

# Authoring emergent narrative-based games

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## Abstract

In this article, we address the particular issue of authoring interactive narrative with respect to video-games and interactive storytelling. We first introduce the narrative paradox between interactivity and narrative content in virtual environments and consider its impact on game design and development. We then introduce the concept of the Emergent Narrative (EN) and the particular philosophy it has been developed upon. Finally, we describe an authoring process for this approach that reflects on the characteristics of interacting within such a narrative framework.

## 1 Introduction

In the recent period, the drive for graphic realism in video games has slowed as technique reaches a plateau of excellence and it becomes hard to differentiate a game in the market through its graphics. Game developers have as a result begun to concentrate on other game design components to improve the quality of their releases. While this had led to a focus on Artificial Intelligence (AI), Interface design (i.e. usability) and playability (i.e. alternative controls), it is interesting to see that it has not fully exploited the full range of experiences a truly interactive narrative could provide. From a

narrative perspective, the approach undertaken by developers has remained very conservative.

Indeed 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. A potential audience that is oriented to movies will find nothing in supposedly narrative-based games as they currently are that movies cannot do better. We argue in this paper that solving the problems in creating truly interactive narratives in games could allow video games to reach this new audience.

Here, we define an interactive narrative (IN) as a story that develops dynamically as the player participates in the game, implying that neither stories nor story paths are pre-determined at design time. Whilst game designers are aware of the advantages of interactive narrative, it is the academic research community that has produced a number of interactive storytelling systems [Cavazza et al 02, Mateas et al 05, Szilas et al 03, Riedl et al 05]. *Facade*, a narrative-based video game designed by Mateas and Stern [Mateas et al 03] illustrates this situation as it was developed as a research project and has not yet been commercially exploited.

Whilst not all game genres can sensibly incorporate interactive narrative, there is a clear role for it in genres such as First Person Shooters (FPS), Role Playing Games (RPGs) or Adventure games. However where narrative is incorporated as more than decoration, it is usually confined to simple branching tree structures, adapting at the narrative level the Finite State Machine approach usually used for control of NPCs. As games expand in size (i.e. *FarCry*), with substantial effort going into assets such as

textures, 3D models, dialogues, story content, the use of tree structures makes it difficult for game developers to manage the high number of narrative possibilities arising from rich environments and characters. The static nature of these structures affects the range of options covered, reduces the framework for player interaction, and impacts on development resources. Tree structures seem ill-suited to the development of large scale narrative environments as they exponentially expand with the addition of narrative elements (i.e. character, environment, story, encounter etc...) or remain so simple that the contrast between visual realism and narrative rigidity threatens the immersion of the player in the game world.

The integration of interactivity into game narratives requires a fundamental rethinking of the design process. The Aristotelian plot-based approach commonly applied assumes authorial control over every aspect of a story (i.e. movie, theatre play, novel) in relation to a static non-interacting spectator. Interaction is entirely absent from the model. Multiple stories may be developed but only as part of an overall story delivered to the spectator. The authoring of interactive narrative presents the paradox that on one hand the author requires control over the unfolding of the narrative whilst on the other the user also expects freedom over their decisions, movements, etc. Solving this narrative paradox [Louchart et al 03] at authoring level would significantly reduce the “scale-up” problem whilst optimising the development of narrative-based games. Conservative plot-based approaches such as the ones currently implemented in videos games are particularly ill-prepared for this task.

The Emergent Narrative (EN) concept [Aylett 99, Louchart et al 02] described in this paper is a novel approach to interactive narrative in which the narrative weight of an application is shared by author and players, rather than being imposed upon the players by the author. It requires a novel authoring methodology which is

discussed below. We will first present how these issues are addressed theoretically by the EN concept and introduce the EN-based application FearNot!. Finally, we will discuss the practical implementation of such an authoring methodology based on content development within the VICTEC (<http://www.victec.net>) and E-CIRCUS (<http://www.e-circus.org>) projects.

## **2 Narrative paradox gaming issue – new interactive structures**

Interactive stories develop through user input and therefore differ from the common linear storytelling tradition. We argue that in order to successfully model interaction within a narrative framework, both author and audience must rethink their concepts and expectations of story. This impacts game design which should be reconsidered with respect to narrative articulation. Fahrenheit (Indigo Prophecy in the U.S.) is probably one of the best example of interactive storytelling in a commercial game and its mechanics hint at some of the required changes.

### **2.1 Game Play and story progression**

Fahrenheit tries to avoid the typical pattern in which game-play hinders story progression. Game-play is often used as an artificial condition to narrative progression. (Adventure game puzzles). This approach, whilst an integrant part of video gaming, often breaks the player's immersion in the story and the distinction should be made between positive gaming challenges (i.e. puzzles, fights, combats) and deterrent or repetitive actions preventing the narrative progression. Fahrenheit aimed specifically at not compromising the quality and rhythm of the story with game-play. The technique used was the “rubber-band” story approach in which the story is somewhat elastic.

Whilst it has a beginning and an end, it is varied by the choices made by the player. Players had, in this game, to live up to their actions and decisions which could not be undone.

The EN approach addresses this particular issue via the inclusion of a Story Facilitator which constantly monitors the player's engagement in the unfolding story. It aims at creating an optimal dramatic experience for the player and can alter certain game-environment properties of game-play if required. For instance, if a player cannot find a set of keys to open a door, the story facilitator could take the decision, if the situation is stalemated, to release another character or enemy from this door and leave it open behind it. This approach is commonly used by game-masters in Role-Playing Games (RPGs).

## **2.2 Story motivation vs. Game Mechanics**

Most games motivate their players with in-game rewards (i.e. ammunition, better weapon, etc.). While this is not in itself a problem, when combined with the save-game facility it can destroy any sense of narrative progression. Experienced players will repeat a scene until they have managed to get the most out of it, for example, trying several options in a scene, until they find the one which results in the optimal reward. This playing style forces the player onto a simple, fixed story path that supports the game challenges but undermines dramatic experience.

