A Player Engagement Model for an Augmented Reality Game: A Case of Pokémon Go

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ABSTRACT

In this paper, we discuss players' engagement in playing Augmented Reality (AR) games. We present four concepts in playing AR games including: 'Player', 'Play', 'Presence', and 'Place'. We discuss each concept based on the individual user scenario using a case study of Pokémon Go. Based on these concepts, we propose an engagement model for players in playing an AR game, followed by research questions formulated by this study. We also highlight safety issues for AR game players such as Pokémon Go in the real-world. Then, we formulate a research question about players' safety in playing this game. In our future work, we will conduct a user study to investigate the usability, user experience, and safety for players to play AR games in both real and virtual worlds.

Author Keywords

Augmented Reality, Game engagement, HCI.

ACM Classification Keywords

H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION

Augmented Reality (AR) is a technology that combines real and virtual reality, enriching user's interaction experiences with a real-world environment through graphical object overlays. AR uses real-world environments and enhances them by blending with virtual objects (Wetzel et al., 2008). As a result, users experience the illusion of a combination of real and virtual environments. AR has unique and promising potential to bridge the gap between real-world activities and virtual experiences, allowing users to engage their imagination, and enhance their creativity (Zünd et al., 2015).

In recent years, AR has been used in many applications including entertainment, education, and the military. AR has become an emerging technology in the game industry, and game companies take advantage of its technical advancements in their game products (Kipper and Rampolla, 2012). AR has an important potential for the

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game industry (Molla and Lepetit, 2010). There are a number of well-received commercial AR games such as Niantic's Ingress, Zombies, Run!, Microsoft HoloLens games, and Nintendo's 3DS games.

Recently, Niantic released an AR-based mobile game called 'Pokémon Go', which has gone viral, attracting more than 20 million users worldwide (Yu, 2016). To date, Pokémon Go is the biggest mobile game in the United States, being played by 21 million active users daily (Kain, 2016). AR games have been around for more than a decade, and Pokémon Go has become a global phenomenon (Hoang and Baker, 2016). The phenomenal success of Pokémon Go has shown the potential of AR technology for the game industry today (Yamazaki and Wagstaff, 2016).

Since Pokémon Go game was released worldwide, it has received mixed reactions from players. Some players claim that the effects of Pokémon Go on players are positive. For instance, players can have health benefits from the gameplay in terms of physical and cognitive well-being (Texas A&M University, 2016). It can also improve the social communication among players. The Pokémon Go game has brought opportunities for people to engage with another while human interaction is becoming scarce (The Project for Public Spaces, 2016). It has the potential to help people with social anxiety and depression (Fernando, 2016).

However, some people claim that players are likely to get injuries, and encounter accidents while they are playing the Pokémon Go game (Tsukayama, 2016). There have been some unforeseen physical accidents while playing it. For instance, unless players are aware of their physical environment, they can get injured while they are playing the game (Tuttle, 2016). The game has the potential to lead players into restricted and harmful areas such as military campuses, construction sites, and private houses.

A player's engagement between the real-world and virtual environments should be balanced in playing the Pokémon Go game so that a player can avoid physical accidents and injuries in the real-world. The literature shows that there is a limited research in the area of players' engagement in AR gameplay in which players need to be engaged in both the real-world and virtual environments. Furthermore, there are a limited number of studies regarding players' safety in playing an AR game in which they need to physical move around in the real-world while playing it. Therefore, in this study, we are interested in exploring aspects of AR gameplay using the Pokémon Go game as an example, highlighting players'

engagement between the real-world and virtual environments as well as players' safety in the real-world environments.

To understand players' engagement in an AR gameplay, we created four user scenarios: 'Player', 'Play', 'Presence', and 'Place' using a case study of Pokémon Go game. Each scenario highlights how a player plays and engages in both the real-world and virtual environments while he or she is playing the Pokémon Go game. Based on these user scenarios, we propose an engagement model for players in playing an AR game. Then, we formulate research questions about players' engagement and safety in playing the Pokémon Go game. The main objectives of this study are:

- To understand players' engagement in both the real and virtual environments of the Pokémon Go game,
- To highlight the importance of players' safety in playing this game, and
- To formulate research questions about players' engagement and safety to play this game.

