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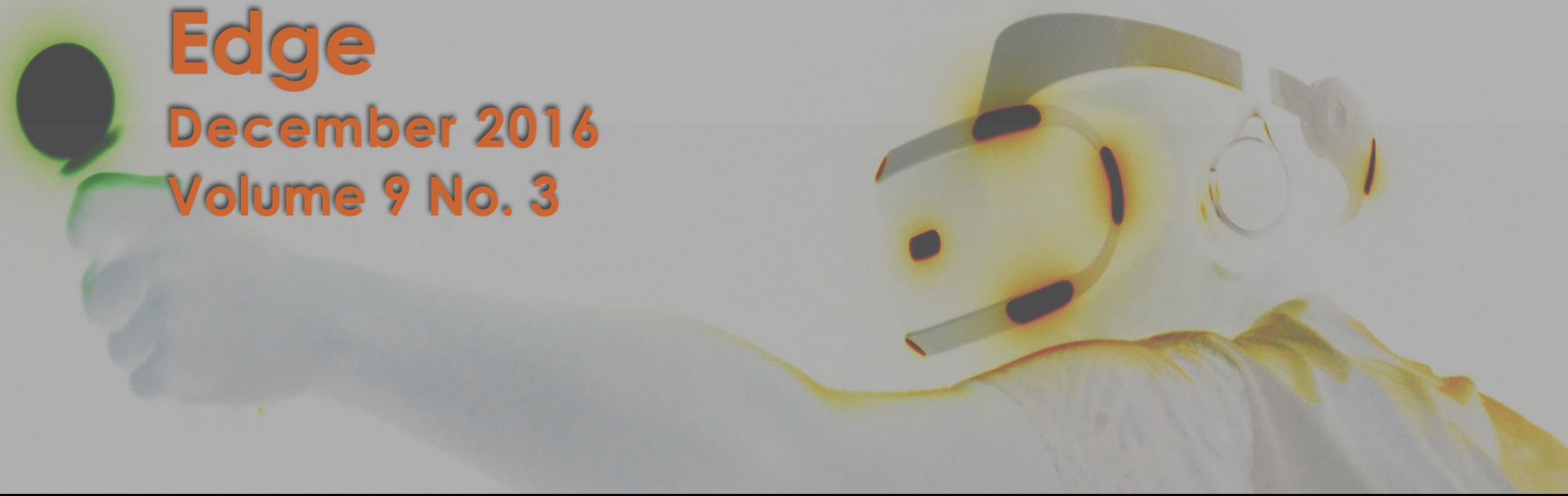
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Pokémon GO 2016: Exploring Situational Contexts of Critical Incidents in Augmented Reality

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Abstract

Pokémon GO, an augmented reality mobile game, captured the attention of millions of people around the world in July 2016. Various sources from around the globe have reported both positive and negative incidents and outcomes related to the game. Some of the incidents have been particularly remarkable for the player, i.e., critical incidents. A critical incident is a single experience, which a person perceives or remembers as unusually positive or negative. Critical incidents typically are highly influential for human behavior, and thus, important to study. Playing augmented reality games can take place in varying situational contexts. Situational context includes information that can be used to characterize the situation of a person, place, or object, and has been shown to be influential in mobile use context. This study investigates in which kinds of situational contexts do critical incidents of augmented reality game Pokémon GO take place. The focus is on four different situational contexts that Pokémon GO can be played in: *sociality*, *interaction state*, *place*, and *reasons for playing*. The study is based on analysing an online survey sample of 226 responses. The findings pose insights and implications regarding augmented reality applications and games in general, and thus, assist the developers in their efforts to provide the users with meaningful and positive experiences with games and other augmented reality applications.

