The reciprocal influences among motivation, personality traits and game habits for playing Pokemon GO

RUNNING TITLE: Motivation, personality traits and Pokemon GO game habits

Abstract

This paper reports a study exploring motivations of Pokémon Game use, individual differences related to personality traits, and game habits. First, it analyzed Pokémon GO motivations through Exploratory Factor Analysis by administering online the Pokémon GO Motivational Scale to a group of Italian gamers (N=560). Successively, a Confirmatory Factor Analysis was conducted testing three factorial models on Pokémon Game motivations on a selected random sample selected (N=310). Results showed a three-factor model of Pokémon GO Game motivations (i.e., Personal Needs, Social Needs and Recreation), accounting for 68.9 percent of total variance plus a general higher-order factor that best fits the data. Individual differences in Pokémon GO motivations and personality traits have been explored showing that high involved Pokémon GO players are introverted, low agreeableness and conscientiousness people, driven by personal social and recreational needs. Reciprocal influences on motivational involvement, personality and game habits were discussed.

1. Introduction

Recently, we assist to an over incoming diffusion of Augmented Reality (AR) apps for mobile devices that, integrating realistically digital information in the physical world (Javornik, 2016), become pervasive technologies for different kinds of people (Rauschnabel, Brem, & Ivens, 2015). Recent studies in this framework, have focused on Pokemon GO apps, a multiplayer location-based AR mobile game that brings fictional creatures known as Pokémon into the real world via smartphone technology (Niantic Inc., USA). Scholars have analyzed gamers' attitudinal and intentional reactions (Rauschnabel, Rossmann, & tom Dieck, 2017), mobility, consumption and its effects on users' wellbeing (Zach & Tussyadiah, 2017), and gamers' motivational factors (e.g., Kaczmarek, Misiak, Behnke, Dziekan, & Guzik, 2017; Rauschnabel, et al., 2017; Yang & Liu, 2017; Zsila, Orosz, & Bőthe, 2017). Fewer studies have focused on gamers' personality traits that predict both Pokèmon GO early adoption (Tabacchi, Caci, Cardaci & Perticone, 2017) and gamers' behaviors during game sessions (e.g., Khalis & Mikami, 2018). In the psychological literature, there is substantial evidence that personality has an impact on motivational constructs, which in turn relate to performance (e.g., Barrick, Mount, and Strauss, 1993; Gellatly, 1996; Bandura, 1986; see Gist & Mitchell, 1992, for a review). Individuals are motivated to start actions when they see many benefits of a particular behavior (Ajzen, 2011; Mendes & Park, 2014). Hence, the present paper is aimed at analyzing individual differences in personality and motivational factors that influence Pokèmon GO consuming and adoption on a population of Italian gamers.

2. Literature Review on Augmented Reality (AR) gaming and Pokémon GO

In the definition by Azuma (2017) AR is "is an immersive experience that superimposes virtual 3D objects upon a user's direct view of the surrounding real environment, generating the illusion that those virtual objects exist in that space". Hence, AR creates a mix of real and virtual items that coexists and interacts with users in a real setting (Koo, Choi, Ham, & Chung, 2018). Since 2000, when Bruce Thomas from Wearable Computer Lab developed ARQuake, a game that allowed users to walk around and view enhanced images through a gyroscope based on their physical location, AR was applied in the context of gaming application (Piekarski & Thomas, 2002). With the successful diffusion of smartphone technologies form 2010, a series of AR games as, for instance, Zombies or Run! quickly gained popularity around the world starting to be downloaded by millions of players from the Google Play App Store. Pokémon GO, released by Niantic in 2016, represents a milestone in the panorama of AR gaming. As most of AR games, Pokémon GO, is based on Geocaching, a recent outdoor activity involving participants to use their Global Positioning System (GPS) mobile device to seek Pokémon imaginary creatures or their eggs, at specific locations marked by coordinates all over the real world. Hence, the virtual game and the real world are reciprocally synchronized. As pointed out by Nilsen, Linton, and Looser (2014), the user's experience of AR gaming relies on contemporary on physical, emotional, social, and mental aspects. Also, in this case, Pokémon GO includes physical aspects related both to the physical feeling of playing the game (i.e., the sense of virtual immersion or presence) and to the physical actions users made interacting with the game. Players go out on foot to catch

