted a larger test sample and granted time for a more "game-like" application.

Finally, the authoring for the EN application showcased in this thesis resulted in the generation of one particular scene of a longer scenario. The decision to design at an early stage a low-level (character-level) authoring tool would certainly have permitted us to implement a greater part of the scenario than featured herein.

However, the great majority (if not all) of the knowledge gathered during this investigation has contributed to this thesis in one way or another. Careful initial planning allowed for the identification of stable objectives and the targeting of project milestones according to which knowledge gathering was based upon.

Finally, great attention was given to the dissemination of ideas and materials. It is essential for research work to be published and known by peers if it is to be relevant to any research community. This investigation was conducted with the interactive storytelling community in mind, and careful attention has been paid in making sure that ideas, concepts and results from this work would be disseminated and communicated to fellow researchers in the field.

9.4 Future work

This thesis does not present a complete implementation of the emergent narrative concept and more work is necessary to develop this approach technically and theoretically. The presented work focuses on the overall articulation mechanisms of the concept and lays down the basis for further developments. By doing so, it answers essential theoretical questions currently discussed in the interactive narrative research field. This research field is however, still in its infancy and more work is needed in order to identify its boundaries and full potential. This section reviews the necessary research work still to be carried out on the particular area of emergent narratives if it is to challenge other more established theories and approaches.

9.4.1 Narrative articulation

Whilst overall story articulation and basic principles are set out in this thesis, it is important from a theoretical perspective to define in detail the exact role and mechanisms of a story facilitator (i.e. the game master role) in the system. Its

functions have been assimilated to those of an RPG game master, and its mechanism should reflect these similarities. There is, however, important work to be carried out in order to identify how these functions could be implemented with respect to agent technology in particular. Some early work has already been presented (Figueiredo et al 06) with regard to this issue. However, a deeper examination of the functions and the limitations of this mechanism must be carried out in order to generalise the principle.

Theoretical research is needed to identify the boundaries of a story facilitator with regard to essential narrative elements, and the amount/type of knowledge it requires to sustain its role. The suggestion advanced in this thesis is that knowledge could be regarded as a dual set of data available to the system for narrative decision making. On the one hand, world and environment knowledge could be readily available to the story facilitator. Its decisions should take into account all dramatic factors available (i.e. story world, character personalities, overall goals, conflict situations and emotional reactions).

On another hand, information concerning the characters themselves could be made available in a less direct manner. General information such as overall goals and personality of each character may be passed directly to the story facilitator; however, lower level information could remain at character level for use in the character's action selection mechanism. To reinforce an agent based approach, the story facilitator could integrate a learning algorithm that would allow for the development of assumptions about other agents based on their previous actions and decisions. In turn, this would feed a modified planning mechanism that would assess the potential consequences of the decisions taken.

9.4.2 Run-time emotion generation

Another area requiring significant research effort is the way in which emotional reactions are generated within characters. These emotional reactions represent the basis for any action to be executed. In the current system, they are configured prior to any interactions taking place in the form of explicit reaction rules, emotions are generated dynamically, but this generation is based on static reaction rules Whilst this is not an issue as far as emergent narrative is concerned, it does contradict the overall vision of narrative as a process. Since the system is primordially dynamic, it makes sense to design a dynamic emotional reaction mechanism in which reaction rules would also be modified dynamically. Such a system would generate reactions rules as the events unfold in real-time. The theory and concepts for such a mechanism are still yet to be addressed. It would facilitate the authoring of narrative content by transposing some of the low-level configuration workload to a higher level. A run-time emotion reaction generation system would also represent a forward step towards the integration of user interaction (i.e. speech, action, gesture) with the system. This suggestion directly concerns authoring and would strongly impact the development and scaling up issues discussed in chapter 3.

Another important issue that should be addressed in this section concerns the overall problem of authoring. Whilst the theoretical work conducted in this thesis provides a clear framework for authoring development, authoring elements should be implemented within an authoring tool. This tool could further address the scaling up issue already discussed by providing the user with an implemented methodology rather than a theoretical one. It would be interesting to combine this authoring tool with expert systems techniques and methods such that the creation of a character could be carried out at the same time as process simulation. Such a tool would allow

the author to create a story, along with its characters, in a way that it would integrate the scenario development cycle described in Chapter 7.

9.4.3 Evaluation

Further work could also concern the evaluation of EN and character-based systems by assessing the emotional contexts in which user decisions are made in comparison to the same decisions made by emotionally-driven characters in a simulation. It would be interesting with respect to the discussions in Chapter 4 to assess the emotional states of interactive/passive users in regard to the emotional states of virtual agents in similar situations. Whilst agent emotions are traceable via character logs, user emotions could be assessed, to a certain extent, via a combined methodology (to be established) using both biometrics and user questionnaires.

It would also be interesting to further evaluate the EN concept within a fully immersive and interactive application. Since the episode (i.e. scene) developed for this thesis was relatively short, it would also be interesting to extend the development of the scenario and assess whether or not the length and number of interactions can have an effect on the user appreciation of a story.

9.4.4 Emotional planning

Finally, another research area could be to investigate the double appraisal mechanism with regard to its application to sequences of actions rather than single emotional states. A suggestion could be that by doing so, an agent could take into account the overall emotional trajectories of a character. This, combined with concepts from characterisation, could achieve greater dramatisation as this would introduce emotional planning to character development.

Whilst no primary investigation work has been carried out on this suggestion, such research could lead to the identification of a novel mechanism for the understanding of character agents and further the integration of dramatisation techniques within synthetic actors.

9.5 Concluding remarks

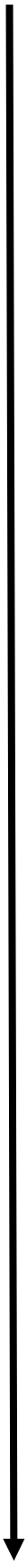
This thesis shows a novel design for interactive narratives where the storyline is emerging from the interactions between characters, environments and users. This design, although mainly theoretical, aims to produce truly interactive dramas that could emulate the narrative qualities of cinema, whilst offering an interactive experience to a user. The author hopes that this work provides a step forward towards understanding and shaping a new interactive narrative medium for both entertainment and education.

Appendices

Appendix A

Propp’s 7 parts narrative model

***Initial situation* Section**	
Aims	It is placed prior to the development of the tale itself (represented by the symbol α); It introduces important characters and present a pre-narrative graphical representation of the different components of the tale.
Example	**Once upon a time, in a land far, far away lived a young princess called Victoria and a poor boy called David. Princess Victoria and David loved each other so much that they decided to get married.**
***Preparatory* Section**	
Aims	Provides the narrative and the reader with the essential necessary knowledge to understand the next section.
Functions involved	Abstentation (β), Interdiction (γ), Violation (δ), Reconnaissance (ε), Delivery (ξ), Trickery (η). Complicity (θ)
Example	**Unfortunately for them, Victoria's father, King Henry would not allow his daughter to marry anyone who was not a knight, and had promised her hand in marriage to her cousin Lord Cedric, who although a knight, was a mean and ugly man, and Victoria did not want to marry him.**
***Complication* Section**	
Aims	The call for action, the logical sequence of events that leads the hero to decision-making, actions and ultimately to leave home and engagement into a quest. Exposes the reasons, the motivations and the goals of the actions, (ABC↑).
Functions involved	Villainy (A), Lack (a), Mediation connective incident (B), Beginning of counteraction (C), Departure (↑)
Example	**King Henry told David that he could achieve a knighthood, and have his daughter's hand in marriage, if he could kill the dragon that lived in the mountain, and was terrorising the people of the land.**
***Donor* Section**	
Aims	The hero in this section is tested, and receives a magical agent or helper that proves to be essential for the achievement of the quest that the hero is engaged in. The sequence DEF provides the hero the means by which the completion of the quest is possible.
Functions involved	First function of the Donor (D), the Hero's reaction (E), Provision or receipt of a magical agent (F)
Example	**David went on a long journey to the mountain in order to kill the dragon and win the hand of his beloved. It was in the mountain that he met a strange wizard called Archibald. Archibald offered to help David, and gave him a magic sword to kill the dragon.**
***Action* Section**	
Aims	It is led by a series of actions and ultimately directly confronts the villain with the hero.
Functions involved	Spatial transference between two kingdoms or Guidance (G), Struggle (H), Branding marking (J), Victory (I), Liquidation of the initial misfortune of Lack (K), the Return (↓), the Pursuit, Chase (Pr) and the Rescue (Rs).
Example	**Thanks to the magic sword, David was able to kill the dragon and went triumphantly back to King Henry's castle. The King was overjoyed, and kept his promise. David became a knight of the land, and the king offered him his daughter to marry.**
***Repeat* Section**	
Aims	At this stage the author can either opt for a repeat of the first stage, by starting a new villainy, or move on to the second move and end the story (***the Second move section***).
***Second move* Section**	
Aims	This section involves the function pair MN (Difficult task, Solution to the task), brings the last actions into a story and concludes the story.
Functions involved	Unrecognised arrival (o), Unfounded claims (L), Difficult task (M), Solution (N), Recognition (Q), Exposure (Ex), Transfiguration (T), Punishment (U), Wedding (W)
Example	**Victoria and David were married at a wonderful wedding ceremony and they all lived happily ever after.**

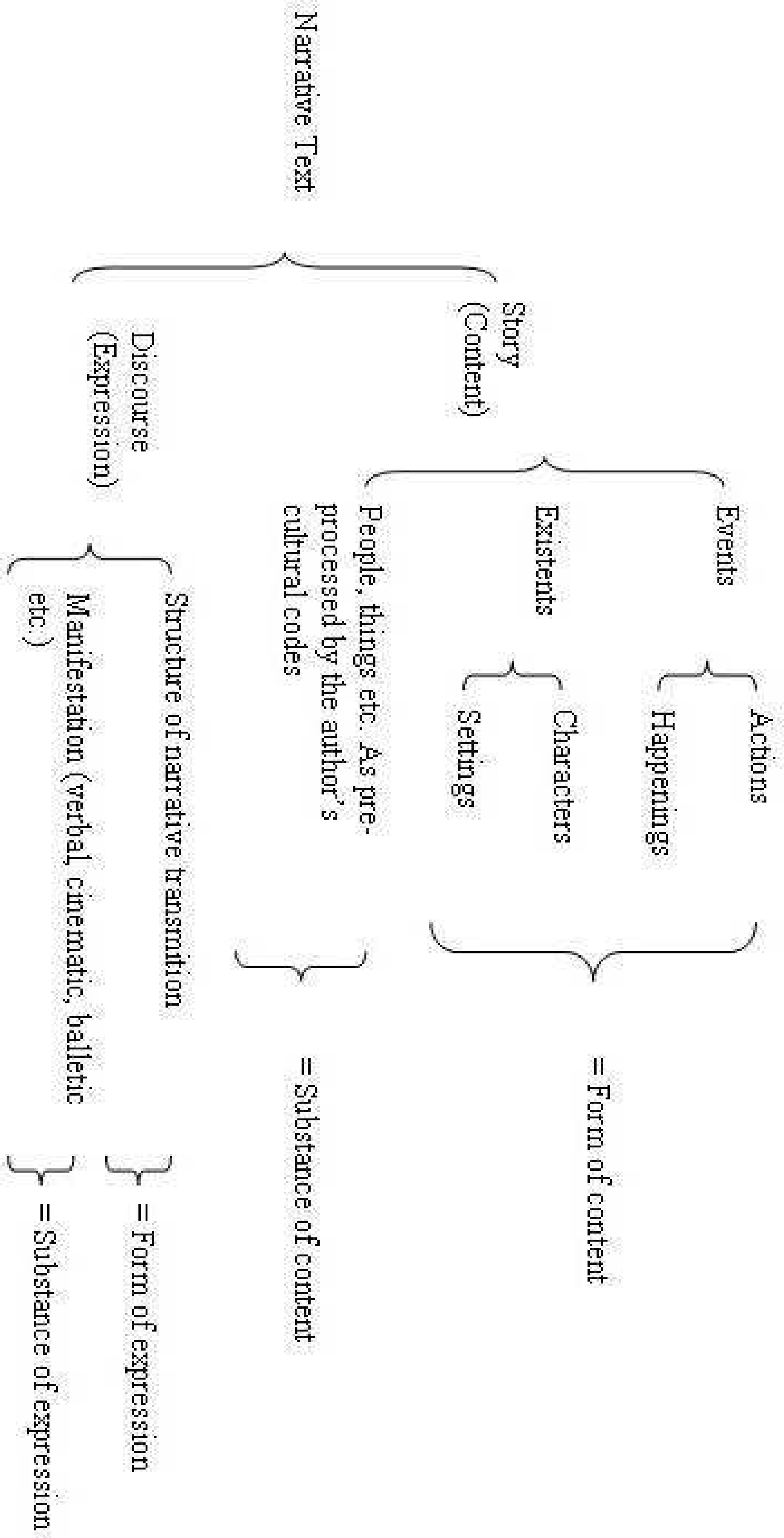


*Auxiliary elements are universal and may appear at any point throughout the

Logical and chronological process

Appendix B

Chatman’s narrative representation (Chatman 78)



Narrative Text
Story (Content)
Discourse (Expression)
Events
Existents
People, things etc. As pre-processed by the author's cultural codes
Actions
Happenings
Characters
Settings
= Form of content
= Substance of content
Structure of narrative transmition
Manifestation (verbal, cinematic, balletic etc.)
= Form of expression
= Substance of expression

