Vancouver Maneuver: Designing a Cooperative Augmented Reality Board Game

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Abstract. In this paper we present *Vancouver Maneuver*, a game for mobile devices using Augmented Reality software to create a cooperative board game experience. Utilizing principles from both digital and analogue board game design, a hybrid game design approach is proposed in order to identify applicable mechanics. By doing so we combine the physical and social aspects of co-located tabletop gaming with the computing power and aesthetics of digital games.

Keywords: augmented reality, board games, co-located play.

1 Introduction

With recent developments in the field of smartphones or tablets, the market for mobile computer games is still growing. Technological improvements, both regarding computing power and the handling of advanced 3D graphics, make it possible for game developers to create games with demanding hardware specifications in mind. Current generations of mobile devices even allow Augmented Reality (AR) applications to be available for a majority of smartphone users.

According to Zagal et al. [1] all games have their roots in the physical world, whether it is sports on wide fields or strategical board games with game pieces. While digital games tend to be more solitary and are experienced individually, traditional games are often played with others. When looking at digital games, the majority of games are played on desktop computers or game consoles, and are either singleplayer games or multiplayer online games where players interact on a mediated basis. One reason for this can be seen in the nature of how computers are typically used—one user at a time and physically separated from other players. Handheld everyday devices like smartphones, on the other hand, break up these restrictions. AR can combine co-located, collaborative gaming, like it is associated with board games, with the processing power and the possibilities of real-time visual feedback known from digital games. The idea is to take the basic concept of a board game and use the device to source out tasks like checking rules, calculating scores and resources or apply chance based numbers. Apart from utilizing well established mechanics from digital games, new concepts and ideas can be introduced, since the combination of analogue and digital games is more as the sum of its parts.

2   Related Work

For mobile AR settings there are several interaction studies like gesture tracking or works related to traditional image and marker tracking (e.g. Peitz et al. [2]) or the recognition of finger movement via camera [3]. With all these new concepts being available, it is the main challenge for game designers to work with the technology and develop applicable games that use them extensively. There also have been studies regarding actual game piece tracking in order to maintain a certain physicality [4]. A new medium will always take some time to explore its full potential, and work like *Art of Defense* by Duy-Nguyen et al. [5] demonstrates how the use of tangible objects is a step in the right direction. As the team explicates in their paper about the game, tangible elements are a vital part in AR games in order to interact with the merged environments of reality and the virtual world. *The Sphero* [6] is an AR installation that focuses on the physical environment around players and thus increases immersion and enjoyability. However, until now, apart from the technological advancements in the mobile AR game domain, little is known about the design approaches and procedures.

3   Our Game Design Approach: Vancouver Maneuver

Designing an AR board game contains practices from both design fields, since developers create games with the physical and social dimension of board games in mind, while simultaneously having the tools and experience of digital game development at their disposal. As a starting point for our game design approach we picked one specific form of game: the cooperative puzzle. While competitive games also have a strong social component they often tend to cause tactical avoidance of conversation and self-restraint. Since it is a common approach for board games we began with an analogue paper prototype which then got transferred into a digital one. Based on these findings we created our game prototype of *Vancouver Maneuver (VM)*. Each player controls a burglar via his/her mobile device, working together to get a key and open a safe. Obstacles include security cameras, laser sensors and locked doors. By rotating rooms players solve different puzzles with increasing difficulty (see Figure 1).
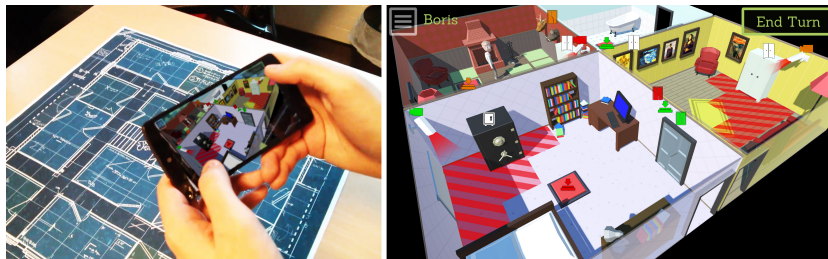

Fig. 1. The board as seen through a mobile device (left) and the screen view (right).

When thinking about board games and its differences in comparison to digital games, there are three interdependent factors to account for regarding game design: the general setting of players, the physicality of game pieces and the social interaction [7]. Regarding the first factor the obvious design choice for *VM* was to position the two player opposite to one another to establish differing vantage points onto the game board in order to encourage social interaction. For example one player has vision over a certain area of the game world and has to describe it to his teammate. Apart from the physical vantage point AR can achieve this through different renderings on the respective players device. There are parts of the game world which are only visible to one player, regardless of his position, but rather linked to his avatar. This also helps to engage the players in real-world movement, an aspect that other AR games like *BloxAR* [8] also valued highly.

The second big aspect of board games is the physicality of game pieces and their interaction. In *VM* this factor is covered by separate board tiles for each rotatable room (see Figure 2). One thing to take account is the mobile device itself. Players tend to look through their virtual camera very often, so a secondary interaction with the other hand is not easy to manage – especially for new players. While interaction with real world objects is mandatory, it is still more reliable to fall back on well-known interaction methods players know from traditional video games. For example, an earlier prototype had single markers on the board to be pushed around like conventional pegs. While this added an additional layer of physical interaction, the flow of the game was much better when players controlled their avatar with pointing the cursor to the desired field on the grid.
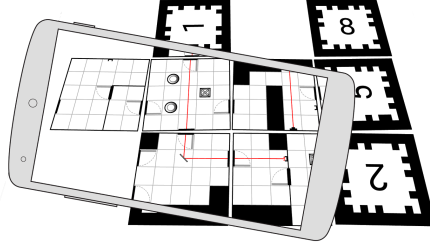

Fig. 2. Diagram of different image trackers representing rooms.

The third and most important part is the social interaction between players. For *VM*, cooperation is inherent regarding basic gameplay, since players get confronted with the same problems at the same time. Examples are the previously mentioned vantage points that require describing elements to a teammate or demanding switch puzzles. Moreover you have individual tasks to perform with your avatar while coordinating those with your teammate. The main challenge for collaborative play forms the solving of puzzles by observation and discussion.

It aims at a certain level of difficulty that is sufficient enough to force players to share information and argue over the best line of action [1].

4   Conclusion and Future Work

Mobile gaming is more prominent than ever, and with the current and future technology in smartphones there is a lot of potential regarding AR. While technical improvements are important, it is equally vital to catch up with the design side of this new medium. We have discussed that a hybrid approach between analogue board games and digital games opens up a research field on its own, since it is more than just a simple combination of two game types. *VM* addresses this issue and first play tests show that the approach is very promising. However, it is only the first step toward gathering knowledge regarding the creation and design of AR board games. The next steps will therefore be a refinement of the game design based on thorough formalized and controlled play testing. To take into account all social experiences and receptions of the game, we plan to set up different game sessions with both dedicated desktop and mobile AR versions of the game in order to compare traditional video gaming to the AR board game. Overall this work provides an illustration of our design experience and hopefully will serve as inspiration for other games of similar type to be developed.

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