2 On the Craft of Interactive Storytelling

2.1. Chapter Preface

The main goal of this chapter is to present a bibliographic review of the field of Interactive Storytelling. This review covers both the most relevant systems to date in the area and what other knowledge is available on the creation of stories.

To the best of our knowledge, there was no such wide review of the different approaches to the area. The text contained here is the first part of the article co-authored with Fábio Guerra and Antonio Furtado, and published in 2009 in the Monografias em Ciência da Computação Series (MCC 36/09), at PUC-Rio.

2.2. Introduction

In this section we present a bibliographic review covering some of the most relevant studies in interactive story creation.

In Section 2.3 we list the main implemented systems for the automatic creation of stories. Some of the main studies on stories in general are the focus of Section 2.4, while Section 2.5 presents a few of the most popular methods applied to the creation of stories.

2.3. Story Generation Systems

Developing a computer program capable of automatically generating stories is not, in itself, a new idea. Already in the 1970s, some Story Generation Systems (SGS) were presented, the most famous of them being Tale-Spin [Meehan 1977], that generated stories from a simulation of characters that pursued specific goals.

Afterwards, other important work appeared, notably Universe [Lebowitz 1985], TAILOR [Smith and Witten 1991], and Minstrel [Turner 1992], where besides character simulation, authorial goals constraints were added.

Recently, several research efforts were initiated aiming at creating and developing narratives that might be told via interactive media. While in the 1970s, 1980s, and part of the 1990s studies in story generation were mostly concerned with the generation of stories in form of text, the goal of most SGSs today is the visualization of the generated results using computer graphics and some form of interaction.

Among the new SGSs we can highlight: Mimesis [Young 2001, Riedl 2004], Façade [Mateas and Stern 2003], LOGTELL [Pozzer 2005, Ciarlini et al. 2005, Karlsson et al. 2006a], IDA [Magerko 2005, Magerko 2006], Mirage [El-Nasr 2007], and GADIN [Barber and Kudenko 2008].

Even though these works have a common motivation, they not necessarily try to solve the exact same problem. Some might show their results in the form of text and others in three dimensional worlds. Some focus on interactivity, while others might not. The way in which this interaction takes place also varies a lot. Also, each system uses a different knowledge base, thus generating stories in completely different genres.

Current SGSs can broadly be classified into three different groups: a) Autonomous character simulation; b) Plot based planning systems (mostly using STRIPS-like planning); or c) Experience management – a newer category focused on the user, not on the plot or in the characters. In this last category, systems tackle a wide range of problems, from user modelling and psychology profiling to motivational feedback and analysis of player moods and actions.

We try here to provide a brief comparison between the presented works, highlighting their most important features, but a direct comparison is hard due to the previously identified differences.

In part this problem derives from the fact that most of the cited studies try to create "complete" systems that solve the whole problem of story craft, instead of breaking the problem into sub-problems and trying to solve each one at time. Also, as a consequence, there is little reuse among the different story generation solutions, especially regarding their supporting knowledge bases.

2.3.1.Tale-Spin

Tale-Spin [Meehan 1977, Meehan 1981] was one of the first programs created to address the problem of automatic story generation. It is capable of describing some simple stories, basically through simulation of the characters' behaviour in the story. During program execution, the user can define an initial story configuration and the main goal of the protagonist. The story then takes form through the interaction between characters in pursuing their goals and the resolution of the resulting sub-problems. A planning algorithm is responsible for generating the plan that will be used by the main character. Once generated, this plan is translated into natural language and then shown to the user.

Physical locations and types of characters are coded, besides procedures to solve problems like locomotion, persuasion and bargaining. A sample generated story is shown in Figure 2.1. One of the main contributions of Tale-Spin was to show that planning algorithms could be very useful in creating convincing characters in the context of a story. Influenced by Tale-Spin, a number of later story generating systems adopted some sort of planning approach.

Even though Tale-Spin is able to generate some interesting stories, most of them do not fare so well. Despite the characters being coherent, stories can turn out to be too short or simply uninteresting. Dehn's [1981] conclusion is that,

besides the satisfaction of the character goals, it would also be necessary to incorporate some kind of authorial goal satisfaction. Since then, other programs have been created that tried to satisfy authorial goals in their stories, such as those used in systems like Universe and Minstrel (to be presented in the following sections).

> Once upon a time George Ant lived near a patch of ground. There was a nest in an ash tree. Wilma Bird lived in the nest. There was some water in a river. Wilma knew that the water was in the river. George knew that the water was in the river. One day Wilma was very thirsty. Wilma wanted to get near some water. Wilma flew from her nest across the meadow through a valley to the river. Wilma drank the water. Wilma wasn't thirsty anymore.
>
> George was very thirsty. George wanted to get near some water. George walked from his patch of ground across the meadow through the valley to a river. George fell into the water. George wanted to get near the valley. George couldn't get near the valley. George wanted to get near the meadow. George couldn't get near the meadow. Wilma wanted to get near George. Wilma grabbed George with her claw. Wilma took George from the river through the valley to the meadow. George was devoted to Wilma. George owed everything to Wilma. Wilma let go of George. George fell to the meadow. The end.

Figure 2.1: Story generated by Tale-Spin

Another important system that builds on the ideas of Tale-Spin is TAILOR [Smith and Witten 1991]. TAILOR differs from Tale-Spin in that it has no user input. The system works only as a problem-solving process where characters pursue their goals. One improvement towards dramatic effect is that TAILOR models a protagonist and explicit antagonists as characters. Thus the protagonist has goals that drive the story, while the antagonists try to foil them, which produces an ever-increasing conflict. However, there is no dramatic guidance, and so the resulting stories resemble a series of moves in a game, not much unlike a game of chess.

2.3.2.Universe

As Tale-Spin, Universe [Lebowitz 1984, Lebowitz 1985] is a computer program designed to generate stories through the use of planning algorithms. But, contrary to what happens in Tale-Spin, the goals and plans generated in Universe are not only related to characters' goals, but also — and especially — to authorial goals.

Characters are defined by personality traits, stereotypes and relations to other characters. With a good cast of characters, the planner uses plot fragments to reach the goals. Such plot fragments are created with the intention of fulfilling the author's goals, and are defined by a list of roles to be filled-up by the

characters, a set of restrictions and consequences, and an ordered list of sub-tasks.

As happens in Tale-Spin, the story is shown to the user under the form of natural language text. A sample story generated by Universe can be seen in Figure 2.2.

> Liz was married to Tony. Neither loved the other, and indeed, Liz was in love with Neil. However, unknown to either Tony or Neil, Stephano, Tony's father, who wanted Liz to produce a grandson for him, threatened Liz that if she left Tony, he would kill Neil. Convinced that he was serious by a bomb that exploded near Neil, Liz told Neil that she did not love him, that she was still in love with Tony, and that he should forget about her. Neil was eventually convinced and married Marie. Later when Liz was finally free from Tony (because Stephano had died), Neil was not free to marry her, and their troubles went on.

