Party Animals: Creating Immersive Gaming Experience for Physically Co-present VR and Non-VR Players

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Abstract
With the rise of Virtual Reality, VR gaming in physically co-present social settings is becoming more important, and the interaction between the VR players and non-VR players pose an interesting game design challenge. Previous work have explored having non-VR players using only controllers, resulting in limited immersion and overlooked co-presence cues. We designed and implemented Party Animals, a VR party game that empowered non-VR users to interact through body gestures and also used physical co-presence cues in the gameplay. The results of our evaluation showed that the immersion of non-VR players was indeed promoted. Party Animals explored new interaction between VR and non-VR players, and integrates physical co-presence cues with the virtual world gameplay.

Author Keywords
virtual reality; physical co-presence; Vive; Kinect; body movement; party game; social game; gameplay

ACM Classification Keywords
K.8.0 [Personal Computing]: General *Games*

Introduction
As a growing number of commercial virtual reality (VR) headsets emerged on the market, VR gaming has become a popular topic for VR applications. However, in a typi-

cal social situation, the players usually outnumber the VR headsets available. Thus, VR party games should aspire to offer an inclusive multiplayer experience for VR players and non-VR players alike.

Keep Talking And Nobody Explodes [2] utilizes the exchange of information between VR player and non-VR players to defuse a bomb in VR world, with the manual accessible to non-VR players only. Although this spoken-only communication is interesting, it provides insufficient immersion for non-VR players.

Playroom VR [4] is a multiplayer VR game, where friends play cooperatively or competitively with VR player through controllers. It brings about the interaction between VR and non-VR players by integrating VR gaming with classic TV console game. However, non-VR players are confined to traditional interfaces, which leads to non-immersive interaction and the benefits of physical co-presence underused.

In the previous work, Cheng et al.[6] proposed a gameplay which created motion feedback for VR player with the help of non-VR players. Although the players interacted closely with one another, the game experiences of VR and non-VR palyers are completely different and isolated. Non-VR players just followed the instuctions on the display, and did not play with the VR player.

To intensify non-VR player's engagement and strengthen the interaction between non-VR and VR players, we incorporated body gestures in our gameplay. This would connect non-VR players to the virtual world through more intuitive interaction. Furthermore, non-VR players needed information from the physical world to accomplish the goal in our games. With this association, the game experience would then be extended to a blended world where the virtual bonds with the physical.

Design and Development

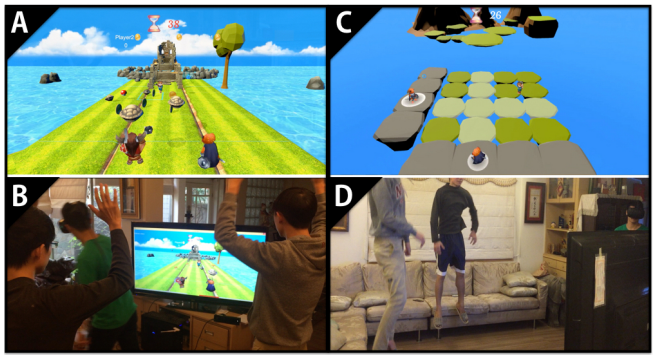

Figure 1: (A)The scene for the first game. VR player needs to get the coins and dodge the throwing objects. (B)In the first game, non-VR players stop the VR player by the throwable object in their characters' hand. (c)The scene for the second game. The non-VR player's jumping would highlight the corresponding row or column. (D)Non-VR players jump simultaneously to make the intersection fall.

Party Animals is a VR party game built with Unity 3D[5]. The game involves three players. One VR player wears the Vive headset with wireless controllers in each hand[1], and the other two are non-VR players whose body movements are captured by Kinect[3]. Party Animals contained two games. In the first game, the VR player's goal is to collect as many coins as possible with their hands or body. On the other hand, non-VR players throw turtle shells at the VR player to earn points. In the second game, non-VR players have to cooperate with each other to make the VR player fall by jumping on the row and column indices of the VR player's position at the same time. The goal of the VR player is to survive until the time runs out.

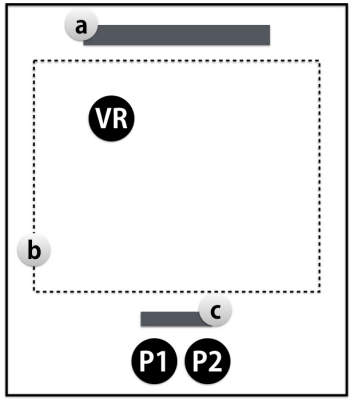

Figure 2: Setup the Game (a)TV or projection screen for non-VR players' display (b)The play-region for VR player (c)Kinect for non-VR player

During the design process, we followed two guidelines: Virtual World Engagement With Body Gestures and Association Between Virtual And Physical Information.

Virtual World Engagement With Body Gestures
Body gestures provide a more immersive way of interacting with the virtual world. In our games, we integrated Kinect as an input to facilitate body gestures for non-VR players. In the first game, non-VR players performed throwing gestures to attack the player with VR headset. In the second game, we implemented moving and jumping gestures, and the two non-VR players would jump simultaneously to reduce the space where VR player stood. This implementation with Kinect makes interaction more straightforward than with controllers and further enhances the engagement of non-VR players.

