

Immersive Interactive Narratives in Augmented Reality Games

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Abstract. The industry of digital games is marked by innovation. Currently, augmented reality has been added to those games, to provide new experiences for players. However, those efforts have been focused on attracting players based on novelty devices. Digital games seem to have high potential for realizing novel interactive narratives. At the same time, there has been some academic discussion about narratives in augmented reality. In this paper, we discuss some relationships between interactive narratives, digital games and augmented reality. We then propose an approach and a specific technology setup for exploring augmented reality games as providers for innovative interactive narratives. In this augmented game space, new technology and devices are not the focus but rather the means for the realization of new experiences.

Keywords: interactive narrative, augmented reality, digital games.

1 Introduction

Digital games have been developed commercially for over thirty years. Although they are seen as one successful area of exploration of digital narratives [8], most of those narratives remain relatively simplistic and with forms derived from other media.

Augmented reality was arguably first proposed in the 1960s [5] and became a field of research and development in the 1990s. Although it has found applications in industrial maintenance, training and medicine, among others, there has been relatively less exploration of it as an expressive medium [6]. With the development of low-cost devices such as the Oculus Rift¹ and Kinect² sensor for the consumer market, this discussion should not be ignored.

There have been efforts, both in academia and in the industry, to combine augmented reality and digital games. Many of those developments are driven by the need of game developers to offer new experiences to their audience. Therefore, augmented reality is presented as technological novelty, without exploration of its expressive potential.

Motivated by the same inspiration presented by McIntyre et al. [6], we present a proposal for augmented reality games that support expressive digital narratives herein.

¹ www.oculusvr.com

² www.xbox.com/en-US/kinect

In order to properly discuss our proposal, we begin by presenting a definition of narrative based on formal structure and medium-dependent storytelling, and discuss digital narratives and their characteristics. We then proceed to present a conceptual view of augmented reality and digital games and their relationships to digital narratives, first as separate fields and then combined. Some examples and limitations of augmented reality games are discussed, leading to our proposal. We conclude the paper with remarks about possible experiments and developments.

2 Digital Narratives

In discussing narratives, we adopt the structuralist framework as presented by Todorov [14], particularly the ideas of the relationship between subject and object, action and minimum complete plot. Therefore, our definition of narrative is that of a transition between states of equilibrium, by means of actions performed by or to them. Those actions are related to the search of a value-object by the subject. The narrator is characterized by the choices of which characters and actions are included in the narrative, which is related to the act of storytelling. The narrator is thus partially dependent on the medium through which the narrative is experienced.

In this paper, we have limited our discussion to narratives experienced through the digital medium, which will be referred to as digital narratives. Murray [8] presents three concepts that are central to digital narratives: immersion, agency and transformation. The proper understanding and exploration of those concepts are necessary for the expressive use of the medium.

The concept of immersion presented by Murray [8] centers on the experience of being surrounded by an unfamiliar environment, overwhelming to the senses. Further, she notes that the participatory nature of the digital medium threatens that experience in the same way as “breaking the fourth wall” in the cinema or the theater may interfere with narratives in those media. However, she notices that participation may also be used in favor of immersion, since it strengthens our experiences.

Regarding participation, Murray [8] associates the concept of agency in the digital medium to the pleasure of observing that one’s actions have significant outcomes in the satisfaction of being able to perform meaningful actions, which goes beyond mere interaction and feedback.

The concept of transformation, according to Murray [8] is related to the digital representation of information, including the information pertaining to the objects of a virtual environment or narrative. Therefore, transformation is the pleasure of assuming different shapes, roles or points of view, including the investigation of multiple options, possibly simultaneously.

There is no inherent reason why the elements of a narrative must be selected and entirely developed by an author before they are made available to its audience. This tradition is motivated by production constraints related to media such as books and the cinema. On the other hand, oral storytelling has an important component of improvisation and adaptation motivated by the interaction

between the storyteller and the audience. In the case of digital narratives, the concepts of agency and transformation may be explored by allowing the user to make interventions on the narrative's characters, actions and their consequences. The concept of immersion is thus related to the influence of the medium on the narrator.