Figure 2.2: Story generated by Universe

2.3.3.Minstrel

Turner [1992] presents yet another SGS, called Minstrel. This system differs from Tale-Spin and Universe by applying a technique called Case-Based Reasoning, which means that it reuses pieces of previously known or pre-generated stories in the generation of new ones. As in Universe, Minstrel also tries to satisfy authorial goals.

In addition, Turner distinguishes between four different kinds of authorial goals: theme, drama, consistency, and presentation.

> The Vengeful Princess. Once upon a time there was a Lady of the Court named Jennifer. Jennifer loved a knight named Grunfeld. Grunfeld loved Jennifer. Jennifer wanted revenge on a lady of the court named Darlene because she had the berries which she picked in the woods and Jennifer wanted to have the berries. Jennifer wanted to scare Darlene. Jennifer wanted a dragon to move towards Darlene so that Darlene believed it would eat her. Jennifer wanted to appear to be a dragon so that a dragon would move towards Darlene. Jennifer drank a magic potion. Jennifer transformed into a dragon. A dragon moved towards Darlene. A dragon was near Darlene. Grunfeld wanted to impress the king. Grunfeld wanted to move towards the woods so that he could fight a dragon. Grunfeld moved towards the woods. Grunfeld was near the woods. Grunfeld fought a dragon. The dragon died. The dragon was Jennifer. Jennifer wanted to live. Jennifer tried to drink a magic potion but failed. Grunfeld was filled with grief. Jennifer was buried in the woods. Grunfeld became a hermit. MORAL: Deception is a weapon difficult to aim.

Figure 2.3: Story generated by Minstrel

Theme goals define the topic and purpose of the story, i.e. what the story is about. Drama goals are responsible for generating suspense, tragedy, presages, and characterizations in stories. Story consistency concerns its credibility and the rationality of the actions performed by the characters. Presentation, in turn, concerns the way in which the story is told to the reader.

Turner [1992] also tried to apply creativity models as a process of search and adaptation wherefrom original stories would ultimately result. In Minstrel, the story is also presented in text format, an example being shown in Figure 2.3.

2.3.4.Mimesis

Mimesis [Young 2001] is an SGS that, unlike the others discussed so far, was built to be used in digital games. The system works as an intelligent controller for virtual environments. Mimesis tries to combine story planning with the use of the generated stories in a commercial game production system. Riedl [2004], in his PhD thesis, highlights two important properties that a story must have to be successful: coherence of plot and characters' believability.

Plot coherency exists when the main events in the story are relevant to its outcome and have a causal relationship between them. Character believability exists when the characters' actions are convincing and motivated by their beliefs, desires and goals.

Riedl [2004] divides SGSs into two groups. The first prioritizes the simulation of the characters in the world, and the second is more focused on plot coherency. According to its proponent [Riedl 2004], Mimesis is positioned between the two groups.

Story planning is initially performed without taking into consideration the desires and objectives of the characters. The generated plan is then extended to include information about the goals established by the events. From this point on, new goals are generated and the system keeps reasoning about the characters' motivations to reach such goals.

2.3.5.The 'Oz Project'

One of the most influential projects in adaptive narrative is the Oz project [Bates et al. 1992]. Developed over a span of about a decade, the research philosophy behind the Oz Project can be summarised as exploring believable agents and their applications to interactive drama.

Oz can be considered a seminal work in emergent narrative and virtual actors for its results in providing dramatically interesting "micro-worlds" that include social believable characters. A believable character is one who seems lifelike, whose actions make sense and lead the audience to suspend disbelief. Oz argues that believable agents are necessary if you want to build interactive story worlds,

by providing engagement and motivation for users. Their work was greatly influenced by Egri's work on dramatic techniques [Egri 1960] on character-based narratives.

Originally Oz had a more strict character focus and used LISP-built systems as its presentation layer to generate English narrative text [Kantrowitz and Bates 1992]. On expanding the use of interactivity in the system, it tuned into an animated world where an user could interact with autonomous characters (called Woggles) as a preliminary step toward interactive drama [Bates et al. 1992b]

This version of the storyworld, Edge of Intention, was presented as an interactive animated art piece at SIGGRAPH-93 [Penny 1993] and was quite praised at the time [Maline 1993]. The system had no drama component at all. A player could interact with the Woggles (by playing the role of a fourth Woggle), while observing them. These autonomous characters "engage in simple social games, exhibit aggression, fear, sadness and joy, play and sleep, and perform several other behaviours' [Dannenberg et al. 1995]. Talk balloons were later added to the system as one method of expressing an agent's internal states graphically.

The Oz group defined a set of requirements for believability in agents that remains useful: Personality; Emotion (their own emotions and responses to the emotions of others in personality-specific ways); Self-motivation (they must have their own internal drives and desires); Change (they should grow and change with time); Social relationships with other characters; and Life-likeness (as in autonomy and responsiveness). Any good agent architecture should support these requirements. Loyall [1997] offers a detailed analysis of the requirements for believability.

One of the major components of the Oz architecture is HAP [Loyall and Bates 1991]. HAP is a believable agent "language" that aims to support expressing complex control relationships among behaviours. This architecture was later extended to include a model for manipulating emotional state called Em [Reilly 1996].

Moving beyond just character social interaction as means to create emergent narratives, the Oz project introduced the idea of plot graphs as an approach to drama [Kelso et al. 1993]. While many early interactive fiction projects use scripts defining branching sequences of events, a plot graph is a little more general, laying out scenes in a directed acyclic graph (DAG); where the arcs represent must-precede relationships. Only after all preceding plot points have happened can the next plot point be executed. Hints and obstacles can be associated with these arcs [Kelso 1993] to affect the change between scenes by the user.

In the plot graph model, major scenes of the story form a partial order and are thus linked together [Kelso et al. 1993]. Nodes represent events and situations

that are the important moments of the story (also known as plot points). Kelso also introduces the notion of *dramatic destiny* to guide the experience of the user.

Building on the plot graph model, Weyhrauch [1997] introduces MOE, Oz interactive drama manager. It controls a story at the level of plot points to provide dramatic guidance. Given a particular set of plot points, the space of all possible stories is the set of permutations of all possible plot points.

MOE is based on the idea of centralized drama manager from the PLAYWRIGHT system [Laurel 1986]. Weyhrauch himself claims MOE is a successor of Laurel's PLAYWRIGHT approach [Weyhrauch 1997]. Laurel's system utilizes a playwriting expert system that "orchestrates system-controlled events and characters so as to move the action forward in a dramatically interesting way" [Laurel 1986]. It collects action suggestions from characters and then selects the first acceptable suggestion that can reach the formal specifications of next incident in story.

While PLAYWRIGHT uses an inference engine, MOE has two core components: a) an aesthetic evaluation function to judge quality of user experience; and b) an adversarial search mechanism that uses this function to guide experience. The evaluation function rates each permutation during search in this story space. It is important to note that although the story space counts every permutation, the search actually only deals with the frontier of available next nodes.