Fahrenheit and several other games (i.e. Deus Ex, Baldurs Gate, Star Wars: Knights of the old republic, Oblivion) try to address this problem by giving the players complex choices. This produces a tighter integration of the narrative into the game-play itself and reduces the predictability of the story path for the player. The potential cost is that the choice process itself may halt the game and undermine the player's immersion in it. Another solution is to not allow the player to restore a saved

game or replay a scene so that all the consequences of a player's actions count permanently. *Façade* [Mateas et al 03] takes this approach and generates an interesting and effective interactive drama that still shows high replay ability potential.

Finally, American game pioneer Chris Crawford has been working on developing an interactive narrative project and his "Erasmatron technology" has been widely discussed within both the games and interactive storytelling communities. It is as yet too early to comment on the validity and technical implementation of the system, which is due for release in January 2008 via a newly founded exploitation company Storytron (<http://www.storytron.com>). However, looking at the basic principles of Storytron's narrative engine, one of the main ideas is to allow players to not only influence the narrative experience by their decisions, but also to direct in a free manner the dramatic unfolding by way of behaviour, as with the EN concept. Computer-controlled characters display their own personalities and react to the user, while stories are described and rendered meaningful by using the concept of the verb [Crawford 04, Crawford 05] to define the potential outcomes of an interactive story.

### **2.3 Game Length**

Increasing the importance of narrative within games would fundamentally alter the player's experience and impact the overall length of the game. It is normally assumed that the addition of interactive storytelling to games will reduce their length, partly by removing the open-ended retry capability and narratively obstructive games challenges already discussed. However, the motivation to replay a game several times will be much higher than for traditional games. Interactive narrative engages players in exploring "What if" scenarios (as in the film *Sliding Doors*), by either replaying the game themselves or by sharing their story experience with other players. *Façade*

presented the players with a relative short in game interaction (around 20 minutes), but most players feel the urge to play the scenario several times. The success of Fahrenheit also suggests that players are eager to experience new concepts and do not experience particular difficulties in accepting changes from current game structures.

### **3 The emergent interactive narrative approach**

An important part of the work carried out on the EN concept was to research interactive media, classical narrative theories and practices in order to propose a formal definition for the concept. A key step was to abandon a plot-based perspective of story for one based on characters and their interaction.

#### **3.1 The story**

It appears that once interactivity is involved, story must become plural. Most of the different approaches studied in recent years (i.e. branching, emergent) deal with multiple stories. However in the case of branching systems, the stories potentially displayed are instances/variations of a given story, while in emergent concepts; they result from the association of micro-stories at character level. Although multiple storylines are common in literature, cinema or even theatre, their integration in games presents the major characteristic that alterations in these sub-stories are made by the player. An Aristotelian plot-based approach is problematic in terms of timing and outcome from a branching point of view and in terms of formulation, articulation and representation from an emergent perspective.

Although the abstract framework of beginning, middle and end can be respected in principle, an emergent approach to interactive storytelling focuses on the actions and paths of individual characters rather than on an overall general story. It is concerned with the experience of the character and its trajectory in the story world and not with an 'objective' spectator's view. A story then becomes a process in which

a character is involved and which it helps to sustain rather than an artefact being presented. The plot-based perspective can be seen as a means of dynamically monitoring the depth, meaning and context of the process, a resource for the story facilitator, rather than the controller of what happens. This requires the plot 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.

Games such as the Medal of Honour or Call of Duty series already make use of the 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 gameplay with the ability of the player to act freely within this framework. The high-level story generates interesting and contextually correct events, which constrain the user's actions while not interfering with their freedom of movement within the story world.

### 3.2 The role of the user

The role of the user is a dividing issue and should be addressed with regard to the type of experience sought by the user. The role of the user is determinant of its mode of interaction and overall articulation [Table 1].

<b>Role of the user</b>	<b>Description</b>	<b>Interactivity</b>
<b>Spectator</b>	In the sense of a reader or a passive audience. The user witness the work and creativity of the author without possibilities of intervention	Extremely limited to none
<b>Author</b>	The user participates to the creation of story content and its articulation from an authorial perspective without taking part in its unfolding from a character or player view point. .	Interactivity is not an issue with this perspective of the user.
<b>Spect-Actor</b>	The user has limited perception of the story unfolding and has also limited interaction with characters with regards to their decisions	Interactivity present but limited by actor's desire to consult the audience
<b>Participant</b>	As in video-games, the user is immersed in the story from a character perspective and only perceive what he as a character has access to within the limitations of its environment	Interactivity present but limited by story environment and game play

*Table 1 User roles in interactive narrative systems*



Since the spectator aspect of storytelling largely involves the user's passive contemplation of the story displayed (i.e. cinema, literature, theatre) one could discard it when considering interactive narrative. Branching techniques developed over the years have created limited forms of interaction. Whilst efficient in manipulating the unfolding of the story plot, these cannot be considered truly interactive since there is no real exchange between the player and the story or characters, but merely the replication of an action-decision tree structure embedded within a story plot. Used within children's literature, this approach reached a wider audience with the emergence of new media and digital technologies, particularly DVDs and CD-ROMs.

The user-as-author is another interesting approach, giving users a well-defined role with creative capabilities (e.g. *The Sims*). This of course does not address the narrative paradox and in fact could be regarded as a deliberate strategy to avoid the problem. By giving the users control of the narrative but not placing them in the environment, this approach eliminates all the parameters responsible for the narrative paradox.