3 Augmented Reality

Milgram et al. [7] define augmented reality (AR) as a category of display techniques (and accompanying technology) in which synthetic information is merged with or overlaid on physical objects. Azuma [1] further proposes that augmented reality systems must possess three characteristics: combining real and virtual elements, allowing real-time interaction and presenting 3D registration.

Regarding display technology, there are two main approaches to making an augmented reality system: by equipping the user with a personal display or by implementing a collective display on the environment. Azuma [1] includes a discussion on the technical solutions available for personal displays, including head-mounted systems. Raskar et al. [11] introduce the term spatially augmented reality to refer to the use of large flat displays or digital projectors to achieve a collective view of an augmented reality system.

Manovich [5] extends the idea of augmented reality to define the broader concept of augmented spaces, as the physical space overlaid with dynamically changing information. He then proposes to reconcile the concepts of immersion and augmentation:

“On one level, whether we think of a particular situation as immersion or augmentation is simply a matter of scale i.e. the relative size of a display. So, whether we should understand a particular situation in terms of immersion or augmentation depends on how we understand the idea of addition: we may add new information to our experience or we may add an altogether different experience. (p.225)”

McIntyre et al. [6] discuss augmented reality and its use for the production of digital narratives by analyzing it as a new medium. It is worth noting that their work is intentionally limited to augmented reality systems employing head-mounted personal displays, in which users observe and interact with the blend of physical objects and digital information from their own point of view. Their work focuses mostly on the adaptation of the new medium to cultural conventions originated in previous media.

Early efforts related to digital narratives in augmented reality follow that approach. One example is the MagicBook project by Billingham et al. [3], in which a physical book is augmented with the presentation of images generated by an augmented reality system. Despite more recent discussions [4] on the characteristics of such augmented books, it is possible to identify in them the concept of addition presented by Murray [8], or the addition of information to an experience, mentioned by Manovich [5].

Immersion in augmented reality can be understood in terms of augmentation, as discussed previously. As such, it depends on the exploration of display and sensor technology. Furthermore, the notion of augmented space provides context for the application of that technology. Agency may be provided by Azuma's [1] requirement of real-time interaction. Transformation is achieved by the inclusion of virtual objects, often fantastical in nature, on the physical environment.

4 Digital Games

There is much discussion about the definition of what a game is, and the usefulness of such definition [12]. We here adopt the definition proposed by Elliot Avedon and Brian Sutton-Smith apud Schell [12]: "Games are an exercise of voluntary control systems, in which there is a contest between powers, confined by rules in order to produce a disequibrial outcome." Digital games are thus defined as games experienced through the digital medium.

Murray [8] presented digital games as a successful field of application of digital narratives. Still, her remarks about the weakness of the narrative elements in digital games remain current. As discussed in the case of augmented reality, narrative in digital games remains largely referential to other media. This results in linear or multilineal narrative plots, often accompanied by schematic characters. Only a few experiments, such as Faade make use of the procedural capabilities of the digital medium for manipulating narrative structures. In that game, the player takes on the role of a guest for a dinner at couple of friends' house. As players finds out, their friends' relationship is in trouble. The game creates different histories of past situations in each game session, in order to surprise the player. Interaction is performed by talking to the couple by typing phrases in natural language. This way, players can try to solve their friends' problems or further destabilize their relationship.

Of particular interest to our discussion is the relationship between the mentioned disequibrial outcome in games and the succession of states of balance and imbalance in Todorov's [14] definition of narrative. It is not our intent to imply that games and narratives are equivalent but that some features in games are conducive to narratives. Murray [8] presents the view of digital games as symbolic drama, which also finds a relationship with the notion of narrative structures.

If one considers Murray's [8] concept of immersion, then in games it is manifested in a way similar to virtual environments: produced by visual and aural synthetic stimuli, often conveyed by a single, external, unattached display. Similarly, it is possible to relate agency to the interaction and feedback between user and procedural simulation. Transformation is implemented by both the exploration of possibility spaces in the procedural simulation, and by participation as a character in the narrative.

Alternatively, Thon [13] proposes a multidimensional model of immersion in games, which encompasses the modes of spatial, ludic, narrative and social immersion. In this case, narrative immersion is related to the player's attention to

the narrative structures present in the game, regardless of participation, while ludic immersion is related to the interaction and exploration of game mechanics. This model clarifies the factors that influence immersion in a game, going beyond sensorial stimulation.