This function is defined by the interactive story author and is supposed to capture the story's aesthetic by trying to measure some authorial features of "emotional intensity" (such as user freedom, motivation, and excitement) and adequate the story to a tension curve.

Weyhrauch's system uses its adversarial search between "MOE moves" and user response actions (user moves). MOE moves are related to plot-fragments proposed by Lebowitz [1985], basically a set of tricks to guide the user experience at any given moment. Ex: bring new character into story, suddenly give a character a strong emotion, cause character to drop dead, etc. Not much unlike motifs [Aarne and Thompson 1961]. In order to perceive 'user moves' in the story world, MOE uses 'recognizers'. Each user move has its own recognizer, simple programs written by the story author.

MOE is not a generative system. The set of moves needs to be created by hand for specific stories. Also, it requires programming the functions to be used to recognize user actions. Together, these restrictions make the system impractical for most authors. Another drawback of MOE is that there is a lack of explicit causality between events; comparing predicted player behaviour against possible future actions requires the entire set of events to be considered for search. There is also no means to logically infer conflicts.

By analysing Oz ideas, Mateas [2002] defines a new discipline called *Expressive AI* where AI research and art mutually inform each other and uses this discipline in developing yet another interactive drama system on top of the Oz tradition.

2.3.6.Façade

Façade [Mateas 2002, Mateas and Stern 2003] is a first-person game (which they call Interactive Drama) whose objective is to present the player with a dramatic situation, with which the player can then interact and unfold.

Mateas and Stern [2003] defend that there are two main approaches to the creation of interactive narratives: structured narratives and procedural simulations. Structured narratives are a more traditional form of narratives, with little possibility for interaction. Procedural simulation, on the other hand, consists in the simulation of a virtual world with several agents interacting with the player, thus generating sequences of events that can be interpreted as a narrative, then called emergent narrative [Aylett 1999]. One of the intents behind Façade was to situate it between these two approaches.

To achieve this, a drama manager was developed that keeps monitoring the ongoing simulation and intervening in the story, handling to the user/player a more structured narrative experience. The drama manager uses the concept of *beat*, defined by McKee [1997] as the smallest unit of dramatic action that can change the state of a story. Each of these units has pre-conditions and effects in the states of the story, generating a graph with the narrative structure. The situations to be presented to the player are chosen from the existing beats, in such way that they reach the desired dramatic level for each moment in the story. Also, Façade tries to enhance the player's dramatic experience; specifically, it encodes the dramatic arc using a mathematical function and uses this in selecting beats in a way that raises the tension in well defined steps.

In order to provide the drama with interesting evolving characters, Façade implements a behaviour definition language (ABL) that extends HAP [Loyall 1997], managing behaviour interrelations, sub-goal success and failure, and adding multi agent cooperation by using a mechanism for handling joint behaviours between two agents [Mateas and Stern 2005].

Although Façade has been a successful experience, its architecture requires a great effort from the prospective authors. It took two years just for authoring the game that has only one scene, two characters, and takes about 20 minutes to complete [Mateas and Stern 2003]. An example of a scene in Façade is shown in Figure 2.4.

Moreover, it is highly debatable whether there is indeed an automatic generation of stories in Façade, as the graph of the narrative structure is pre-assembled and all dialogues have been previously recorded. The main

contribution of Façade was to prove it possible to develop digital games with strong dramatic appeal.

Figure 2.4: A snapshot of interacting with the Façade system

2.3.7.LOGTELL

LOGTELL [Ciarlini et al. 2005, Pozzer 2005] is a system that targets the generation and three-dimensional presentation of stories. It differs from other systems by allowing interaction already at the generation phase of story events, while (for now) the user does not participate directly in the story during dramatization and playback. LOGTELL uses a planning approach with goal inference for its characters, whose actions are restricted to a pre-defined repertoire, conforming to the pioneering work by Vladimir Propp [1973].

The starting point in LOGTELL is modelling the genre of the stories to be generated, by way of three conceptual schemes: static, dynamic and behavioural. The static schema must indicate the valid states in the chosen literary genre. The dynamic schema describes which transitions are possible between two valid states. The behavioural schema concerns characters' goal inference logic model, where which set of goal inference rules to be applied is defined by character type.

In this approach the generation of events takes place in a step by step way, allowing the user, at each reached state, to accept the generated state or to request the planner to try and produce other alternatives. The user can also insert additional goals or even specific events. To support this interaction with the system, the user can query a library of typical plans (a plan hierarchy) that matches the specified pre-requirements [Karlsson et al. 2006a]. LOGTELL in its current form, as well as Tale-Spin, does not provide for a mechanism to

manipulate authorial goals, although it is possible to embed them partially (and in an indirect way) into the rules of the behavioural schema. Consequently, these kinds of goals can only be addressed and reached by way of user interaction.

It is important to note that work on a conceptual model and its stronger integration into the system are ongoing [Karlsson et al. 2010a]. Example screens of plot creation and dramatization in LOGTELL are shown in Figures 2.5 and 2.6.

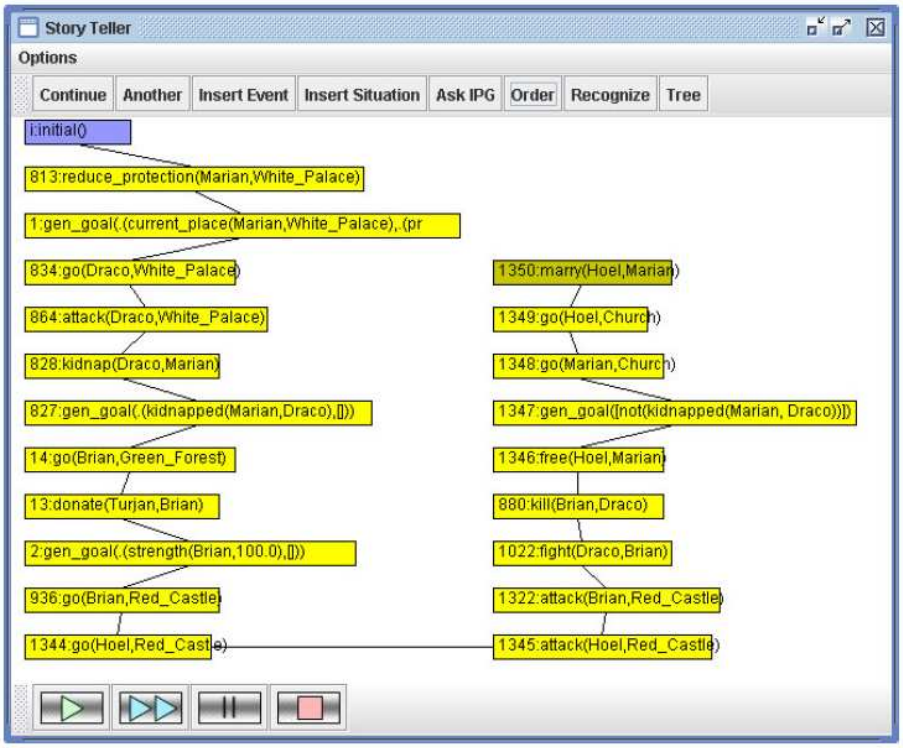

Figure 2.5: An example plot generated using LOGTELL

Figure 2.6: A scene during the dramatization of a plot in LOGTELL

2.3.8.Systems Based on Author/User Modelling

More recent research has sharpened the focus on some sort of user experience and satisfaction modelling. Different approaches taking this model into account when generating/adapting a story present interesting results, even though they are mostly oversimplified. This is a wide area that uses different capabilities; the works grouped here are recent promising systems that try to tackle the user experience problem.