1. Introduction

Pokémon GO (Niantic, Inc., 2016) is a mobile game in which the purpose is to find Pokémon creatures and battle others with the collected Pokémon. The game was launched in July 2016 and was quickly adopted around the world: according to market intelligence firm Newzoo (2016), Pokémon GO was downloaded 550 million times in first 80 days. The game also had more downloads in its first week in the Apple App Store than any other app in history (Polygon, 2016). By November 2016, the total number of downloads had exceeded 600 million (Kotaku, 2016). However, since its peak, the download trend has turned into decline, falling to less than 10 million monthly downloads in November 2016 (BBC, 2016). Also, as is merely natural to mobile games in general, similar downfall has occurred with the player base (SurveyMonkey, 2016). Nevertheless, millions were still playing the game and making in-app purchases four months after the game was published (BBC, 2016). Pokémon GO was estimated to have generated \$950 million in revenues during 2016 (Venturebeat, 2017).

Pokémon GO uses an augmented reality mechanics (i.e., supplementing the real world with animated characters). The game requires navigating in the real world setting and thus requires the player to be physically active in order to play the game (Baranowski, 2016). These kinds of games requiring physical activity to play the game are referred to as exergames (Kari & Makkonen, 2014). Exergames themselves are widely studied in regard to physical activity but limitedly in mobile context (Kari, 2014). There have already been reports about the positive influence of Pokémon GO to physical activity and increased exercise (e.g. Althoff, White, & Horvitz, 2016; Howe et al., 2016; Nigg, Mateo, & An, 2017; Serino, Cordrey, McLaughlin, & Milanaik, 2016), outdoor activity, cultural and historical awareness, socialization (Serino et al., 2016), and its ability to help those suffering from severe social withdrawal (Tateno, Skokauskas, Kato, Teo, & Guerrero). The game has also been suggested to lead people to replace sedentary indoor screen-time with active outdoor time (LeBlanc & Chaput, 2016; Nigg et al., 2017). Although, question has been raised regarding the sustainability of the increased physical activity (Howe et al., 2016). Despite its many benefits, there have also been reports of negative incidents that have occurred while playing the game, such as trespassing, violence (Serino et al., 2016), and accidents and injuries (Joseph & Armstrong, 2016). The study by Colley et al. (2017) also suggests there are both positive and negative aspects in Pokémon GO. They report, for example, that the game's design fortifies present geographically-linked biases, that the game may have instigated a fairly uncommon shift in global human mobility patterns, and that the game has geographically-linked safety risks (Colley et al., 2017). Overall, we have heard reports on both the positive and negative incidents of the game (McCartney, 2016).

Studying these kinds of positive and negative effects of the game is of course important, but investigating also other aspects of the game, or through the game, is highly warranted. For example, studying the critical incidents of Pokémon GO and augmented reality mobile games in general is very important when considering the positive and negative reports regarding Pokémon GO. However, this kind of research is still very limited. Therefore, this study aims to fill this gap and provide further insights on the matter, hence increasing the theoretical and practical understanding of this specific phenomenon.

The main research question of this study is: In what kinds of situational contexts do critical incidents of augmented reality game Pokémon GO take place?

An answer to this question can pose important findings and implications regarding not just the game itself but also augmented reality applications and games in general, as well as mobile exergames. Therefore, this study increases the theoretical understanding on the usage experiences of these kinds of games and also aids the developers in their efforts to provide the users with meaningful and positive experiences with games and other augmented reality applications. The findings can also assist the developers in achieving the positive incidents and in avoiding the

negative ones. This paper consists of six sections. After this introduction, the concepts of situational context and critical incident are presented, followed by methods, results, discussion, and finally, limitations and future research.

2. Background

2.1 Situational Context

Situational context includes “information that can be used to characterize the situation of an entity. An entity is a person, place, or object that is considered relevant to the interaction between a user and an application, including the user and applications themselves” (Dey, 2001, p. 5). Situational context is something that varies depending on the product or service under use. For example, the situational contexts between using augmented reality mobile games, or virtual reality console games can be different in many ways. Whereas mobile gaming can take place outdoors in the city or nature, console gaming practically always takes place indoors.

