Unscripted Narrative for Affectively Driven Characters

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Abstract

We discuss work carried out at the University of Salford (UK) and INESC-id (Portugal) on the design and implementation of interactive dramas in 3D graphics environments. We present detailed requirements and methods for the design of unscripted (emergent) dramas based on research into role-playing games. We describe the affectively driven intelligent autonomous characters implemented and discuss both theoretical and technical issues relating to its computational implementation. Finally we consider the implications for game design and new genres of game.

Introduction

The video games industry has successfully demonstrated over the last two decades that virtual characters, virtual worlds/environments and even virtual societies could reach and entertain a large population of today's developed societies. Video game companies have also developed, as for any other media type, a range of applications, domains and genres. However, it is important to acknowledge that, despite the fact that original applications are still being produced on a regular basis [1, 2], the majority of games released nowadays reflect too often the commercial choices made by games companies to sacrifice creativity and originality for cash generating formulae.

Although this relative lack of creativity and originality is understandably driven by commercial constraints, it has left the game industry, over the past few years, to rely on technical and computational progress to justify the release of new products (i.e. improved graphics, wider environments etc..). More often than not, direct action has been prioritized in regard to the game story itself and consequently, the current representation of narrative in today's video games (i.e. cinematic, tree approach) has become a means of invoking action sequences rather than relating to the story experience or any narrative drive. However, the emergence of educational and pedagogical applications and the developing interest of the education community in ICT and VR has raised important issues with respect to narrative articulation and the way stories can be represented in 3D virtual environments. Since action is less predominant in pedagogical and educational applications, the main focus of concern has switched from the linking of direct action sequences involving the player/user to the smooth articulation of role-play and educative content (i.e. role-playing, storytelling and participative activities).

The research reported here on the Emergent Narrative concept [3,4,5,6] is oriented towards the definition of a narrative theory adapted to the VR medium (whether game or VR application). The main aim of this work is to reconcile the freedom of movement, navigation and decision inherent to VR and the unfolding of interesting and meaningful stories and narratives. Such an approach would benefit both educational and entertainment domains by allowing pedagogical content to be dispensed through appealing media and would give game designers the opportunity to more efficiently exploit game worlds and environments while orchestrating the articulation of meaningful stories.

In addition to the presentation of the main findings and results of our theoretical investigation on the emergent narrative concept, we present in this work technical details of the computational implementation of the concept.

The narrative representation in VR

Representing and communicating stories in VR and 3D virtual environments is a challenge that involves the (re)-consideration of essential narrative elements such as the role of the user, the form and nature of the story, the capabilities of the narrative medium and ongoing issues about user interactivity and immersion. Stories have been studied for centuries and narrative theories came to life from Plato [7] onwards. In spite of a number of different concepts and approaches, many applied in today's communication media, there are many issues proper to VR that are still unaccounted for.

Until the recent development and arising of VR in the world of communication and entertainment, Plato's categorization of stories could almost be considered as universal rules. Stories were either told by the author/poet directly (Diegesis) or showed to the audience through the use of characters (Mimesis). However, it is difficult to apply such a description of the narrative form to the possibilities brought by VR technologies. A place where the audience is not static and has the possibility to interact with the characters or environments of the story brings another dimension to storytelling altogether and extends the boundaries of both narrative creation and articulation. A story can from now on, not only be told or shown, but, can also be experienced and lived through. The emergence of interactivity also creates difficulties for the articulation of plot structures as first envisaged and defined by Aristotle [8]. The inherent freedom of movement proper to VR, indisputable element of immersion for any VR experience, collides with the Aristotelian vision of articulated plot events and elements in regard to a given timescale associated to the story in display. This narrative paradox can only be observed in interactive VR applications and it does not seem possible to resolve it through the use of existing narrative theories. From Plato's story definition and Aristotle's plot consideration, all the way to Propp's meta-structural narrative articulation [9], Campbell's cyclical diagrams [10] and Barthes and the French Post-Structuralism's top-down analytical masterpiece [11], one novel element needs to be considered and incorporated into the narrative question: interactivity.

Narrative paradox, the role of the user, constraints and challenges.

