Embodied Reporting Agents as an Approach to Creating Narratives from Live Virtual Worlds

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Abstract. The most common approach to creating interactive narrative involves interactive experiences which take place within the constraints of a previously constructed story. In this paper we explore an alternative approach in which participants in a virtual world, e.g., a game, simulation or large online community improvise events. These events form the raw material for the subsequent creation of narrative sequences. Building on the theoretical concept of *narrative voices* — fictional personas that deliver information in narrative form — we suggest some new approaches to creating narratives from live events. We then present one such approach, embodied reporting agents, in which automated non-player characters inhabiting a virtual world report on ongoing events to editor agents. The editor agents, in turn, compile their information and pass it to presenter agents who ultimately narrate it to external viewers. We sketch how such 'witness-narrators' can be used to investigate creation of tension and drama in the interactive story world.

1 Introduction

The main problem facing the creation of meaningful and engaging narratives that are also interactive is that interactivity disrupts the effective use of traditional narrative devices; the more interactivity for the participant, the less control over the narrative techniques and meaning the author has. Techniques to try and solve this have included methods of limiting interactivity and guiding participant actions. This can be done, for example, by only giving the participant the illusion of controlling the narrative [13], trying to overtly persuade or guide players to follow the designed action [8, 15], making the experience a game and setting the player specific goals to achieve [24], and having developers working in real time to try and create interactivity for the players depending on what they do, e.g., MMOG's like Eve [2]. Most successful interactive narrative experiences such as those found in commercial games tend to employ a combination of these methods.

In general, these methods adopt a common approach where a set of story constraints is created first, and then interactive experiences take place within these. This tends to require the creation of multiple story threads and possibilities, where the number of possibilities created is directly related to the level of interactivity experienced by the participant. Generative and emergent approaches to creating narrative have also been explored. These have tended to be based upon the creation of sets of

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algorithms to generate stories and character behaviour [4, 18, 21]. However, narratives produced by machine alone tend to seem irrelevant and uninteresting due to lack of context and style, and have not made use of or enabled high levels of audience interactivity [7]. In this paper we explore an alternative approach in which real participants improvise events in a virtual world (e.g. game, simulation or large online community), which provides the raw material for subsequently creating narrative sequences. In other words, we are interested in how we can create narratives from interactive virtual worlds, rather than how can we create interactive virtual worlds from narratives.

We envisage a range of potential applications for this approach including in:

- Simulation and training – narrating events from real-time simulations (e.g., emergency rehearsals, maintenance, social skills training and other educational scenarios) so as to provide feedback for participants after the event as part of debriefing, or possibly even during the event so as to support coordination.
- Television – more engaging ways of presenting computer games on television, building on a spate of recent TV game shows in which teams of contestants compete through computer games (e.g., Time Commanders [1] in the UK)
- Massively Multiplayer Online Role Playing Games (MMPORG) and online communities – creating news feeds for large online communities in order to build community, motivate players, drive events and seed future activities.

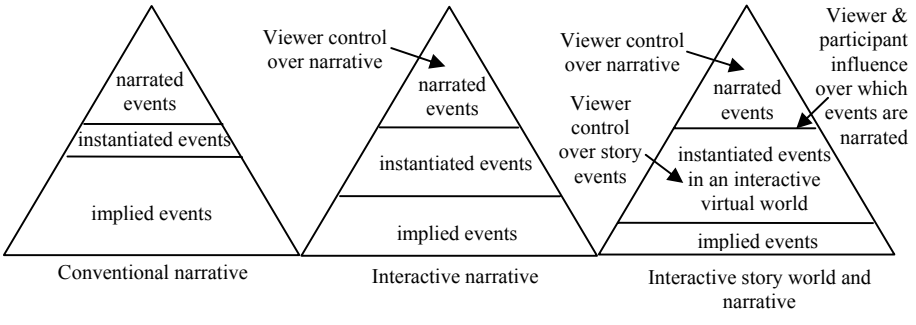

Fig. 1. Traditional and interactive narrative in relation to instantiated and implied story world

Fig. 1 compares our approach with existing traditional and interactive narratives. Conventional linear narrative (Fig. 1, left) involves the narration of story events to viewers. Many other story events will be implied but not directly narrated, e.g., the history of preceding events and the thoughts, beliefs and motivations of the characters involved [17]. A few events may actually be instantiated but not narrated, e.g., scenes may be filmed and chapters and sections may be written but subsequently edited out of the final narrated story (although these do sometimes make their way into the "director's cut" or unabridged versions). In interactive narrative (Fig. 1, middle), the viewer is able to control the narration of events, at least to some extent. E.g., they may be able to choose between different branches of a plot or to follow different characters. In turn, this may require that significantly more story events are instantiated than are narrated, e.g. entire sequences may be filmed or written that are never visited by

the viewer. Here, the audience experiences a line of discourse through a set of stored possibilities [20]. In our approach that we might call 'interactive story world and narrative' (Fig. 1, right), participants interact with a virtual world in order to instantiate story events. A selection of these events is then narrated to external viewers who are not initially involved in directly interacting in the virtual world. These external viewers may then also interact with the narrative and both participants and viewers may also interact with the mechanism that determines which instantiated events get narrated and how this happens. However, even with this approach, there are still story events that are not instantiated, for example the backstory (history) behind the virtual world or the innermost thoughts and beliefs of the participants.