It has been suggested that the underlying situational context can influence the behavior after a product or service experience (Mehrabian & Russell, 1974; Xiao & Benbasat, 2011). Prior research has indeed demonstrated that situational context is important in mobile use context (e.g. Hong & Tam, 2006; Liang & Yeh, 2011; Liu & Li, 2011; Mallat, Rossi, Tuunainen, & Öörni, 2009; Salo & Frank, 2015). For instance, Salo and Frank (2015) found that the situational context of critical mobile application incident can influence use continuance and word-of-mouth.

This study focuses on four different situational contexts: *sociality*, *interaction state*, *place*, and *reasons for playing*. Three of the situational contexts (sociality, interaction state, place) were derived from Salo & Frank (2015), who studied situational contexts of critical incidents in mobile application usage. In addition, the context reasons for playing was investigated in this study.

Reasons for playing - refers to the primary reasons why the user has taken up the action itself, in this case, playing Pokémon GO. Considering the exergaming nature of Pokémon GO and many other augmented reality mobile games, the reasons for playing were investigated specifically from the point of view that the game was played mainly for *fun*, *exercise*, or both. Previous research has shown that with exergames, and thus, with Pokémon GO, the reasons for playing can be hedonic (e.g. fun), utilitarian (e.g. exercise) (Osorio, Moffat, & Sykes, 2012), or both fun and exercise simultaneously (Berkovsky, Coombe, Freyne, Bhandari, & Baghaei, 2010).

Sociality - seems to play an important role in Pokémon GO (Serino et al., 2016; Tateno et al., 2016). In this study, sociality refers to whether the game is played alone individually or together with others. Prior research has shown that the pleasure of using a system can come from either the use itself or from interaction with others. Hence, sociality can be influential regarding the user experience (Junglas, Goel, Abraham, & Ives, 2013).

Interaction state - refers to the state of mind in which the user conceives the activity (Apter, 1989) of playing Pokémon GO. For interaction state, this study applies Apter's (1989) reversal theory. It presents a pair of meta-motivational systems, “telic” and “paratelic”, which steer human behavior. These meta-motivational systems are presented as two different states: the “telic” task-oriented state and the “paratelic” activity-oriented state. They indicate whether one is motivated by achievement and future goals or the enjoyment of process in the moment. The task-oriented state is more serious and the activity-oriented state more playful. When in the task-oriented state, a person has some important goal or task in mind, whereas in the activity-oriented state, the person has the behavior itself in mind (Apter, 1989). An example of playing Pokémon GO in a task-oriented state is when a player's mind is set to beating an opponent or to achieve something. An example of an activity-oriented state is spontaneous playing with just the enjoyment in mind.

Place - describes the real world setting in which the game is played. Pokémon GO and other augmented reality mobile games can be used in various places (Althoff et al., 2016; American Heart Association, 2016; Serino et al, 2016). In this study, place has been categorized into home, nature, public setting with permitted access, public setting with forbidden access, car, and other places.

The selected situational contexts are extensive but obviously not all-inclusive. Other influential situational contexts, for example, the emotional state (Lee, Kim, & Kim, 2005), have also been shown to influence the usage of technology. And according to Chávez, Ide, and Kirste (1999), information about context can be practically unlimited. In this study, the focus was on those contexts that are typically present when playing Pokémon GO. Therefore, these contexts are considered to include the most central ones involved with the actual gaming experience, and hence, the ones most essential to understand. An example (derived from the data of this study) of a contextual setting while playing Pokémon GO is: playing Pokémon GO for fun in nature together with others in an activity-oriented state.

2.2 Critical Incident

A critical incident is defined as a single experience, which a person perceives or remembers as unusually positive or negative (Edvardsson & Roos, 2001). Critical incidents, typically, are particularly influential for human behavior (Flanagan, 1954). For example, a single critically negative incident may overrule a set of average positive incidents and lead to discontinuance or other unwanted behavior with the service or product in question (Cenfetelli, 2004). Critical incidents have a significant role in creating customer relationships and establishing user perceptions towards the products, services, and providing companies (Edvardsson & Strandvik, 2000; Payne, Storbacka, & Frow, 2008). Thus, examining critical incidents can have important implications for both research and practice. Previous research has examined critical incidents of mobile applications (e.g. Salo & Frank, 2015) and services (e.g. Gummerus & Pihlström, 2011; Salo, Olsson, Makkonen, Hautamäki, & Frank, 2013), but to author's best knowledge, not of mobile augmented reality games.