BACKGROUND

Pokémon Go is a location-based AR mobile game that encourages players to play and travel simultaneously between real-world and virtual environments (Pokémon Go, 2016). It uses real-world locations for players to navigate and explore in order to play the game. In this game, players go outdoors to search the virtual characters called 'Pokémon'. Game levels increase as a player succeeds in capturing more characters. The players need to go around as many places as possible to capture more virtual monsters and earn more game points.

Unlike conventional mobile games, player's physical movement is largely involved in Pokémon Go's gameplay. Players need to use real-world locations displayed by the game to search information about the locations of Pokémon. For instance, there is a higher chance for players to find Pokémon at locations such as parks, historical monuments, and other landmarks. In addition, players need to look for PokéStops and Gyms in the real-world to collect more game points. Therefore, in this game, players always pay attention to not only virtual gameplay but also physical movement in the real-world. The player's gameplay in the real-world is as important as virtual gameplay in the Pokémon Go game.

Although Pokémon Go encourages players to wander around the real-world environment, it is always important for them to pay attention to their surroundings to avoid unexpected accidents while playing it (Pokémon Go, 2016). For instance, players should avoid playing this game while driving. Players should balance their engagement between the real and virtual worlds. In the gameplay, if players place a higher focus on virtual gameplay, they may encounter physical accidents or injuries in real-world. On the other hand, if players pay greater attention to the real-world, they may miss out opportunities in the game. Therefore, the synchronization of player's engagement between virtual gameplay and physical movement is important. Figure 1 shows a screenshot of the Pokémon Go game.

Figure 1. The Pokémon Go game.

RELATED STUDIES

In this section, we review related studies about AR-based games. The AR technology was employed on mobile devices to enhance real-world creative activities, support education, and open new interaction possibilities for users (Zünd et al., 2015). The researchers designed and developed an AR-based game called 'City-Wide gaming', which encourages players to play and explore the city by solving puzzles related to historical sites and famous locations (Zünd et al., 2015). This game enabled developers to be more creative in developing AR games. Furthermore, it provides students with a playful AR game tool to explore the city in the real-world.

An AR outdoor game called 'TimeWrap' was designed and developed by a research group in Germany, and it was played in the city of Cologne, Germany (Wetzel et al., 2008). In this game, a player is equipped with an AR system including a head-mounted display (HMD), a laptop, a GPS sensor, and a PDA with an interactive map to provide the player with information about current locations and game status. This game also encourages players to play and explore in real-world.

In commercial games, the Pokémon Go precursor 'Ingress' is a popular mobile-based AR game, with 7 million players worldwide in 2015 (Sam, 2015). It is a location-based AR game in which players are encouraged to go outdoors and explore the real-world to play the game. This game is also considered as a location-based exergame in which players' physical movement is largely involved (Ma et al., 2014). There are other commercial games that use the fusion of real-world environment and virtual objects. For instance, the 'Real Strike' military based game is a first-person shooting game that combines real-life surroundings with 3D animation. 'Zombies Run' is another example of a mobile-based AR game that targets players who want a fun way of jogging or running around to maintain their fitness while they are playing.

RESEARCH GAPS

Although there are a number of similar games like 'Pokémon Go' in the market, the study about player's engagement between virtual and real-world environments is very limited. Furthermore, there is a very limited study about player's physical safety in playing such mobile-based AR games in which players' physical movement in the real-world is heavily involved. Therefore, in this study, we would like to investigate player's engagement in the real-world and virtual environments while they are playing an AR game. Furthermore, we would like to

investigate players' safety while they are playing the game in the real-world.

APPROACH

In this study, we discuss four concepts: 'Player', 'Play', 'Presence', and 'Place' in the Pokémon Go game to understand how a player plays and engages in this game physically and virtually. Based on structured observations of 6 people playing Pokémon Go for 3 days, we created a persona and user scenarios for each concept. We observed 4 male and 2 female players, aged between 22 and 32. 'Persona' is defined as "A model of a user that focuses on the individual's goals when using an artefact" (Blomkvist, 2002, p.1). Scenarios specify how users carry out their tasks in a specified context (UsabilityNet, 2016). Our persona "Kim" acts as a player in the user scenarios (See Table 1). Based on these user scenarios, we propose an engagement model for a player in playing an AR game. Next, based on the engagement model, we formulated questions that will be addressed in a future study by conducting a user study to investigate the game's usability and user's experiences, and safety.

Name	Kim
Age/Gender	24/M
Education	Final Year University Student
Major	Computer Science
Goal	To become a successful software engineer
Hobbies	Playing digital games, and Comics

Table 1. A Persona 'Kim'.