Association Between Virtual And Physical Information
Despite the capability of detecting multiple physical properties, the interaction and the exchange of information are still restrained in the virtual world. We integrated the information from both virtual and physical world in our gameplay to eliminate this boundary. In our first game, by making VR character temporarily invisible, non-VR players needed to consult the real-world location of the VR player in order to make a successful attack. In the second game, the cohesion of information from both worlds occurred between the two non-VR players. They targeted the VR player with virtual information provided by the monitor, and synchronized their jumping in the physical world.

Evaluation

In order to investigate our game experience and design, we adopted the extended Short Feedback Questionnaire(eSFQ)[7], which inspected the enjoyment, curiosity and co-experience of games. We recruited six users in our evaluation process.

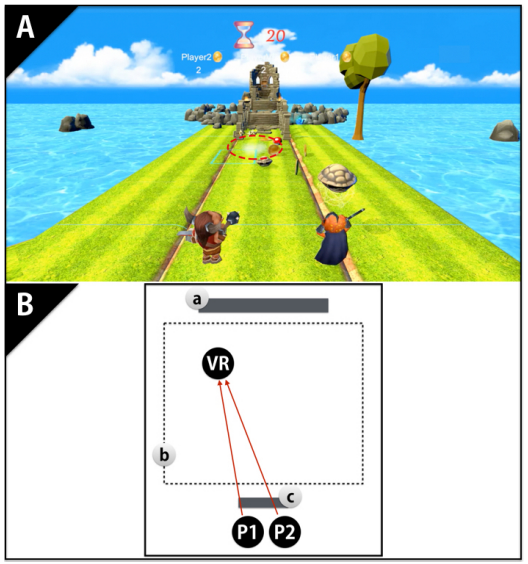

Figure 3: (A)The VR player turns invisible on the display. (B)Non-VR players need to consult the real-world location of the VR player in order to make a successful attack.

All of them have the experience in both VR and Kinect-based gaming. Every subject played firstly as VR player and then as non-VR player for each game. The mean of the experienced fun level for Party Animals was 4.33 (SD = 0.51)(5 meaning Yeah, fun and 1 meaning Yawn, boring). The game experiences with the interaction modalities were similarly described, i.e., being fun(83%), intuitive(66%), great(66%), exciting(50%), but also a bit tiring(66%). Five out of the six subjects indicated that they wanted to play the game again. The curiosity about Party Animals was rated with a mean of 3.83 (SD = 0.40) (5 meaning very curious and 1 meaning not curious at all). The game experiences for the interaction with others were all positively described

as fun(100%), competitive(100%), happy(66%), cooperative(66%). The results of the eSFQs showed that the inteface and design of Party Animals are practical and interesting.

Also, we collected the comments from all participants for their gaming experience. Qualitative comments appeared to corroborate the eSFQ results. For instance, P2 remarked *"It was really fun but a little bit tiring. Playing with friends is really exiciting and full of joy."* In addition, some participants commented that the association between phycial world and virtual world induced a more intuitive interaction. P4 said, *"I would hurl the turtle shell as if it really existed."* P3 also mentioned, *"After the VR player vanished, I would try tweaking the throwing direction based on his movements in the physical world."* On the other hand, one participant proposed an interesting idea as a VR player: *"It would be interesting to interact more closely with other players, such as touching."*

Future Work

Merging the play area: In our game design, the play area of VR and non-VR players were separate. By merging the play area, the spatial relation might become more intuitive and may further boost the level of engagement.

Association of more physical properties: According to the evaluation results, associating the physical location of the VR player indeed fostered a better sense of participation. We also plan to inspect the influence of associating more physical properties, such as head and limb movements.

Conclusion

Party Animals explored the idea of fostering more engagement and immersion for non-VR players in VR party game. We designed a multiplayer gameplay by integrating body movements and associating physical information with the virtual world. Our evaluation showed that our gameplay was interesting, and the interaction was straightforward as well as natural for non-VR players. We hope to encourage more ways of bridging the virtual and physical world to carry out more immersive gaming experience for players in VR party games.

Acknowledgements

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References

[1] HTC Vive. https://www.vive.com/ca/product/

[2] Keep Talking and Nobody Explodes. http://www.keeptalkinggame.com/

[3] Microsoft Kinect. https://developer.microsoft.com/zh-tw/windows/kinect

[4] Playroom VR. https://www.playstation.com/en-au/games/the-playroom-vr-ps4/

[5] Unity3D. https://unity3d.com/cn

[6] Lung-Pan Cheng, Patrick Lühne, Pedro Lopes, Christoph Sterz, and Patrick Baudisch. 2014. Haptic Turk: A Motion Platform Based on People. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '14)*. ACM, New York, NY, USA, 3463–3472. DOI: http://dx.doi.org/10.1145/2556288.2557101

[7] Christiane Moser, Verena Fuchsberger, and Manfred Tscheligi. 2012. Rapid Assessment of Game Experiences in Public Settings. In *Proceedings of the 4th International Conference on Fun and Games (FnG '12)*. ACM, New York, NY, USA, 73–82. DOI: http://dx.doi.org/10.1145/2367616.2367625