We believe that the concepts of agency and ludic immersion overlap, in the case of digital games with interactive narratives, since both are directly related to the player's interaction and choices within the game.

5 Augmented Reality Games

If we consider augmented reality as a class of displays for digital information over physical objects, and digital games a realization of games in the digital medium, then augmented reality games become a way to project the mechanics and narrative of digital games back onto the physical world. In doing so, Manovich's [5] concept of augmented space should be considered, otherwise we might have implementations of physical games in which the digital medium is employed for the sake of technology.

Bernardes et al. [2] present a broad survey of augmented reality games, divided into two categories based on the dimensions of the physical space required for the game: large area games and limited area games. Large area games mostly use personal displays, either head mounted or hand held. Limited area games also employ projector-based techniques, often to implement augmented board games. Those are examples in which technology is shallowly added to the experience of playing the original, physical board game.

Most of the games using personal displays apply the first-person view approach discussed by McIntyre [6]. In the case of spatially augmented reality display, a magic mirror metaphor [8, p.69] is also used. In this situation, users see their image, captured by a video device, presented on a screen or projection over a surface as if it were a mirror. The video image is processed and interactive virtual objects are added to it.

Although most augmented reality games are still limited to the two categories mentioned before, some projects in academia have explored other possibilities. Marc Owens' Avatar Machine [10], illustrated in Fig. 1 places a camera on a fixed rig on the user's back, who also wears cardboard accessories to make him look closer to a game character. Users wear a head-mounted display and see themselves through the camera, mimicking the "third-person view" often used in digital games. Although not formally an augmented reality system by Azuma's (1997) definition, the Avatar Machine has at least two interesting properties in the discussion of possibilities for narratives in augmented reality games. First, the system uses a head-mounted display to present an external point of view to the user. Usually, these displays are coupled with cameras in order to preserve the user's own point of view. Second, it provides a physical transformation of the player into a game character.

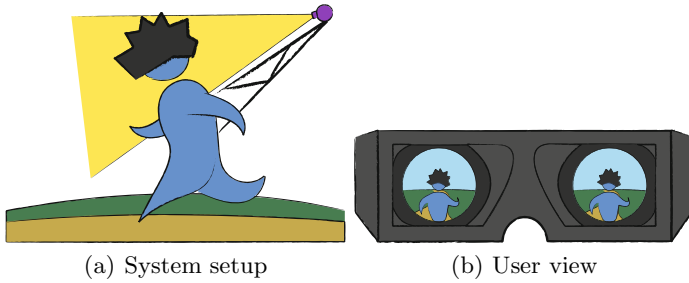


Fig. 1. A schematic presentation of the avatar machine

6 Our Proposed Setup for Augmented Reality Games

Having discussed digital narratives, augmented reality and digital games, we argue that, currently, augmented reality games are either built as explorations and proofs of concept for new display and sensor technology, or as digital games with a novel display. To build expressive augmented reality games, it is necessary to further integrate the concept of augmented space into the structure of the game, creating mechanics or narrative that actually involve the interplay of physical and synthetic three-dimensional space.

McIntyre et al. [6] state that users of augmented reality systems may have expectations about camera work based on previous media, e.g. cinema, but as the user is in control of the “camera,” many film techniques cannot be employed. While that is true if one considers that an augmented reality system based on a personal display must present the user with a view from their own perspective, there is no technological constraint for such. Owens’ Avatar Machine [10] provides an interesting example in the exploration of alternative views, as discussed in section 5.

In a previous work, the use of an immersive system based on a third-person view of the user was evaluated in terms of usability factors: ease of learning, discomfort [9]. In that system, the user plays a digital game in a closed room, wearing a head-mounted display. However, the display presents a view of the room taken from a camera placed near the ceiling. Instead of a first person view or a magic mirror, users see themselves as a third-party observer. This relates to Manovich’s [5] remark that “augmented space is also monitored space.”

At the time, the problems found were technological in nature: limitations of the head-mounted display and user tracking. However, now a new version of the system might be constructed with devices such as the Oculus Rift and one or more Kinect sensors, at a lower cost than before. While that research was aimed at the assessment of usability factors of the interaction technique, we propose an extension of that system, to explore immersive interactive narratives in digital games.

