

# Using Out-of-Character Reasoning to Combine Storytelling and Education in a Serious Game

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**Abstract.** To reconcile storytelling and educational meta-goals in the context of a serious game, we propose to make use of out-of-character reasoning in virtual agents. We will implement these agents in a serious game of our design, which will focus on social interaction in conflict scenarios with the meta-goal of improving social awareness of users. The agents will use out-of-character reasoning to manage conflicts by assuming different in-character personalities or by planning to take specific actions based on interaction with the users. In-character reasoning is responsible for the storytelling concerns of character believability and consistency. These are not endangered by out-of-character reasoning, as it takes in-character information into account when making decisions.

**Keywords:** Interactive Storytelling, Drama Management, Autonomous Agents, Emergent Narrative, Serious Games, Conflict, Social Behaviour.

## 1 Introduction

A well-known issue in the field of interactive storytelling is the trade-off between users' freedom of action and a pre-authored plot: the narrative paradox. We wish to extend previous work on this paradox by addressing it in the context of serious games. Such games are defined by having educational meta-goals that need to be attained. In our opinion, the necessity of this attainment is similar to having a pre-authored plot as both require the story to evolve in a particular way. Thus, we focus on finding a balance between freedom of action and achieving a story that supports attainment of educational meta-goals.

We will develop a game dealing with social interaction in the domain of law enforcement by police officers. The meta-goal of our game is improving users' social awareness and it focuses on social behaviour in conflict situations. Scenarios include settings in which police officers are required to interact with civilians, e.g., loitering juveniles.

We base our research on work done on the Virtual Storyteller (VST) [6], a story generation system that uses an *emergent narrative* approach. This enables characters in a storyworld to carry out actions autonomously so that a story emerges from their joint behaviour. Such an agent-based approach offers much more freedom of action than simple branching narratives. For instance, in a scenario in our serious game that involves loitering juveniles, a police officer has

a variety of options to confront them, e.g., by rapidly approaching them, demanding respect with a loud voice or by taking a more calm, submissive stance towards the youngsters. These approaches will have different effects on the juveniles' reactions and, accordingly, on the emergent story. For a first prototype of our serious game, we will build on the recently developed interactive version of the VST architecture [1]. This allows users to control one or more characters in the story, while other characters are controlled by autonomous agents (as in previous versions). The first prototype will have menu-based interaction and a 2D graphical interface. Ultimately, components of our research will be used in a multi-modal 3D training environment.<sup>1</sup>

Currently, the VST uses techniques from improvisational theatre, in which the agents controlling the non-player characters can reason *out-of-character* to determine which actions to take *in-character*, i.e., as a character in the story-world. We aim to extend this mechanism to equip virtual agents with the means to reason about meta-goals and make decisions in such a manner that educational prerequisites are satisfied by the emergent narrative, while maintaining character believability.

Generally, narratives revolve around a central conflict between a protagonist and an antagonist that emerges from their disagreement on some topic. This idea of conflict coincides with the domain of our serious game; therefore, we assume that a conceptual understanding and formalisation of conflict can assist out-of-character reasoning in agents.

## 2 Related Work

The concept of out-of-character (OOC) reasoning was first explored and implemented in the context of FATiMA, the architecture underlying the serious game FearNot! The FATiMA architecture allows agents to choose to perform actions that have the highest emotional impact [5]. Thus the emergent narrative can be guided in a distributed manner.

OOC reasoning in the VST continues this line of work by using several improv techniques, in particular that of *late commitment* [6]. This lets the system's agents assert facts of any kind that were until then undecided upon, if they are of use for story progression. For instance, an agent can assert OOC that its character has a key in his possession to open a locked door so that the narrative does not become dull or end at this point.

Because of the importance of conflict for narratives, recent work [2, 7] has attempted to formalise the concept of conflict in order to implement it in serious games and story generation systems, respectively. However, the former only deals with resource management for different characters and does not tackle user-character conflicts, while the latter only considers planning as a cause for conflict.