Appendix C

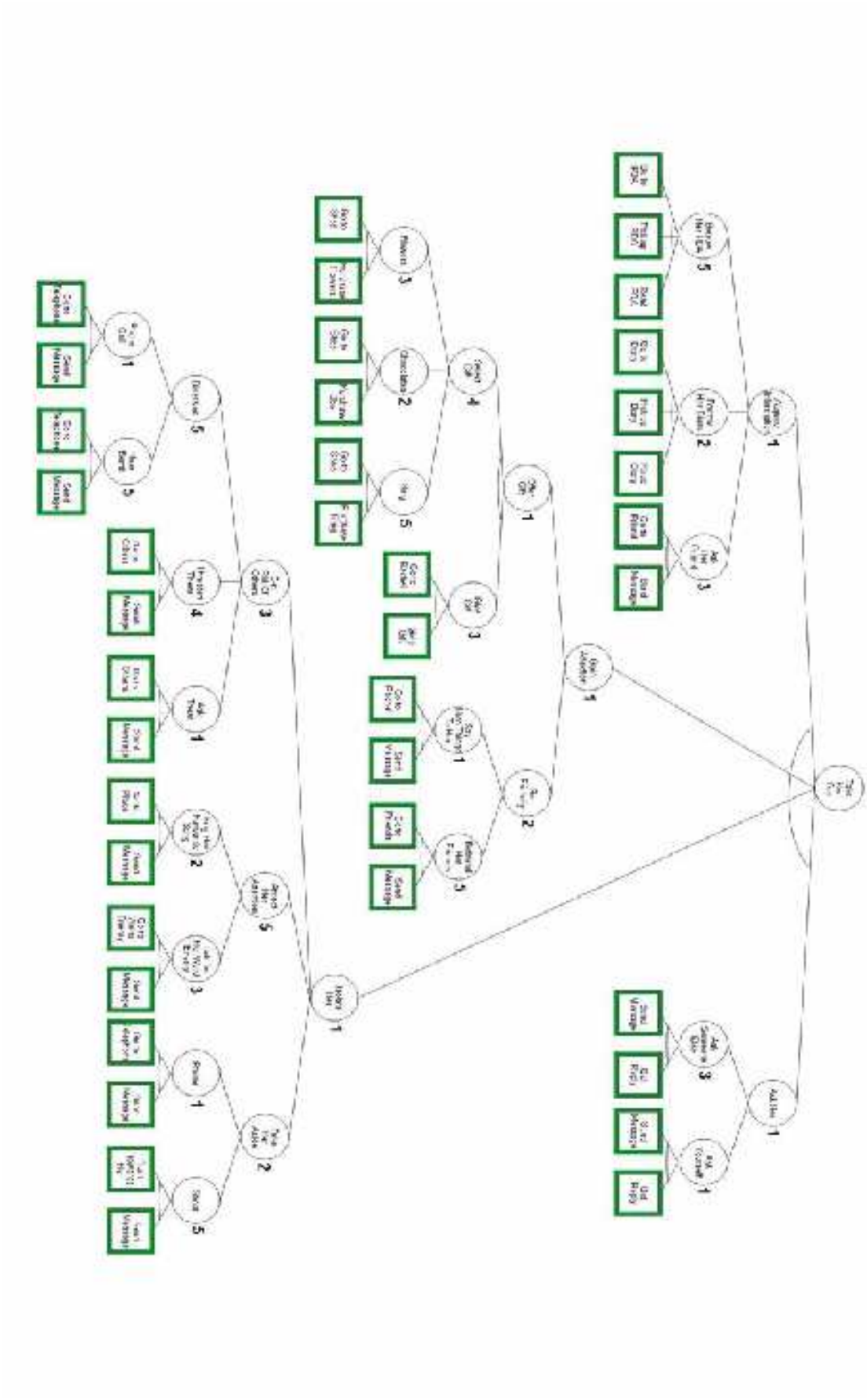
Martin’s narrative comparison table (Martin 86)

Aspect of narrative structure	Words used to describe it		
	Tomashevsky (1925)	**Barthes (1966)**	**Chatman (1978)**
Basic unit of narration	Motif – "smallest particle of thematic material"	Functional unit (cf Propp)	Narrative statement
Categories of units		Functions (actions linking story surface) and indices (static elements integrated at thematic level)	Process statements (events) and statis statements (existents)
Subclasses of Units	Bound motifs: Can't be omitted in retelling; dynamic (change situation) or static Free motifs: Can be omitted (not essential to plot line)	Cardinal functions – kernels - related actions that open/close uncertainty Indices: character traits, thoughts, atmosphere that require deciphering Functional catalysers: Optional actions filling narrative space between cardinal functions Informants: Minor indices that fix setting, time.	Actions (brought about by agent) Happenings Character (combines traits and existents) Setting
Interaction at level of action	Sequence of situations – conflicts between characters	Kernels with associated satellites make up a sentence from opening (choice) to end (consequences)	Kernels and satellites
Integration at higher level	Character, "the usual device for groupings together motifs"	Action – a complex of character roles involved in particular kinds of situation (cf Greimas)	Narrative macro-structures as described by Aristotle, Frye, Propp, other types of action – pattern, theme
Further integration	Syuzhet Theme	Level of "Narration" that reintegrates "functions and actions in the narrative communication".	

Appendix D

A character plan representation (I-Storytelling)

(Cavazza et al 02)



Appendix E

Game-Master Knowledge Elicitation rules

If *"Taking longer than expected"*
And *"It is a descriptive encounter"*
And *"The player is asking questions"*
Then report, **"Give short unambiguous answers that don't prompt further questions"**

If *"Taking longer than expected"*
And *"It is a social type encounter"*
And *"The scripted conversation has happened"*
And *"The expected player's initiated conversation has not happened"*
And not *"The player has initiated non-expected conversation"*
Then report, **"The NPC has to initiate conversation with the player and has to hint on the information given"**

If *"Taking longer than expected"*
And *"It is a social type encounter"*
And *"The scripted conversation has happened"*
And *"The expected player's initiated conversation has not happened"*
And *"The player has initiated non-expected conversation"*
And *"The majority of players are not involved or interested"*
And *"It is taking more than half an hour"*
Then report, "**The conversation with the NPC must be closed**".

If *"Taking longer than expected"*
And "It is an information gathering encounter"
And *"Insufficient information to proceed to the next encounter"*
Then report, **"Need for information".**

If *"Taking longer than expected"*
And *"It is a problem solving encounter"*
And *"The puzzle is solved"*
Then report, "**Force them on the next encounter**".

If *"Taking longer than expected"*
And *"It is a problem solving encounter"*
And *"The puzzle is not solved"*
And not *"The player is enjoying the challenge of the puzzle"*
Then report, "**Need for help to carry on quest**"

If *"Taking longer than expected"*
And *"It is a combat encounter"*
And *"The combat is stalemated"*
And not *"The stalemate is intentional"*
Then report, "**Need to influence in combat**"

If *"Experience of an unexpected branching of the story"*
And *"There is a single character involved"*
And not *"The player is happy to retire the character from the campaign"*
And not *"Quick rejoin of the character to the main party"*
Then report, "**Need to act on character**"

If *"Experience of an unexpected branching of the story"*
And *"Party pursues a player defined activity"*
And not *"The party coincidentally pursues future plot events"*
Then report, "**Need to act on plot**"

If *"Experience of an unexpected branching of the story"*
And *"Party pursues a player defined activity"*
And *"The party coincidentally pursues future plot events"*
And not *"The party has not omitted an essential encounter"*
Then report, "**Need to redirect the party towards plot**"

If *"Experience of an unexpected branching of the story"*
And *"The party incorrectly determine what is to be done next"*
Then report, "**Give them hints that they are going the wrong way**"

If *"Experience of an unexpected branching of the story"*
And *"The party reinvented itself"*
Then report, "**Can they still continue the mission?**"

Action expansions:

The conversation with the NPC must be closed
- The NPC actively cease the conversation.
- Another NPC acts to interrupt the conversation and talk away the conversation NPC.
- An NPC takes the player away (either by speaking to the player or other member of the player's party)

Need for information
- Meeting an NPC that they need to talk to (force the encounter to them).
- **Meet with an NPC (the patron) that is going to question them about what they know, assess their knowledge and highlight the gaps.**

Force them on the next encounter
- Pulling them by bringing the encounter to them by hinting on what the next encounter is (natural=consequence of the problem solving).
- Push them. Less satisfactory, out of character. (Something literally pushes them out of where they are). Contrived and not always possible.

Alternatively, remind them out of character to get on with it. Break of the immersion

Need for help to carry on quest
- Give them a hint by having them notice something.
- Give them an out of character hint.
- Solve it for them (either directly out of character or through an NPC)

Need to influence in combat
- The enemy makes a mistake
- The enemy withdraws or attempt to withdraw.
- You provide the player with the possibility to withdraw.

Need to act on character
- Agreement with player that this action will be resolved on a one to one session and offer of a temporary player for the meanwhile.
- With the agreement of the rest of the players, resolve it at that time.
- Kill off the character and take him out of play (kill, marry, prison etc..)

Need to act on plot
- Is this going to be an enjoyable subplot to have?
- How do I tie this back to the original story?
- Present some sort of insurmountable obstacle (provides thinking time).
- Drag them back to the main story and throw pieces of information

to re-generate interest in the main plot"

Need to redirect the party towards plot
- Present them with an obstacle.
- Present them with information that prioritises something else.
- Force them onto the next encounter.
- Let them go anyway and meet the encounter not properly prepared,

but make sure that they are going to be able to escape by provision of a way out.

Give them hints that they are going the wrong way
- Blank encounter. No information about what they should do next. Give them emptiness.
- If they don't pick up the hint, send another NPC that will point them in the right direction.

Can they still continue the mission?
- Do what the referee has prepared (information-wise)
- Break the session (for re-planning = question them about the re-invention and prepare adequately for the next session"

Appendix F

Emergent Narrative Scenario Back-Story

Backstory

10000 years ago

An alien survey vessel enters the Sol system searching for habitable planets for colonisation far beyond the outskirts of their normal empire and detects a breathable atmosphere on the water rich third planet. Entering orbit the sensors reveal the presence of complex life forms and early indications of an intelligent indigenous species. The crew decide to land in order to take specimens as this world looks highly promising. They land first in South America and interact with the original natives there. There they erect a marker stone to commemorate their first point of landing and their claim to this world. They have the locals translate their words into the native script and carve it into the stone in their own manner. They then move their ship across the Atlantic to survey the other continents, but as they do so they notice that their ships engines are struggling and so set down on the Giza plateau for repairs. When they do so they find to their horror that native bacteria are eating away at critical engine components, the aliens technology being semi-organic in nature. They will not be able to take off soon and furthermore the earthly infestation is liable to get deeper into the workings of the vessel and eliminate all power. In order to preserve the ship they bury it within the rock of the plateau itself, hermetically sealing it in the stone. They activate their emergency beacon and await rescue.

While they wait they proceed to collect samples, and interact with the natives, who regard them, after an initial demonstration of their powers, as gods.

Time passes and no help comes, unable to move freely outside their spaceship (the oxygen content of the earth's atmosphere is too high, and eats away rapidly at alien tissues) they recruit the natives to provide them with food and supplies. This is done through a priesthood, who are given access to the "gods" and certain artefacts of limited power. In time a temple complex is built up around the entrance to the ship, and the ordinary natives never see the "gods" directly only the priests who interpret the god's wishes and instruct the populace.

After some generations however even the aliens age and in order to preserve themselves they seal themselves into stasis chambers and close up the ship, putting in place safeguards between the temple and the ship to prevent nosy natives from interfering. (They cannot seal the tunnel as their rock boring device has degraded beyond further use due to bacterial infection)

6000 years ago

With the rise of the ancient Egyptian civilisation and the subsequent expansion of an organised state in the area, the early pharaoh, comes upon the plateau of Giza and the magnificent Sphinx, already weatherworn with age, nearby is a town and a temple of terrible demon worshipping magicians. There is a fierce battle and the local magicians cast terrible spells at the pharaohs army before numbers tell and the magicians flee into hiding and the temple is cast down and buried in the sand. The battle passes into Egyptian myth. The Sphinx as a great landmark is one factor that causes later Egyptian leaders to build the pyramids there.

However a religion that has survived 4000 years does not just disappear. The cult leaders disperse around the ancient world, using the artefacts they have been able to carry away to set up cells of the cult wherever they go. They find a world that tends to persecute magicians and witches and so the cult goes underground, awaiting the day when the gods will return.

50 Years ago

Passing through a sector of supposedly barren space a small alien scout craft picks up a faint distress call and comes to investigate. The aliens technology has advanced significantly since the first ship arrived and is even more dependant upon the organic components. As soon as they enter the atmosphere they start to lose power and crash in the new Mexico desert near the town of Roswell. Over the next few days the air force recovers the alien craft and a number of bodies which rapidly decay in the earth's high oxygen atmosphere. Similarly much of the alien vessel, including its power plant decays over the next few days. What is left is un-powered and incomprehensible, and is rapidly hidden away by the government and ends up in the air forces secret development facility in Area 51.

10 years ago

After years of study scientists in Area finally manage to produce a power supply that can work the alien computer rendering its records available, however they are incomprehensible.

5 years ago

Deep in the Amazon rainforest the ruins of an early Toltec city are being excavated, by Dr Y. In the heart of the city's temple is discovered a stone slab. On one side is an indecipherable script, cut deep into the stone with remarkable precision. On the other side, cut by stone tools is another indecipherable script, almost faded with age, beneath this, and clearly more recent are Toltec pictograms. This slab causes some interesting discussions in the archaeological community. Dr Y however is vilified for his translation of the Toltec pictograms.

4 years ago

Dr Y is picked up by the CIA and inducted into their Area 51 programme. Their monitoring of the scientific community spotted that one set of script on his slab matched the pictograms on the alien computer. With this slab as a guide they are able to translate they alien script to some degree and discover what the scout ship was doing when it crashed to earth.

6 months ago

Having identified the location of the first ship as Giza, the CIA recruits Professor X, to assist them in locating it. He is able to recall the battle of the Pharaoh with the magicians of Giza and locate the likely site of their temple.

The CIA now plans to investigate the temple site to see what they can discover about the first alien landing.

In order to maintain security the CIA has constructed a team of scientists and other personnel from the Roswell project to investigate the supposed location of the alien artefacts. However their team is not as reliable as they may suppose….

Appendix G

Character definitions

Character 1:

Colonel Paul Radsinsky (expedition leader)

Physical characteristics, general information:
Gender: Male
Nationality: American
Height: Tall
Body shape: Strong and muscular
Strength: Medium to high

Biography: (RPG/Conflict RPG)
The expedition leader is Colonel Paul Radsinsky, an ex air force special operations soldier now working for the CIA. He has been involved in the Area 51 project for some years but purely in a military capacity. He has no special skills in technology or archaeology.
Now 45 yrs of age this will probably be his last operational mission, before he retires to a desk job at Langley or the Pentagon. In all the missions he has carried out he has never left a deserving and loyal comrade behind or failed to achieve his objective. He is totally loyal to the USA and will do anything to protect it.

Personality traits: (Video Games)

1. **Brave**
   Although not suicidal, Colonel Radsinsky knows when and how to take risks.
2. **Blunt**

Considered rude by most of the people who had operated under his commandment, Colonel Radsinsky believes that ranks are being established for a reason and that he doesn't have to be considerate of other members of his squad as far as friendship is concerned. Being rude also encourage obedience and respect (sometimes) and leave no doubts on the hierarchy within the group.