In this new setup, illustrated in Fig. 2, a single rectangular room is used to represent different scenarios of the game world. Four cameras are positioned near

the ceiling, in the corners of the room. The floor of the room is mapped onto a grid, with a border along the walls to account for maneuvering of the player and the fields of view of the cameras. To complement tracking by the cameras, kinect sensors are installed parallel to the walls. Information from the cameras and kinect sensors are used to determine the player's position and to segment their silhouette from the image captured.

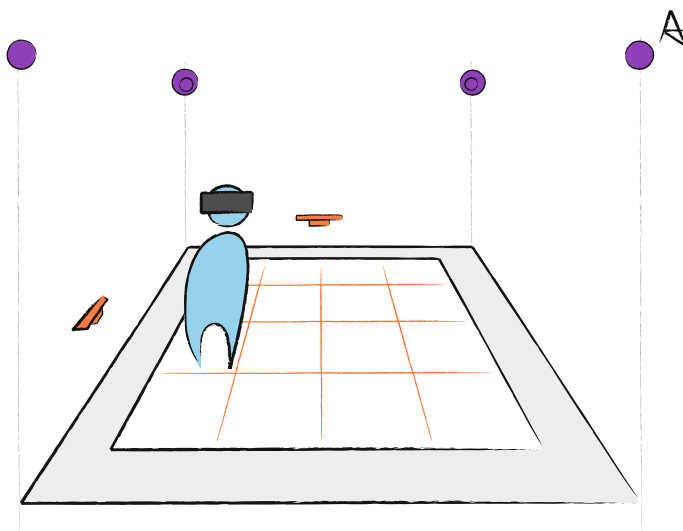


Fig. 2. Setup for the augmented game space

Players wear an Oculus Rift or similar head-mounted display, and they view an image composed from one of the four cameras with added virtual elements. This way, they can see themselves inside a virtual room and may interact with computer-generated characters. Fig. 3 illustrates this experience. Further, they may cross the threshold of a virtual door, into the maneuvering space at the edge of the physical room. As they turn around, a new point of view from one of the four cameras is chosen, depending on the organization of the spaces in the game world. This allows the exploration of a much larger virtual space mapped onto a single physical room. Thus, an augmented space is created by overlaying a virtual topology, visualized through an immersive display. Physical transformation may be adopted to fit the head-mounted display on the game's narrative; for instance, by encasing it on a helmet prop for a medieval fantasy game.

The use of a head-mounted display reconciles the concerns about immersion related to sensorial stimulation and the modes of spatial and narrative immersion proposed by Thon [13]. Further, the presentation of the user's image from an external point of view may provide the distance required by Murray [8] to avoid breaking immersion. In this configuration, the technology, as the medium-dependent portion of the narrator, qualifies the user as a character of any narrative to happen in the game, as well as their actions.

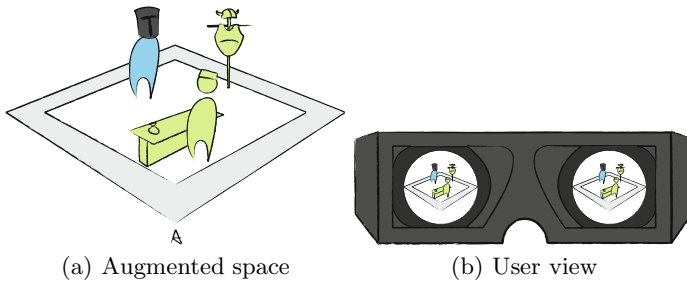


Fig. 3. The augmented game space experienced by a user

7 Conclusion

In this paper, we argued that augmented reality and digital games are two potential fields of application where expressive digital narratives may be created. Their combination may in turn lead to immersive (or augmented) narratives that are different from those experienced through other media. However, current efforts are often focused in technological aspects or referencing solutions created for previous media.

In this context we present an alternative technological setup for augmented reality games in an enclosed space, intended to explore those narratives. The technical feasibility of the proposal is based in a previously tested setup.

We have not discussed the specific forms or structures of such augmented narratives under this proposed setup herein. Since this work is aimed primarily at augmented reality games, the aspect of game mechanics in augmented space could also be discussed. We consider both lines of research as future work.

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