3. Methods

This study followed a quantitative approach. The data was collected between middle of July and early November 2016 by using an online survey. The survey was English language and meant for international audience. The survey was created with the LimeSurvey 2.05+ software. Before the survey was launched, it was pre-tested with ten early adopters of Pokémon GO, based on which few small modifications were made. Invitation to participate in the survey was distributed through social media (Facebook, Twitter, and Reddit) and different discussion forums with varying topics (e.g. gaming, wellness, lifestyle, cooking, culture, young elderly, etc.) in order to reach a wide range of players. Obviously, this method has the limitation of only being able to reach those who are following the mentioned social media channels or the discussion forums used to distribute the survey. Also, certain populations are less likely to have Internet access and to respond to online questionnaires. However, as Pokémon GO requires data connection in order to play the game, the lack of Internet access most probably does not rule out any target respondents.

Only those respondents who had experience of playing Pokémon GO were asked the questions concerning critical incidents and their situational context. To collect the contextual information about the critical incidents, an exact wording of previous critical incident research (e.g. Bitner, Booms, & Tetreault, 1990; Meuter, Ostrom, Roundtree, & Bitner, 2000) was used: "Think of a time when you had an outstandingly positive or negative experience [with Pokémon GO]", followed by a series of questions; first, about whether the incident was positive or negative, and then more detailed questions regarding the critical incident and its situational context. The descriptive questions

regarding the situational context were all structured multiple-choice questions, and those can be found in the appendix. The survey also included other questions for the purpose of another study.

The collected data was quantitatively analyzed with the IBM SPSS Statistics 24 software. The ‘Cannot say’ responses to the situational context questions were excluded from the analysis of the particular context, e.g. if a respondent was unable to state the interaction state of the incident, that response was excluded from the analysis of the interaction state. The study also investigated the differences between the situational context responses and the positivity/negativity of the incident. The statistical significance and the strength of the dependencies between the responses and positivity/negativity of the incident were analyzed through contingency tables (crosstabs), the Pearson’s χ^2 tests of independence, and the Cramér’s V coefficients. In some instances, the common condition for the validity of χ^2 test of "No more than 20% of the expected counts are less than 5 and all individual expected counts are 1 or greater" (Yates, Moore, & McCabe, 1999, p. 734) was not met. Consequently, as proposed in the widely used guidelines by Agresti (2002), the results of Pearson’s χ^2 tests were advanced with (Monte Carlo) exact tests. The Monte Carlo tests were based on a 10 000 sampled tables and 99 % confidence level. This procedure is considered reliable and independent of the dimension, allocation, distribution, and the balance of the analyzed data (Mehta & Patel, 2012). The level of significance was set at $p < 0.05$ level.

4. Results

In total, the survey received 226 complete responses, which were used for the analysis. The sample turned out to be female-dominant, as 66.4 % of the respondents were female. The age of the respondents ranged from 12 to 64 with mean age being 28.8 years old. More detailed description of the sample is presented in Table 1.

Table 1: Description of the sample (N = 226)

	n	%
Gender		
Male	72	31.9
Female	150	66.4
Other	4	1.8
Age		
-20 years	26	11.5
21-30 years	136	60.2
31-40 years	35	15.5
41- years	29	12.8
Employment status		
Full-time student	80	36.9
Employee	110	50.7
Unemployed	11	5.1
Other	16	7.4
N/A	9	-
Household type		
One person household	67	31.0
One family household without kids	85	39.4
One family household with kids	61	28.2
Other	3	1.4
N/A	10	-

Out of all the reported 226 critical incidents, 176 (77.9 %) were positive and 50 (22.1 %) were negative. The distribution of all the critical incidents as well as the positive and negative incidents between different situational contexts is presented in Table 2.