Pokémon creatures. Moreover, they share with other anonymous players information about Pokèstops (i.e., marked places in the game environment located at select sites in the real world such as historical markers, monuments, and art installations). Here, gamers find Pokèballs, Pokèmon Eggs, and other items such as Revives and Potions to use now that players can access Gyms. These are places where Trainers (i.e., expert gamers) go to sharpen their battling skills and where their Pokémon creatures go to gain experience. The Pokémon GO final goal is to involve Pokémon gamers to compete against each other to capture Pokémon GO creatures and win Pokémon battles or fights (i.e., a form of competition between Pokémon creatures). Thus, Pokémon GO includes also mental aspects concerning problem-solving, deductive thought or reason to achieve the game and social elements of collaboration, negotiation and relationship building between gamers (see Das, Zhu, McLaughlin, Bilgrami & Milanaik, 2017 for a review). As well Pokémon GO gives users a singular affective experience concerning “the way the game affects a player emotionally, by the sympathies they develop with game characters or players and the emotions brought forth by immersion in the game world” (Nilsen et al., 2014, p. 89). Peculiarly, Pokémon GO creates an exciting mix of game, sociality and physical presence (Liszio & Masuch, 2016), a cross-domain approach that was almost absent in the mobile AR game panorama and encourage participation as well (Baranowski, 2016). From its launch in the AR gaming marketplace, the game quickly develops reaching over 100 million users (Smith, 2016) also becoming a worldwide phenomenon (Tang, 2017). Late statistical data report that Pokémon Go has about 65 million players actively playing every month, and approximately 5 million that are actively playing every day (Anthony, 2017).

Some studies in the emergent field of AR gaming have analyzed user adoption behavior (Rauschnabel et al., 2015; Rauschnabel et al., 2017), marketing potential (Scholz & Smith, 2016), and user requirements (tom Dieck, Jung, & Han, 2016) and have evidenced that different factors drive different usage patterns. In this paper, we focus on recent studies on the growing popularity of Pokémon Go that have considered the psychological dimensions related both to motivational factors (e.g., Kaczmarek et al., 2017; Rauschnabel et al., 2017; Yang & Liu, 2017; Zsila et al., 2017) and personality traits (Tabacchi et al., 2017; Khalis & Mikami, 2018) in different sample of Pokémon GO gamers recruited in Europe or USA.

2.1. Motivational factors for playing Pokémon GO

A considerable number of studies has analyzed the impact of motivational factors on playing Pokémon GO. For instance, Kaczmarek et al. (2017) have examined the three primary motives related to the use of AR mobile game such as achievement, immersion and socializing (Yee, 2006; Yee, Ducheneaut, & Nelson, 2012) on a population of Pokémon Go Polish gamers. Their results have shown that gamers with high levels of achievement motivations acquire and test their power within the game, enjoy searching for rare Pokémon creatures or eggs and compete with other players in Gyms. Individuals with high levels of immersion motivations, that is a mix of desires related to finding and knowing things that most other players don't know about, creating characters or customizing their appearance and using the game to avoid thinking about real-life problems (Yee, 2006; p. 6), appreciate the game world and its story, enjoy the training experience offered by different Pokémon GO species and regions in the gameplay (Kaczmarek et al., 2017). Furthermore, gamers with

high levels of social motivations use Pokémon Go to interact with other players in the real-world at Pokéstops and Gyms or to expand their social networks, via Facebook profiles (Kaczmarek et al., 2017). Furthermore, authors have analyzed Pokémon GO motivational factors in the so-called Pikachu Effect, a phenomenon that explains the relationship between specific gaming motives and health outcomes. Their results have shown that health and social motivation were related to health outcomes in Pokémon GO gamers. Gamers who spent more time playing Pokémon Go, especially men, were more physically active, and also prone to increase the time spent outdoors (Kaczmarek et al., 2017).

In the study of Rauschnabel et al. (2017) Pokémon GO motivational factors related to the hedonist, emotional, and social benefits, as well as social norms that guide German consumers' reactions. Gamers' attitudes toward playing Pokèmon GO are mostly driven by the level of enjoyment people receive as well as by nostalgia, the flow experience, and the physical activity, but are decreased by the risk of being injured or hurt while playing. Indeed, the physical risks associated with the gameplay experience tend to hinder Pokémon GO.

Applying the model of online gaming motivations by Demetrovics et al. (2011), Zsila et al. (2017) have identified a series of psychological motives associated with Pokémon Go in Hungarian gamers such as Social, Escape, Competition, Coping, Skill development, Fantasy, Recreation, Outdoor activity, Nostalgia, and Boredom, also developing a 10-factor model of Pokémon Go motivation. In line with previous studies on AR games (Demetrovics et al., 2011; Király, Urbán, & Griffiths, 2015), authors have reported that recreation represents the most influential motivational factor, and it refers to players' motivation to relax and enjoy the entertaining aspects

of the game. Conversely, Skill development and Escapism are the weakest motives: low scores on these dimensions have evidenced that players use Pokémon Go neither to develop their cognitive, visual, and other skills neither to escape from real life.