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<sup>1</sup> See <http://www.commit-nl.nl/projects/interaction-for-universal-access/> for a description of the Dutch national project that is the context of our research.

### 3 Using OOC Reasoning to Combine Diegesis and Pedagogy

In this paper, we argue for an emergent narrative approach that splits agents' minds into in-character (IC) and OOC parts. By doing so, we can separate diegetic, i.e., storytelling, and pedagogic concerns between these parts—the IC part being responsible for the former and the OOC part for the latter. Nonetheless, the two are linked as an agent's OOC part can access IC information and take it into account when making decisions such as taking a particular action, to ensure that character believability and consistency are maintained. For example, an agent can use late commitment to explain possibly inconsistent character actions.

The distributed nature of the emergent narrative approach has several advantages over a centralised approach. Because each of the agents has its own beliefs about the world, it can behave in a believable manner that is unique to itself. Its behaviour is motivated by its own experiences and is thus consistent. This would not necessarily be the case if it was directly controlled by a central entity. Thus, emergent narrative lets the agents' IC reasoning account for diegetic concerns of consistency and believability.

Conversely, the pedagogical concerns can be satisfied by letting the agents reason about the educational meta-goals OOC. To improve users' social awareness, they require feedback on the possible effects of their social behaviour. We postulate that this can be done by letting agents reason OOC to let the conflict escalate. Dutch law enforcers are currently training conflict scenarios with the help of a theory about social interaction called the interpersonal circumplex [3]. Central to this theory is the notion that certain personalities oppose each other. We wish to incorporate this idea in our system by letting agents reason OOC, e.g., by letting them use late commitment, to adopt IC personalities that oppose that of the user so that the conflict intensifies.

After this OOC intervention, agents' IC behaviour should be able to let the conflict develop in a natural way, i.e., reaching a climax and having positive or negative resolution, which should reflect the effectiveness of the user's (change in) approach. As conflicts may not always emerge spontaneously following this structure, agents monitor the goings-on OOC to guide the story where necessary, e.g., by exaggerating their IC personality to stir up the conflict. We believe that our OOC reasoning mechanism should draw from the fields of narrative and sociological research by combining their definitions and theories of conflicts, cf. dramatic *story arcs* such as Freytag's Pyramid [4, pp.99–101] and the concept of a *conflict cycle* [2]. This will enable agents to monitor the conflict so that it develops in a natural way. For example, an agent may incite a conflict by letting its character take offence at a certain utterance of the user. This can be explained by letting it use late commitment OOC and adopt a personality that is consistent with this behaviour. If the user does not adapt his behaviour hereafter, he seemingly did not learn from the juveniles' reactions as his approach triggered the conflict. Then, the agents could reason OOC to introduce a 'bad' ending, e.g., the juveniles running away, continuing to loiter in another place. If

the user had adapted his approach to the juveniles, a better resolution would have ensued.

## 4 Conclusions

The issue of conjoining diegesis and pedagogy seems similar to overcoming the narrative paradox. Therefore, we aim to expand previous forays into OOC reasoning—proposed as a way to overcome the narrative paradox—by equipping virtual agents with the means to reason OOC about conflicts so that the meta-goal of our serious game—improving social awareness—can be attained by users. Our idea is that agents can use OOC reasoning to influence their IC personalities through late commitment and monitor the conflict as it develops to take additional actions if necessary to provide a learning example. By taking IC information into account during OOC reasoning, agents can choose IC actions that do not lead to a decrease in character believability and consistency. As the story evolves in reaction to players' actions, they become aware of their own social behaviour and learn that different individuals require different approaches.

We believe that, by implementing this distinction between IC and OOC reasoning in agents, the game will offer a high degree of interactivity and freedom with consistent and believable characters, while at the same time ensuring that the educational meta-goals are reached. We have recently started development of the game prototype in which we intend to implement our ideas. Future work will focus on a more developed theory of conflict based on narrative and sociological research, combining this with the interpersonal circumplex theory.

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