3. **Focused**

One mission equals one objective. Colonel Radsinsky believes that one of the reasons why he has been so successful during his military career up to now is essentially due to his abnegation towards the objective of a mission. He knows from experience that the missions that do not achieve their objectives or fail to bring back brave and deserving soldiers home are the ones whose objectives are either to broad or numerous or where primary objectives are ignored and new objectives established while conducting a mission.

4. **Intransigent**

Colonel Radsinsky is intransigent in regards of what or who could interfere with the prime objectives of a mission. If elements of the squads do not behave for the interest of the mission and the United States of America, he would have no remorse in eliminating those elements. It happened in the past and he is convinced that it is part of his duty, for the interest of his country

and the mission to prevent non-loyal soldiers or untrusting encounters from putting the mission in peril.

Quirks: (Video Games) [Deepened personality without interfering with action decision of the character]

1. Colonel Radsinsky is deeply religious and often pray god when in mission, sometimes even during battlefield action.
2. Colonel Radsinsky has a deep aversion of the unknown. His missions are carefully planned and subject to very little improvisation on the intervention ground.

Priorities: (RPG/Conflict RPG)

1. Preserve the lives of all team members (excepting those who may turn out not to be loyal American citizens)
2. Protect humanity from any alien threat
3. Preserve the secrecy of the mission
4. Recover any alien technology discovered

How the character helps to define, belongs to the environment? (Interactive theatre)

In this particular story Colonel Radsinsky should help to define the environment by acting and guiding the different members of the party with caution. The environment is unknown to all the members of the squad and is potentially very dangerous. Although it is supposed that Alien life is by now totally extinguished, the CIA does not possess enough information on alien technology to confirm such supposition. On another hand, the squad also expects to face all kind of deadly traps possibly designed by ancient Egyptian priests to prevent foreigners to access the "gods".

How the character chooses to be in the environment, what are its objectives? (Interactive theatre)

Colonel Radsinsky's motivation to be in the environment is clear and justified by him being part of the squad and the leader of the mission.
His main objective in regards to the environment is to explore it until he finds something significant worth of military value that would justify the whole mission. Leave the environment and make sure no one else than the US forces can access the environment. If such task impossible then destroys the environment so no one can access any interesting discovery.

Occupation: (Interactive theatre): CIA group leader

Occupational activities: (Interactive theatre):

1. Give orders
2. Decide on team strategy
3. Decide on individual strategy
4. Dispatch teams
5. Express warning
6. Get respected
7. Ask Translation

Passion: (Interactive theatre): The success of the mission

Origin of passion: (Interactive theatre): Loyal and committed to the US government

Foible: (Interactive theatre): Personal glory and ambition

Virtues: (Interactive theatre): Honour and loyalty

Constraints: (RPG/Conflict RPG)

1. Cannot read hieroglyphs
2. Cannot read Alien language
3. Do not want to die

Emotioneering (Video Games / Freeman):

Character deepening elements: (Video Games)

Emotional pain & regrets: Colonel Radsinsky lost tragically his wife several years ago in a car accident. He since then accepted and volunteered for the most dangerous missions he could possibly be involved in. His secret motive is to get as high as he can in the American military hierarchy so he can justify to himself somehow the time he dedicated to the army and how worth that time spent in mission was worth over the time he didn't spent with his late wife during their life together.

Character 2:

Lieutenant Joe Bellini (second in Command)

Physical characteristics, general information:
Gender: Male
Nationality: American
Height: Tall
Body shape: Strong and muscular
Strength: High

Biography: (RPG/Conflict RPG)
Lieutenant Joe Bellini is a technical operative of the air force attached to the CIA operation to Giza. Joe Bellini is a technical wizard and has been working on the alien technology from the Roswell crash since the Americans were able to build a power source to make it work. He has picked up some of the alien language in the process of working with Dr Mike Brighton

His role in the mission is to assess any alien technology found to determine if it is safe to remove, and what items if there is a limit on weight and size should be removed first. Joe Bellini is loyal to the USA, and focussed on achieving the CIA mission.

Personality traits: (Video Games)

1. **Nervous possibly subject to panic:** Lieutenant Joe Bellini is a technical type of person and his position in the army has so far been more justified by his technical abilities and knowledge than his military achievements. Lieutenant Bellini has never been implicated in significant terrain mission since he joined the Air Force, let alone a dangerous one. His assignment to this mission has been decided according to his knowledge on alien technology and it is believed that the strong leadership of Colonel Radsinsky will compensate his inexperience in terrain situation. His position as the second in command is only justified by the fact that the squad is composed of only three military figures, one of which is the mission commander while the other one is just a simple soldier with no technical knowledge or expertise.
2. **Loyal:** Despite his inexperience, Lieutenant Bellini is trusted to be loyal to his country and the United State of America. Indeed, Lieutenant Bellini feels extremely grateful to the pentagon to have been assigned to deal with alien technology. He has no interest whatsoever in betraying its country if he wants to collect in the future the benefits of working on such technology.
3. **Individualistic:** Although loyal to the cause of the squad and the squad itself, Lieutenant Bellini is before all part of the mission because he believes that being the first to discover and understand alien technology will give him the leading edge in order to participate on any development made on it. He has high ambitions and plays in his interest first. It is clear in his head that he is not there to share the discovery of technology with the scientists on board for the secret operation, he will try to get the maximum information possible from them without revealing the extend of his own knowledge.
4. **Naïve:** Lieutenant has proven in the past in his army career to be subject to influences. Although this character trait is not ideal for this type of mission, the people in charge of this mission prefer to incorporate someone that will be easily convinced if the arguments are

rightly presented than a strong headed technical expert that might prove to be a potential problem to deal with once the mission completed.

Quirks: (Video Games) [Deepened personality without interfering with action decision of the character]

1. Has a high pretension as far as his physical aspect is concerned. Fancy himself as a good-looking man who can seduce women very easily.

Priorities: (RPG/Conflict RPG)

1. Discover alien technology.
2. Identify its purpose, and determine if it is safe to remove.
3. Recover all technology possible.
4. Prevent the destruction of any alien device (value to humanity outweighs other considerations)

How the character helps to define, belongs to the environment? (Interactive theatre)
Although not in his environment, Lieutenant Bellini's role as a member of the squad will help in defining the environment when dealing with alien technology. His knowledge and expertise will help in giving a new and thorough dimension to the alien technological aspect.

How the character chooses to be in the environment, what are its objectives? (Interactive theatre)
Lieutenant Bellini chooses to be in the environment voluntarily as he sees in this mission the opportunity to get involved in some great development projects. Although he is nothing like a courageous and brave military person, Lieutenant Bellini believes that the team of experts that accompany him should prevent him to be exposed to dangerous situations.

Occupation: (Interactive theatre): Second in command

Occupational activities: (Interactive theatre):

1. Express orders on what to remove from the ship
2. Decide on individual strategy
3. Express warning
4. Ask Translation
5. Prevent the destruction of the alien technology

Passion: (Interactive theatre): The finding of groundbreaking technologies
Origin of passion: (Interactive theatre): The perfect launching pad for a career and potentially future commercial activities
Foible: (Interactive theatre): Selfish and naive

Virtues: (Interactive theatre): loyalty

Constraints: (RPG/Conflict RPG)

1. Cannot read hieroglyphs
2. Do not want to die

Emotioneering (Video Games / Freeman):

Character deepening elements: (Video Games)

Regret: Regrets to have come and volunteered for the mission when things start to become a bit dangerous. Regret to have found his limits so early in his life and to have been so naive in regards to the danger involved in that type of operation.

Character 3:

Dr Brighton (The Vilified Archaeologist)

Physical characteristics, general information:
Gender: Male
Nationality: American
Height: Medium height
Body shape: Thin
Strength: Weak

Biography: (RPG/Conflict RPG)
Dr Brighton is a young professor assistant from New York He has a doctorate in archaeology from Harvard in the US and a speciality in ancient South American
Cultures. He is the original translator of the alien language and as such is a necessary person to have along in order to translate any writings found.

Dr Brighton is most excited about this mission, as success will prove that there is a link between aliens and the tablet he found in Brazil, and could be one of the most important discoveries humankind has ever made. He believes that the aliens, being more advanced than us must be benign in their intentions, and that in time their existence must become public knowledge. Recovery of artefacts is one step closer to establishing communications with the aliens.

He hates Professor Camberra who led the campaign in academia to destroy his career following the publication of his translation of the "toltec" slab. This is increased by the fact that Professor Camberra has not had the decency to apologise now that he can see that Dr Brighton was right all along.

Personality traits: (Video Games)

1. **Passionate:** Dr Brighton is a passionate person and passion is very much part of his personality. He wouldn't have gone that far in his research, studies and work if it were not for his passion of archaeology. The fact that Dr Brighton is passionate can lead him sometimes to excitement or overexcitement. That's how he ended up in a fierily argument with Professor Camberra when carried away by his excitement he exposed a theory on a possible alien language while still not possessing enough proofs to back the theory up. Such passion for his research has already, in the past, pushed Dr Brighton to take risks for the sake of science. Despite local advice of not going, he decided to cross half of an hostile Brazilian jungle on his own to find an ancient "Totec" he suspected would be situated near a source in the middle of the jungle. His passion is often translated into an unreasonable curiousness.
2. **Not forgiving:** Dr Brighton is a person to speak his mind and can shows determination when needed. In shorts he is not the type of person that would leave matters unresolved. Although a generally good person and in any case spiteful, Dr Brighton has still not forgiven Professor Camberra's critics and his attempt to ruin his career. That you don't agree with someone's idea is after all something that is inevitable and common in the scientific and research community, however, trying to ruin somebody's career to prove a point is unacceptable. Dr Brighton promised himself that one day or another he would make Professor Camberra pay heavily for his defiance.
3. **Militant:** Dr Brighton is a militant at heart, name a cause and you would certainly find out that he is actively engaged within that cause. Global warming, AIDS in Africa, Whale hunting in the Nordic countries are all causes where Dr Brighton is an active member. Although being employed by the CIA for this mission, he still thinks it is the American government's duty to make the matter of Alien technology public and recognise its existence within the Area 51. He has been militating and expressed his opinions on the matter for some times with his different superiors. For this reason Colonel Radsinsky has been advised to keep an eye on him. The only reason for Dr Brighton to be part of the mission lies in the simple fact that he is the one who made the first alien translation and knows the language better than anyone else within the CIA, he could be an important asset if the squad finds more samples of Alien language.

4. **Franc:** Let's face it. If Dr Brighton would have been playing the research game better and bent down in respect to Professor Camberra when it was advised to him, his career could have been very different. However, this is not part of his personality. Contrarily to Professor Camberra who is an eminent researcher working with an impressive team of research assistants and used to diplomacy, Dr Brighton prefers to consider himself as independent and like to see for himself rather than placing judgment on what is being reported to him. For that reason Dr Brighton does not use diplomacy and deals with people in an open and franc manner, whatever the consequences.

Quirks: (Video Games) [Deepened personality without interfering with action decision of the character]

1. Talk in a sarcastic manner.
2. Whistle when nervous

Priorities: (RPG/Conflict RPG)

1. Discover alien artefacts
2. Communicate with the aliens
3. Make the alien existence public knowledge
4. Preserve humanity from any threat

How the character helps to define, belongs to the environment? (Interactive theatre)
The fact that Dr Brighton established the link between the Brazilian "Totec" and Alien language, as well as being the first and certainly only expert in the world in understanding and generating the language makes him belonging to the environment. Furthermore, his presence, intervention and explanations in regards to Alien language will help in defining the environment too. Dr Brighton is going to be essential in defining the environment once inside the space ship, since his knowledge of the language is going to help in revealing more about the Alien civilisation.

How the character chooses to be in the environment, what are its objectives? (Interactive theatre)
Dr Brighton sees being part of the team as an achievement and an incredible source of excitement too. He is, at the end of the day the one that discovered and translated the Alien language and feels somehow as if he sort of owns it. His motivation for being in the environment are immense, he is driven there by passion and curiousness but also the desire to be one of the first to have access to Alien civilisation. His objectives are simple, help the squad in gathering information about Alien technology and civilisation, ideally make contact with Aliens if possible and ultimately make the existence of Aliens public.

Occupation: (Interactive theatre): Researcher, Specialised in ancient languages

Occupational activities: (Interactive theatre):

1. Decide on individual strategy
2. Protect the human race
3. Bring back proof of the alien's existence
4. Communicate with alien

Passion: (Interactive theatre): Learn more of the Alien civilisation
Origin of passion: (Interactive theatre): Bring it to the public eye and be recognised as the one who discovered and conquered the Alien civilisation. Do with Aliens what Champellion did with Egyptian pharaohs at the beginning of the century.
Foible: (Interactive theatre): Excessive enthusiasm can lead to unreasonable behaviour.

Virtues: (Interactive theatre): Ethically correct.

Constraints: (RPG/Conflict RPG)

No language constraints

1. Do not want to die

Emotioneering (Video Games / Freeman):

Character deepening elements: (Video Games)

Ashamed: Dr Brighton is actually ashamed of how foolish he has been as a young researcher and how people like Professor Camberra have taken advantage of him, exploiting his findings as there own while mocking him. He actually almost gave up his research and suffered psychologically badly of the whole incident. In his mind, the only way to regain his soiled honour is to prove to the world that he was right about the alien language system and that Professor Camberra in particularly was wrong. Then given the advantage he would have gained on the public opinion from his findings, do his best to totally ruin Professor Camberra's reputation as a serious researcher and present him as conservative, afraid of the future and senile.

Character 4:

Professor Camberra (Leading Egyptologist)

Physical characteristics, general information:
Gender: Male
Nationality: South African
Height: Tall
Body shape: Thin
Strength: Very weak (old)

Biography: (RPG/Conflict RPG)
Professor Camberra is an aged and respected Egyptologist only recently brought in to the Area 51 project. He has been brought in because of his extensive knowledge of Egyptian myth and has been able to identify the likely place of the temple of the magicians on the Giza plateau. He is being brought along because of his expertise and skill in excavations and knowledge of early Egyptian languages.