Table 2: Distribution of critical incidents between situational contexts

	n	%	Positive %	Negative %
Reasons for playing (n = 222)				
Fun	119	53.6	51.7	60.9
Only exercise	0	0	0	0
Both fun and exercise	103	46.4	48.3	39.1
N/A	4	-	-	-
Sociality (n = 220)				
Alone	66	30.0	23.7	53.2
Together with others	154	70.0	76.3	46.8
N/A	6	-	-	-
Interaction state (n = 214)				
Activity-oriented	165	77.1	77.6	75.0
Task-oriented	49	22.9	22.4	25.0
N/A	12	-	-	-
Place (n = 224)				
Home	15	6.7	5.7	10.4
Nature	43	19.2	18.8	20.8
Public setting (permitted)	148	66.1	68.8	56.3
Public setting (forbidden)	3	1.3	0.6	4.2
Car	9	4.0	4.0	4.2
Other	6	2.7	2.3	4.2
N/A	2	-	-	-

Table 3 summarizes the results of the Pearson’s χ^2 tests of independence, Monte Carlo exact tests, and Cramér’s V, which were used to examine the statistical significance and strength of dependencies between the responses and the positivity/negativity of the incident. To clarify, these tests indicate whether the positivity/negativity of the incident was related to the response and how strong was the relationship. With sociality and place, the common condition for the validity of χ^2 test was not met, and the (Monte Carlo) exact test result was referred to.

Table 3: Positivity/Negativity dependencies on situational contexts

	N	χ^2	df	p	P(Monte Carlo)	V
Reasons for playing	222	1.232	1	0.267	0.321	0.074
Sociality	220	15.329	2	<0.001	0.001 (exact)	0.264
Interaction state	214	0.139	1	0.710	0.834	0.025
Place	224	6.395	5	0.270	0.257 (exact)	0.169

χ^2 = Pearson’s χ^2 ; df = Degrees of freedom; p = P values for Positivity/Negativity dependencies; P(Monte Carlo) = P values with Monte Carlo exact tests; V = Cramér’s V. Level of significance was p<0.05

As can be seen, the only situational context in which there was a statistically significant dependency with positivity/negativity of the incident was the *sociality* ($\chi^2(2)=15.329$, $p_{(\text{Monte Carlo})}=0.001$, $V=0.264$). The most typical social setting in which critical incidents take place is *together with others*, as 70 % of the incidents took place in this setting. However, the incidents were distributed contra wise between positive and negative incidents as 76.3 % of the positive incidents took place *together with others*, whereas only 46.8 % of the negative incidents took place *together with others*.

Regarding the other situational contexts in which there were no statistically significant dependencies with positivity/negativity of the incident, the responses suggest the following: Concerning the *reasons for playing*, a bit over half of the critical incidents took place when the reason for playing was solely fun. A somewhat bigger proportion of negative (60.9 %) than positive (51.7 %) incidents took place when fun was the reason for playing. However, this difference was not statistically significant. It is to be noted that, as none of the respondents reported a critical incident with purely exercise reason for playing, the statistical comparison was made just between fun and both fun and exercise. Nevertheless, out of all the reported critical incidents, 46.4 % took place when the game was played for both fun and exercise reason. This demonstrates that people do play Pokémon GO to combine fun and exercise or to make exercising more fun.

Concerning the *interaction state*, the results indicate that around 75 % of the critical incidents take place in activity-oriented state, with almost no difference between positive and negative incidents. This suggests that most players' motivation to play Pokémon GO comes from the enjoyment of process in the moment, and when playing, most players have the playing itself in mind.

In terms of *place*, the results show that the majority of critical incidents take place in public setting with permitted access (66.1 %). Nature (19.2 %) is the second most common place where critical incidents occur. Generally, the differences between the proportions of positive and negative incidents are rather small in terms of place. As might be expected, a bigger proportion of negative than positive critical incidents take place in public setting with forbidden access and in a car. However, the difference is not statistically significant. Still, it is something that the developers should acknowledge.