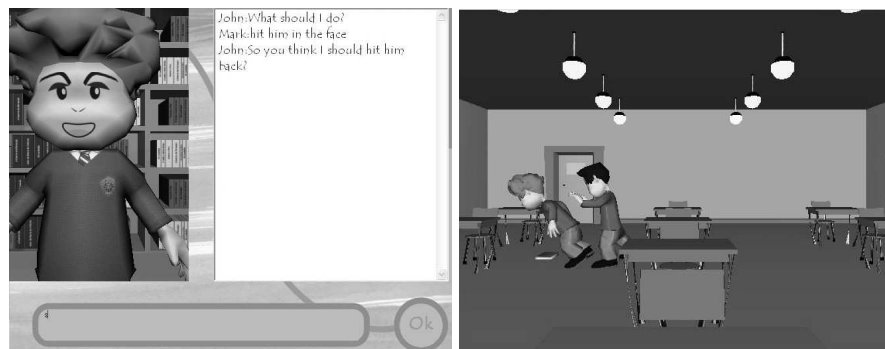
User-as-participant is the iconic case for the EN concept and in general for the integration of interactive narrative into games. In this case the choices of the characters are made by the user and the unfolding of the story is a direct consequence of these decisions. Such an approach is by definition character-based with the user is assimilated as a character in a similar way as a player in a human-based RPG. In RPGs the users' sole responsibility is to immerse themselves in a role, take on the character's motivations, goals and desires and through actioning these explore the environment and encounter other characters. This approach is both immersive and engaging for the user and does not limit them to a fixed plot line, thus maintaining

immersion and suspension of disbelief. Human-based RPGs represent the most successful form of interactive entertainment and reach a wide audience worldwide. Immersive participative modes in video games constrain the player much more heavily, reducing the immersive qualities of the medium.

#### 4. FearNot! and emergent narrative

FearNot! is an application created in the EU IST FP5 project named VICTEC (<http://www.victec.net>) 2002-2005 and being extended in an FP6 project eCIRCUS (<http://www.e-circus.org>) for longitudinal evaluation in schools during 2007. It is based on the Forum Theatre approach of Brazilian dramatist Boal [Boal 00] which aimed at changing the status of an audience from spectator to spect-actor by giving sections of the audience responsibility for the activities of different characters.

Within FearNot!, short episodes in which the character is bullied [Figure 1] are followed by interaction in which the child is asked for advice [Figure 1]: this advice then influences the actions of the character in the following episode via its impact on the character's internal emotional state.



**Figure 1: Scenario character and user interactions**

The episodes are not pre-scripted but are generated by interaction between the characters, who have an affective appraisal system and autonomous action-selection capabilities, producing an emergent narrative. The pedagogical effect is based on the

idea that empathy between the child user and the victimised character can be developed so that the child really cares what happens: evaluation has shown that this does indeed happen [Hall et al, 2005]. The aim is to allow a child to explore coping strategies for a serious problem that has no ‘magic wand’ solution: it is not a game as such. Its approach is for example not in the least like the RockStar game Bully (Cavis Canem Edit in the UK) where the player goes round dealing out violence for violence. FearNot! might however be seen as part of the serious game movement.

AI agent technology and affective processing have been used in the architecture developed for FearNot! This architecture incorporates emotion into the reasoning process and is based on a continuous planner where emotions such as hope and fear play a central role in managing goals and choosing between possible plans.

In addition to the varying internal state of the characters, ‘physical’ actions in the graphical world have an indeterminate outcome. For example a character, who is pushed may or may not actually fall over – this is determined at runtime. For this reason exactly what will happen in a specific episode is hard to predict. In order to relate the advice of the child to the situation of the character, a Story Facilitator agent is responsible for selecting the location, props and characters for each succeeding episode. If the child has advised the character to hit back, it may set up an episode where victim and bully confront each other directly. On the other hand, if the advice was to tell someone, it may set up an episode where a third character is present so that the victim may decide to approach them for help. The Story Facilitator is also responsible for deciding when an episode has finished via the use of set triggers it can recognise. This is needed precisely because the content of an episode is unscripted.

## 5 Narrative authoring

Due to the non-deterministic nature of the concept, the task of actually authoring such interactive drama requires the author to follow a certain number of good practices. Like all bottom-up structures, the authoring of an EN scenario must be based on empirical data and built up with regard to a series of simulations at different points of its development.

The first step in authoring such interactive application is to actually consider the different general actions that could be performed by the characters and users and consider their implications for each potentially concerned character of the party. This way a series of triggers is set up for interactions between characters. From a theoretical point of view, these triggers should not be automatic as in a rules-based system but conditioned to the internal state of the character. They should represent the different possibilities that could be offered to a particular character at any moment in the drama.

The second step of the process concerns the different possibilities of interventions from the Game Master (GM) and its decisions. In the same way as it is done with the characters, the GM's actions and decisions, in order to trigger reactions, must be parameterised within the characters composing the party. The first and second steps of the process implement content relative to goals, motivations and desires for both characters and GM.

The EN scenario is then developed specifically on the basis of system simulations with regards to possible user action selections. For instance, in order to develop a scenario where the user makes one decision; the process would run a simulation up to the point of user interaction and then simulate decisions possibilities and record the reactions from other characters in these different situations. Whilst this

approach will undoubtedly require the author to create some extra content for specific situations as they arise by means of simulations, it therefore scale up more efficiently than most branching tree approaches as the only actions implemented are the ones that would occur in one or several instances of the scenario. In the case of a situation where a character has the possibility to react to a user action by either selecting action A or B; if in all the simulations action A is always selected, action B has therefore no need to be implemented and would then be left out of the scenario development process and the system altogether. A scenario can therefore be developed relatively quickly since it does not require implementing actions or situations that would not occur at run-time based on the simulations carried out during scenario development.

