Designing Multi-Gateway Interactions In A Multi-Player Strategy Game

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Abstract
In this paper, we present a novel computer vision based game which exploits multiple game gateways that enable different roles, different multiplayer experiences and also the transition from the traditional on-screen display to the mobileVR in single or multi-player mode while preserving the continuity of the immersive gaming experience. A detailed design and study are given. Three groups of play testers (*n=20*) played the game while being photographed, and were subsequently interviewed.

Author Keywords
Virtual reality; multiplayer games battle arena; head mounted display; mobile display; innovative interface.

ACM Classification Keywords
I.3.7 Three-Dimensional Graphics and Realism: Virtual reality; J. Computer Applications

Introduction
The social nature of multiplayer games provides compelling play experiences that are dynamic, unpredictable, and satisfying [1]. Recent studies have indicated that playing games against other people is more fun and exciting than playing alone [3]. Currently, most multiplayer video games are designed assuming that all players essentially share the same
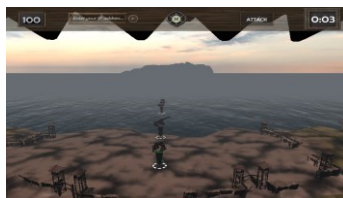
Figure 1: First level game (6 players)

Figure 2: Second level game fortifications placement

Figure 3: MobileVR HMD display

technology [9]. That is, their gameplay relies on interconnected PCs, mobile devices, etc. Past studies have shown the use of mobile devices as a uniquely capable adjunct to games that are currently played on computers or as a stand-alone gaming platform not related to computers [7]. However, very few examples support gameplay among a network of heterogeneous devices, and when they do, they try to provide a uniform experience regardless of the technology used [10]. Novel developments in Virtual Reality (VR) have proven to be capable of enabling its users to experience immersive virtual environments and experience a VR world much like they experience the real world through multiple sensorial channels [2,7]. This collection of immersive VR technologies, including computing systems, head-mounted displays (HMD), and more recently mobileVR engages the player's mind and provides methods for increasing the sense of presence [11] and contributes to building an enhanced feeling of immersion as compared to traditional computer systems [12]. The current paper proposes a multiplayer game experience that exploits multi-gateway interactions through multiple interface technologies. We use a heterogeneous networked system in which desktop computers and mobileVR devices offer two different gateways to the game. As opposed to enable a similar gameplay through the different technologies, we take advantage of the particularities of each interface technology to provide a different gameplay and experience to the same multiplayer game. In this paper, we report on a novel game experience we have developed as part of a school project at the University of Madeira in which immersive VR and the social nature of a multiplayer online computer-based strategy game are entangled. The combination of these interactive gateways in a game provides an engaging user

experience and innovative interface. In this paper we also report on the playtesting of this novel approach, with 20 participants.

State of the art

The deployment of games software is rapidly expanding, especially on the PC and Mobile markets. Video games play an important role by letting people explore new worlds; think, talk, and act roles that otherwise would be inaccessible to them. Multiplayer online battle arena games provide an opportunity to assess team performance. A past study suggests that mobile phones are used as user inputs to enhance the user experience in the virtual world created by games. Mobile phones are providing many features which allow for new forms of interaction in games played on them [5]. However, other approaches were able to go one step further, by implementing games that can be played across different devices and mediums, like the "Epidemic Menace" [6]. These examples show us that games are definitely getting out of their traditional formats and are trying to reach for new ways of interaction, that can make them stand out of the crowd. It is with this certainty that we propose *Explornesia: The Battle*, a multiplayer game that exploits multi-gateway interactions through multiple interface technologies.

Game design

Explornesia: The Battle is a game that presents a conflict of interests among two sovereign nations of the Iberian Peninsula. Players join either of the teams, Spain or Portugal, and adhere to the art of medieval war by employing their military supremacy in both land and sea. The story begins with the player taking control of a naval vessel, which is armed for destruction. The

Implementation

Both the computer (Windows) and the mobile (Android OS) version of the game are written in C# using the game development engine Unity. Furthermore, the computer version utilizes additional components such as Photon Unity Network package and FMOD Plugin. For the HMD development, we utilize Android Studio for Unity. An UDP communication is employed to send/receive messages between the two devices. For development and play testing, we used the Samsung Galaxy S6 as the display unit for VR BOX 2.0 (google cardboard based HMD). As for the duration of the game, the first game level has 3 minutes' time limit while the second game level composed of two turns without any time limitation.

land forces have to fortify their strongholds in order to defend and attack their opponents, who are on the other side of the seafront. The first game level (see Figure 1) is a multiplayer battle game arena introduced along with the concept of competitive and collaborative team effort. The goal is to earn fortification points, as well as able to unlock power-ups by sinking enemy vessels in preparation for the upcoming defence of their strongholds. Following the naval battle (see Figure 2), the fortification points collected by the player during that phase are transferred for the reinforcement of the land units in order to defend their beachhead. Strategy and cunningness are the quintessential ingredients for the glorious victories. Although some wars were won purely by brute force, the unfair advantage of spying behind the enemy lines and trickery has claimed even the sharpest tools in the box. And for this reason, we decided to incorporate this aspect into our game. In *Explornesia: The Battle*, players utilize their personal computers in order to strategically setup the fortification for defence, whereas players utilize a mobile phone based virtual reality HMD as a tangible representation of a binocular which enables them to view further into the horizon. This allows the battalion leader (the player) of the stronghold to have a different role and abilities, i.e. to spy on the fortification arrangement of the opponents (see Figure 3). These two gateways can be played by a single player or by a duo playing side by side, taking charge of a gateway. Under these game dynamics, we present a strategy multiplayer battle game where an innovative tangible interface allows users to combine a traditional game display and a mobileVR HMD, which can be combined and smoothly transitioned, while maintaining immersion.