2.3.8.1.IDA

Magerko's Interactive Drama Architecture (IDA) uses an author-centric approach to interactive drama [Magerko 2006]; and views the medium of Interactive Drama as the means for a human author to communicate an artistic vision [Magerko 2005]. IDA uses an omniscient story director agent to maintain the plot's progression, which is (as in MOE [Weyhrauch 1997]) essentially the playwright described by Laurel in her thesis [Laurel 1986]. This director agent is connected to a game engine, thus providing players a rich 3D environment where to interact with a story.

IDA's director agent follows the characters in the storyworld, giving directions to them when necessary to perform particular plot elements and to guide the player to stay within the story space. It also tries to prevent violations of the story by triggering reactive or pre-emptive behaviours to help avoid the possible problems.

These director actions receive a score dependent on the current situation needs. If a situation is urgent (requiring reactive direction), action weights will be assigned to favour effectiveness. Characters in the story are agents developed in the Soar architecture [Laird et. al 1987].

One of the most interesting aspects of this system is its use of a player model to adapt the story and try to avoid violations to its coherency. IDA hypothesizes future player behaviour, represented by the player's goals and the knowledge that they have gathered [Magerko 2005].

The story representation used revolves around the partial ordering of abstract plot points. In order for a given event to be possible in a story, it needs to be created by an author and included in IDA's library of plot points.

The timing of events in IDA is based on preconditions, as well as when the player is expected to violate a set of constraints imposed by the author on the plot. But a key difference from other systems is that the representation has no explicit concept of causality as nodes in the "plot graph" do not have explicit post-conditions. At the beginning of the experience, any plot points without parents are labelled as active. The director keeps a list of all active plot points.

The system starts with a pre-written story to guide the player and makes use of the mentioned inferred player knowledge to make part of its experience player-specific. It models short-term player behaviour and treats the results of that model as a hypothesis of future player behaviour [Magerko 2006].

In order to make use of these hypotheses the system needs to maintain an internal simulation of the game environment and an author-defined player model on that environment. By contrasting the observations from this simulation with the plot representation, the system tries to direct characters to avoid plot violations. Director actions are rated by the author in terms of two dimensions, subtlety and effectiveness.

The player model is somewhat complex, based in an internal probabilistic rule-based model of the player's behaviour that should be specified by the author of the interactive experience. Magerko also states that the model is domain-dependent and needs to be created by the author as a programmer [Magerko 2006].

Even though the usage of a player model brings interesting considerations into play, expecting the author of an interactive story to program a complex user model is impractical in most situations. Another possible issue with IDA's approach is that the use of a collection of plot point with no representation of causality makes the author works much harder in creating an environment where the coherency and dramatic quality of a story can be guaranteed.

2.3.8.2.GADIN

A more generative system is GADIN (Generator of Adaptive Dilemma-based Interactive Narratives), where the story designer is only required to provide genre specific storyworld knowledge, such as information on characters and their relations, locations and actions [Barber and Kudenko 2007a]. The system is provided with knowledge of generic story actions and dilemmas based on a set of clichés encountered in soap operas. The focus around dilemmas helps to create dramatic tension and the system also employs a user model to try to ensure user's enjoyment.

The main focus of the generated stories in this system is the use of dilemmas. GADIN will basically work to expose the user to a dilemma by planning to satisfy its preconditions. The plan to achieve a dilemma thus becomes a storyline (or part of it).

On being passed a dilemma the planner finds all plans to achieve it - given the current storyworld state and background knowledge – and then performs a search among the plans to pick one. Shorter plans are favoured, arguably to result in "less opportunity for the user to violate the plan" [Barber and Kudenko 2007a].

Another interesting feature of GADIN's usage of dilemmas is that not only the user character will face them. Non-player characters (NPCs) will also experience dilemmas throughout the story. This increases the believability of the characters as they exist in the story in a more life-like manner, which also provides for a richer and more dynamic storyworld. On the extreme case, the system can create a non-interactive story, so there is always a story going on whether or not the user interacts with it.

The user model is based on predicting the choices he's going to make (dependent on his previous choices) [Barber and Kudenko 2007b] and combined with a fixed author-defined 'interestingness' value for each dilemma outcome, is used to select the next dilemma to be presented to the user. Each dilemma has associated assumptions as to how the modelled values change dependent on the user decision.

Currently GADIN makes use of 5 different types of dilemma: betrayal, sacrifice, greater good, take down (an action which will result in the worst possible utility but also the worst outcome for the enemy), and favour [Barber and Kudenko 2008]. An overarching story connects these dilemmas within a plotline that is dynamically created, starting from a random selected goal among the ones available when the story starts.

Even though the use of dilemmas increases dramatic tension and the NPCs in the world exhibit a good level of autonomy, GADIN's approach presents some shortcomings. The use of dilemmas alone does not guarantee that the selected plotline will be interesting. Also, it currently is a text only control-based system. This means that the story presentation, especially the interactivity with the story, is not fully developed. In its current version the user selects a sequence of actions until he chooses to pass control to the system, which then acts until a user action is required. In this scenario, a lot of possible story violations will simply not happen as the user's ability to interact with the plot is severely limited, thus possibly limiting player engagement.

2.3.8.3.Mirage

Another recent storytelling system that utilizes player knowledge to help elicit user engagement is Mirage. It does so by heavily borrowing from acting theory in the definition of its characters behaviours [El-Nasr 2004] along with inferred knowledge about player actions. For instance, in order to choose character goals that oppose the user, a representation of user intention or goals is required.

Mirage's actors choose between different tactics (adaptive acting behaviours) [El-Nasr 2007] based on predicted player behaviour to try and reach their goals for a certain scene. If a goal is not reached by a certain behaviour, actors will select another approach to continue trying, giving the player a good

demonstration of their intentions and creating a "feeling of empathy through an understanding of characters' emotions and choices" [El-Nasr 2007].

In this aspect, Mirage resembles the approach to believable agents as improvisational actors used in the Virtual Theater project [Rousseau and Hayes-Roth 1998]. However, Virtual Theater models actor personalities, which is not the focus of El-Nasr's system. Another difference is that, while in Virtual Theater users participate in the construction of the story through directions sent to their avatars, in Mirage they have more direct control.