Developing such a scenario also poses problems in regard to the actual representation of the scenario. Where one generally draws up a content map or plan for a novel in order to check out progresses in the development of a scenario, such approach is not possible with a bottom-up model. The author must be able to work out progresses based on partial tree type representations retracing scenarios occurring in different simulations up to the point of current development. This scenario development method leaves possibilities for altering story contents and developing specific and details interactions. With regards to the actual representation of an EN scenario, it must be done once the interaction with the users has taken place and retrace their journey and the decisions made. It can either be represented by a Finite State Machine (FSM) diagram that would cover the story in which the user would have participated or a text-based output retracing that same story.

## **5.1 Scenario and character authoring**

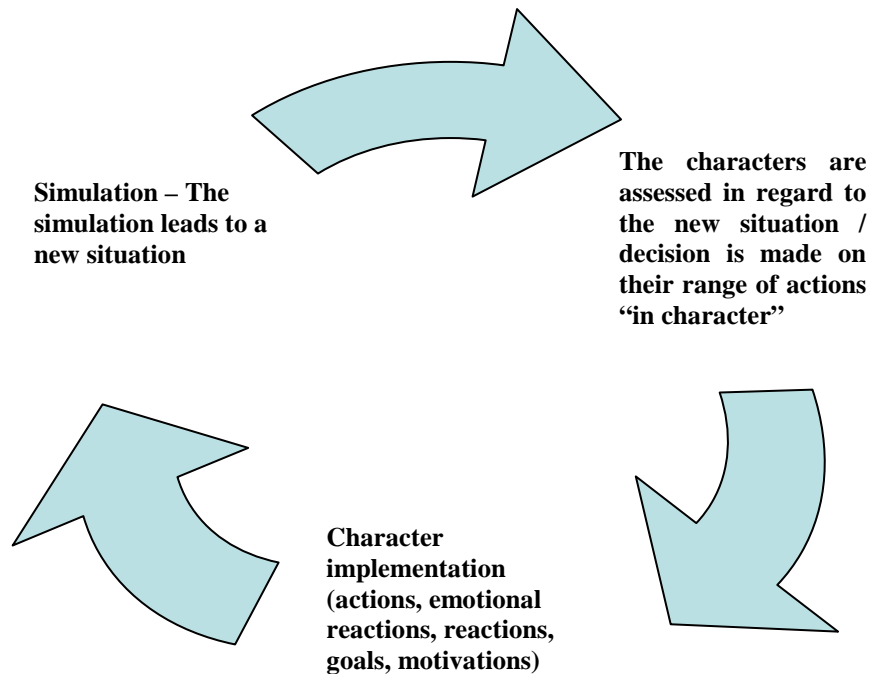
Branching narrative based on a plot-based view fits naturally with a top-down authoring process in which the overall story is decomposed into story elements.

Character-based emergent narrative on the other hand requires a bottom-up approach in which story elements are synthesised in real time via character interaction. Thus the environment design and other narrative events must be created in order to favour character interactions and story development and simulation becomes an important part of the authoring process.

The implementation approach is not dissimilar to the development method used in organic Improv. Organic Improv is a theatre technique in which the basic principle is to give characters a certain amount of information about themselves (i.e. temper, objectives, goals, reaction tendencies etc...) and to immerse them into a given situation. Their reactions “in character” are then used as the backbone for a future production or help in highlighting weaknesses in the definition of characters.

The EN approach requires authoring of characters defined by their skills, emotion setups, personalities, action tendencies, goals and emotional reactions. Static checking followed by interaction simulation is used to identify areas where further development is required. This methodology is “organic” in the sense that the NPCs in an EN application do not take “out of context” actions and do not require global action management. The development process is illustrated below in **[Figure 2]**. This approach is very similar to domain design in the AI Planning community [Aylett and Jones 96] which shares the problem of synthesising actions so as to produce intended behaviour and not non-intended behaviour. In this work, static checks involve making sure that no actions have pre-conditions that mean they will never be selected, taking into account the world states that actions in the set under consideration can produce if executed. The action repertoire selected for a character being authored can be expanded by making this type of check to indicate missing actions. While tools exist for this type of checking [McClusky and Simpson 04], they are not character-based

and would require extension for use in this context, where which of the characters being defined are intended to interact with each other must also be considered.