The remainder of this paper explores this third approach in more detail. Section 2 briefly reviews previous approaches to creating narrative from live events in virtual worlds. Section 3 then considers how narrative theory distinguishes between different narrative voices and how this suggests some new approaches to creating narratives from live events. Finally, section 4 presents one such approach – embodied reporting agents.

2 Producing Narrative from Live Events in Virtual Worlds

A number of techniques have been explored that allow action within virtual environments to be captured and edited so that a report may be included in other virtual environments or be transferred into other media.

One approach is to use virtual cameras to capture activity and broadcast in real time an edited narrative to viewers. For example, in the inhabited TV show "Out of This World" [5], there were four virtual camera operators in the virtual world who captured the action from various perspectives. Their output was fed into a conventional TV mixing desk where a professional TV director produced a video mix, which was then projected in a theater in front of a live audience. Similarly, in the improvised online drama "Avatar Farm" [9], camera operators captured different views of the unfolding drama on the virtual set, and a camera director was responsible for selecting which camera view would be web-cast live at any moment in time.

Another approach is to record the activity of an avatar. In the CAVERNsoft system [19], recording of an avatar's movements and audio is possible as part of general support for persistent virtual environments. This facility has been used to create the Vmail system [16], a form of VR email. Some multi-player 3D games also employ record and replay techniques to show highlights of previous game-play. Examples of these include FIFA soccer from Electronic Arts and the automobile game Driver from GT Interactive Software, the latter allowing players to edit together their own movies from recordings of their own actions.

Alternatively, all activity within a virtual environment can be completely recorded. For example, as part of the COVEN project, the DIVE system was extended with event logging facilities that could completely record an entire virtual environment and the activity within it. Although initially implemented to support the statistical analysis of patterns of user activity in relation to network traffic [11], this recording facility was subsequently extended to allow a previous session to be recreated (although not

within another live virtual environment). The dVS system supports a similar facility for recording and then replaying a virtual environment.

The technique of temporal links [14] extends this general approach by providing a flexible mechanism for dynamically inserting past recordings of multi-user sessions within other live virtual environments. All activities within a collaborative virtual environment are recorded, including the environment itself, multiple users' movements, speech, and interactions with virtual objects. The recorded events are then recreated within a live virtual environment so participants can move around the recorded material, viewing it from any perspective. By manipulating the properties of the "temporal link" application, developers and end-users can manipulate the temporal, spatial and presentational relationships between the live environment and the recording. For example, recordings can be fast-forwarded or run backwards; the recorded material may appear to be directly overlaid on, or may be scaled relative to the live material; it may also be presented indistinguishable from the live material or it may be rendered translucent to make it ghostlike.

Various applications of the temporal links technique have been demonstrated [13], including to allow actors to enter an environment and quickly enact and record complex scenes that are then played out many times, to create flashbacks within a story, to support the post-analysis and discussion of events within virtual environments and to create offline rendered, high quality animations.

3 Narrative Voices

The techniques described in the previous section focus on generating accurate information from an interactive experience and presenting it as a review of what actually happened. Their aim is to inform an audience of interesting activities that have occurred, and as such they are conceptually similar to the presentation of news or sports in traditional media. However, in narrative fiction, there is usually a sense of a narrator's personality behind the information that is presented, a certain *someone* whose presentation and description of events is done in such a way as to produce an effect. This fictional persona who delivers the information, and the effect they may have on the information they present, is an integral part of a narrative experience, and an important authorial device.

The theory that describes the concept of different information sources or personas within a story often refers to them as 'narrative voices'. This theory is most richly described in literary fiction, and we have drawn on the theories of Rimmon-Kenan [22] and Chatman [6] to inform the concept of narrative voices within our work.

Narration can be done by many different types of fictional persona, which can range from the implied voice of the author to a character within the story. Also, it may be done by different narrators at different times in a single story. An examination of the characteristics of different narrators described in these theories shows a range of possible types of narrative voice and also reveals that some are underused in current work in this field.