Playtesting

We ran a playtest session at the Madeira-ITI to evaluate the game experience of this game. Three groups of 5, 7 and 8 participants (n=20, age≅24) played the game and were subsequently interviewed. We have applied the Game Experience Questionnaire from FUGA [4] along with a semi-structured interview. The players' reports can be seen in Tables 1 and 2. From these results and the visual cues that we obtained during the playtests, we could conclude that the play testers experienced immersion as well as cohesion with the flow [8]. Furthermore, in consonance with the results, we could conclude that play testers experienced positive emotions and depicted in involvement with their peers. Regarding the interviews results, some of the play testers said that having "*different viewing perspectives*" allowed them to be engaged in an "*immersive environment*" and the transitions between devices was perceived in a positive manner. Moreover, they emphasized that "*the tangible transition to the HMD felt subtle and appropriate*" what supports the inherent metaphor in the game. Finally, play testers enjoyed "*playing as a team*" and "*socializing with their teammates and opponents*" underlining the competitive and collaborative interaction of the game.

Conclusion

In this paper, we presented our novel computer vision based game *Explornesia: The Battle* which exploits multiple game gateways that enable different roles, different multiplayer experiences and also the transition from the traditional on-screen display to the mobileVR in single player mode while preserving the continuity of the immersive gaming experience. The findings from the playtest suggest that play testers enjoyed the overall realistic aesthetics and were more engaged

GEQ In-Game version

	N	Median
Flow	19	2
Positive Affect	19	2.5
Sensory and Imaginative Immersion	19	2

Table 1: Table results from GEQ In-Game version

GEQ Social Presence Module

	N	Median
Psychological Involvement – Empathy	19	2.33
Behavioral Involvement	19	1.83
Psychological Involvement – Negative Feelings	19	1.4

Table 2: Table results from the GEQ Social Presence Module

when faced direct competition (multiplayer). Our data also indicates that, play testers fully understood the purpose of having a multi-gateway interaction within the game as a strategic move. Moreover, they understood the tangible metaphor in the game. Further research by the group will focus on refinement and optimization of the game based on the feedbacks from the playtest participants.

Acknowledgements

References

1. Max V Birk, Benjamin Buttlar, Jason T Bowey, Susanne Poeller, Shelby C Thomson, Nicola Baumann, and Regan L Mandryk. 2016. The Effect s of Social Exclusion on Play Experience and Hostile Cognitions in Digital Games. *Chi '16*, January: 1–14. https://doi.org/10.1145/2858036.2858061

2. Roland Blach, Jurgen Landauer, Angela Rosch, and Andreas Simon. 2016. A highly flexible virtual reality system. *Future Generation Computer Systems* 14, 3: 167–178. https://doi.org/10.1016/S0167-739X(98)00019-3

3. Brian J. Gajadhar, Yvonne A. W. De Kort, and Wijnand A. IJsselsteijn. 2008. Influence of Social Setting on Player Experience of Digital Games. *Proceeding of the twentysixth annual CHI conference extended abstracts on Human factors in computing systems CHI 08* 3: 3099–3104. https://doi.org/10.1145/1358628.1358814

4. W.a. IJsselsteijn, Y.a.W. de Kort, and K. Poels. 2013. Game Experience Questionnaire. 1–9.

5. Mark Joselli, José Ricardo Da Silva, Marcelo Zamith, Esteban Clua, Mateus Pelegrino, Evandro Mendonça, and Eduardo Soluri. 2012. An architecture for game interaction using mobile. *4th International IEEE Consumer Electronic Society - Games Innovation Conference, IGiC 2012*: 1–5. https://doi.org/10.1109/IGIC.2012.6329846

6. Irma Lindt, Jan Ohlenburg, Uta Pankoke-Babatz, Sabiha Ghellal, Leif Oppermann, and Matt Adams. 2005. Designing Cross Media Games. *Proceedings of PerGames 2005 - 3rd International Conference on Pervasive Computing - PERVASIVE 2005, Munich, Germany*: 62–65.

7. Aaron Muszalski. The iPhone: Alternate Gaming Interface, or Harbinger of an Augmented Future? Retrieved January 5, 2017 from https://laughingsquid.com/the-iphone-an-alternate-gaming-interface-or-harbinger-of-an-augmented-future/

8. Jeanne Nakamura and Mihaly Csikszentmihalyi. 2002. The Concept of Flow Optimal Experience and Its Role in Development. *Handbook of positive psychology*: 89–105. https://doi.org/10.1007/978-94-017-9088-8_16

9. Jouni Smed, Timo Kaukoranta, and Harri Hakonen. 2002. Aspects of networking in multiplayer computer games. *The Electronic Library* 20, 2: 87–97. https://doi.org/10.1108/02640470210424392

10. Robert Speck, Paul J Diefenbach, and D Ph. 2013. Asymmetrical Gameplay Across Heterogeneous Devices: Designing a Lexicon for Cross-Platform Development Robert Speck, Paul J. Diefenbach, Ph.D. 4503. https://doi.org/10.1145/2503385.2503462

11. Jonathan Steuer. 1992. Defining Virtual Reality: Dimensions Determining Telepresence. *Journal of Communication* 42, 4: 73–93. https://doi.org/10.1111/j.1460-2466.1992.tb00812.x

12. M Zyda and M Zyda. 2005. From visual simulation to virtual reality to games. *Computer* 38, 9: 25–32. https://doi.org/10.1109/MC.2005.297