Although not a direct solution, there are several ways to avoid the problem of interactivity versus narrative structure just discussed. The two main approaches both revolve around the consideration of the users and their roles. The simple fact of casting the user as either a spectator or an author actually annihilates the problem by separating interactivity and storyline. For instance, if the user is cast as a spectator as in cinema, the focus is on the unfolding of the storyline and does not integrate interactivity. On another hand, when the user is cast as an author, the main focus is switched towards the interactive features of the application or medium rather than the storyline. In this case, the storyline is usually left to the sole imagination of the user. Video games however approached the narrative paradox issue differently and often assigned the user a role to play. Although we consider that role-play can potentially be a valid solution to the narrative paradox, it has to be said that the way it is actually conducted in video games is far too constraining of the user's freedom of movement and interactivity and still relies far too much on "cinematics".

Conducting a story through the VR medium also represents a challenge when considering the nature and essence of the story itself. Several questions must be asked and answered. How to design or make a story interactive? How to treat and process the user input within a story? In addition, the accessibility and success of video games over the last couple of decades, has influenced, the general public's view in associating immersion and interactivity in VR with direct action sequencing. That users have high expectations of action when dealing with VR displays may also represent an obstacle to the development of narratives in VR if not dealt with appropriately.

The emergent narrative solution

Since narrative theories do not currently deal with interactivity and present a rather restrictive consideration of the user with respect to story articulation, our research has been oriented towards the study of stories and narrative structures that break with the general high level plot approach as seen in film [12], classical theatre and other common narrative media. Our interest in a more participative and interactive narrative approach, has widened our field of research to alternative and interactive forms of theatre such as Boal's Forum Theatre and street theatre [13, 14], Role Playing Games (RPG) in their many forms and aspects (i.e. board, conflicting and live), and obviously video games [15].

Our research was mainly empirical since there are very few resources available for the detailed study of RPGs and was conducted using professional Knowledge acquisition solutions [16] and international experts on the subject.

The emergent narrative concept presented in this work is based on the idea that a story, as well as being authored and displayed in classical forms such as the ones we are accustomed to, can emerge directly from the interactions between its different protagonists and build itself on the causal relationship between its different elements.

Our emergent narrative approach is one that considers narrative unfolding and its significance as being integrated threads of a single process, made of narrative tensions, causal links, logical and affective decisions, personalities and priorities. Most of these elements are inherent to the characters themselves, users or not, and (re) place the character at the centre of the story. Besides the problems generated by the need to combine both a temporal structure and a narrative framework, displaying narratives in VR poses the problem of scalability. This character-based approach is not composed of one single storyline to which the different characters must conform in order to give sense to but of as many storylines as there are characters. The multiplication of the storylines makes it a suitable approach for interactive drama and interactive experiencing. Although such an approach and its different techniques function well in the world of RPGs and other practices of this type, its basic principles must be studied from a high level perspective and adapted to direct computational implementation.

Our theoretical reflection on the emergent concept and the related fieldwork we have conducted have resulted in a number of interesting findings, both in the theoretical and practical / implementation domains. From a theoretical point of view, the articulation of a process-based narrative model makes an argument for the greater value of multiple character-based experiences over less scalable plot and tree-type approaches. On a more practical perspective, since the character is in the centre of his/her narrative, in a direct computational implementation, the focus of development must be oriented towards the completeness of the character, **[table 1]** gives relevant characteristics.

Physical and general characteristics (Nationality, gender, height, body shape, strength)
Biography (Motivations, goals)
Personality traits (Major character traits, personality chart (agent system))
Quirks and priorities
Environment/character relationship How does the character help in defining the environment ? How does the character chooses to be in the environment ? What are its objectives ?
Occupation and occupational activities
Passion, origin of passion
Virtues and constraints
Layer cakes (emotioneering™)
Chemistry NPC to NPC (emotioneering™)
Character deepening elements (emotioneering™)