Narrators may be embodied i.e. have a physical presence, or they may be omniscient. Omniscient narrators have no physical presence and can be in all places at all times. This sort of narrator is often the one whose voice we accept as the objective truth in the matters they describes, since they are generally more objective and, therefore, accurate. Embodied narrators have personalities that colour their view of what they present. For example, they often have a vested interest in showing the information in a biased way, and this may or may not be apparent to the audience. This is a popular narrative device; e.g., where a narrator may at first appear to be sympathetic to a protagonist but in the end turns out to be plotting his downfall. There are various factors that affect the particular type of information an embodied narrator provides and the reliability of his narrative, including:

- Physical – the spaces and events that the he physically has access to;
- Perceptual – what the he is able to perceive;
- Emotional – his motives and the relationship he has with events and characters;
- Ideological – the world view and value system that influences his judgment of events;
- Temporal – the passage of time between events and his narration of them, and also the influence of other events in between.

In fiction the audience is made aware of unreliability by signs or indicators in the narrative. Rimmon-Kenan describes the main sources of unreliability as: limited knowledge, personal involvement, and problematic value-schemes. There are a variety of ways in which a character-narrator's knowledge may be limited. For example, his character may be very young or too inexperienced to understand the events that are happening, or perhaps we find that he did not have sufficient access to events to see them clearly and is instead relying on his interpretation rather than certainty. A character's involvement with the plot or other characters may lead to biased information. For example, if the narrator has a particular dislike of a character his interpretation of the character's actions may be distorted by his own feelings. A problematic value-scheme generally only becomes apparent if it seems to disagree with that of the overall voice of the narrative. For example, facts may unfold in a story and prove a narrator to be wrong, many other characters' views may be different to those of the narrator, or there may be internal inconsistencies within his narration itself.

Embodied narrators can be positioned either inside or outside of the story world. If they are outside they tend to take a story-teller role. Embodied narrators that are inside the story world are called character-narrators. These fall into two distinct types, the witness-narrator and the protagonist-narrator. The protagonist-narrator is a central character who describes his experiences in the story world. This also has parallels in the work described in section 2, e.g., a central player or character that relates his experiences directly. However, the concept of the witness-narrator has yet to be explored in interactive narrative. The witness-narrator views events from within the action, but is not directly involved in furthering the unfolding plot. This means they often provide a more objective and broader view to that of the protagonist, and differences in accounts may occur according to their personality and role in the story.

4 Reporting Agents

In this section we briefly outline a new approach, *embodied reporting agents*, which offers the possibility of new forms of interactive narrative that more closely resemble the dramatic experience of a fictional narrative.

4.1 Concept

The reporting agents technique is based on the principles that agents that capture information about a 3D virtual environment are directly embodied within this environment (and so are visible and subject to the same constraints as other participants in the environment); and responsibility for extracting, filtering and reporting of information is distri buted between different types of agent [10]. Specifically, a 3D environment can be inhabited by participants (the members' avatars, capable of directly influencing the environment) and 3 types of agents – reporters, editors and presenters. Reporters are embodied in the virtual environment, but unlike the participants cannot influence it directly. Events the reporters judge significant are reported to editors. Editors have two main responsibilities. First, they pass interesting segments of the output generated by the reporters to the presenter(s). Since reporters are not infallible, this data should be verified as necessary before being passed on, e.g., by clarifying conflicting reports or by requiring multiple reporters to detect the same event. Second, editors attempt to maximise the collection of relevant and interesting information by assigning reporters in such a way as to provide good coverage of the events in the environment, e.g. by directing idle reporters to under-reported or interesting regions within the environment. Presenters are responsible for delivering information to the viewers at an appropriate time and in an appropriate format (e.g. SMS messages vs animated talking heads). Different kinds of presenters may have differing temporal relationships to the reported events, e.g. real-time vs retrospective commentary, and/or report differing degrees of detail, e.g. focusing on major events, or a more detailed summary of all events, or only on events which touch a particular character.

4.2 Implementation

We have implemented a prototype reporting agents system based on ‘Capture the Flag’, one of the game types provided by Unreal Tournament (Fig. 2). The prototype consists of a variable number of embodied reporter agents, a single (non-embodied) editor agent and one or more (non-embodied) presenter agents. We use the Gamebots interface [3] to allow agents to communicate with the UT game server. The agents themselves are implemented using the SIM_AGENT toolkit [23]. Gamebots provides each reporter with data that approximates to that available to a player. A reporter’s sensory range is limited, and to obtain information about events in other parts of the game world, the reporters must physically move to a different location. By remembering the objects in the game world that they have sensed in the past and the state of objects that they can currently sense, the reporters can attempt to infer which events are taking place within the game, and their significance. The current implementation also includes three presenter agents: an “in game” presenter that provides brief topical

reports of events in the game in real time, an “IRC bot” presenter that produces periodic summaries of events in the game on an IRC channel while the game is in progress (see fig. 3), and a “post game” presenter that generates a text summary of events in the game when the game is over (see fig. 4). Viewers can direct the activities of the reporters and editors (in a general way) by interacting with the “in game” and “IRC bot” presenters. E.g., a viewer can indicate an interest in particular kinds of events (which may relate to a particular team or player). This information is used by the editors to direct reporters to events that viewers are likely to find interesting, and by reporters in deciding, e.g., which players to follow and which events to report.