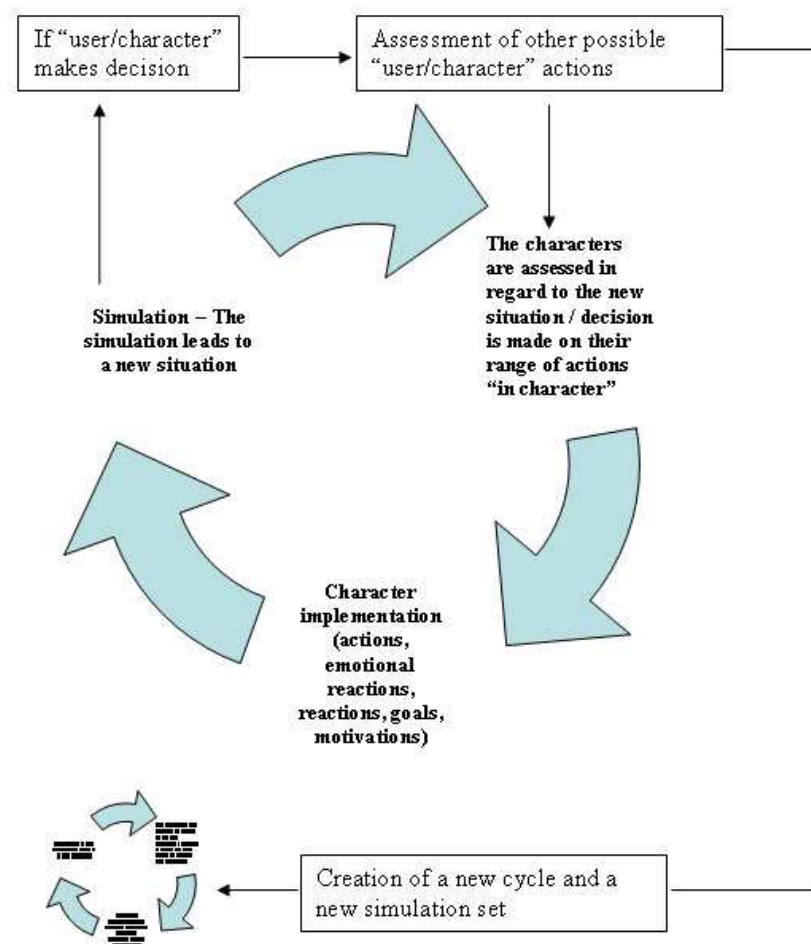


**Figure 2: Scenario implementation cycle – non-interactive design**

To carry out dynamic checks, the author assigns a specific character to the player and runs various simulations in order to examine the actions selected in various contexts. These actions must fit the character definition that the author has in mind. As before, the world states created are used as a starting point for the design of other characters [Figure 3]. The advantage of this approach is that only part of the potential search space needs to be examined rather than the complete universal plans of all characters and their interactions.

Indeed, this echoes the points made by Orkin [Orkin 06] with respect to the inclusion of AI planning and goals for the NPCs in F.E.A.R. He argued that this made it much easier for the designer to produce complex yet relevant NPC behaviour

because the declarative nature of goals allowed the designer to keep control of the 'what' while the planner allowed simulation of the 'how', which of course also includes the 'when'."



**Figure 3: Scenario implementation cycle – interactive design**

An analogy would be to compare the scenario content to a narrative surface across which the users travel. Their decisions influence the path they follow and the subsequent unfolding of the story.

## 5.2 Character implementation – a case study

Since the story is acted out by autonomous characters, the main task is to author characters' personality and behaviours. Characters with the necessary rich action repertoire and sophisticated affectively-driven action selection mechanism require a



complex architecture for successful implementation. Successfully instantiating instances of such an architecture is a highly technical task requiring a programmer-level understanding of what each parameter involved contributes. Much the same point has been made in AI Planning about the need to understand the algorithms of the planning software when defining domain knowledge for it [McClusky and Simpson 04]. Since most authors do not possess such a skill set, the whole authoring process must eventually be embodied in user friendly authoring tools. The successful design of such tools depends however on generalising the experience of hand development, and here we discuss a specific case study with this in mind.

The FearNot! application discussed above incorporates an affective agent architecture called FAtiMA [Dias et al 05]. This incorporates two components required in any EN agent architecture: a continuous planner and an emotional personality model. The planner allows the character to act intelligently its continuous property allows it to re-plan its actions in the case of unexpected events. The simulation of emotions provides characters with believability giving the illusion of an independent inner life.

The emotion model used is based on the OCC cognitive theory of emotions [Ortony et al 88], where emotions are defined as valanced (good or bad) reactions to events. This theory defines 22 emotions through a set of rules: for example a character will be *happy-for* another character if an event occurs which is congruent with the second character's goals and the second character is liked by the first character.

The assessment of this relationship between events and the character's emotions is called *appraisal* and is carried out in relation to the agent's goals, standards and attitudes. Goals represent world states that the agent desires to attain.

Standards refer to ethics and social and moral standards, and attitudes represent the agent’s preferences and dispositions towards objects or people.

Emotions add a certain level of unpredictability to the unfolding of stories whilst their intensity value can also be used as a surrogate for dramatic intensity and its impact on characters. The distinction between the cognitive activity of planning and emotional responses is reflected in the authoring process in which data for these two components is significantly different.

Name	Description
Personality	This is the emotional disposition of the character. It influences how it generates emotions and how it emotionally reacts to events.
Emotional Reactions	What are the emotional variations experienced by the character for specific events
Action Tendencies	Impulsive actions caused by certain events and emotions.
Goals	The goals that the character wants to achieve.
Actions	The actions that the character can use to reach a goal.

**Table 2: overview of character authoring components**

[Table 2] summarises the components that must be authored for each character in FATiMA with an indication of the role they play in character behaviour. The next two sections describe the authoring process of character personalities and goals. These are illustrated with a set of examples from a light-hearted alternative implementation of the Red Riding Hood (RRH) folk tale for which the specification can be found in [Appendix 1].

### 5.2.1 Emotions and personality

Emotions affect the way a character reacts to situations and provide greater believability in the character’s actions, reactions and decisions. For each character the profile for each of the 22 different emotions of the OCC model must be defined. Some

of these are directed towards others (i.e. anger, gratitude) and some are self-directed (i.e. joy).

A character's personality is defined by setting individual threshold and decay values for these emotions which control at what point an emotion will be generated and how long it takes to fade away. [Figure 4] shows the personality configuration for two characters of our RRH implementation.

```
<EmotionalThreshold emotion="Love" threshold="3" decay="5" />
<EmotionalThreshold emotion="Hate" threshold="5" decay="5" />
<EmotionalThreshold emotion="Hope" threshold="3" decay="3" />
<EmotionalThreshold emotion="Fear" threshold="5" decay="5" />
.
.
.
.
.
<EmotionalThreshold emotion="Reproach" threshold="3" decay="8" />
<EmotionalThreshold emotion="Gratitude" threshold="2" decay="5" />
<EmotionalThreshold emotion="Anger" threshold="6" decay="8" />
```

**Figure 4: Personality configuration**

In this example, Little Red Riding Hood herself is configured as a character that experiences gratitude relatively easily (i.e. very low threshold) and is also calm: she does not generate anger easily and only for a short period of time (i.e. very high anger decay). Both threshold and decay in FAtiMA are expressed on a scale ranging from 1 up to 10.