5. Discussion

The purpose of this study was to provide first insights into the critical incidents of Pokémon GO and augmented reality mobile games in general, with special focus on the situational context in which the critical incidents occur. The main research question of the study was: *In what kinds of situational contexts do critical incidents of augmented reality game Pokémon GO take place?*

The study shows that the most typical social setting in which critical incidents take place is together with others. As also the vast majority of positive critical incidents seem to take place together with others, it indicates that the possibility to play Pokémon GO in interaction with other people is perceived important by the players. It is also something that is highly valued. The developers of augmented reality games should keep this in mind and, if feasible, implement their games with good multiplayer features or other possibilities to play the game together with others.

The finding that out of all the reported critical incidents, 46.4 % took place when the game was played for both fun and exercise reasons simultaneously, demonstrates the ability of Pokémon GO and other mobile augmented reality games to make exercise more fun. Therefore, these kinds of games could be used to promote the physical activity of people who are otherwise not so interested in exercising. People working with physical activity promotion could recommend these games for their target groups as a way to be more physically active. These games could also be used in school or similar settings to encourage people to participate in physical activity and replace sedentary

screen-time. But the promoters should remember to highlight the fun aspects of the games. Furthermore, considering some negative news on the media, reminding about the safety aspects would also be wise. The marketers of augmented reality games could bring out the possible exercising benefits or means of making exercising more fun in their marketing messages.

The results propose that a bigger proportion of negative than positive critical incidents take place in public setting with forbidden access and in a car. This suggests that the developers of these games should more strongly state that mobile augmented reality games should not be played in these settings.

This study provides valuable first insights into the situational contexts and critical incidents of Pokémon GO, and thus, increases the theoretical understanding on the usage experiences of augmented reality games. The findings and implications also assist the developers in their efforts to provide the users with meaningful and positive experiences and in avoiding the negative ones.

6. 6. Limitations and Future Research

This study has few notable limitations. First, although providing important insights regarding the situational contexts and critical incidents of Pokémon GO, the study did not investigate the actual effects of those incidents to user behavior or the influence of situational contexts. This kind of investigation would of course be important as well. To be able to conduct such investigation properly, more data would need to be collected. This is actually in our future plans. Second, as the game was rather new at the time when the data for this study was collected, it could have possibly influenced people to more easily report positive rather than negative incidents. Although, considering the popularity of the game, it is possible that people simply have that much more positive than negative incidents with the game. Third, the sample was somewhat unbalanced with around two thirds of the respondents being female. However, there is no reason to believe that this would have affected the results significantly.

Future research can build on the insights from this study in investigating various aspects of augmented reality games. Also, in addition to online survey, future studies could benefit from using other data collection methods, such as personal or group interviews. It could also be beneficial to use other analysis methods to investigate the different aspects around this important phenomenon.

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Appendix

Descriptive questions regarding the situational context

[When the experience took place...]

1. What was your reason for use/playing?

- Fun
- Exercise
- Both (for fun and exercise)
- I cannot say

2. In what kind of social setting the incident took place?

- Alone
- Together with others in a same place
- Together with others over network
- I cannot say

(For the analysis, the contexts *together with others in a same place* and *together with others over network* were combined to *together with others* category. This was done because the answers revealed that both can occur at the same time)

3. What was the surrounding setting?

- Home
- Nature
- Public setting (e.g. city area, school area, hospital area, etc.) with permitted access
- Public setting (e.g. school area, hospital area, private property etc.) with forbidden access
- I was in a car
- Other
- I cannot say

4. Did you play Pokémon Go for the sake of enjoyment or playing (no set goal) OR to achieve something specific (clear goal in mind)?

- For enjoyment
- For achievement
- I cannot say

(*For enjoyment* = Activity-oriented; *For achievement* = Task-oriented)

The full question items used for this study are available from the author by request.