Professor Camberra is still in a state of some shock following the revelation of the prehistoric alien presence on earth and his sanity has been somewhat shaken as a result, although he still doesn't believe in it and consider the idea as pure heresy. Much of what may be found will challenge established historical record. However he has been assured that the alien involvement will never remain public and that to assist in the cover story he will be able to report on the ancient ruins in so far as they are not connected to the alien presence. This would in itself be a great discovery, which would win him world renown. Of course this is dependant upon the alien element remaining secret, clearly he would be either mocked if it were found out that he was part of an expedition looking for ancient aliens, or humiliated if their actual presence were confirmed due to his earlier opposition to Dr Brighton's assertions. Anyway he is sure that they are not going to discover anything there and that this whole expedition is doomed to fail, however, he has all interests in being part of it.

Personality traits: (Video Games)

1. **Manipulator:** Professor Camberra has been on the scene for a long time now; he knows the tricks and techniques of diplomacy. He knows also that in today's society the best and only way to get something is to use those techniques to push people against each other in order to achieve what you are seeking for. He has however no problem of conscience and actually believes that showing signs of conscience is actually an admission of weakness. Lying is okay as long as it is does not interfere with long term plans.
2. **Coward:** Needless to say that Professor Camberra is also far to be a hero. His changes of opinions and sides are somewhat famous for who knows about the world of Egyptology. He often, in the past, took position in favour of the strongest parties, only to change side when things would not work in his favour. He somehow managed his career that way and managed to get where he is mostly due to political placements. Although his double face has helped him to build his career, the times have changed and another of those trick could possibly terminates his career as an

academic and museum curator. It is essential for him to demonstrate that the position he took against Dr Brighton was correct and justified.

3. **Self-interested**: The prospect of, at the same time, finish off to ruin Dr Brighton's career and regain a certain scientific reputation by discovering a major piece of archaeology, was more than what Professor Camberra needed to volunteered for the mission. He would in any case gain from the expedition and considers it as a golden opportunity to give his career a second wind. If the aliens do not exist, he will be able to report on their non-existence and finish off Dr Brighton. On another hand, if they do exist, thing he doesn't believe in anyway, he negotiated with the CIA for the exclusive rights to comment on new Egyptian discoveries in the temple and the insurance that the American government will not go public on the alien matter (Which he is sure they won't anyway). The American government will take care of Dr Brighton and make sure he does not reveal anything of sensitive matter by giving him two options, either he is quiet and enjoys a nice academic career in a good research centre or he will not be published anywhere and will get a reputation of conspiracy theorist that would end his career or worse. In any case, if the situation recommends it, he will himself make sure that nothing of academic value in regards to the existence of aliens is made public.
4. **Uncertain:** Professor Camberra has not enjoyed the smoothest of rides in the last 20 years or so; he slowly lost most of the confidence that made him a very convincing researcher and a leading Professor. He is nowadays very much pessimistic in regards to his own abilities to deliver a good and appropriate judgment and has developed over the last few years a certain difficulty in committing himself and making decisions. Generally balancing the for and against of every important decision until someone makes a decision for him. He has also started to consult a psychologist in the last few month in regards to that issue and fears for his own sanity, all of which is unknown to the CIA services that have mounted this operation.

Quirks: (Video Games) [Deepened personality without interfering with action decision of the character]

1. Repeat often the same story
2. Speaks with a very posh accent

Priorities: (RPG/Conflict RPG)

1. Prevent knowledge of the aliens becoming public.
2. Discover everything possible about the ancient "magicians" culture
3. Remain sane!

How the character helps to define, belongs to the environment? (Interactive theatre)

The character perfectly belongs to the environment since he is a Egyptologist. He also helps to define the environment in the first part of the game when the squad has to deal with exploring ancient Egyptian temples. His knowledge of the environment will bring depth and clarity to the environment.

How the character chooses to be in the environment, what are its objectives? (Interactive theatre)

The motivations and objectives for the character to be part of the environment are quite well established. From an archaeologist perspective, that's where he belongs and the prospect of making ground-braking discovery is the main source of motivation. From a career perspective, being part of this expedition is a chance to finish off research rival Dr Brighton.

Occupation: (Interactive theatre): Leading Egyptologist

Occupational activities: (Interactive theatre):

1. Decide on individual strategy
2. Prevent the knowledge of Alien culture to go public
3. Bring back proof of the ancient magical rites' existence

Passion: (Interactive theatre): Discover everything of interest about the ancient Egyptian culture.
Origin of passion: (Interactive theatre): He is an Egyptologist and a major discovery would give a boost to his fading career
Foible: (Interactive theatre): Selfish and self interested, mentally weak, pride

Virtues: (Interactive theatre): His determination for success is enormous; this is his last chance to make any lasting effect on his scientific community.

Constraints: (RPG/Conflict RPG)

1. Cannot understand Alien Language
2. Do not want to die

Emotioneering (Video Games / Freeman):

Character deepening elements: (Video Games)

Regret: Professor Camberra actually regrets what he did against Dr Brighton. He thinks he has overreacted and should not have done what he has done to him, especially since it has failed and Dr Brighton is still an active member of the community. Professor Camberra thought Dr Brighton was another of those cocky young doctors who think that they are going to revolutionise the world, he was wrong and Dr Brighton has shown real charisma and dignity in their argument. He knows he should have calm down the matter and apologise when he had the opportunity to do so a couple of years ago when Dr Brighton let the door opened to solving the different between the two men. However pride and reputation were taken into account and apologises never came.

Character 5:

Doctor Maria Collimore (Professor assistant)

Physical characteristics, general information:
Gender: Female
Nationality: American-Egyptian
Height: Tall
Body shape: Thin
Strength: Strong

Biography: (RPG/Conflict RPG)
Born of an American mother and an Egyptian father, Dr Maria Colimore is Professor Camberra's star pupil and openly loyal to him. He has insisted that she is necessary for any expedition to help him with notes and analysis. However Dr Maria Colimore is also a member of an ancient cult, descended from the magicians of Giza, who believes that the time is right for the ancient gods to awaken. She hopes that she will be able to enter the inner sanctum of the gods and arouse them from their sleep of millennia, she will then be elevated to their high priestess with rulership over mankind in the service to her gods.

Dr Maria Colimore is skilled in Egyptology and hieroglyphics and can also read and speak the alien language. She is also possessed two "magic" items handed down through the centuries. A ring that can project from lightning and an amulet that both provide shielding and identification to the gods. She has no real knowledge of what lies beyond the fabled temple of the gods however and will have to react as the others to the discoveries as they are made.

Personality traits: (Video Games)

1. **Loyal:** At least to Professor Camberra. He was the one who interviewed her when she seeking for a job in Egyptology, he offered it to her despite her lack of academic record in the subject, thinking that her passion for ancient Egyptians would compensate her weak research background. She is a woman of charisma and can be blunt from time to time but on another hand she can be loyal to the ones that have helped her in the past.

2. **Fanatical:** Since she was a little girl, her only role models were the ancient gods. She grew up with them and as always thought she has a privileged place next to them. Her faith is such that she decided not to go to study Egyptology despite her knowledge and background on the sole reason that she thought that university Egyptology teaching would have perverted her faith with pseudo science and beliefs of ancient civilisations and possibly make a mockery of her ancient gods. She believes that it is time for the gods to be awaken and she is ready to sacrifice herself for them. Only the concrete proof of alien existence and strong persuasion could make her change her mind in regards to the gods and their existence.
3. **Brave:** Brave might not be a word strong enough to describe Dr Maria Collimore. Nothing seems to scare her and risk seems to be something she seeks for. Give any dangerous order and she would certainly be one of the first in action. She knows she has been good with the gods in the past and that she serves their cause, if she comes to die it is because the gods wanted to have her with them. She is not scared to die.
4. **Sentimental:** Often people hide their feelings and display an alternative image to their character. This is the case of Dr Maria Collimore. Despite several short relationships, she never found the right person; she committed herself to abandon everything once she has found the one that would show her passion, love and synergy. She might be determined but love could directly influence her decision if she was going to meet it.

Quirks: (Video Games) [Deepened personality without interfering with action decision of the character]

1. Dark: She is a dark person and can sometimes look like she has a murderer's mind. She like blood and monsters and likes to talk about it. More often than not in order to scare people around her and get the image of a spooky girl associated with her.

Priorities: (RPG/Conflict RPG)

1. Awaken the gods, all other considerations are secondary (even at the cost of her life, since they can resurrect her, however she must remain alive at least until she has a chance to awaken them)
2. Preserve the secrecy of the cult
3. Recover any magic items (alien technology) for the cult.

How the character helps to define, belongs to the environment? (Interactive theatre)

Her knowledge of Egyptology and more particularly her knowledge of ancient gods will help to define the environment, especially areas of cult and religious practices.

How the character chooses to be in the environment, what are its objectives? (Interactive theatre)

Her motivations for being in the environment are clear and her objectives is to awake the gods so they can rule once again on earth as they did thousands of years ago. Find the gods and address them.

Occupation: (Interactive theatre): Research assistant / Ancient cult member

Occupational activities: (Interactive theatre):

1. Decide on individual strategy
2. Prevent the secrecy of the public
3. Bring back proof of the ancient magical rites' existence
4. Awake the gods
5. Not afraid to die

Passion: (Interactive theatre): Awaken the gods
Origin of passion: (Interactive theatre): Faith
Foible: (Interactive theatre): Could be influenced by someone she trust

Virtues: (Interactive theatre): Determined

Constraints: (RPG/Conflict RPG)

No language constraints

Emotioneering (Video Games / Freeman):

Character deepening elements: (Video Games)

Hiding a secret: She is the member of a cult dedicated to the Egyptian ancient gods, Ultimately she is ready to sacrifice herself for the gods to awake and run the world again.

Character 6:

Sergeant Dave McLean (The bag carrier)

Physical characteristics, general information:
Gender: Male
Nationality: British
Height: Tall
Body shape: Very strong
Strength: Very strong

Biography: (RPG/Conflict RPG)
Sergeant Dave Mc Lean is a CIA operative, ex Navy Seal, assigned to the Area 51 project. He has been working there for 10 years providing security for the facility and muscle for operations that it has been necessary to carry out.

In fact he is actually an agent of MI5 that has been put into place in the US years ago during the cold war when Britain suspected that the US was concealing weapon research programmes from its allies, in fact the suspicious activity turned out to be the work related to the Roswell crash.
Sergeant Dave Mc Lean is well liked and trusted by the Area 51 staff and as such has for some time been able to pass information out of the facility to the British government including the alien language. With this information they have been able to build a detector to pick up alien communications and listen in to the alien distress beacon and read what it was saying. In addition to the call for help that the Roswell ship picked up it periodically also transmits the alien commanders report, sent just in case they didn't make it, that earth is a fertile world ripe for colonisation, it will however need some planetary engineering to reduce the oxygen content of the atmosphere, this will sadly cause the death of most animal life but plant life should survive and will provide a viable biosphere that can be populated with alien animals.
The British government is clearly concerned about this, since another alien vessel could pick up the transmission and earth could not repel the aliens if they decided to colonise the planet. It is therefore a priority to shut off this beacon. Unfortunately their detector is non-directional and so they were unable to locate the source. They must rely on the American mission to locate the alien ship and hope that their operative can shut down the beacon.

Personality traits: (Video Games)

1. **Double faced:** Sergeant Dave Mc Lean has no problem being nice with someone while thinking of his next move to trick that person. He is a special agent of the British MI5 and as a spy is very well trained at lying and manipulating people's impressions and opinions of him. He has no conscience whatsoever as far as the people part of the squad are concerned. The only thing that matters is the beacon and his cover. In other word, do whatever you can do achieve those objectives and use anyone you need to for it.
2. **Ruthless:** The first rule of his mission is that no emotion should interfere with the mission. Similar missions have been conducted before where he had either to befriend or befriend and eliminate people that could have interfered with his mission. He has got one aim and no one must discover his cover, the unfortunate who will uncover him would have to die, whoever it is.
3. **Controlled / calm:** He has been trained to be the best and get the best out of any situation. Sergeant Dave Mc Lean's decisions are always the right ones for the goals and causes he is involved in. He never makes mistakes and always manages to keep p his cover. He is calm in any situation and do not let fear or passion alter his decision-making. He has especially trained himself and gathered information about the other members of the party to actually make the right decisions when needed.

4. **Loyal:** Sergeant Dave Mc Lean is before all, loyal to the queen of Britain. Although h has been working inside the American military system for years, he has never done anything than serving her majesty the best he could, often risking his own life in the action. Nothing could make him change his mind in regards to his mission.

Quirks: (Video Games) [Deepened personality without interfering with action decision of the character]

1. Quiet: Sergeant Dave Mc Lean does not say much generally, however, when he speaks, his words are meticulously chosen and always the right ones for the situation.

Priorities: (RPG/Conflict RPG)

1. Discover the alien beacon
2. Shut down or destroy the beacon, all other considerations are secondary
3. Preserve his cover

How the character helps to define, belongs to the environment? (Interactive theatre)
The character will help in defining the environment when or if the Alien beacon is discovered. He is the only one aware of the existence of the beacon and will bring a lot of information that will help to define the environment and justify himself in regards to how he belongs to the environment.

How the character chooses to be in the environment, what are its objectives? (Interactive theatre)
Primary objective is to discover this beacon, so he has all interest in being very co-operative with the rest of the expedition until he finds the beacon. Being co-operative will also keep his cover safe.

Occupation: (Interactive theatre): Bag Carrier (British agent)

Occupational activities: (Interactive theatre):

1. Decide on individual strategy
2. Prevent the secrecy of the public
3. Shut down / destroy alien beacon

Passion: (Interactive theatre): Switch off the beacon
Origin of passion: (Interactive theatre): Loyalty to the Queen of England and the human race.
Foible: (Interactive theatre): None

Virtues: (Interactive theatre): Save the human race from alien invasion

Constraints: (RPG/Conflict RPG)

1. Cannot understand hieroglyph

Emotioneering (Video Games / Freeman):

Character deepening elements: (Video Games)

Hide a secret: He is not who he pretends to be and could potentially be much more of a key player than the other member of the squad would think at the first impression.