Emotions are generated by domain-specific appraisal rules for events that are considered sufficiently important to impact on the character. An appraisal rule specifies the event to be appraised and up to 3 parameters: **desirability** (how desirable is the event for the character itself), **desirability for other** (how desirable the event is for the other character that is involved in that action, if any) and **praiseworthiness** (How praiseworthy does the character consider this action to be). Using the valences (positive or negative) of these 3 values, the emotion module determines which

emotion is generated. Their absolute values determine the intensity of the generated emotion. These appraisal rules are referred to in the OCC as emotional reactions.

[Figure 5] shows an emotional reaction for Little Red Riding Hood.

```
<EmotionalReaction desirability="-15" praiseworthiness="-15">  
<Event subject="*" action="SpeechAct" target="[SELF]" parameters="announceEating" />  
</EmotionalReaction>
```

**Figure 5: An example of emotional reaction**

This particular example shows that if another character (i.e. anyone in this case (\*)) announces the desire to eat Little Red Riding Hood this is highly undesirable and negatively praiseworthy.

The OCC prospect-based emotions hope and fear are also automatically generated by the process of planning. When characters build an intention (i.e. they try to pursue a goal), they feel both **hope** that their plan to reach the goal will succeed and **fear** that it might not succeed. Once the goal either fails or succeeds, the hope and fear emotions are transformed into **satisfaction** and **relief** (for a positive outcome) or into **disappointment** and **fears-confirmed** (for a negative outcome). Fortunately an author needs not to worry about specifying rules for generating those emotions, as the continuous planner generates these automatically.

The FAtiMA architecture implements two separate mechanisms linking emotion to character actions. Firstly, emotions feed back in the planning process and facilitate goal selection. Thus action templates for the planner can be defined with emotional values as pre-conditions, as discussed below in section 5.2.2. Secondly, generated emotions can be used to trigger action tendencies. These are spontaneous reactions triggered by intense emotions and are not part of the planning process. They allow the agent to fulfil certain goals via reactive behaviours. An action tendency is an action that is triggered when the agent is in a certain emotional state

and a particular event occurs. **[Figure 6]** shows an example of an action tendency for Little Red Riding Hood which causes her to scream if anyone announces an intention to eat her.

```
<ActionTendency action="SpeechAct([Subject],screaming)">
  <Preconditions>
</Preconditions>
  <ElicitingEmotion type="Distress" minIntensity="3">
    <CauseEvent subject="*" action="SpeechAct" target="[SELF]"
      parameters="announceEating" />
  </ElicitingEmotion>
</ActionTendency>
```

**Figure 6: An example of action tendencies**

In this case, if this event occurs and Little Red Riding Hood feels distress above a minimum intensity of 3, her reaction will be to scream. Action tendencies are spontaneous in the sense that they are carried out on the sole basis of the emotion felt by the character. This can be observed in real-life as people tend to react emotionally to certain situations without relying on cognition.

By defining the agents' goals and action tendencies, the author builds the characters' personalities. Just as in cinema, where a character is identified by its quirks and objectives, in FearNot! personalities are modelled as action tendencies, goals and emotional parameters. These features are then used in real time as a way for stories to emerge. **[Figure 7]** summarises two simulations of our RRH story that feature two different personalities for Little Red Riding Hood. In example A, Little Red Riding Hood's personality configuration is the one of a character that is not particularly fearful. Consequently, when meeting the Wolf in the forest, Little Red Riding Hood does not take a defensive approach to interaction and is willing to listen to the Wolf's proposal. On the other hand, Little Red Riding Hood exhibits a more fearful personality in example B and generates fear rather than interest. As a result of her emotional state, Little Red Riding Hood in example B decides to end the

interaction with the Wolf which in forces the Wolf to re-plan its actions and leads him to decide to eat her.

<p><b>RRH</b> enters the Forest  <b>Wolf</b> enters the Forest  <b>Wolf</b> says to RRH: Hello, may I introduce myself? I'm Lupo. May I ask for your name?  <b>RRH</b> says to Wolf: Oh, hello, my name is Maia.  <b>Wolf</b> says to RRH: I have a proposal to make. You look like you need some potatoes as urgent as I do. What do you think? Should we work together and try to steal some? I have a plan.  <b>RRH</b> says to Wolf: You're right I really want some potatoes, let's hear your plan.  <b>Wolf</b> says to RRH: Ok here's the plan, I need you to steal the key from the Woodmans pocket. Be careful not to wake him up. I can't steal the key because my hands are too big to reach into his pocket. Once you have it we can unlock the heavy gate and I will be able to push it open.  <b>RRH</b> steal Key  <b>RRH</b> unlock Gate  <b>Wolf</b> pushopen Gate  <b>Wolf</b> says to RRH: Halleluja, I'm in potato heaven.  <b>RRH</b> says to RRH: Yummy, finally some potatoes again.</p>	<b>A</b>	<p><b>RRH</b> enters the Forest  <b>Wolf</b> enters the Forest  <b>Wolf</b> says to RRH: Hello, I'm surprised to meet someone out here, what's your name? I'm called Lupo.  <b>RRH</b> says to Wolf: I should really not be speaking to you, I gotta go.  <b>Wolf</b> says to RRH: Hey, I know I look a bit dangerous, but I'm harmless. I'm a vegetarian.  <b>RRH</b> says to Wolf: I really gotta go, sorry.  <b>Wolf</b> says to RRH: You leave me no choice, but to eat you then, I am not going to starve here.  <b>RRH</b> says to Wolf: Aaaaaaaaaaaaaahhhhhhhh, HELP.</p>	<b>B</b>
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**Figure 7: EN simulation using different personalities**