The architecture described in [El-Nasr 2004] uses a representation that is adapted from acting theory [Benedetti 1994] which, in order to stimulate engagement, abstracts some narrative constructs. These narrative constructs are defined as: I) Relationship values: relationships between characters; II) Dramatic tension/conflict in a drama; III) Character immediate goals; IV) The object/character the user is attending to; and V) User stereotype estimates.

In performing the dramatic narrative, Mirage tries to follow the Dramatic Arc principle. A story is divided into scenes, which in turn are further divided into beats [El-Nasr 2004]. Each scene and beat has goals, pre, and post conditions. When a scenic goal is achieved the narrative advances towards achieving the narrative objective. In order to proceed with this goal, the system selects beats, that when executed, will move the story forward. The system allows modulation of projected dramatic tension by selecting beats that increase or decrease tension appropriately.

The dramatization of Mirage's single interactive narrative happens in a rich 3D world supported by an architecture that implements an agent model and utilizes varying animations attached to the same action with different 'adverbs' associated to them, i.e. if a character wants do draw a sword, it can do it *slowly*, *violently*, etc. Mirage also makes use of a scripting language [El-Nasr 2007] that allows designers to define an evaluation function that influences the way the system estimates a user's character given its actions and story context.

Initial usability studies with cinema and theatre experts suggest that actor behaviour in Mirage managed to be adaptive and to instil empathy in users of the system [El-Nasr 2007].

2.3.8.4.PaSSAGE

Yet another SGS that tries to model the player to tailor his experience is PaSSAGE (Player-Specific Stories via Automatically Generated Events). PaSSAGE uses automatic player modelling to learn player's preferred style of play, and then uses that model to dynamically guide the selection of the content of an interactive story [Thue at al. 2007].

It is distinct from Mirage in that Mirage tries to model player's character [El-Nasr 2007], while PaSSAGE attempts to fit the player into categories of playing style. Mirage defines its model as values along traits of character stereotypes (e.g. cowardice, self-interest, etc.). PaSSAGE, on the other hand, categorizes player type stereotypes (fighter, power gamer, etc.); which are quite similar to the player archetypes for Multi-User Dungeons (MUDs) defined by [Bartle 1996].

PaSSAGE assembles its stories by drawing from a library of possible events, called encounters, each having been annotated by an author with information concerning which player types it would be suitable for. When determining which encounter to run, PaSSAGE examines each encounter's set of branches, quite in a game-tree like way. To help maintain a stronger sense of story, encounters are grouped into sets corresponding to the many phases of the Monomyth [Campbell 1949]. As it is, the creation of a story space requires a lot of manual labour.

These encounters can go through refinements (via role passing and hinting) [Thue at al. 2007] and are implemented by the use of triggers, usually started when a player approaches a suitable location. Characters satisfying the encounter's trigger conditions assume the behaviours authored for this event, which are tailored to encourage the player's preferred styles of play.

The player model vector then changes depending on player action selection. For instance, if the player is showing an interest in gaining riches, the model's value for the Power Gamer type increases. The five stereotypes are: Fighter, Method-Actor, Storyteller, Tactician, and Power Gamer; and each is associated with a value that fluctuates.

2.3.9. Other Relevant Systems

Some other systems, although not so often mentioned in the literature, are also relevant to this discussion and will be briefly described here.

The approach adopted in the DEFACTO project [Sgouros 1999] uses successive evaluations of rules to control the generation of an interactive story where the user is the protagonist. The interaction among characters' goals is explicitly represented and an Aristotelian conception of plot (more on Aristotle ideas will be discussed in Section 2.4.1) is used to lead the story to a climax and then resolve it.

The chaining of events, however, is not explained by pre- and post-conditions, making the control of what can and what cannot occur rather complex. Additionally, it does not allow the use of planning algorithms to develop sequences of events for the achievement of goals. The need of user intervention seems to be high if one wishes to generate a complete plot. Goals are inferred by means of rules analyzing the current situation, but the choice of actions to achieve goals appears to be more reactive than deliberative.

The approach described in [Cavazza, et al. 2002] adopts a character-based model to make user interventions at any possible time. Characters are autonomous agents, executing plans to achieve their goals, and, from their interactions, it is expected that a narrative will eventually emerge. Users are spectators but can "physically" interact with the context and even advise characters, affecting their decisions and the resulting stories. In order to decide, at real-time, the actions to be performed, characters consult a Hierarchical Task Network (HTN), corresponding to pre-compiled plans. In this way, the system does not have to pay the price of using problem-solving planners while presenting a 3D animation. It might demand more effort to model the behaviour of the characters, but it makes sense if one does not consider maximizing the alternatives as a requirement. The main doubt about pure character-based approaches is to what extent dramatic and engaging narratives may actually result. The task seems to be easier with genres like sitcoms, wherein the climax of a story is not so clearly distinguishable. On the other hand, the usage of HTNs in storytelling seem very promising, even though the ordering of events is more rigidly set than in other planning approaches.

In the Teatrix environment [Paiva, et al. 2001], where Propp's functions are used to model synthetic characters that interact with other, characters are directed by children, in a virtual world. Each child directs one character and the synthetic characters are autonomous. All characters have a role in the story, specifying the functions in which they can take part.

Synthetic characters have goals that change according to the situation. They plan and try to execute actions (i.e. functions) according to their roles. The approach seems interesting for education, but the control of the consistency of actions and goals and the generation of dramatic situations are not guaranteed. Additionally, the use of predefined plans in the planning process can enhance the performance, but might limit the amount of different stories that can be generated.

Yet another approach related to Propp, but this time in a case based reasoning (CBR) system, is the one followed by Fairclough and Cunningham [2003], which uses an expert case-based character director system where cases in the case base are closely tied to Propp's functions.

The use of approaches like Propp's ideas in pure plot-based approaches leads to systems more concerned with the guidance of interactive stories than with their generation [Spierling et al. 2002]. For each "Proppian" function within a story of a certain genre, such systems present alternatives to be chosen by the users. Still, we claim that to obtain an effective method to generate stories, it is necessary to extend Propp's ideas, adding semantics to the functions (and to their specializations), so that preconditions, effects and goals can be fully expressed. As previously discussed, this is exemplified in LOGTELL [Pozzer 2005].

Another SGS proposal that deserves special mention in this category, for its "early influence", is Erasmatron. Developed by Chris Crawford, Erasmatron is a system initially intended for the use by artists to create stories.

The Erasmatron system [Crawford 1999] was intended to support the authoring process of interactive stories. It tries to balance plot-based and character-based approaches by using the notions of verbs and sentences. Actions are represented by verbs with roles assigned to characters to form sentences. Such a proposal is close to the way Propp's functions are extended in LogTell. Functions are implemented as logical operations, with parameters, pre- and post-conditions.

Even though Crawford claims that humanly interesting stories can be created only by artists [Crawford 1999], he argues that Erasmatron provides a system where authors can create "artist's algorithms" that automatically direct character behaviour to some extent.

2.4.Story Models

The creation of stories is a task regarded as non-trivial or difficult to perform by even the most renowned authors. Among other things, it is important to have a deep understanding of certain minimum requirements regarding stories, as it is known that not every sequence of events results in a story of quality.