Table 1: Emergent Narrative character definition for interactive drama

However, the success of such an approach lies in the author's ability to create roles, environments, props and relationship according to a global vision of the experience itself. Indeed, in order to be able to interact intelligently and meaningfully between themselves, characters must have been thought through with respect to their different potential relationships with each other and their place in the world must have been clearly established. In addition to the creation of both worlds and characters that would be likely to interact in interesting and potentially dramatic ways, the game or experience author must formulate the setting up and emergence of situations likely to trigger the different protagonists into action and decision-making. This consideration brings us to the question of narrative control within this approach. It is not yet feasible to envisage the modeling of a human Game Master's (GM) mind for this purpose; the level of cognition and context analysis required is and will still be for a number of years unreachable. However, the knowledge acquisition exercise already mentioned showed that there are certain techniques used by a GM to control the game's unfolding that can be modeled as seen in **[table 2]**.

Context	Trigger type	Event type
Character Management		
The player is not interacting / not attentive	**No interaction when there is an opportunity**	**Send an NPC to directly interact with the player and prompt a reaction**
The player is suicidal	The player is taking **obvious and unnecessary risks**	**Remind the character of the potential consequences of its actions**
Drama Management		
Action takes longer than expected	The player has insufficient information to proceed	**Send NPC to assess knowledge and highlight gaps (hints)**
Unexpected branching of the story	The player is acting out of role	**Remind roles and rules, bring next encounter**
Player incorrectly determines what to do next	Player pursue wrong goal, goes to the wrong direction	**Give hints they are going the wrong way or emptiness**

Table 2: Examples of character and drama trigger and event types

Although, a rich definition of character and the GM's narrative control modeling are essential to the success of the research presented, the definition of an affective agent framework is the key to its realization and implementation. Since the character is at the centre of narrative development from both its own and the system's perspective, the development of intelligent agents that can react and therefore act autonomously under certain stimuli (narrative, emotional, personality) is a requirement in order to translate theory into implementation. Affect is seen as central to the creation of unscripted narrative since it both produces dramatically interesting action-selection and the accompanying expressive behavior required to establish the context of an action in a character's motivations.

In the rest of this paper we discuss an initial experiment in implementing emergent narrative, carried out in the European Framework V project VICTEC (Virtual ICT with Empathic Characters) [17].

The aim of this project was to apply Boal's Forum Theatre approach to virtual dramas in education against bullying. Short, unscripted dramatic episodes of bullying between virtual characters are divided by interaction episodes in which the child user is asked to help the victimized character by suggesting what they should do. The advice influences the character's choices in the next episode, which is watched by the child, so that they perform the role of *spect-actor*. Bullying is naturally episodic and while each time is different in some sense each time is also the same, making it a good initial candidate for an emergent narrative approach. The requirement that the child influence the character also requires an emergent approach, since branching on every possible suggestion over a number of episodes would otherwise produce a combinatorial explosion, while the child soon notices if a scripted agent in fact takes no notice of what they say. The agent framework developed for the project allows construction of virtual intelligent agents that express and react to emotions in a natural and meaningful way,. It has been designed so that it does not only apply to the specific context of school bullying, but can be used in the more general realization of emergent dramas.

The FearNot! agent framework

The agent architecture used in the FearNot! demonstrator (Fun with Empathic Agents to Reach Novel Outcomes in Teaching) is shown in **Figure 1**. Their behaviors, rather than being generated by a conventional planner are primordially influenced by their emotional states and personality. Their emotional status affects their drives, motivations, priorities and relationships. FearNot! provides two distinct levels in both appraisal and coping mechanisms. The reactive level provides a fast mechanism to appraise and react to a given event, while the deliberative level takes longer to react but allows a much more complex and rich behavior.