Appendix H

Character personalities

Role: Colonel Radsinsky
ID: 1

Emotion	Threshold	Decay
Love	8	8
Hate	5	5
Hope	3	7
Fear	8	3
Satisfaction	8	3
Relief	5	5
Fears-Confirmed	5	5
Disappointment	5	5
Joy	8	3
Distress	8	5
Happy-for	9	5
Pity	8	5
Resentment	9	5
Gloating	5	5
Pride	7	7
Shame	4	7
Gratification	5	5
Remorse	10	10
Admiration	8	8
Reproach	3	7
Gratitude	7	10
Anger	3	7

Role: Lieutenant Bellini
ID: 2

Emotion	Threshold	Decay
Love	3	7
Hate	5	5
Hope	8	3
Fear	3	7
Satisfaction	5	5
Relief	4	4
Fears-Confirmed	5	5
Disappointment	3	5
Joy	3	5
Distress	3	5
Happy-for	4	5
Pity	4	6
Resentment	4	5
Gloating	5	5
Pride	3	7
Shame	3	7
Gratification	2	6
Remorse	3	6
Admiration	3	7
Reproach	3	7
Gratitude	7	7
Anger	4	8

Role: Dr Brighton
ID: 3

Emotion	Threshold	Decay
Love	4	8
Hate	3	7
Hope	2	7
Fear	9	2
Satisfaction	7	4
Relief	5	5
Fears-Confirmed	5	5
Disappointment	3	5
Joy	2	6
Distress	8	5
Happy-for	9	5
Pity	7	3
Resentment	7	5
Gloating	5	5
Pride	5	10
Shame	2	8
Gratification	5	5
Remorse	10	10
Admiration	10	2
Reproach	3	7
Gratitude	4	10
Anger	3	7

Role: Professor Camberra
ID: 4

Emotion	Threshold	Decay
Love	8	2
Hate	2	7
Hope	7	2
Fear	1	5
Satisfaction	4	4
Relief	5	5
Fears-Confirmed	5	5
Disappointment	4	4
Joy	2	6
Distress	2	5
Happy-for	10	5
Pity	10	2
Resentment	10	5
Gloating	5	5
Pride	2	10
Shame	2	8
Gratification	2	5
Remorse	10	10
Admiration	10	2
Reproach	2	4
Gratitude	10	1
Anger	2	5

Role: Dr Maria Collimore
ID: 5

Emotion	Threshold	Decay
Love	2	8
Hate	2	7
Hope	3	5
Fear	10	1
Satisfaction	5	5
Relief	5	5
Fears-Confirmed	5	5
Disappointment	8	2
Joy	10	6
Distress	10	5
Happy-for	10	5
Pity	10	2
Resentment	10	5
Gloating	5	5
Pride	8	2
Shame	8	1
Gratification	8	5
Remorse	2	10
Admiration	2	10
Reproach	8	5
Gratitude	9	2
Anger	8	5

Role: Sergeant MC Lean
ID: 6

Emotion	Threshold	Decay
Love	8	8
Hate	8	5
Hope	3	7
Fear	8	3
Satisfaction	8	3
Relief	5	5
Fears-Confirmed	5	5
Disappointment	8	8
Joy	8	3
Distress	8	5
Happy-for	9	5
Pity	8	5
Resentment	9	5
Gloating	5	5
Pride	10	7
Shame	10	7
Gratification	5	5
Remorse	10	10
Admiration	8	8
Reproach	8	4
Gratitude	10	10
Anger	10	4

Appendix I

Double appraisal code

The reactive process -

The implementation of the double appraisal is carried out at the reactive level via the appraisal of events for emotional reactions. The code below, in order to illustrate the process, shows a small part of the implementation developed for this thesis.

– The TOM-appraisal method:

This method is called in the coping mechanism and evaluates the impact of an event on an emotional mind represented in the process. In the case of the implementations developed in this work, the mind used in the double appraisal is a representation of the minds of either the agent or other agents. These representations are totally independent from any agents, and therefore do not interfere with the agents actions and decisions.
The function matches any given event to events available in the XML database that defines each agent. If an event matches, it is used to generate an emotional reaction. The event pool is then cleared in order that it does not interfere with further appraisals.

```
public void TOMAppraisal(Event event) {
       Reaction emotionalReaction;

emotionalReaction = _emotionalReactions.MatchEvent(event);
       if(emotionalReaction != null)
       GenerateTOMEmotions(event, emotionalReaction);
       _eventPool.clear();
              }
                                    ----
Get emotional reaction
If emotional reaction exists
Generate emotions.
                                    ----
```

The coping mechanism:

The coping mechanism first accesses a set of valued actions previously selected via SelectAction() in the action tendencies class. It assigns an event to these actions and makes them directly appraisable via the TOMappraisal(). The method selects the action that scored the highest emotional impact for processing.

```
public void Coping() {
       ValuedActionSet Actions;
       ValuedAction[] _actions = {null,null,null};
       ValuedAction va = null;
       Event _event = null;
       float vaValue = 0;
       float TOMValue = 0;
       float BestValue = 0;
       ValuedAction BestAction = null;
       TOMAction _TOMAction = null;
       TOMAction[] ActionList = {null, null};
       _TOMState = new EmotionalState();
       _TOMState = _emotionalState;
       int ActionSetLength = _actions.length;

       Actions = _actionTendencies.SelectAction(_emotionalState);
       for(int i = 0; i < ActionSetLength ; i++){
              _actions[i] = Actions.GetValuedAction(i);
                     va = _actions[i];
                     if(va == null){
                     vaValue = 0;
                     }
                     else{
                _event = ActionToEvent(va);
              TOMAppraisal(_event);
              TOMValue = _TOMState.GetEmotionImpact();
                _TOMAction = new TOMAction(va, TOMValue);
              ActionList[i] = _TOMAction;
                  }
       }
       for(int i = 0; i < ActionSetLength ; i++){
              if(ActionList[i] == null){
              }
              else{
              if(ActionList[i].GetTOMValue() > BestValue){
                     BestAction = ActionList[i].GetValuedAction();
                            BestValue = ActionList[i].GetTOMValue();
                     }
              }
       }
       _selectedAction = BestAction;
       }
                                    ----
Initialise values
For every action do
   Get valued action
   If valued action exists
       Convert valued action to event
       Appraise event
       Get Action from emotional impact
       Add action to action list
    End if
End for

For every action do
   If current Action exists
       If action value > best value
```

```
            Best action = get best valued action
            Best value = get value from action.
          End if
      End if
End for

Selected action = Best Action
                                    ----
```

The action to event mechanism:

This function generates an event from any given action, such that it can be appraised as part of the coping mechanism. The action is always turned against itself so that the agent can appraise it as if directed towards itself.

```
private Event ActionToEvent(ValuedAction va){
       Event e;
       String subject = null;
       String action = null;
      String target = _self;
      actionValued = va.GetAction();
       StringTokenizer st = new
       StringTokenizer(actionValued.toString(),"(");
        if (st.hasMoreTokens()) action = st.nextToken();
       e = new Event(subject,action,target);
       return e;
        }
                                    ----
Initialise values.
Get String from Valued action
Get action from Valued action string
Get event from action token
                                    ----
```

The action selection set mechanism:

This function checks available actions for a value and a relevance to the process. A processed action is then created and is composed of a valued action, a float (intensity), a Boolean state and a position (int). If the slot in the valued action set is empty or null, then the processed action is added in the slot, and its state is turned to true such that it can replace itself until all the slots are full. If the slots are all full and more actions need to be processed, the lowest action intensity is selected, and if the new value is higher, it replaces this. It is finally compiled in an array that is returned as the type for the coping mechanism. The valued action set is invoked at the beginning of the coping mechanism and the actions selected for double appraisal are those selected by this mechanism.

```
public ValuedActionSet SelectAction(EmotionalState emState) {
             Iterator it;
             Action a;
             ValuedAction va;
             ProcessedAction lowestAction = null;
             ValuedActionSet ValuedSet = null;
             float lowestIntensity = 100;
             int lowestPosition = 0;
             ValuedActionSet Set = null;
             ProcessedAction[] _selectedActions = {null, null, null};
             ValuedAction[] Actions = {null, null, null};
             float[] Intensities = {0,0,0};
```

```
              int _ActionList = _selectedActions.length;
              float intensity =0;

              it = _actions.iterator();
                 int counter = -1;
              while(it.hasNext()) {

             a = (Action) it.next();
              va = a.TriggerAction(emState.GetEmotionsIterator());
                    if (va!=null) counter++;
                  intensity =
a.GetActionIntensity(emState.GetEmotionsIterator());

if (counter <_ActionList
     {
        if(va != null){
       _selectedActions[counter] =  new ProcessedAction(va, intensity,
counter);
       Actions[counter] = va;
       Intensities[counter] = intensity;
}
              } else  {

       for(int i = 0; i < _ActionList ; i++){
              if(_selectedActions[i] == null)
                  {
                     lowestAction = null;
                      lowestIntensity=0;
                      lowestPosition = i;
               break;
              else if (i==0) {
                      lowestAction = _selectedActions[0];
                      lowestIntensity=Intensities[0];
                      lowestPosition = 0;
                             }

       if(_selectedActions[i].GetActionIntensity() <= lowestIntensity){
                      lowestAction = _selectedActions[i];
                      lowestIntensity = Intensities[i];
                      lowestPosition = i;
              break;
                     }
                      }

  // Add an entry if value higher than lowest entry //

       if((intensity > lowestIntensity) || (lowestAction==null)){
       _selectedActions[lowestPosition] = new ProcessedAction(va, intensity,
lowestPosition);
       Actions[lowestPosition] = va;
       Intensities[lowestPosition] = intensity;
       }
         }

       }

       ValuedSet = new ValuedActionSet(Actions);
       System.out.println("Value Set " + ValuedSet);
       return ValuedSet;
       }
                                    ----
Initialise values
While there are more actions
   Get next action
   Get valued action from action
   If valued action exists
      Increment valued action counter
```

```
   End if
   Get action intensity
   If counter < number of selected actions
       If valued action exists
           Current selected action = current processed action
           Add valued ation to list of action
           Add intensity to list of intensities
       Else
           For every selected action do
                If selected action does not exist
                   Lowest action does not exist
                   Lowest intensity is 0
                   Lowest position is current
                   Exit for
                 Else if I equals to 0
                    Lowest action is current selected action
                    Lowest intensity is current lowest intensity
                    Lowest position is 0
                  End if

                 If selected action's intensity <= lowest intensity
                    Lowest action is current selected action
                    Lowest intensity is current lowest intensity
                    Lowest position is current position
                 End if
          End For

          If intensity > lowest intensity or lowest intensity does
not exist
               Create new processed action with Lowest positioned
selected action
               Position valued action in lowest position in actions
list
               Position intensity in lowest position in intensities
list

          End if
          Create Set of action values.
          Return valued set
                                ----
```

The deliberative process -

The implementation of the double appraisal at the deliberative level differs from its reactive counterpart, in the sense that the process does not assess and select actions but intentions. Therefore, whilst the appraisal process is similar, the overall approach is different at coping level.

The deliberative coping mechanism:

This initially accesses a set of valued intentions previously selected and ordered by the agent's planner. Since these intentions have been assigned an event, they are therefore directly appraisable. The coping mechanism extracts the event for each intention and re-appraises it reactively in a non connected emotional state (as in the reactive layer). It then selects the intention that scored the highest emotional impact for processing. The plan associated with this action is executed, starting by its next unexecuted step.

```
public void Coping() {
             IntentionSet IS;
             ValuedIntention vi= null;
             Intention i = null;
             Intention intention=null;
             Intention HighestIntention = null;
             Event event = null;
                Event _event = null;
             float TOMValue = 0;
             Plan p = null;
             ActiveEmotion fear;
             ActiveEmotion hope;
             float fearIntensity;
             float hopeIntensity;
             Step copingAction;
             float HighestValue = 0;
             _TOMState = new EmotionalState();
             _TOMState = _emotionalState;

             Intention[] ListIntentions = {null, null, null};
             int _ListIntentions;
             _ListIntentions = ListIntentions.length;

             IS = _planner.GetRelevantIntentions();
             for( int a = 0; a < _ListIntentions; a++){
             vi = IS.GetValuedIntention(a);


             if(vi!= null){
                    intention = vi.GetIntention();
                    event = vi.GetEvent();
                   _event = ActionToEvent(event);
                    TOMAppraisal(_event);
                    TOMValue = _TOMState.GetEmotionImpact();
                  if(TOMValue > HighestValue){
                    HighestValue = TOMValue;
                    HighestIntention = intention;
                           }
                    }

             }
             i = HighestIntention;
             if(i != null) {
                    p = _planner.ThinkAbout(i);
                    }

             if(_actionMonitor == null && p != null) {
                    copingAction = p.UnexecutedAction();
                    if(copingAction != null) {
                           i.SetAnActionWasMade(true);
                           fear = i.GetFear();
                           hope = i.GetHope();
             if(fear!= null) fearIntensity = fear.GetIntensity();
             else fearIntensity = 0;
             if(hope!= null) hopeIntensity = hope.GetIntensity();
             else hopeIntensity = 0;

             _selectedAction = copingAction;
             _selectedActionValue = Math.max(hopeIntensity,fearIntensity);
                 }
             }
      }
                                    ----
Initialise values
For each intention in intention list do
```

```
   Get current valued intention
   If valued intention exists
      Get intention from valued intention
      Get event from valued intention
      Appaise event
      Get emotion impact value
      If Value > highest value
         Highest value = Value
         Highest intention = intention
       End if
     End if
End for
If highest intention exists
   Start planner
End if

If action monitor does nos exist and planter exists
    Get coping action from planner
    If coping action exists
        Get fear emotion
        Get hope emotion
        Get fear intensity
        Get hope intensity
        Selected action = coping action
        Compute selected action value
     End if
End if
                                  ----
```

Intention set selection mechanism:

The main function of this mechanism is to modify the existing FAtiMA intention selection mechanism so that it does not only return one relevant intention but several stored in an array. An intention set has been defined in the deliberative layer along with a valued intention type. Intentions are returned to the coping mechanism as an array.

