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Tankwar - AR Games at GenCon Indy 2005

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Abstract

By introducing virtual content onto a regular tabletop, augmented reality (AR) offers a compelling display medium for enhancing tabletop games. Coupled with tangible user interfaces, it constitutes a truly novel environment for games. Our research investigates the possibilities and constraints for succesful game design, starting with principles drawn fom tabletop and conventional computer games, and moving towards designs unique to AR. Our first major game, AR Tankwar, was recently demonstrated at GenCon Indy 2005 to over 300 players and many more spectators. This paper presents a short overview of AR Tankwar along with results from questionnaires and player discussion at the convention.

Keywords: Augmented Reality, Game design, Evaluation

1. Introduction

Players of tabletop games such as miniatures and role-playing games have long dreamt of augmenting their games with computer animation, simulations and mapping tools. The chief problem has been the difficulty of introducing display and interaction equipment in such a way that it does not significantly disrupt the game's normal social experience. By allowing the display of 3D models on the table between players, AR affords game designs that take advantage of the social setting of tabletop play, while using computer resources for simulation, mapping, conflict resolution and visualisation. For a more detailed treatment of the potential of AR for game design see [3].

War games have a long history; at least two centuries in their current form. They began as a tool for military planning and training, and have evolved into a popular recreation. In modern war games, players compose armies of miniature troops and lay them out on a table to represent battle formations. Play is turn-based; each turn usually consists of movement, one or two fire phases, and morale. Conflict resolution is handled using dice and measuring tapes, with ambiguous situations determined by player consensus. To enhance suspension of disbelief, players use terrain models, green tablecloths, and cotton wool to represent the battlefield and the effects of combat. Game rules are often very complicated and in some games, individual turns may take an hour or more to resolve.

More recently, computerised war games have been developed in which conflict resolution and visualisation is handled by the computer. Such games, particularly those that run the battle at interactive speeds (termed RTS for 'real time strategy') have become immensely popular, and are one of perhaps 6 major computer game genres. However, the PC environment limits social interaction, and reduces player control to that afforded by a mouse and keyboard.

In general, AR refers to display systems that merge virtual content with the real world in some way. In particular, we make use of video see-through augmented reality using the ARToolkit [1]. Users wear a head mounted display (HMD) with a camera on front. A 3D transformation is obtained by processing the video with the ARToolkit, and this is used to draw graphics that are merged with the video and displayed to the user.

2. AR Tankwar

Tankwar is a tabletop war game for augmented reality. Players control small armies of tanks, artillery and helicopters in real time. Using them, they attempt to capture and defend map objectives. The game is played on a virtual map laid out on a tabletop using augmented reality. Units, objectives and obstacles are drawn onto this map, making them fully virtual. Players use a lens-based selection technique [2] to interact with their units. They can order them to move or shoot at particular targets. Some unit behaviour is automatic, mean that players need not micromanage and are free to focus on strategic concerns, and the other player.

The game also incorporates view frustums to aid collaboration, zooming with the magic lens, a speech interface, and transitions between the exocentric AR view, and an immersive egocentric view at ground level.

Since AR has not yet significantly applied to games, there is little guidance for effective game design. We decided to start simple by taking ideas from tabletop and computer games and merging them. Tankwar has described by players as a cross between miniatures war gaming and RTS games, or more simply as a tabletop RTS.

The advantage of AR is that it introduces virtual content into a social space, and we wanted to encourage social interaction during play. To encourage this, Tankwar was designed to run at a comparatively slow speed to allow time for discussion and commentary.

3. Demonstration

GenCon Indy is a large games convention held annually in Indianapolis, focusing on card, board, miniatures, and role-playing games. Attendance is approximately 25,000 people across four days. We demonstrated Tankwar for 30 hours in a large enclosure within the convention's exhibit hall. Visitors were able to try the game, and played approximately 10 minutes each. We collected questionnaires from most players, and gather general feedback from discussions with players.

For GenCon, we disabled some advanced features, both for practical reasons, and to keep the game simple for

Figure 1: The AR Tankwar demo booth at GenCon Indy 2005

demonstration. For example, the zooming interface confused less able visitors, and the speech interface required training the system for each voice. Players played 2 at a time, and generally occupied opposite sides. For this demonstration, we used 2 iO Display Systems i-glasses SVGA with Logitech 4000 cameras front with a pivot.

4. Results

Around three thousand people stopped to watch Tankwar, and about 300 people played. We asked players to fill out a short questionnaire about their experience, and gathered general feedback. We collected a total of 230 questionnaire responses. Though we attempted to treat all players equally, the constraints of collecting data in a demonstration environment obviously act as a confounding influence on our results.

Players reported discomfort caused by the weight of the HMDs. Children and those with smaller heads were unable to tighten them sufficiently. Players rated comfort with $mean = 2.93$, $sd = 1.09$ (5 is comfortable).

Players had trouble with seeing detail in the HMDs, and responded to *Could you easily tell what was going on?* with $mean = 3.35$, $sd = 1.15$ (5 was easy). Though the zooming interface to make it wasier for some players, more able players frequently requested such a feature. Players also suggested higher contrast between different unit types to combat lack of clarity in the HMDs.

Though players appeared able to control their units effectively, they rated ease of use (1 is hard, 5 is easy) at $mean = 3.34$, $sd = 1.63$. Some players grasped the control system and the idiosyncracies of AR tracking immediately, while others required coaching and were frequently confounded when they moved the lens out of their field of view, or concealed the table markers.

Despite problems with the game, players saw the potential of the medium. When asked *Cost notwithstanding, how willing would you be to play multi-player tabletop games augmented using headsets?* (5 was 'Willing'), players responded with $mean = 4.08$, $sd = 1.07$. Players acknowledged that the system was a prototype, and though they gave low ratings to some of the questions, their comments were usually quite positive. Contradictory positions such as 'hard to see what's happening, uncomfortable headset, map keeps flipping out, I love it!' were common.

Players seemed quite willing to interact socially during play - challenges, exclamations and boasts were fairly common, particularly between pairs of players who knew each other already. Increasing the game speed, even to conventional RTS speeds, did not appear to reduce this. However, we were unable to gather any data on this.

A demonstration is a difficult environment to gather useful data from. Conditions meant that players played different scenarios, some played alone against computer opponents, and others had to play with a volunteer standing behind them holding the HMD steady. There were also practical problems with the HMDs. Despite efforts, we obtained them only at the last minute, and were unable to experiment with rigging them to hat or helmet to make them more comfortable.

Nonetheless, the demonstration gave us positive feedback for the value and future of Augmented Reality games. Though players reported a range of problems, they were generally very interested in playing such games in the future. We believe that most of the problems reported are surmountable technological problems, opportunities for improved design, or simply circumstance.

5. Conclusion & Future Work

AR enables the development of tabletop games that incorporate graphical visualisation, simulation and conflict resolution performed by computer. AR was our first serious attempt to build an AR game. Gameplay was based on ideas from conventional tabletop and computer games, and was intentionally simple.

We encountered practical problems with the HMDs, but despite these, players were enthusiastic about the technology. However, AR games will not be commercially viable until these problems are overcome.

In future work, we plan to conduct a detailed comparative evaluation pitting AR Tankwar against a tabletop and a computer equivalent to examine in more detail the differences in play style between these three mediums. Using the results of the demonstration, this evaluation, along with the experience of designing and playing the game, we will derive guidelines for future AR game development. Finally, we will use these guidelines to build more AR games, and work towards designs unique to AR.

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