PLAYER

'Player' is defined as someone who will "interact with the system of a game in order to experience the play of the game" (Tekinbaş and Zimmerman, 2003, p. 80). We outline a user scenario for 'Player' in Pokémon Go game:

User Scenario - Player

"Kim downloaded the Pokémon Go game. He registered it and created a virtual player. He read the game instructions about how to play it. Unlike other games, this game encourages him to go outdoors and hunt the virtual monsters called 'Pokémon'. He goes outdoors and starts playing in his neighbourhood. Once he starts walking, his virtual player in the game is also moving based on the location displayed by the game. He is focusing on the game to search the hints of the locations of Pokémon. In the real-world, he is also paying attention to the physical environment to navigate according to the location suggested by the game".

A 'Player' in Pokémon Go game refers to both real-world and virtual players. Like other games, a virtual player in the game represents a real-world player. This virtual player moves around according to the real-world player's physical movements. For instance, a virtual player walks in the game based on the locations where the real-world player is moving in a real-world environment.

In this game, the synchronization between real and virtual players is important to accomplish game tasks such as searching the locations of Pokémon, PokéStop, and Gym. For instance, the game displays the location of Pokémon closer to the virtual player. The player in the real-world

needs to explore his or her surroundings to experience real-world locations where the game hints at the existence of Pokémon. Based on this concept, we state that 'Player' in the Pokémon Go game is a person's physical and virtual participation in both real and virtual worlds.

PLAY

'Play' is defined as "a participatory form of entertainment where people make choices that affect the course of events. Choices in play are constrained by the rules, and this requires player to be clever, imaginative, or skillful in the play" (Adams 2015, p.3). We outline a user scenario for 'Play' in Pokémon Go:

User Scenario - Play

"Kim plays Pokémon Go in the city centre by guessing that he can hunt more Pokémon there. When he starts playing the game, it shows the location of the city area. Then, he searches the possible locations of Pokémon and PokéStop. He navigates the virtual map on the mobile screen so that he can get information about where to hunt Pokémon. While he is playing the game, he is physically walking in the real-world as well. He receives a vibration alert from his mobile, meaning that there is a Pokémon monster close to him. Then, in the real-world, he walks to the location suggested by the game. He finds a Pokémon, and he catches it successfully".

The concept of 'Play' in Pokémon Go refers to both real-world and virtual gameplay by players. Unlike conventional digital games, a player's physical play is important in Pokémon Go as players need to travel and explore in the real-world to discover Pokémon. Simultaneously, players need to engage in virtual gameplay to find the locations of Pokémon. The synchronization of play between the real-world and virtual environments is a key factor. While players are playing the game, they are mobile in the real-world. If a player stops being mobile in the real-world, they will not achieve game tasks to reach higher levels. Based on this concept, we state that 'Play' in the Pokémon Go game is player's gameplay in both real and virtual worlds.

PRESENCE

'Presence' refers to a sense of 'being there' in a virtual environment (Tamborini and Skalski, 2006). 'Presence' refers to a type of user's flow experience that occurs during teleoperations (Draper et al., 1998). We outline a user scenario for 'Presence' in Pokémon Go:

User Scenario - Presence

"Kim is playing the Pokémon Go game on the bus. He is searching the possible location of Pokémon. He suddenly sees that one Pokémon appears nearby him. Then, he tries to catch it immediately. He turns on AR mode on the game. He sees a Pokémon and a virtual ball appear on the screen with the background of the real-world. By the time he turns on AR mode, he can feel his presence not only in the virtual world but also in his real-world environment. Then, he successfully catches the Pokémon by throwing the virtual ball".

'Presence' in Pokémon Go refers to player's a sense of 'being there' in both the real and virtual worlds. Unlike traditional digital games, in Pokémon Go, player presence

is important in both real and virtual worlds because of the need to engage in the virtual world to play the game while physically searching for the locations of Pokémon in the real-world. When a player turns on AR mode in the game, the real-world environment is displayed overlaid with digital objects (e.g. Pokémon monster). While AR mode is on, the player has a sense of 'being there' in both the virtual and real worlds. The synchronization of the player's presence in both the real and virtual environment is important in Pokémon Go. Based on this concept, we state 'Presence' is a player's a sense of 'being there' in both real and virtual worlds while playing the game.