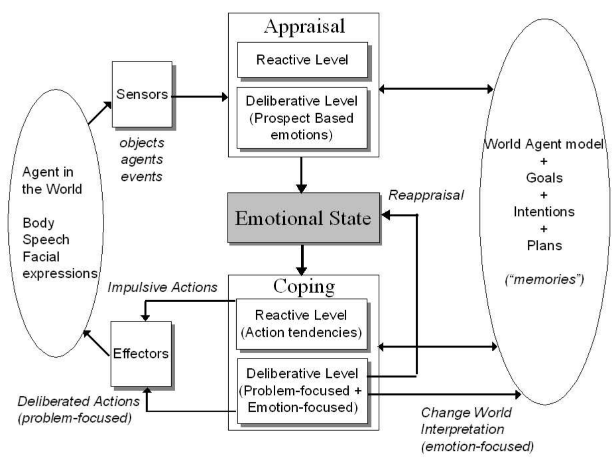

Figure 1: VICTEC agents' architecture diagram

The emotion model

The emotion definition adopted by the VICTEC team is the one proposed by Ortony, Clore and Collins (OCC) [18]. The OCC model is an approach based on a valence (good or bad) reaction to an event and the structure of emotions it defines can be seen as a hierarchical organization for emotion types. Based on the OCC theory, the VICTEC project represents an emotion with the following attributes: **[Table 3]**

The type attribute refers to the generic type of the emotion experienced. Each emotion type can be realized in a variety of related forms with varying degrees of intensity (i.e. emotion type Fear can generate an emotion range from concern to petrified). The attribute Valence describes the value, positive or negative, of the reaction that originated the emotion, while the target and cause attributes help in addressing and accessing both emotional impact and potential answer to the stimulus. In order to reflect on the dynamics of the emotional system itself, the intensity of an emotion must be attenuated through time from the moment it is generated onwards.

Attribute	Description
Type	The type of the emotion being experienced
Valence	Denotes the basic types of emotional response (positive or negative)
Target	The name of the agent/object towards the emotion is directed
Cause	The event/action that caused the emotion
Intensity	The intensity of the emotion. A logarithmic scale between 0-10
Time-stamp	The moment in time when the emotion was created

Table 3: VICTEC agents' emotion attributes

In order to generate such phenomenon, we applied Picard's [19] decay function for emotions where intensity is characterized as a function of time. At any time (t), the value for the intensity of an emotion is (em) is given by the formula:

$$Intensity_{em,t} = Intensity_{em,\ t0}\ x\ e\text{^-}bt$$

The appraisal mechanism

As shown in *Figure 1*, the appraisal mechanism is composed of two distinct layers. The reactive layer appraisal is handled by a set of emotional reaction rules, based on Elliot's Construal Theory [20]. A reaction rule consists of an event that triggers the rule and values for OCC appraisal variables affected by the event (desirability, desirability for other, praiseworthiness etc).

The deliberative layer is responsible for appraising events according to the character's goals, thus generating prospect-based emotions like hope and fear. These emotions guide and influence the deliberative coping mechanism. FearNot! includes two of the OCC's goal types; *active-pursuit* and *interest goals*. *Active-pursuit* goals are goals that the character actively tries to achieve (i.e. going to a dentist appointment) while *interest goals* represent goals that the character has but does not pursue (i.e. avoiding getting hurt). The OCC *replenishment goals* are not used since they could be considered as *active-pursuit goals* with cyclic activation and deactivation. An *active-pursuit goal* is defined in the VICTEC's agent architecture by the following attributes; ***Id*** *(goal identifier), Type (interest or active-pursuit),* ***Pre-conditions, Success-Conditions and Failure-Conditions***. Unlike the *active-pursuit goal*, the *interest goal* does not have any pre-conditions, success or failure conditions since it does not become active or inactive. However the *interest goal* possesses one extra parameter; a protection-constraint. This supports modeling of conditions that the character wishes to maintain, so the planner will try to prevent actions that threaten such conditions.

When an event is appraised, the deliberative level checks if any goal has become active, and if so, an intention to achieve the goal's success conditions is created thus generating hope and fear emotions according to the goal's probability of success. At the same time, this layer monitors all active goals and actions chosen to achieve them, updating the probability of action effects thus changing plan probabilities and generating new hope/fear emotions.

The action selection and coping mechanism

Like the appraisal mechanism, the action selection process is composed of reactive and deliberative levels.

The schematic layer consists of a set of action rules: each contains a set of preconditions that must be true in order to execute the action and an eliciting emotion that triggers this particular action. The action set is matched against all the emotions present in the character emotional state and the set of rules with positive matches is activated. The action rule triggered by the most intense emotion is selected for execution. If more than one action rule is selected (i.e. triggered by the same emotion), the most specific one is preferred.