The development of a program capable of evaluating the quality of a story is still an open issue that is far from being solved by current technology [Mueller 2003]. Moreover, it can be argued that there is no exact solution for this problem as the elements that make a story compelling and interesting vary according with personal tastes.

From this comes the following question: how to generate a good story using a computer, if there is no precise formulation of what that means?

There are two ways of facing the field of Artificial Intelligence (AI), usually called 'strong' AI and 'weak' AI. Followers of 'strong' AI claim that a computer can be programmed so that it can be compared to a human mind and is capable of everything that our mind is capable of doing [Searle et al. 1980]. On the other hand, in 'weak' AI the computer is seen as a tool, with which it is possible to simulate models that only mimic the behaviour of parts of the human mind [Searle et al. 1980].

Models are simplifications of reality, created from some well-defined hypotheses. At least in theory it is possible to create a model of what constitutes a good story and apply it to a SGS. This work is strongly based in this hypothesis. As there are simplifications, not every story considered as good by a person will be considered so by the model, and vice-versa. The better the model, the better

this relationship will be. Add to this mismatch the fact that people with different tastes and life experiences, tend to prefer different models.

Each author usually uses his/her own model for the creation of stories. Differences in the model originate differences in each author's 'style'. There is no ideal, right, or wrong model. But there are models that can be more easily adapted to certain situations.

There are several studies seeking to understand what makes a story and what the key elements for its analysis are. This section will present some of these studies, which were selected because they are widely known and utilized, as well as for being useful in building a model for the automatic generation of stories.

2.4.1. Aristotle

Aristotle [2004], in the 4th century BC, was one of the first to try to put down on paper the fundamental principles on which stories are based. Despite having focused mainly on tragedy, his comments are applicable to other areas and his work still continues relevant today. Many of the most important concepts on the subject were originally submitted by him.

One of his ideas was the division of tragedy in six fundamental parts:

- Mythos or 'plot'
- Ethos or 'character'
- Dianoia or 'thought', 'theme'
- Lexis or 'diction', 'speech', 'elocution'
- Melos or 'melody', 'music'
- Opsis or 'spectacle'

Plot concerns the combination of the acts; while characters, the characteristics of the agents in play. Thought relates to everything that is said and is related to the subject; while music, elocution, and spectacle define the media and place in which the imitation (mimesis) is to be made [Aristotle 2004].

According to him, the plot is the most important part, followed by characters, thought, elocution, music, and spectacle; in this order. Aristotle [2004] was also the first to decompose the plot structure into sub-parts. He defines tragedy as an imitation of an action that is admirable, complete (composed of an introduction, a middle part and an ending), and possesses magnitude. Therefore, according to Aristotle, so that the plots are well formed, they must not begin or end at random, but established under the conditions indicated.

Several other important contributions were made in his work. Aristotle also gave some valuable advice for the composition of tragedies, as shown in Section 2.5.

2.4.2.Separation in Levels

After Aristotle, a long time passed without more deep studies in the subject. His treaty on poetics was relegated in favour of his more famous *Rhetoric*; *Poetics* only became hugely influential after a long while, especially since the 18th century AD with the Age of Enlightenment.

An important movement that helped boost current story models was the Russian formalism that took place in the early 20th century AD in Russia.

Shklovsky [apud Landa, 1990] was one of the leaders of this movement. One of his major contributions was the division of stories into two separate levels, called fabula and *sjuzhet*. While fabula corresponds to a chronological sequence of events, *sjuzhet* is a different representation specific to these events, be it through a temporal re-ordering of the events, the use of narrative techniques, or the use of different points of view.

This separation proved very useful in helping analyse literary works. Another Russian formalist, Tomashevski [apud Landa, 1990] defined the structure of a narrative as resulting from the tension between fabula and *sjuzhet*. According to him, when a reader receives the text in form of a *sjuzhet*, he needs to reconstruct the fabula in his mind as a necessary step to understand the story. For him, the *sjuzhet* has its own structure, where coherence is not guided by constraints of time or causality, but by artistic needs as suspense, curiosity, and sympathy.

More recently, some scholars and authors came to utilize similar divisions. Chatman [1978], for example, in his work divides stories into two levels: story and discourse. This model is often used, including by some SGSs [Young 2001, Riedl 2004].

Mieke Bal, in her book [Bal 1997], utilizes another separation in three levels: *fabula*, *story*, and *text*. One can argue that the *sjuzhet* is divided into story and text. The later being related to the medium used to tell the story, be it a book, movie, virtual environment, or any other communication medium. In the remainder of this work we'll use the term *narration* when referring to Bal's *story*, in order to avoid confusion with "story" in the habitual sense.

This separation is more interesting (in this context) than the ones proposed by Shklovsky [apud Landa, 1990] or by Chatman [1978], as usually the same generated story can be told using different media. This aspect alone can much facilitate reuse among SGSs.

2.4.3.Motifs

When looking at stories and story structure, the analysis of the constituent parts of popular stories can yield very useful insight and information. Folktales, myths, and popular culture have pooled together rich repertoires of stories and motifs along the years from which inspiration can be drawn in creating new stories.

In order to categorize and compare folk tales, and understand their distribution and inter relations, they are often catalogued in terms of tale types and motifs. The most influential attempt to catalogue and categorize these narratives is the monumental guide by Aarne and Thompson [1961], which became the *de facto* catalogue for this kind of tales. The index builds upon Aarne's system devised to organize and index Scandinavian collections; Thompson enlarged its scope and introduced the AT-number system as a bibliographic tool for ease of reference.

A tale type is basically a self-sufficient narrative, and a motif can be seen as the smallest unit within such narrative. A motif can be any recurring element that has symbolic significance in a story: an idea, an object, a place, and incident, or a combination of statements about them. Also, as a narrative unit, it can also determine with which other motifs it can be combined.

Paraphrasing Haring [2006], the concept of a "tale type" arises when people apply their capacity for abstracting to their experience of hearing a story in different words or with different features, then determining how similar they are. A tale type encompasses one or several motifs. Also, it represents a high level relation between stories with a certain degree of similitude, and "not a constant unit of measure or a way to refer to lifeless material from the past. Instead, it is adaptable, and can be integrated into new thematic compositions and media" [Uther 2004]. Examples of tale types according to the AT-number system include: AT300 – Dragon Slayer; AT310 - Maiden in the Tower. Rapunzel; AT510 – Cinderella; and AT545b – Puss in Boots.

Although these definitions have often been criticized for being too imprecise and not accounting for the functionality of the motifs in the tales, "these are nevertheless useful terms to describe the relationships among a large number of narratives with different functional and formal attributes from a variety of ethnic groups, time periods, and genres" [Uther 2009] and, as such, can be useful in providing material for further understanding storytelling and the evolution of stories.