PLACE

'Place' is defined as a socially or geophysically defined location (Champion, 2010, p. 27). In a virtual environment, 'Place' means where a player has the feeling of being surrounded by a type or a kind of location in the virtual world (Champion, 2007, p. 27). We outline a user scenario for 'Place' in Pokémon Go:

User Scenario - Place

"Kim is playing Pokémon Go on campus. He is looking for the location of a PokéStop to collect virtual balls. The game shows the location of PokéStop, which is nearby the library in real-world. He walks to the library. He realizes the existence of a Pokémon in the library. He goes inside the library, and he sees a Pokémon there. He turns on AR mode and catches it. By the time he switches on AR mode, he realizes that he is in the library not only in the virtual world but also in the real-world environment".

'Place' in Pokémon Go refers to the locations in both real and virtual worlds. In most traditional games, players do not need to be mobile to play the game. However, in Pokémon Go, it is necessary for players to be mobile in both real and virtual worlds. When the game displays a particular location of a Pokémon, a player needs to physically go to this location in the real-world. If a player catches a Pokémon at a particular place, they need to be mobile to other places to search for more Pokémon. Therefore, in Pokémon Go, places in both real-world and virtual environments are always related and synchronized. Based on this concept, we state that 'Place' in Pokémon Go is a location where a player has a sense of 'being there' or presence in both real and virtual worlds.

ENGAGEMENT MODEL

Based on the user scenarios for 'Player', 'Play', 'Presence', and 'Place', we propose an engagement model for players in playing an AR game. Engagement is the degree of activity or attention someone gives to a person or object over a period of time (Martey et al., 2014). Game engagement refers to how players experience a game (Jabar and Felicia, 2015, p.741; Ravaja et al., 2005), how they can connect emotionally and mentally to a game's features, and how they play a game to succeed their goals in the game (Csikszentmihalyi, 2008; van Reekum et al., 2004).

In this engagement model, we propose that a player's engagement in both real and virtual worlds is vital in playing AR games like Pokémon Go. While a player is playing the game in the virtual world, they need to engage

in the real-world to achieve game tasks. The synchronization of player's engagement between real and virtual worlds is important in the gameplay. Figure 2 shows an engagement model for players in an AR gameplay.

Figure 2. An engagement model for player in AR game.

Based on the engagement model, we formulate the following research questions.

- What is a player's engagement in the real-world in playing the Pokémon Go game?
- What is a player's engagement in the virtual world in playing the Pokémon Go game?
- Is there a correlation between a player's engagement in real-world and virtual environments?

PLAYER'S SAFETY

As a Pokémon Go player wanders the real-world keeping his or her eye on the mobile screen, it can lead to incidents including minor and major cases such as accidents and crimes (Tortermvasana, 2016). The author also cautions that this game can bring people to places where they normally avoid, putting their safety at risk. The local authorities of many countries advise players to play safely including personal and road safety, being aware of restricted and dangerous areas, and privacy breach. Based on these statements, in this study, we formulate the following research question regarding player's safety in playing the Pokémon Go game in real-world.

- Is Pokémon Go safe for players to play in the real-world environment?

CONCLUSION AND FUTURE WORK

In this study, we discuss the concepts of 'Player', 'Play', 'Presence', and 'Place' in Pokémon Go. We create a user scenario for each concept. Based on these concepts, we propose an engagement model for players in playing an AR game. Then, we formulate research questions about player's engagement in both real and virtual worlds while playing Pokémon Go. We also highlight the potential of safety issues in playing this game and formulate a research question concerning players' safety in the Pokémon Go gameplay. In our future work, we will conduct a user study about usability, user experience, and user's safety in playing Pokémon Go. We will conduct a focus group with Pokémon Go players to find out their good and bad experiences, and safety in playing it. The engagement model in this study can provide insights for researchers into designing AR games in the future.