The core of the coping or conceptual layer is built up according to a partial-ordered continuous planner [21]. Once the appraisal process is completed, the planner selects the currently most intense intention, which corresponds to the goal generating the most intense fear or hope emotion. The selected intention becomes the target goal for the planner to achieve. More than one plan may be generated and the planner must select one in order to continue planning or execution. As soon the selected plan is brought into focus it generates hope/fear emotions, including emotions caused by action threats to interest goals. The continuous planner will then either remove a plan flaw or execute an action if the plan is complete. Unlike other planners, FearNot! planner can also use emotion-focused strategies to drop an unlikely plan, to improve a plan or to resolve a flaw. The resulting plan is stored with the intention and can be pursued later on.

Plan representation

FearNot generates Partially Ordered Plans, which are modeled as a set of operators and additional constraints. These operators are a slight modification of STRIPS [22] operators, associating probability values with the effects. A plan operator consists of the action with pre-conditions and effects attributes, where the pre-conditions list contains a set of conditions that must be verified in order to execute the action and the effects a list of conditions that will hold when the action ends.

Figure 2 shows the operator that for the GetUp action. In order to get up, the agent cannot be already standing up. This condition is represented by the character status property, which has to be different than "Stand". Since this property has one of the three values: "Stand", "LieDown" or "Sit", the character may get up if it is seated or lying down **[Figure 2]**.

```
                Operator
Action: GetUp
Preconditions:
   Property: ?SELF(Status) Op: != Value: Stand
Effects:
   Prob: 1.0 Property: ?SELF(Status) Value: Stand
```

Figure 2: Operator example

As well as a set of operators, a plan includes ordering constraints, causal links, binding constraints and open pre-conditions.

Emotion Focused Coping

Marsella and Gratch [23] introduced the use of emotionally focused coping in planning processes.. Emotion-focused coping works by changing the agent's interpretation of circumstances thus lowering strong negative emotions and is often used by people, especially when problem-focused coping (which corresponds to acting on the environment) has low chances of success.

The FearNot! deliberative planner uses the emotion focused strategies of acceptance, denial and mental disengagement. Acceptance is the recognition that something is not possible to achieve, and thus failure is accepted. When a plan has a very low probability of success, the planner will accept plan failure and will not try to improve it. If no other plan that achieves the goal remains, the goal also fails. But the most important role of acceptance is when a plan step threatens another goal (say an interest goal protected condition). If the active pursuit goal generates stronger emotions than the interest goal, the plan is maintained and the protected condition failure is accepted. Otherwise, the plan will be dropped. Mental disengagement is used whenever acceptance is applied and works by lowering the goal's importance (thus lowering the disappointment experienced by the character).

Traditional planners deal with threats by applying promotion or demotion, i.e. by ensuring that the threatening step will become before or after the threatened step. In addition to this process, the deliberative layer can use denial to deal with such threats. If the step effect that threatens the condition does not have a very high probability of happening, the agent can ignore the threat assuming that the effect will never happen anyway by lowering the effect probability.

The agent architecture we have discussed here, where the planning and coping system are affectively driven, is offers a useful test platform for the computational implementation of the emergent narrative concept described earlier. Indeed, since the agents in VICTEC are emotionally driven, any significant interaction with a child user or another agent will result in the alteration of the agent's emotional state. Since the agent makes decisions based on that emotional state, this potentially affects its perception of actions and alters the probability of plan success and the resulting feelings of hope and fear. This, in turn, influences the actions selected for execution by the agent and allows for the unfolding of narratives different in form and content (i.e. according to their context) without the need for scripting them.

Early experiments conducted in the VICTEC project show that children react well to the Emergent Narrative concept, in particular the way it supports interactivity. Comparison of feedback from a small initial sample suggest that the feeling of 'being heard' and the believability of the character are both higher than in an earlier scripted version. The advantages are evident when developing practical examples. For instance, if a child advises the victim to hit the bully back, many different narrative outcomes are possible. Depending on its emotional state and its level of confidence, the victim could decide to deny or follow the advice. Its reaction to the advice would in turn affect the emotional state of the bully, increasing or diminishing its own level of confidence and potentially, altering its action decision too. Where this scenario was generated by the FearNot! demonstrator without scripting, its implementation through a more conventional tree type approach would have posed problems and would have affected the scalability of the system.