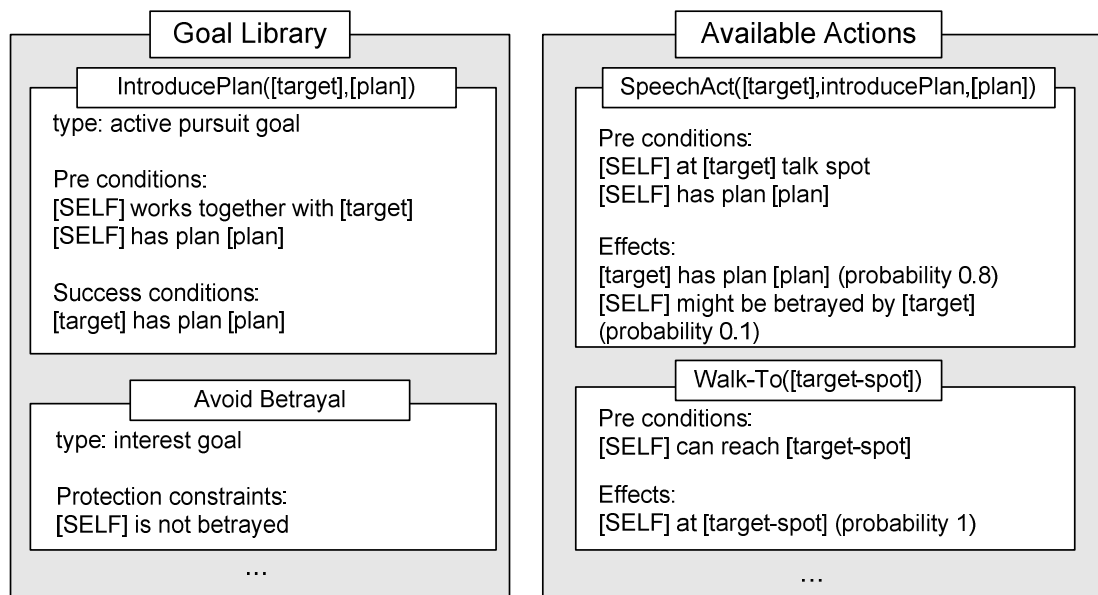
### 5.2.2 Planning

The EN planning system aims at generating plans (sequences of actions to execute) in order to reach certain goals. So that characters show rich behaviours, a large repertoire of actions is required. According to standardised planning-languages (i.e. STRIPS [Fikes and Nilsson 71]), an action is described by its preconditions (that have to be fulfilled for the action to be executed) and its effects. Additionally an action can possess one or more corresponding effects in the front-end/ visualization layer of the application. For instance, an action could for example be executed as an animation, a request to change the world state (e.g. opening a door), a line of dialogue or the movement of the character to another place. A categorization of actions is therefore necessary to manage the great variety of possible action executions. However, a more detailed description of this topic is beyond the scope of this paper [Aylett et al 06].

The planner also requires the specification of goals in a similar way. Based on the OCC goal categorisation [Ortony et al 88], the EN system presented herein features active pursuit and interest goals. An active pursuit goal has pre-conditions that indicate when it can be activated (transformed into an intention) and success and failure conditions. Active Pursuit goals are always applied, when the agent wants to reach a certain state, they are the goals that the characters actively try to achieve, such as pushing someone's books off a table.

An interest goal, on the other hand, is used to apply protection constraints over a certain condition. They represent goals that a character has but does not actively pursue, for example avoiding getting hurt. In contrast to active pursuit goals, where the agent wants to reach a certain world state, interest goals reflect world states the agent wants to preserve. The planner uses interest goals to prioritize plans over others (plans that might possible damage protection constraints will be less favourable).

Each goal has a set of emotions associated with it (the prospect based emotions of the OCC theory), the two most important emotions being hope (that the goal will be achieved) and fear (of not achieving it). These emotions represent the importance of the goal to the agent since the goals generating the strongest emotions are the ones that require more attention from the agent. Goals and action definition are illustrated in **[Figure 8]**.



**Figure 8: Example of goal and action definitions for the Wolf character**

The Wolf's active pursuit goal of introducing a plan to Little Red Riding Hood can be reached by the two plan steps of walking to Little Red Riding Hood and using the introducePlan speech act. However, the Wolf can neither be sure whether the plan will be successful (i.e. Little Red Riding Hood accepting the plan), nor whether there will be repercussions (Little Red Riding Hood betrays the Wolf and gets him into trouble). These uncertainties are reflected by the probability values of the introducePlan speech act's effect. The probability values do not necessarily have to statistically match the real outcome; instead they should be seen as the agent's estimation of the effects of his actions. The effect that the Wolf might be betrayed, leads to a conflict with his interest goal of avoiding betrayal and makes this plan less favourable. The Wolf thus would prefer less risky alternative plans.

In the example, entities in square brackets like *[target]* represent variables, which provide the possibility to generalize plans. For example the Wolf can introduce either different plans or this plan to different characters.



### **5.2.3 Dialogue**

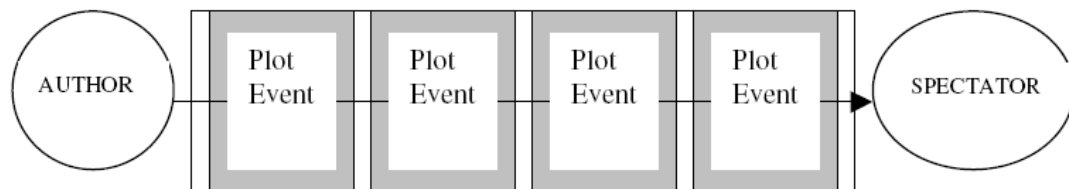
Unless agents possess the ability to generate natural language expressing their conversational intent, a human author is required to write dialogue. It is important in this approach for the dialogue to be as reusable and modular as possible. FearNot! features a pattern-based language generation engine that interprets the SpeechAct actions generated by the planner into actual utterances. The authoring thus requires the author to either restrict the use of dialogue to the content of the language engine's database or extend it [Louchart et al 04].