Criticism towards the type index states that often only few variants are presented and that there is too much focus on oral tradition, leaving out important tales in written form. A systematic inspection also showed that many folktale complexes that had not previously been included in the tale type index could be integrated with no difficulty [Uther 2000]. The catalogue has later been

expanded to address these issues; and an extended reference system proposed as the ATU system [Uther 2004].

Both the indexes using the AT-number system and the ATU system, list tale types and their variations, origins of the tale, as well as provide and analysis of the tale and lists of its constituent motifs. An index of motifs [Thompson 1989] is used as reference for individual motifs throughout the type index.

Thompson [1989] classifies and indexes motifs in folk literature in an elaborate classification of these into broad categories. As previously stated, motifs can be as simple as magic objects (e.g. the *magic cap* [D1067.2,]), statements about character roles (e.g. the *unpromising hero* [L100,]), or incidents (the *magic air journey* [D2120,], *sacrifice of human being to dragon* [B11.10,],) and fantastic events (*waking from magic sleep by letting a tear fall on sleeper* [D1978.2,], *external soul - a person keeps his soul or life separate from the rest of his body* [E710,]).

As stated by Thompson, each of these motifs lives on because they have been found attractive by generations of tale-tellers [Leach 1972]. This is precisely one of the reasons why the usage of such motifs can be seen as a promising way of guaranteeing a certain level of "interestingness" to a story.

Tale types provide insight into the relation between motifs and on variations and analogies between different stories. Motifs, besides presenting "popular" story pieces, often contain ingenious solutions to contradictions or dead-ends present in folk stories.

2.4.4.Literary Functions

Strongly influenced by the work of the Russian formalists, Vladimir Propp [1973], performed a study where he intended to establish a proper method to classify Russian folk tales and its parts. In contrast to tale types and motif indexes (as Aarne and Thompson [1961]), Propp's approach tried to identify the purpose of each part or action in the tales.

In his effort, Propp drilled into about one hundred tales and by analyzing character and action types he then introduced the concept of literary function as a character procedure, defined from the point of view of its importance to the unfolding of the action.

Propp realized that the same actions were attributed to characters in different stories. Thus it was possible to examine the tales from the character functions. He defined the names and attributes of the characters as variables, and the actions (functions) they play as constants. In his work the main interest resided in knowing what was done and not by whom or how it was done.

He drew four main conclusions. The first was that the constant elements are the roles of characters, which form the basic constituent parts of a tale. The

second conclusion was that there are a limited number of functions in Russians folk tales. The third was that the sequence of functions is always identical.

From there, Propp [1973] reached a conclusion completely unexpected for him. According to the established criteria, all folk tales had the same classification. This happened because they are all derived from the same primordial tale, which contains the set of all literary functions.

2.4.5.Monomyth

Besides Propp [1973], other researchers have faced the possibility that all stories could be defined from a single scheme of story. One of these researchers was Campbell [1968], considered one of the greatest scholars of universal mythology. His study is of great relevance, as many of the modern success stories were built based on his theory.

Campbell [1968] dealt basically with mythological stories, with the hero's figure and its journey into the story; and reached for some support from psychology for comprehending the transformation that take place in the hero's mind.

Some psychology scholars believe that the rites of passage that one must go through in the myths represent in some way the human psyche. Carl Jung followers associate the emergence of universal types and motifs, mythical or not, to action of the so called archetypes of the collective unconscious [Furtado 2006].

Campbell compares dreams and numerous stories involving myth from different places and times, and finds a great deal of similarities among them. He then elaborated a theory according to which all the stories about myths in the world are in fact based on a single outline. And this outline or scheme he named monomyth (borrowing the term from James Joyce's work as homage [Campbell 1968]).

In his journey, conforming to this scheme, the hero must go through a series of steps or stages that ties into a cyclical diagram. The journey is divided in three main parts: departure (or separation), initiation, and return. In the first part, the hero leaves the comfort of his world to enter an unknown world of strange powers and events.

At initiation he gets to know better the other world and faces obstacles until achieving his main goal. In the last part, he decides to return to his home world, where order must be restored and the hero can enjoy the gains achieved in his journey.

2.5.Methods for the Creation of Stories

The studies discussed so far are important in helping the goal of defining a model for stories. But they do not help in determining the quality of a given story, especially as this is concept that depends too much on individual tastes.

Although there is not much scientific literature on how to write good stories, there are numerous guides written by experienced authors who tried to somehow formalize their techniques for the creation of interesting stories [Field 1982, Howard and Mabley 1995, Vogler 1998, McKee 1997, Tobias 2003]. These efforts can serve as a base or as help in the development of a story generator.

These guides were chosen among other reasons for their popularity, availability and because they are potentially easier to program in a computer. Although each book focuses on a specific medium, the interest here is to seek elements that could be used in any other media.

2.5.1.A Good and Well Told Story

McKee [1997] compares a good and well told story to an orchestra, in the following way: A good and well told story — in which structure, configuration, characters, genres, and ideas mix continuously — is like a symphonic piece. To achieve *harmony*, the writer needs to study the elements in a story as if they were instruments in an orchestra, first separately and then in harmonic accord [McKee 1997].

There are several elements essential to the quality of a story. However, just a few will be addressed in this work. According to Aristotle [2004], the most important elements are plot and character, in this order. And these elements will receive most attention.

Most guides do not make a clear distinction between story levels. But, when translating the method to a computer, this distinction is fundamental. Thus, the story generation process can be divided into three main problems: the construction of the characters, the generation of the fabula, and the generation of "narration".

There is still no consensus on the order in which this problem should be addressed. Aristotle [2004] states that the plot must be defined before the characters. On the other hand, there are also authors who defend the opposite [Egri, 1960 apud Glassner, 2004]. Many times both can be addressed in parallel. This decision is up to the tastes of each author and certainly will influence the final 'style' of the generation technique.

2.5.2.Characters

A character is presented to the audience through its actions and these are what define its characterization. Field [1982] goes beyond and affirms several times that "Character is action — what a person does is what she is, not what she says".

McKee [1997] emphasizes that personality is shown to the audience during times of great tension and pressure. A real character is revealed through choices that a human being takes under pressure – the bigger the pressure, bigger the revelation, more real is the choice to the essential nature of the character.

"The function of a character is to bring to the story the necessary characterization qualities to make choices in a credible way. [...] Each character must bring to the story the combination of qualities that allow the audience to believe that the character can and must do what it does" [McKee 1997].

According to Bates et al. [1992], in order for the audience to believe that a character can and must do something, it must be guided by its goals, intentions, and emotions. Every story must have a main character, called the protagonist. According to Field [1982], the first task in creating a character is defining what he needs. Antagonists can be defined as the forces that stop the protagonist from fulfilling its needs. This force can be internal or external, as shown in Howard and Mabley [1995].

The antagonist is the opposing force, the difficulty that actively resists the protagonist efforts to reach its goals. These two forces form the story conflict or conflicts. [...] there are various movies where protagonist and antagonist are, clearly and distinctively, different persons in opposition one to the other. In this kind of story, the protagonist has what's called an external conflict, a conflict with other. But, in many other movies, the protagonist is its own antagonist [...] the main conflict takes place inside the central character [Howard and Mabley 1995]. Besides the protagonist, and possible antagonist, several other characters can appear in the story, each and every one with a specific function.