REFERENCES

- Adams, E. Fundamentals of game design (3rd e.d.) New Riders, (2013).
- Blomkvist, S. (2002). Persona—an overview, Uppsala University. <http://www.it.uu.se/edu/course/homepage-hcinet/ht04/library/docs/Persona-overview.pdf> (Accessed August 06, 2016).
- Champion, E. Virtual places. Playing with the Past, Part of the Series of Human-Computer Interaction Series, (2010), 27-62.
- Csikszentmihalyi, M. Flow: The psychology of optimal experience. New York, NY: Harper Perennial Modern Classics, (2008).
- Draper, J. V., Kaber, D. B. and Usher, J. M. Telepresence. Human Factors, 40 (3), (1998), 354-375.
- Fernando, G. (2016). How Pokémon Go is helping people with social anxiety and depression. <http://www.news.com.au/technology/home-entertainment/gaming/how-pokemon-go-is-helping-people-with-social-anxiety-and-depression/news-story/bdf546cd7979d0c11480fcb596e61538> (Accessed August 06, 2016).
- Hoang, T. and Baker, S. (2016). Why Pokémon Go has been a viral success. Business Insider, <http://www.businessinsider.com.au/why-pokemon-go-has-been-a-viral-success-2016-7> (Accessed August 6, 2016).
- Jabbar, A. I. A. and Felicia, P. Gameplay engagement and learning in game-based learning: A systematic review. Review of Educational Research, 85 (4), (2015), 740-779.
- Kipper, G. and Rampolla, J. Augmented reality: An emerging technologies guide to AR (1st e.d.). Syngress, (2012).
- Kain, E. (2016). 'Pokémon Go' is the biggest mobile game in US history- And it's about to top snapchat. <http://www.forbes.com/sites/erikkain/2016/07/13/pokemon-go-is-the-biggest-mobile-game-in-us-history-and-its-about-to-top-snapchat/#4ed08a30722b> (Accessed August 8, 2016).
- Ma, M. et al. Virtual, augmented reality and serious games for healthcare, Berlin, Heidelberg: Springer Berlin Heidelberg, (2014), 199.
- Martey et al. Measuring game engagement: Multiple methods and construct complexity. Simulation & Gaming, 45(4-5), (2014), 528-547.
- Molla, E. and Lepetit, V. Augmented reality for board games, Proc. International Symposium on Mixed and Augmented Reality (ISMAR), (2012).
- Pokémon Go. Explore, (2016). <http://www.pokemongo.com/en-au/explore/> (Accessed August 8, 2016).
- Project for Public Places. (2016). <http://www.pps.org-/blog/author/admin/> (Accessed August 8, 2016).
- Ravaja, N. et al. The psychophysiology of video gaming: Phasic emotional responses to game events. In Proc. DiGRA 2005 Conference, (2005).
- Sam, R. Meet endgame: Proving ground- Google's AR mobile game. (2015).
- Tamborini, R. and Skalski, P. The role of presence in the experience of electronic games. In P. Vorderer & J. Bryant (Eds.), Playing video games: Motives, responses, and consequences (pp. 225-240). Mahwah, NJ: Lawrence Erlbaum Associates.
- Tekinbaş, K. S. and Zimmerman, E. Rules of play: Game design fundamentals. MIT Press, (2003).
- Texas A&M University. (2016) Health benefits of Pokémon Go. ScienceDaily. <https://www.sciencedaily.com/releases/2016/07/160715181715.htm> (Accessed August 8, 2016).
- Tortermvasana, K. (2016). Pokemon Go sparks safety fears. <http://www.bangkokpost.com/news/general/1047245/pokemon-go-sparks-safety-fears> (Accessed August 8, 2016).
- Tsukayama, H. (2016). Pokémon Go's unexpected side effect: injuries. <https://www.washingtonpost.com/news/the-switch/wp/2016/07/08/pokemon-gos-unexpected-side-effect-injuries/> (Accessed August 8, 2016).
- UsabilityNet. Scenarios of use (Use cases). (2016). <http://www.usabilitynet.org/tools/scenarios.htm> (Accessed August 8, 2016).
- van Reekum, C. M. et al. Psychophysiological responses to appraisal dimensions in a computer game. Cognition & Emotion, 18, (2004), 663-688.
- Wetzel, R., McCall, R., Braun, A-K. and Broll, W. Guidelines for designing Augmented Reality games. Proc. FuturePlay, (2008).
- Yamazaki, M. and Wagstaff, J. (2016). Success of Pokémon Go adds impetus for change at Nintendo. Yahoo Finance. <http://finance.yahoo.com/news/success-pokemon-adds-impetus-change-nintendo-232207842--sector.html> (Accessed August 8, 2016).
- Yu, H. (2016) What Pokémon Go's success means for the future of augmented reality. Fortune (online). <http://fortune.com/2016/07/23/pokemon-go-augmented-reality/>. (Accessed August 8, 2016).
- Zünd F. et al. Augmented creativity: bridging the real and virtual worlds to enhance creative play. In Proc. SIGGRAPH Asia 2015 Mobile Graphics and Interactive Applications, (2015).