The method checks intentions for intensity and returns a set of intentions. These are composed of the intention name, its intensity and the relevant event that correspond to the intention for appraisal purposes.

```
public IntentionSet GetRelevantIntentions() {
             Iterator it;
             ActiveEmotion fearEmotion;
             ActiveEmotion hopeEmotion;
             ActivePursuitGoal g;
             Intention intention;
             IntentionSet _IntentionSet = null;
             ValuedIntention vi = null;
             ValuedIntention _vi = null;
             ValuedIntention lowestIntention = null;
             float fearIntensity;
             float hopeIntensity;
             float intensity;
             float lowestIntensity = 100;
             Intention _lowestIntention;
             int lowestPosition = 0;
             int inext;
             ActivePursuitGoal Goal = null;
             ArrayList SuccessConditions = null;
```

```
		Event _event = null;
		Intention[] Intentions = {null,null,null};
		ValuedIntention [] IntentionList = {null,null,null};
		int _IntentionList;
		boolean state = false;


		_IntentionList = IntentionList.length;
		it = _intentions.values().iterator();

		while (it.hasNext()) {
			hopeIntensity = 0;
			fearIntensity = 0;
			intention = (Intention) it.next();
			if ((hopeEmotion = intention.GetHope()) != null) {
				hopeIntensity = hopeEmotion.GetIntensity();
			}
			if ((fearEmotion = intention.GetFear()) != null) {
				fearIntensity = fearEmotion.GetIntensity();
			}
			g = intention.getGoal();
			if (g.CheckSucess()) {

_emotionalState.AppraiseGoalSuccess(hopeEmotion, fearEmotion, g);
	it.remove();
	RegisterGoalSuccess(intention);
				}
			else if (g.CheckFailure()) {
_emotionalState.AppraiseGoalFailure(hopeEmotion, fearEmotion, g);
	it.remove();
	RegisterGoalFailure(intention);
				}
				else {
			intensity = Math.max(hopeIntensity, fearIntensity);
			Goal = intention.getGoal();
			SuccessConditions = Goal.GetSucessConditions();
			_event = toEvent(SuccessConditions);
			_vi = new ValuedIntention(intensity, intention, _event,
state);
					for(int i = 0; i < _IntentionList ; i++){

	if(IntentionList[i] == null){
	vi = new ValuedIntention(intensity, intention, _event, true);
			IntentionList[i] = vi;
			Intentions[i] = intention;
			_vi = vi;
			break;
			}
				}

	for(int i = 0; i < _IntentionList ; i++){
			if(IntentionList[i] == null){
			lowestIntention =null;
			lowestIntensity = 0;
			_lowestIntention = Intentions[i];
			lowestPosition = i;
			break;
			}

	if(IntentionList[i].GetIntentionValue()<lowestIntensity){
			lowestIntention =IntentionList[i];
			lowestIntensity = IntentionList[i].GetIntentionValue();
			_lowestIntention = Intentions[i];
			lowestPosition = i;
			break;
			}
				}
```

```
      if(intensity > lowestIntensity){
      if(_vi.GetState() == false){
      vi = new ValuedIntention(intensity, intention, _event, true);
            IntentionList[lowestPosition] = vi;
            Intentions[lowestPosition] = intention;
                                       }
                                 else {}
                           }

                     }
            }

      _IntentionSet = new IntentionSet(IntentionList);
      return _IntentionSet;
      }
                                  ----
Initialise values
Get intention list
While there are intentions left
    Get next intention
    Get hope intensity
    Get fear intensity
    Get intention's goal
    If goal is successful
       Appraise goal success
       Register goal success
    Else if goal is a failure
       Appraise goal failure
       Register goal failure
    Else
       Get highest hope or emotion intensity value
       Get new goal
       Get success conditions
       Get event from conditions
       Get valued intention
       For each intention within the intention list
          If current intention does not exist
              Get Valued intention
              Put valued intention in the list
              Put intention in the list
              Get out of the for
           End if
       End for

       For each intention within the intention list do
            If current intention does not exist
                Lowest intention does not exist
                Lowest intensity = 0
                Lowest intention is current intention
                Lowest position is current position
                Get out of cicle
            End if
       End for

       Lowest intention = current intention
       Lowest intensity = value from intention
       Lowest position is current position
     End if
End while

If intensity > lowest intensity
    Create new valued intention with selected intention and
intensity
```

```
    Position valued intention lowest position within intention list
    Position intention in lowest position in intentions set
End if

Create intention set from intention list
Return intention set
                                ----
```

The Intention to event method:

This method takes the success conditions for an intention (goal) and changes it into an event using a tokeniser. The subject is set to null and the target to self as in the reactive process.

```
public Event toEvent(ArrayList SuccessConditions){
       String AL;
       Event e = null;
       String subject = null;
       String action = null;
      String target = null;
       StringTokenizer st;
       String name;
       String literals;
       boolean constant = true;
       ListIterator li;
       Condition Cond;
       li = SuccessConditions.listIterator();

       while (li.hasNext()) {
              Cond = (Condition) li.next();
              AL = Cond.getName().toString();

              if (AL == null)
              return null;
              if (AL.charAt(0) == '?') {
              constant = false;
              AL = AL.substring(1);
              }
              st = new StringTokenizer(AL, "(");
              name = st.nextToken();
              if (st.hasMoreTokens()) {
              st = new StringTokenizer(st.nextToken(), ",");
              subject = st.nextToken();
              if (st.hasMoreTokens()) {
              st = new StringTokenizer(st.nextToken(), ",");
              action = st.nextToken();
              if (st.hasMoreTokens()) {
              st = new StringTokenizer(st.nextToken(), ")");
              target = st.nextToken();
                     }

              }
       }
              else literals = null;
                     }

       subject =null;
       target = _self;

       e = new Event(subject,action,target);
       e.SetTarget(target);
       e.SetAction(action);
       e.SetSubject(subject);

       return e;
```

```
      }
                                  ----
Initialise values
Get success conditions

While there are success conditions left
    Get next condition
    Get condition string
    If condition name does not exist
       Exit function
    End if

    Get name, subject, action and target tokens from string
End while

Create new event
Set event target
Set event action
Set event subject
Return event
```

Appendix J

Story extension

Original story: Story 1:
Colonel - Let's be clear about what we are all about to do! No one has ever been down there! Our intelligence reported this site has a potential threat to our land security! We all know why we are here today! The technology possibly hidden in there is all that matters to us. In the unlikely event of an encounter of any type, we are to wipe this place down and make sure no one or nothing ever come out of this temple! Dead or alive!
Colonel - God bless you all. Military personnel in formation, the others behind me, keep an eye for traps, and do not loose sight of each other. All right, let's go!
Lieutenant - Yes Sir!
Sergeant – Following your order Sir!
Professor – Yes sir, yes!
Doctor – OK Sir!
Researcher – Following your order Sir!
Colonel – Explores temple
Lieutenant - Explores temple
Sergeant – Explores temple
Professor – Explores temple
Doctor – Explores temple
Researcher – Explores temple
Sergeant – Colonel! Here! Here come here. I have something odd here; it looks like a metal door with strange writings on top of it!
Colonel - Professor! Are these hieroglyphs there above the door say anything of what might be behind it?
Professor - Hum Yes Colonel!, Well, this is strange, these do not appear to be conventional hieroglyphs! There are actually two sets of text there. One that can be interpreted as a death threat to any mortal disturbing the lizard gods, no idea whose these can be! The other one although looks like Egyptian hieroglyphs contains many symbols I have never encountered and does not make any sense to me I am afraid!
Colonel - Ok, Everybody step back! We are going to blow this one up and see what it is hiding. Bellini, MCLean hold assault position!
Professor - Colonel, this temple is thousands of years old, this door is magnificent and such artefact has never been discovered before! Surely we can't just blow it up, we need to find a way to open it or leave it as it is. This is an archaeological wonder!
Colonel - I am not sure you are getting the whole picture there Professor! Right here and right now I am in charge! You do what I tell you to do when I tell you to do it!
Colonel – Destroys the door and the door opens
End of scene!

Lengthened Story 1:
Non-dramatic and non-meaningful actions added in *italics*

Colonel - Let's be clear about what we are all about to do! No one has ever been down there! Our intelligence reported this site has a potential threat to our land security! We all know why we are here today! The technology possibly hidden in there is all that matters to us. In the unlikely event of an encounter of any type, we are to wipe this place down and make sure no one or nothing ever come out of this temple! Dead or alive!
Colonel - God bless you all. Military personnel in formation, the others behind me, keep an eye for traps, and do not loose sight of each other. All right, let's go!
Lieutenant - Yes Sir!
Sergeant – Following your order Sir!
Professor – Yes sir, yes!
Doctor – OK Sir!
Researcher – Following your order Sir!
Colonel – Explores temple
Lieutenant - Explores temple
Sergeant – Explores temple
Professor – Explores temple
Doctor – Explores temple
Researcher – Explores temple
Sergeant – Colonel! Here! Here come here. I have something odd here; it looks like a metal door with strange writings on top of it!
Colonel - Professor! Are these hieroglyphs there above the door say anything of what might be behind it?
Professor - Hum Yes Colonel!, Well, this is strange, these do not appear to be conventional hieroglyphs! There are actually two sets of text there. One that can be interpreted as a death threat to any mortal disturbing the lizard gods, no idea whose these can be! The other one although looks like Egyptian hieroglyphs contains many symbols I have never encountered and does not make any sense to me I am afraid!
Colonel - Ok, Everybody step back! We are going to blow this one up and see what it is hiding. Bellini, MCLean hold assault position!
Professor - Colonel, this temple is thousands of years old, this door is magnificent and such artefact has never been discovered before! Surely we can't just blow it up, we need to find a way to open it or leave it as it is. This is an archaeological wonder!
Colonel - I am not sure you are getting the whole picture there Professor! Right here and right now I am in charge! You do what I tell you to do when I tell you to do it!
Colonel – Lieutenant, bring me the detonator!
Lieutenant – Here you are Colonel!
Colonel – Ok, back off now!
Lieutenant –Back off
Researcher –Back off
Professor –Back off
Doctor –Back off
Sergeant –Back off
Colonel – Destroys the door and the door opens
End of scene!

Appendix K

Questionnaire example

Presentation of Backstory - Interaction – User choices – Scenario 1

Decision 1	
Decision 2	
Decision 3	
Decision 4	
Decision 5	
Decision 6	
Decision 7	
Decision 8	
Decision 9	
Decision 10	

Question 1: What are the 3 most meaningful* actions in this scenario? By order of importance: - mark them between 1 and 10 with 10 the highest value	
Action 1:	
Action 2:	
Action 3:	

* - meaningful in this context refers to the importance of the
of the actions on the unfolding of the story

Question 2: What are the 3 most dramatic* actions in this scenario? By order of importance: - mark them between 1 and 10 with 10 the highest value	
Action 1:	
Action 2:	
Action 3:	

* - Dramatic in this context refers to how interesting
the action is to the reader

Question 3: Rank this story according to the following:
1 = Very Bad
2 = Bad
3 = Good
4 =Very good

Answer:

Interaction – User choices – Scenario 2

Decision 1	
Decision 2	
Decision 3	
Decision 4	
Decision 5	
Decision 6	
Decision 7	
Decision 8	
Decision 9	
Decision 10	

Question 4: What are the 3 most meaningful* actions in this scenario? By order of importance: - mark them between 1 and 10 with 10 the highest value	
Action 1:	
Action 2:	
Action 3:	

* - meaningful in this context refers to the importance of the
of the actions on the unfolding of the story

Question 5: What are the 3 most dramatic* actions in this scenario? By order of importance: - mark them between 1 and 10 with 10 the highest value	
Action 1:	
Action 2:	
Action 3:	

* Dramatic in this context refers to how interesting the action is to the reader

Question 6: Rank this story according to the following:
1 = Very Bad
2 = Bad
3 = Good
4 =Very good

Answer:

Presentation of Character definitions

Question 7: In the view of these character definitions do you think you would have made the same choices?

Yes - No

If no – explain what you feel you would have done differently:

Question 8: Which Scenario did you prefer best?

Appendix L

Stories generated by the system

Story 1:

Colonel - Let's be clear about what we are all about to do! No one has ever been down there! Our intelligence reported this site has a potential threat to our land security! We all know why we are here today! The technology possibly hidden in there is all that matters to us. In the unlikely event of an encounter of any type, we are to wipe this place down and make sure no one or nothing ever come out of this temple! Dead or alive!
Colonel - God bless you all. Military personnel in formation, the others behind me, keep an eye for traps, and do not loose sight of each other. All right, let's go!
Lieutenant - Yes Sir!
Sergeant – Following your order Sir!
Professor – Yes sir, yes!
Doctor – OK Sir!
Researcher – Following your order Sir!
Colonel – Explores temple
Lieutenant - Explores temple
Sergeant – Explores temple
Professor – Explores temple
Doctor – Explores temple
Researcher – Explores temple
Sergeant – Colonel! Here! Here come here. I have something odd here; it looks like a metal door with strange writings on top of it!
Colonel - Professor! Are these hieroglyphs there above the door say anything of what might be behind it?
Professor - Hum Yes Colonel!, Well, this is strange, these do not appear to be conventional hieroglyphs! There are actually two sets of text there. One that can be interpreted as a death threat to any mortal disturbing the lizard gods, no idea whose these can be! The other one although looks like Egyptian hieroglyphs contains many symbols I have never encountered and does not make any sense to me I am afraid!
Colonel - Ok, Everybody step back! We are going to blow this one up and see what it is hiding. Bellini, MCLean hold assault position!
Professor - Colonel, this temple is thousands of years old, this door is magnificent and such artefact has never been discovered before! Surely we can't just blow it up, we need to find a way to open it or leave it as it is. This is an archaeological wonder!

Colonel - I am not sure you are getting the whole picture there Professor! Right here and right now I am in charge! You do what I tell you to do when I tell you to do it!
Colonel – Destroys the door and the door opens
End of scene!