## **6 Managing emergent narratives at run-time**

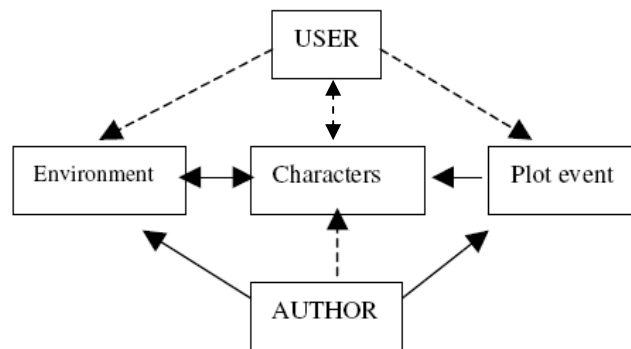
Story or drama management is typically a crucial area of interactive narrative and the role of a manager is to keep the overall story 'on track' in the face of player actions. The implication of the arguments advanced so far is that in EN the drama manager should not focus attention on the quality and meaning of the overall story but on the quality of the performance experienced by the different characters (i.e. players, other agents), so that 'staying on track' is no longer an objective. This requires the development of metrics of performance quality, but since it should be measured 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 that the EN approach aims to protect. Global management can then be confined to events exogenous to the characters: entrances, exits, the outcome of unpredictable physical actions. 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 8].



Conventional narrative structure



Emergent narrative cycle

*Figure 8 The emergent narrative articulation*

This approach has in fact already been the subject of many applications in the domain of Live RPGs where it has proved successful in adapting scenarios from literary classics such as Shakespeare’s Hamlet (<http://www.grutbildning.to>). The EN concept regards characters represented in the story world by a set of goals and potential actions that reflect their personalities. The drama manager acts according to a set of rules directly extracted from RPG practices. These rules are distributed within the characters’ personalities and goals and adequately triggered when the performance requires them.

## Conclusions

In this article, we have underlined the current issues concerning narrative articulation in video games (i.e. narrative paradox). Whilst most games feature an important amount of narrative elements, very few show original story management. In recent years, with the notable exception of Fahrenheit, very few video games proposed a truly interactive narrative experience to players. Such feat has been achieved in academia where the research in interactive narrative is currently animated by the release of projects (i.e. Façade, the Storytron story engine) that are pioneering the whole genre of interactive drama.

We have described herein a novel character-based narrative concept that specifically addresses the narrative paradox encountered in video games and interactive storytelling. The Emergent Narrative concept allows for the development of interactive narratives that emerges from the interactions between characters, players and environments. This approach has been designed with the clear intention of facilitating the development of interactive narratives by focusing on the characters and their interactions. Its particular authoring process has been described and illustrated in this paper. Whilst it challenges conventional narrative authoring, we believe that the EN authoring would benefit large narrative environments by identifying (via simulations) areas that need to be specifically developed for an interactive drama to take place, whilst not relying on the tedious design of large universal action trees for characters and stories.

The EN concept requires the author to define characters in depth and to create story elements such as events and timing around the characters. This approach differs from the common practice of defining characters to fit a pre-determined story. This could be challenging for writers and part of our future work is to develop an authoring tool

that can help unifying those 2 differing viewpoints by automatically building EN characters based on example stories provided by the author [Kriegel et al. 07].

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## **Appendix 1 - Little Red Riding Hood Backstory**

### **Backstory – Scene: the magic forest:**

The magic forest is right at the centre of the magic land. It is well known for its magic lawn, which is the only place in the world where the famous magic potatoes grow. Magic potatoes are loved by all inhabitants of the magic land for their psychedelic feel-good properties. Until recently everyone in the magic land lived peacefully together and there were enough potatoes for everyone to have a constantly good time. However, since the new chancellor is in power, things have changed. Tensions between different magical races that used to get along well are stirring up, certain races have been classified as “dangerous” and this is all fuelled by a constant potato shortage. The chancellor claims that potatoes are government property and that potato export is the key to a wealthier future for the whole magic land but many people suspect he is involved in dubious transactions and acts in his own interest. In order to prevent the locals from their usual practice of picking potatoes a hunter has been installed in the forest who is supposed to enforce the new laws. Citizens who collaborate and help to track down criminals are rewarded with extra potato rations.

### **Character – Maia (Red Riding Hood):**

Maia is supposed to pay her granny a visit. It’s a beautiful day and she is wearing her favourite red hoodie. However, today all she can think about is tonight’s big party. She only agreed to visit her granny because that gives her the opportunity to collect some magic potatoes for the party. Plus Granny also likes them. Her only worry is that this new overambitious hunter catches her with the potatoes. She could get into a lot of trouble. If only she knew that there is also a dangerous wolf on the loose that she needs to worry about...

### **Character - Willie:**

Willie is the new hunter in the magic forest. He takes law enforcement very serious. He could already make the forest a much safer place by arresting most of its dangerous inhabitants including bears, wolfs and squirrels. However there is one wolf that he could not catch so far but he won’t be able to hide forever.

Willie is also fighting a determined battle against potato theft much to the dislike of the locals. This morning he built a big fence around the magic potato lawn. The only key to the gate is in his pocket.

Right now he is having a well deserved rest and is taking a nap but the slightest sound will wake him up, his loaded gun next to him...

### **Character – Lupo (Wolf):**

Lupo is the only wolf left in the magic forest. He feels discriminated and all he wants is to leave the country. However he needs some disguise because Willie has his spies everywhere. A hoodie would be ideal.

The other big problem is, that Lupo would give anything for a few potatoes but since this morning they are all behind this big fence: Another trick of this new hunter to make his life more difficult.

Lupo, a convinced vegetarian, realizes that the lack of potatoes makes him aggressive and when he starts feeling hungry he is for the first time in his life actually fancying some meat. That is when this girl in red comes along the way....