Conclusion

Despite the fact that its potential is theoretically demonstrable and that the research community as made a lot of progress with it in the last few years, the vision of an emergent narrative system is one that will only be recognized once computationally implemented and demonstrated. Although it poses many problems, technical and theoretical, it appears from our research that one of the main challenges is the interdisciplinary skills necessary for its implementation. Interactive dramas based on a bottom up approach, such as the one presented on our emergent narrative research, cannot be partially implemented. While the design of appropriate characters is a complex task and requires a level of expertise not often available in computer and science laboratories, state of the art agent approaches such as continuous planning and multi-agent interaction models usually absent from games companies is also needed. In addition, new testing methodologies are required. The VICTEC project has succeeded in bringing the necessary skills together in an ambitious and successful project. The theoretical work on emergent narrative associated with the technical achievements of agents and agent framework design has made this vision of an agent-based emergent narrative approach possible. Many new issues – for example action synchronization and validation, intelligent camera and others – have been raised and more extensive evaluation is required, but the project has met its objective of an emergent and unscripted narrative for anti-bullying education.

References

[1] http://www.quanticdream.com/
[2] http://thesims.ea.com
[3] Aylett, R. 1999. *Narrative in virtual environments – towards emergent narrative*; AAAI Symposium on Narrative Intelligence pp 83-86
[4] Aylett R, Louchart S, 2003. *Towards a narrative theory of VR*. Virtual Reality Journal, special issue on storytelling, Volume 7 January 2004
[5] Louchart S, Aylett R, 2004. *Narrative theories and Emergent Interactive Narrative*. IJCEELL Journal-V14 N6 pp 506-518.
[6] Louchart S, Aylett R, 2004. *The emergent narrtive theoretical investigation*; Proceedings Narrative and Learning Environments Conference NILE04 pp 25-33
[7]Plato. La republique. GF-Flammarion, Paris 1966.
[8] Aristotle, 330 B.C. – 1987. *The Poetics of Aristotle, translation and commentary by Stephen Halliwell*; Duckworth.
[9] Propp V, 1928 – 1998. *Morphology of the Folktale*. University of Texas Press, 1998.
[10] Campbell, Joseph. 1949. The hero with a thousand faces. Fontana Press. 1993.
[11] Barthes, Roland. 1966. *Communication 8, Introduction à l'analyse structurale des récits*. Editions du Seuil. 1981
[12] Bordwell D. Some theories of narration.Chapter in: Narration in the fiction film. Routledge. London. 1986
[13] Boal, A. 1999. Legislative theatre: Using performance to make politics. Routledge. 1999
[14] Izzo Gary (1997) The art of Play, the new genre of interactive theatre, Heinemann Portsmouth. 1997
[15] Freeman D (2003) Creating emotions in games – the craft and art of emotioneering. New riders 2003.
[16] Jesper, Juul. A clash between Game and Narrative.. Digital arts and culture conference Bergen 1998.
[17] Empiricom Limited. Http://www.empiricom.co.uk
[18] Http://www.VICTEC.org
[19] A. Ortony, G. Clore, and A. Collins. *The Cognitive Structure of Emotions*. Cambridge University Press, New York, reprinted 1994 edition, 1988.
[20] Picard, R. 1997 *Affective Computing*. MIT Press.
[21] Elliot C.: "The Affective Reasoner: A process model of emotions in a multi-agent system". Northwestern University, PhD Thesis, Illinois, 92.
[22] S. Russell and P. Norvig. *Artificial Intelligence: A Modern Approach*. Prentice Hall, 1995.
[23] Fikes, Nilsson. STRIPS: A New Approach to the Application of. Theorem Proving to Problem Solving
[24] S. Marsella and J. Gratch. Modeling coping behavior in virtual humans: don't worry, be happy. In *AAMAS 2003*, pages 313–320. ACM Press, 2003.