Story 2:

Colonel - Let's be clear about what we are all about to do! No one has ever been down there! Our intelligence reported this site has a potential threat to our land security! We all know why we are here today! The technology possibly hidden in there is all that matters to us. In the unlikely event of an encounter of any type, we are to wipe this place down and make sure no one or nothing ever come out of this temple! Dead or alive!
Colonel - God bless you all. Military personnel in formation, the others behind me, keep an eye for traps, and do not loose sight of each other. All right, let's go!
Lieutenant - Yes Sir!
Sergeant – Following your order Sir!
Professor – Yes sir, yes!
Doctor – OK Sir!
Researcher – Following your order Sir!
Colonel – Explores temple
Lieutenant - Explores temple
Sergeant – Explores temple
Professor – Explores temple
Doctor – Explores temple
Researcher – Explores temple
Doctor - Colonel, everyone, I have something strange there. There are some writings on this stone. A strange drawing and some hieroglyphs!
Doctor - These are not your usual Egyptian statues! If you look around the necks, they all have a different symbol. It is believed that these are representing ancient gods, prior to the ones to which most of Egyptian mythology is based upon. I have been studying these for some times now. My only conclusion being that it seems to refer to dark gods - our equivalent to evil!!
Colonel - OK nothing to worry about here!. Come on everybody; remember what we are looking for, a sort of entrance to another chamber!
Colonel - Here! Here come here. Hell man, I think this thing might be real after all.
Colonel - Professor! Are these hieroglyphs there above the door say anything of what might be behind it?
Professor - Hum Yes Colonel!, Well, this is strange, these do not appear to be conventional hieroglyphs! There are actually two sets of text there. One that can be interpreted as a death threat to any mortal disturbing the lizard gods, no idea whose these can be! The other one although looks like Egyptian hieroglyphs contains many symbols I have never encountered and does not make any sense to me I am afraid!
Colonel - Ok, Everybody step back! We are going to blow this one up and see what it is hiding. Bellini, MCLean hold assault position!
Professor - Colonel, this temple is thousands of years old, this door is magnificent and such artefact has never been discovered before! Surely we can't just blow it up, we need to find a way to open it or leave it as it is. This is an archaeological wonder!

Colonel - I am not sure you are getting the whole picture there Professor! Right here and right now I am in charge! You do what I tell you to do when I tell you to do it!
Colonel – Destroys the door and the door opens
End of scene!

Story 3:

Colonel - Let's be clear about what we are all about to do! No one has ever been down there! Our intelligence reported this site has a potential threat to our land security! We all know why we are here today! The technology possibly hidden in there is all that matters to us. In the unlikely event of an encounter of any type, we are to wipe this place down and make sure no one or nothing ever come out of this temple! Dead or alive!
Colonel - God bless you all. Military personnel in formation, the others behind me, keep an eye for traps, and do not loose sight of each other. All right, let's go!
Lieutenant - Yes Sir!
Sergeant – Following your order Sir!
Professor – Yes sir, yes!
Doctor – OK Sir!
Researcher – Following your order Sir!
Colonel – Explores temple
Lieutenant - Explores temple
Sergeant – Explores temple
Professor – Explores temple
Doctor – Explores temple
Researcher – Explores temple
Researcher - Colonel!, Here!, Here come here.. I have something odd here; it looks like a metal door with strange writings on top of it!
Colonel - Lieutenant! Have you got any idea what these inscriptions might mean?
Lieutenant - Colonel, these seem to be the same symbol set we recovered in New-Mexico. I couldn't translate it into the details but it seems to refer to some sort of farm land or exploitation next to a digit symbol by the look of things!. The last line reads the sun must meet the eye! Not sure what that means!
Researcher - I think I got it Colonel!! If you look down the diagram, it is not an eye, although it looks like it, but a hole in an eclipse type shape. Just like this door and the small round shape it has there in the middle. Let me orient the beam of light from my electric torch directly towards the hole!
Door opens!
End of scene!

Story 4:

Colonel - Let's be clear about what we are all about to do! No one has ever been down there! Our intelligence reported this site has a potential threat to our land security! We all know why we are here today! The technology possibly hidden in there is all that matters to us. In the unlikely event of an encounter of any type, we are to wipe this place down and make sure no one or nothing ever come out of this temple! Dead or alive!

Colonel - God bless you all. Military personnel in formation, the others behind me, keep an eye for traps, and do not loose sight of each other. All right, let's go!
Lieutenant - Yes Sir!
Sergeant – Following your order Sir!
Professor – Yes sir, yes!
Doctor – OK Sir!
Researcher – Following your order Sir!
Colonel – Explores temple
Lieutenant - Explores temple
Sergeant – Explores temple
Professor – Explores temple
Doctor – Explores temple
Researcher – Explores temple
Doctor - Colonel, everyone, I have something strange there. There are some writings on this stone. A strange drawing and some hieroglyphs!
Doctor - Oh my god, this is fascinating, my grand father was right all along! These are the four element guardians, they represent ancient gods, prior to the ones to which most of Egyptian mythology is based upon!. If the predictions are right they shall return within 7 days of their temple being penetrated! By entering this chamber we have provoked their return! The infidels will all die and I shall trust them with my life! This family talisman should revive the sacred guardians!
Statues are starting to be animated and move towards the party
Colonel - In the chest, Fire at the red light in the chest! Fire! Fire!
Statues are not stoppable
Statues kill Lieutenant
Colonel - Out! Everybody out! Mission abandon! Out!!!
End of scene!

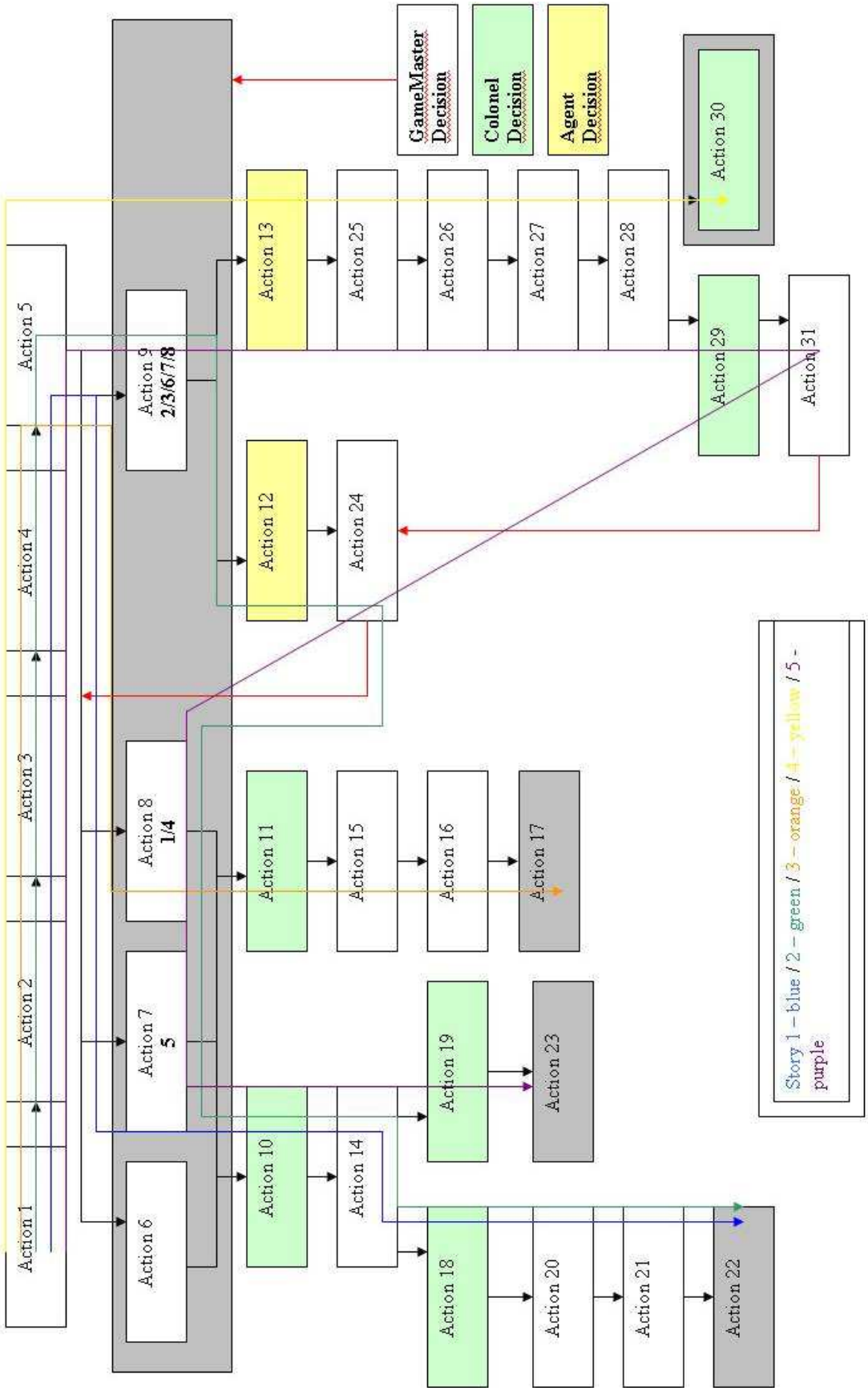
Story 5:

Colonel - Let's be clear about what we are all about to do! No one has ever been down there! Our intelligence reported this site has a potential threat to our land security! We all know why we are here today! The technology possibly hidden in there is all that matters to us. In the unlikely event of an encounter of any type, we are to wipe this place down and make sure no one or nothing ever come out of this temple! Dead or alive!
Colonel - God bless you all. Military personnel in formation, the others behind me, keep an eye for traps, and do not loose sight of each other. All right, let's go!
Lieutenant - Yes Sir!
Sergeant – Following your order Sir!
Professor – Yes sir, yes!
Doctor – OK Sir!
Researcher – Following your order Sir!
Colonel – Explores temple
Lieutenant - Explores temple
Sergeant – Explores temple
Professor – Explores temple
Doctor – Explores temple
Researcher – Explores temple

Doctor - Colonel, everyone, I have something strange there. There are some writings on this stone. A strange drawing and some hieroglyphs!
Doctor - Oh my god, this is fascinating, my grand father was right all along! These are the four element guardians, they represent ancient gods, prior to the ones to which most of Egyptian mythology is based upon!. If the predictions are right they shall return within 7 days of their temple being penetrated! By entering this chamber we have provoked their return! The infidels will all die and I shall trust them with my life! This family talisman should revive the sacred guardians!
Statues are starting to be animated and move towards the party
Colonel - In the chest, Fire at the red light in the chest! Fire! Fire!
Statues are not stoppable
Statues kill Lieutenant
Colonel - You stupid weirdo! (to Doctor)
Colonel – Kill Doctor
Statues stop and break into pieces
Colonel - OK nothing to worry about here!. Come on everybody; remember what we are looking for, a sort of entrance to another chamber!
Colonel - Here!, Here come here.. Hell man, I think this thing might be real after all.
Colonel - Professor! Are these hieroglyphs there above the door say anything of what might be behind it?
Professor - Hum Yes Colonel!, Well, this is strange, these do not appear to be conventional hieroglyphs! There are actually two sets of text there. One that can be interpreted as a death threat to any mortal disturbing the lizard gods, no idea whose these can be! The other one although looks like Egyptian hieroglyphs contains many symbols I have never encountered and does not make any sense to me I am afraid!
Colonel - This is a door, therefore it should open one way or another, look for clues on the structure of the door and the wall!
Colonel accidentally orients the light beam onto the door and triggers the opening of the door - End of scene!

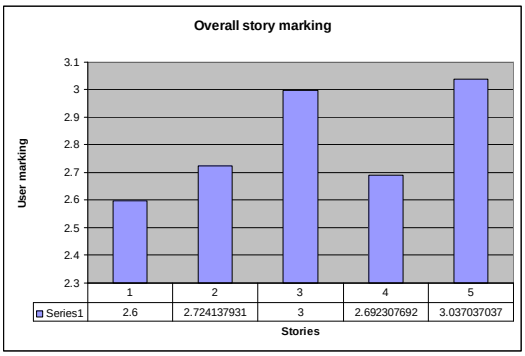
Appendix M

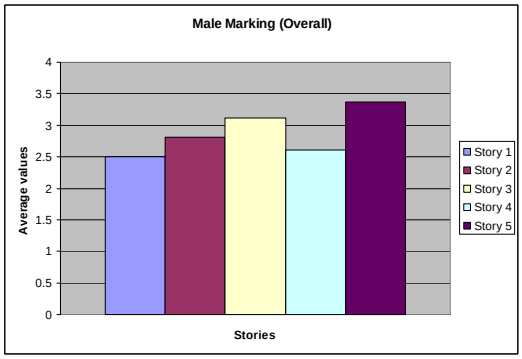
Stories representation

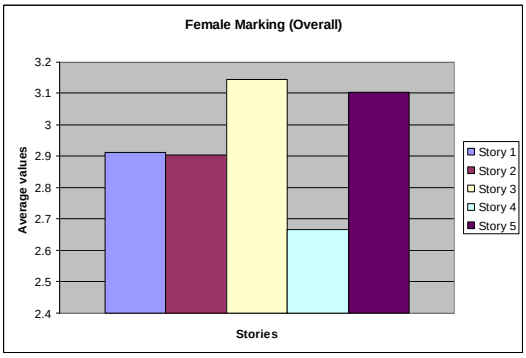

GameMaster Decision
Colonel Decision
Agent Decision
Action 1
Action 2
Action 3
Action 4
Action 5
Action 6
Action 7 5
Action 8 1/4
Action 9 2/3/6/7/8
Action 10
Action 11
Action 12
Action 13
Action 14
Action 15
Action 16
Action 17
Action 18
Action 19
Action 20
Action 21
Action 22
Action 23
Action 24
Action 25
Action 26
Action 27
Action 28
Action 29
Action 30
Action 31
Story 1 – blue / 2 – green / 3 – orange / 4 – yellow / 5 - purple