Fig. 2. An embodied reporter and a player within Unreal Tournament

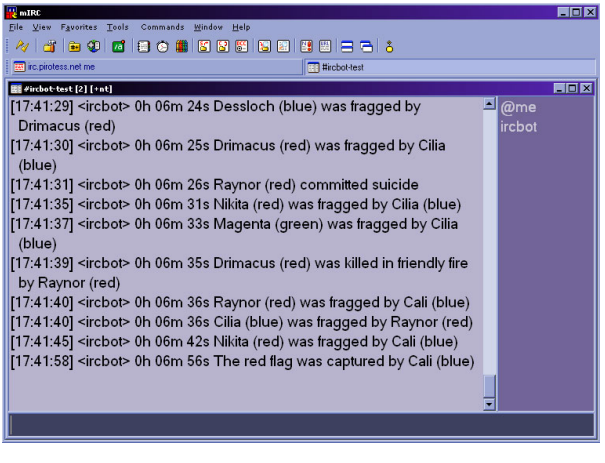

Fig. 3. Example periodic summaries on an IRC channel by an “IRC bot” presenter

The match was a Capture the Flag game on ctf-simple, lasting for 3 minutes and without any score limit. A frantic start to the match saw the red team take an early advantage, claiming the first flag capture of the game. With this seemingly spurring them on, they went on to establish a sizeable cushion between themselves and their opponents. By the end of the match, the red team had a large score advantage over their adversaries, the game ending up as a whitewash with the final scores at 5-0.
1st minute: an unknown player took the blue flag, and this resulted in a successful flag capture. The flag changed hands en route…

Fig. 4. Example summary of events by a "post game" presenter

5 Discussion

The key differences between the reporting agents approach and the techniques for producing narrative from live events in virtual worlds described in section 2 can be characterized in terms of three issues: omniscience, bias and embodiment.

- Omniscience refers to whether there is some component of the system that is able to capture a canonical view of events. i.e., a particular version that all involved can agree captures all of the essential events from a privileged central perspective.
- Bias refers to the potential of the system to deliberately bias the retelling of stories from captured events. Bias might be introduced at the recording stage or in the subsequent editing and presentation of events.
- Embodiment refers to whether and how the recording of events is visible to the participants. Are they aware that they are being recorded and are they able to react accordingly, e.g. by constraining their behaviour.

The techniques described in section 2 tend towards being omniscient, relatively unbiased and disembodied whereas reporting agents are not omniscient, may be biased, and are embodied. The concept of an embodied narrator who also has a detectable presence in the story world, physical limitations and a personality, i.e. a narrator who is a character, has been rather less explored, particularly in the role of a character-witness. By combining the three roles of reporter, editor and presenter in a single agent, we begin to approach the notion of a "witness-narrator" who is embodied inside the story world, but not in a role that is central to the plot. The characteristics of the embodied character-narrator underpin a rich array of possibilities for developing narration that is more complex than a straightforward rendition of an experience. By exploring qualities described in the theory, we can develop new possibilities for the acquisition and presentation of information from interactive events to provide not just reviews but stories.

6 Future Work

In our future work, we propose to explore how reporting agents can be employed in order to shift some of the events that are 'instantiated' by the viewer/participant into the 'narrated events' level of our diagram. In particular, we intend to investigate the role of witness-narrators in creating tension and drama in the interactive story world.

Because witness-narrators view events from *within* the action, the narrative they construct out of these events is influenced by their personalities and the context in which they view the events. When these narratives are fed back into the story-world to the viewers and participants, they inevitably influence the participants' perception of the events. This biased perception of the story-world will, in turn, have an impact on the participants' choices as to what events are to be instantiated.

This recursive process, whereby instantiated events are fed back into the story world via internal narrators' points of view, which, in turn, influence the unfolding of the story events, will be explored within a game scenario in which interactive story worlds are actively explored by the participant players. The players' choices will be influenced by the narratives produced by agents. In order to successfully proceed in the game story world, the player will need to actively seek to unmask conflicting narratives, biased interpretations, unreliable reports and elaborate their own personal view of the events, i.e. their own narrative.

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