According to Vogler [1998], by relating collective unconscious archetypes with story characters, Campbell [1968] assigned to these characters functions they must obey in the story. Vogler [2007] lists in his book some of these archetypes and their functions, they are: hero, mentor, threshold guardian, herald, shapeshifter, shadow, ally, and trickster.

2.5.3.Fabula

Frank Daniel [apud Howard and Mabley, 1995] defined, in a much simpler way, the basic dramatic circumstance of a good story: Someone needs desperately something and is having difficulties in obtaining it. The author's task is finding out what is this thing and how is the search for it going to take place.

Some authors state that it is possible to enumerate all the dramatic situations found in stories. The dramatic situations describe what the story is about; for example, if it is a story of rescue, revenge, or disaster.

Polti [1945] created a list with 36 dramatic situations. For each one he presents a brief description and a set of character roles. Even if the soundness of such lists is arguable, they can be very useful in the automatic generation of stories.

Both McKee [1997] and Field [1982] describe a simple technique, very popular among movie script authors, using small paper cards. The technique consists in writing in each card a description in few words of a scene or sequence, until all scenes are defined. From there on, each scene is incremented with descriptions more and more complete, until they get to their final versions. Different card colours can be used to differentiate between different parts (or acts) of the story.

In other words, the usage of this technique implies building an event hierarchy in the story, using a top-down approach to its resolution. First one must define what the story is about, who the protagonist is, and what its dramatic need is. Then the story is divided into acts and the acts are decomposed into scenes, which are in turn refined into sequences of character actions.

2.5.3.1.Divisions of Fabula

There are several ways to divide a fabula. Usually it begins with the event that "provokes" the story, upsetting the stability of the protagonist's home world. Then the main character goes through progressive complications until getting face to face with a situation (crisis) calling for a tough and momentous decision. After that, the story reaches its highest point (climax) and then moves towards its closing [Howard and Mabley 1995, McKee 1997, Field 1982].

Field [1982], strongly influenced by Aristotle, defined a structure that must be adopted in order for a story to be successful. In summary, this structure (that he called paradigm) comprises three acts, having a turning point at the end of the two first acts. The main purpose of the first act is to present the protagonist and his dramatic needs to the audience, as well as the circumstances in which the events take place. During the second act, numerous obstacles to his goals are presented to the protagonist. And, during the last act, the story is resolved in a relatively satisfying way.

Field defends his proposal, with some reservation: "Do all good scripts conform to this paradigm? Yes. But this does not guarantee that they are good scripts or good movies. The paradigm is a form, not a formula [...] it is what keeps story cohesion. The spinal cord, the skeleton and the story are what determine the structure; the structure does not determine the story" [Field 1982].

McKee [1997] describes yet other divisions into acts that are also used. According to him, stories with many acts tend to cause a smaller impact on the audience.

2.5.3.2.Comparative Studies

There are several comparative studies related to stories, and they often deal with the fabula level, concerning the actions that are performed by the characters.

Among these studies, the work by Propp [1973] is certainly the most utilized in SGSs. This comes from its easy integration with existing Artificial Intelligence techniques, especially those applied to planning/scheduling, and to its appropriateness to game-like scenarios. In his study, Propp defined 31 literary functions, as the building blocks of Russian folk tales.

Lord Raglan [2003], in his study on heroes, traced parallels between several hero stories in mythology, and found some important similarities. Based on his observations, he defined a pattern indicating 22 steps for the hero's progress.

Another comparative study of great importance was performed by Campbell [1968]. His model is one of the most popular in story generation in different media. One can notice its application in a wide range of popular books and movies.

Starting from Campbell's work, Vogler [1998] proposed a method for the creation of stories based on the monomyth. Vogler [1998] claims that stories that follow the steps in the monomyth have a higher chance of being successful.

Even though Campbell [1968] and Raglan [2003] seem to have had far more influence on the actual production of books and films than Propp [1973], we found no reference to the application of their models to current automatic story generation systems, apart from a few casual mentions to Campbell's work. However we believe that their ideas can be very useful to story crafting.

2.5.4.Story (*Narration*)

While the fabula is the set of all events in a story, the *narration* contains only the events that will be shown to the public, laid out in the order in which they will be presented [Bal 1997].

Howard and Mabley [1995] highlight what should be added at the level of narration to enhance the quality of stories:

"A good and well told story includes another crucial element: the way in which the audience lives/feels the story. What a spectator knows, when he gets to know, what he knows that some character does not, what the spectator expects, what he fears, what he can anticipate, what surprises him – all these are

elements that are part of the technique of telling a story" [Howard and Mabley 1995].

It is through narration level techniques that the author manages to attract the audience's attention. There are many such techniques, but we will cover only a few of them.

Several techniques depend mostly on the chosen medium, while some others are more general. It is important to notice that each medium has its own attraction mechanisms (cf. for example, with respect to comics, the insightful remarks of Scott McCloud [McCloud 1994, McCloud 2006] on story presentation). Moreover, when a story is adapted from a medium to another — a book to a movie, for instance — many changes may need to be done in order to keep the audience's attention.

When comparing interactive media with non-interactive ones, even bigger differences can be noticed. The techniques presented here are mainly based on non interactive media, or on media with limited interactivity. As a simplifying hypothesis, we shall assume that the narration will be built from an already generated fabula.

According to McKee [1997], curiosity and consideration are two key elements in keeping the audience interested, which can be attained by means of three different techniques: mystery, suspense, and dramatic irony.

In mystery, the characters know something that the audience does not know, but has interest in knowing. In this case the interest is kept due to the audience's curiosity.

On the other hand, in dramatic irony, the opposite happens. It is the audience that knows something that the characters do not know. Attention is kept by the compassion the audience feels towards the characters. According to Howard and Mabley [1995], dramatic irony puts the spectator in a position of superiority and this translates into a feeling of participation.

In suspense, both the audience and the characters have the same information. Suspense then combines both curiosity and consideration. Ninety per cent of movies, comedies and dramas, create interest in this way. In suspense, however, curiosity does not concern facts, but consequences. Characters and audience move side by side through the narrative, sharing the same knowledge. But what nobody knows is "how is everything going to end?" We are led to feel empathy and relate to the protagonist [McKee 1997].

According to Genette [apud Bal, 1997], one way to capture a lesser or greater degree of attention to some specific episodes is to alter exhibition timing. This can be accomplished through ellipses, summaries, slow-motion, and pauses. An ellipsis happens when some event in the story is omitted. A summary, when

some event is presented to the spectator in a shortened form. With slow-motion and pauses the opposite happens: a long time is spent with an event regarded as small at the original fabula level.

Another important technique when analysing the narration level is the story point of view [Bal 1997, McKee 1997]. A given story may be seen through different points of view, each one able to result in a complete different experience to the spectators.