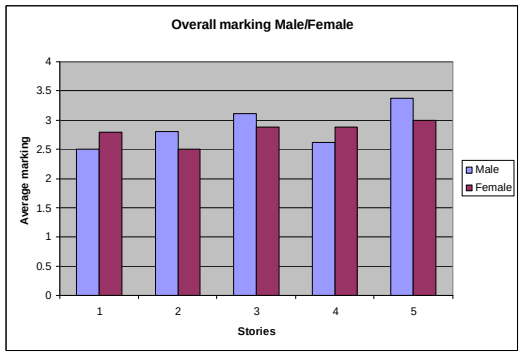
Appendix N

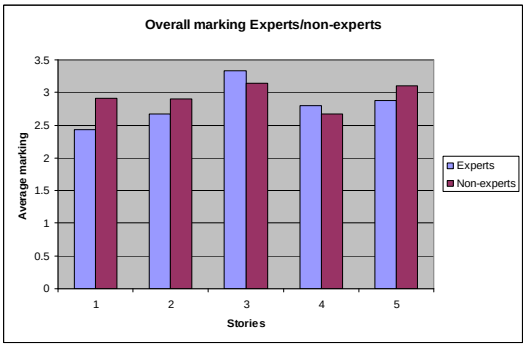
Evaluation results

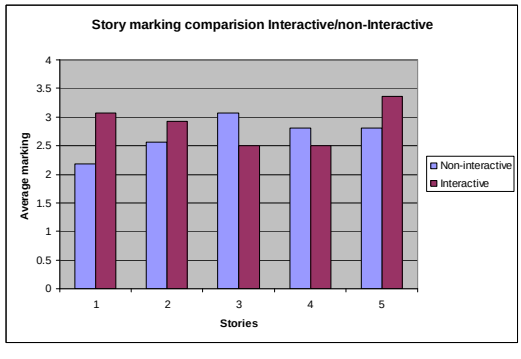


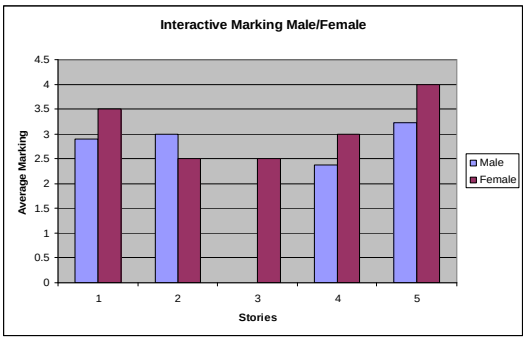


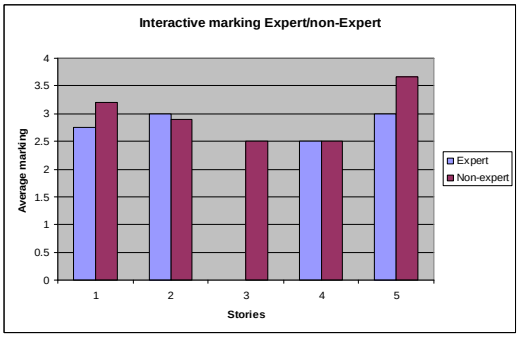


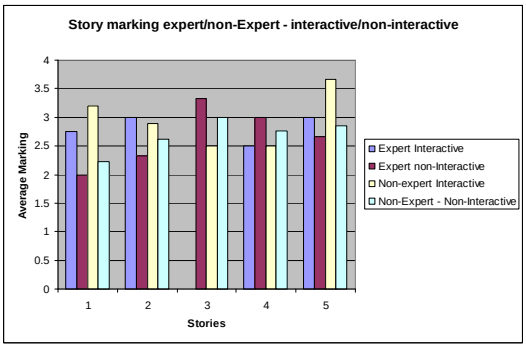


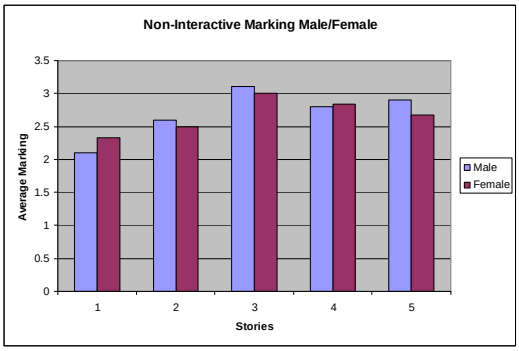


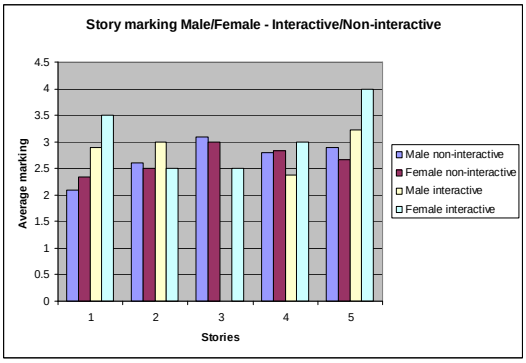


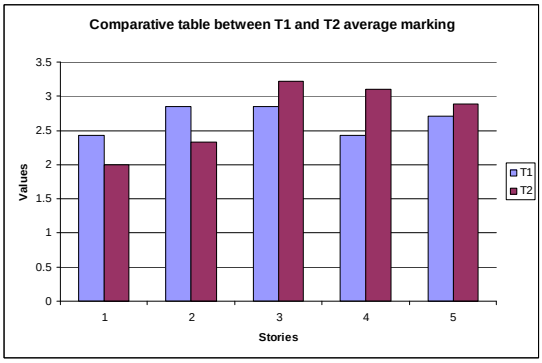

Interactive Marking Male/Female
Average Marking
Stories
Male
Female

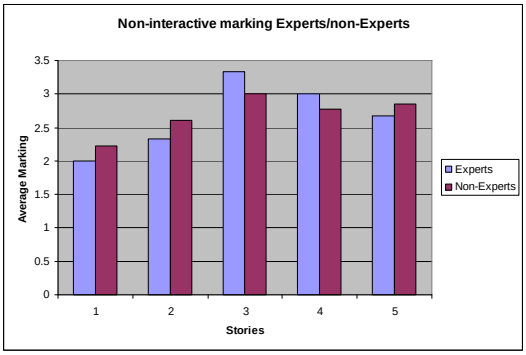

Interactive marking Expert/non-Expert
Average marking
Stories
Expert
Non-expert

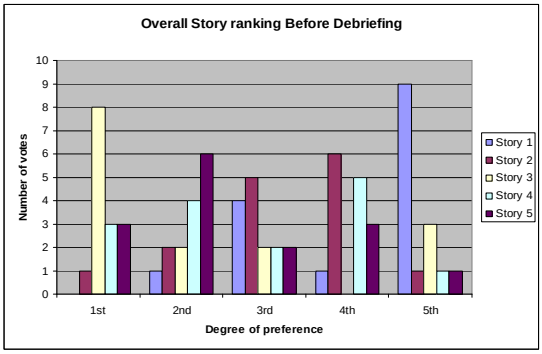

Story marking expert/non-Expert - interactive/non-interactive
Average Marking
Stories
Expert Interactive
Expert non-Interactive
Non-expert Interactive
Non-Expert - Non-Interactive

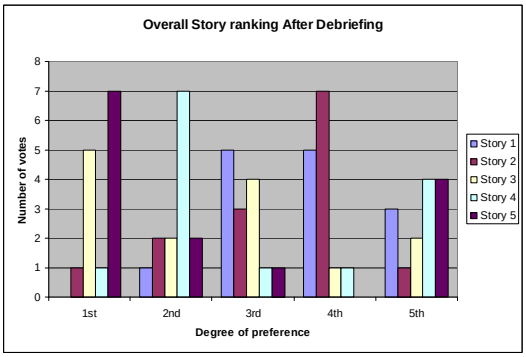

Non-Interactive Marking Male/Female
Average Marking
Stories
Male
Female

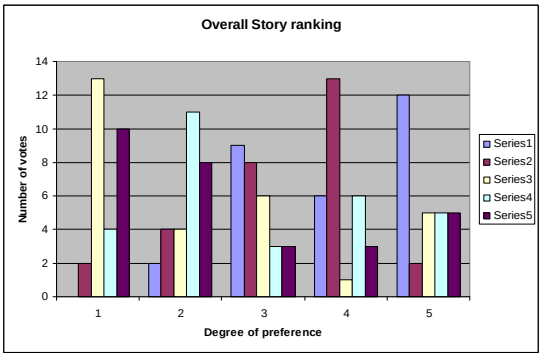

Story marking Male/Female - Interactive/Non-interactive
Average marking
Stories
Male non-interactive
Female non-interactive
Male interactive
Female interactive

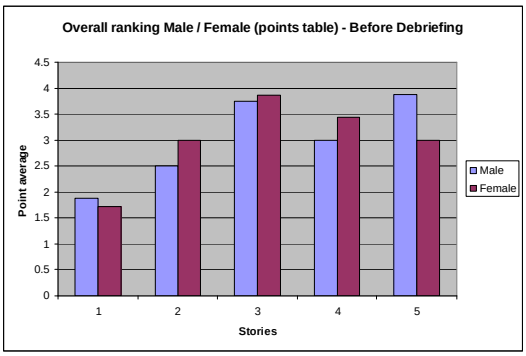

Comparative table between T1 and T2 average marking
Values
Stories
T1
T2

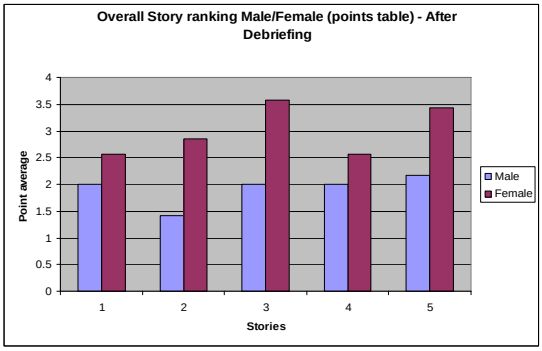

Non-interactive marking Experts/non-Experts
Average Marking
Stories
Experts
Non-Experts

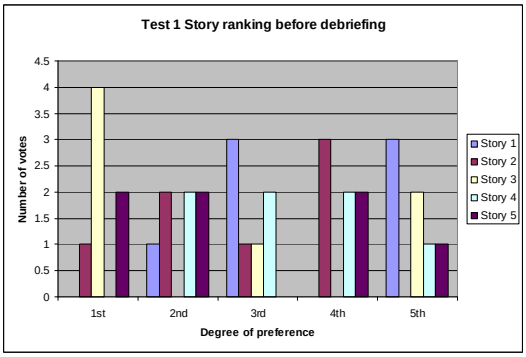

Overall Story ranking Before Debriefing
Number of votes
Degree of preference
Story 1
Story 2
Story 3
Story 4
Story 5

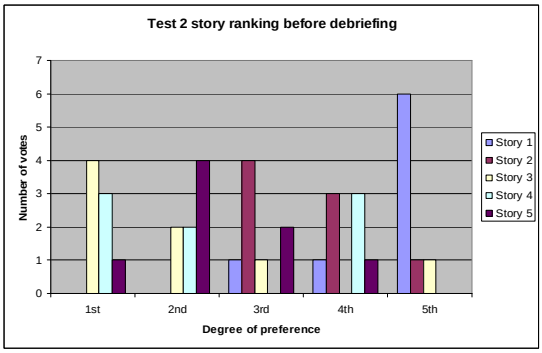

Overall Story ranking After Debriefing
Number of votes
Degree of preference
Story 1
Story 2
Story 3
Story 4
Story 5

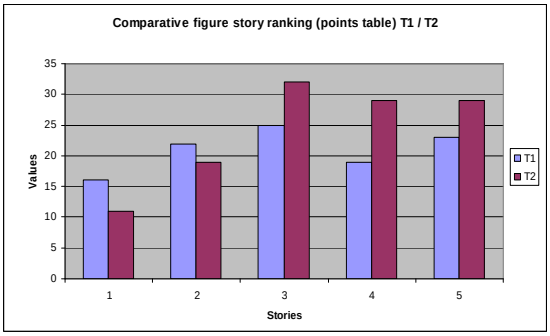

Overall Story ranking
Number of votes
Degree of preference
Series1
Series2
Series3
Series4
Series5

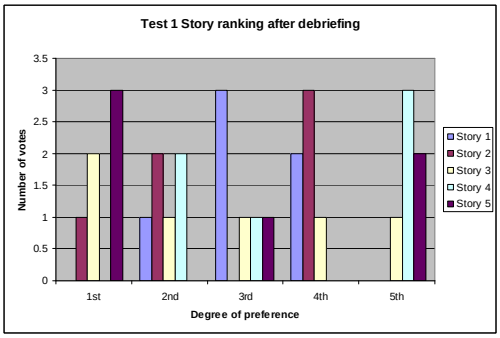

Overall ranking Male / Female (points table) - Before Debriefing
Point average
Stories
Male
Female

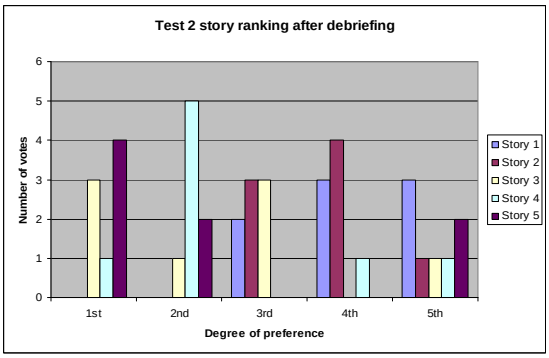

Overall Story ranking Male/Female (points table) - After Debriefing
Point average
Stories
Male
Female

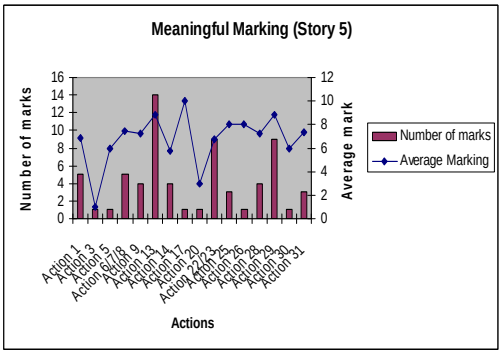

Test 1 Story ranking before debriefing
Number of votes
Degree of preference
Story 1
Story 2
Story 3
Story 4
Story 5

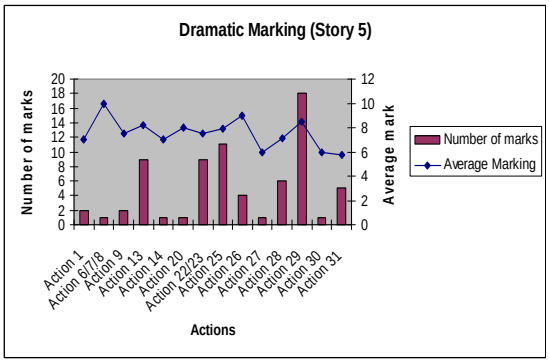

Test 2 story ranking before debriefing
Number of votes
Degree of preference
Story 1
Story 2
Story 3
Story 4
Story 5


Comparative figure story ranking (points table) T1 / T2
Values
Stories
T1
T2


Test 1 Story ranking after debriefing
Number of votes
Degree of preference
Story 1
Story 2
Story 3
Story 4
Story 5


Test 2 story ranking after debriefing
Number of votes
Degree of preference
Story 1
Story 2
Story 3
Story 4
Story 5


Meaningful Marking (Story 5)
Number of marks
Average mark
Actions
Number of marks
Average Marking


Dramatic Marking (Story 5)
Number of marks
Average mark
Actions
Number of marks
Average Marking

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