Yang and Liu (2017) have shown seven main motives that bring US gamers to adopt Pokémon Go such as Exercise, Fun, Escapism, Nostalgia, Friendship Maintenance, Relationship Initiation, and Achievement. Both Fun and Friendship Maintenance were positively correlated with well-being, whereas Escapism and Nostalgia negatively related to it. Relationship Initiation linked with both better and poorer well-being. Also, Zach and Tussyadiah (2017) have found on a sample of US players that enjoyment of the Pokémon GO game, as well as motivation to win a battle, have a significant behavioral impact of playing Pokémon GO on mobility and spending as well as on users' well-being. Specifically, the game affects travel motivations among its players, leading people to move beyond their neighborhoods, to take a day trip to or stay overnight in other areas for the sole purpose of playing the game. In turn, the enjoyment of playing the game and its behavioral consequences develop a sense of community among players, improve mobility by travel and visitation, and also encourage physical activity. More recently, Vaterlaus, Frantz, and Robecker (2018) evidenced that college students' motivations for playing Pokémon Go were the chances to explore their environments while getting exercise and achieve the mission of the game related to "Catch Pokémon."

2.2. Personality and Pokémon GO

Fewer studies in the recent literature on Pokémon GO have linked the early adoption of Pokémon GO and its engagement to personality factors (i.e., Tabacchi et al., 2017;

Khalis & Mikami 2018). In this framework, Tabacchi et al. (2017) have affirmed that personality traits such as Introversion, Agreeableness, and Conscientiousness are psychological precursors of Pokémon GO usage and that gamers scoring high on these personality traits are also more engaged in game playing. Similarly, Khalis and Mikami (2018) have evidence that players with higher levels of social competence, agreeableness, and extraversion as well as lower social anxiety catch more Pokémon and gain more experience points during gameplay. As well, gamers with greater social competence and conscientiousness visit more Pokéstops and cover greater physical distances.

3. The present paper

Based on these findings, considering that both motivation and personality are critical factors of the Pokémon GO adoption, the present article has a twofold goal. First, it is aimed to understand the motivational benefits of playing Pokémon GO in a sample of Italian gamers, and successively to explore individual differences in motivational needs and personality traits concerning Pokémon GO game habits.

More specifically, we first analyzed motivational factors underlying the Pokémon GO game by performing an exploratory factor analysis (EFA) of an instrument, named Pokémon GO Motivational Scale (i.e., PokeGOMS), we developed for the present research. Successively, we evaluated the psychometric properties of the PokeGOMS testing three different factorial models of motivation in Pokémon GO through confirmatory factor analysis (CFA). Finally, we used a series of two-way ANOVA tests to determine the relationships between Pokémon GO motivational dimensions, personality traits, as defined in the light of the Big Five factors model (McCrae &

Costa, 1999), and Pokémon GO game habits (i.e. time usage, game access sessions, number of captured or collected Pokémon creatures, personal level of gamers' expertise as Trainer).

4 Method

4.1. Participants

Participants were 560 Pokémon GO players (360 male and 200 female), respecting our inclusion criterion for the sample composition, who completed an online survey without monetary compensation or another kind of gratification to join the study. Participants' median age was 24.55 (SD: 7.2), and they described themselves as students with a college degree (63%), employed (23%) and unemployed (14%). Participation in this study was on a voluntary basis. All the data handling was conducted agreeing with the Ethical Principles for Conducting Research with Human Participant and the Italian Law on Privacy.

4.2. Material and procedures

Potential participants had access to a flyer with a brief explanation of the study and a URL link. The link allowed access to the participant information sheet and a confidential online survey. The flyer was made available on the Facebook pages of two groups of Pokémon GO players, counting more than 5.000 users. A snowball sampling procedure was adopted, asking participants to recruit future subjects from among their acquaintances. Data were automatically collected when participant filled an electronic version of an assessment instrument consisting of demographic questions (i.e., gender, age, instruction), Pokémon GO usage (i.e., gaming time,

number of game sessions, numbers of captured Pokémon, number of collected species and personal level as a trainer) and the following measures.

Pokemon GO Motivational Scale (called PokeGOMS), which is an online seven-point Likert scale (1= “totally disagree” to 7= “totally agree”), we developed for the present study. Through a review of the literature, we identified 13 Pokémon GO motives, some of them reported in previous studies, as significant factors that drive game-playing (e.g., Kaczmarek et al., 2017; Yang & Liu, 2017; Zsila et al., 2017). Specifically, we considered curiosity, showing own creativity, knowing cultures different from their own, knowing new people, meeting friends, managing a variety of social experiences, spending free time, making something trendy, escaping from life, expressing aggression, expressing sexuality, expressing hidden personality aspects and performing physical activity. Psychometric properties of the PokeGOMS are presented in the following.

The Italian version of TIPI, called I-TIPI (Chiorri, Bracco, Piccinno, Modafferi, & Battini, 2015).

I-TIPI is a ten items scale that is comprised of 10 items, each consisting of a pair of descriptors that were scored from 1 (strongly disagrees) to 7 (strongly agree). Two items represented each dimension of the Big Five (E - Extraversion, A - Agreeableness, C - Conscientiousness, ES - Emotional Stability and O - Openness), one stated in a way that constitutes the positive pole of the dimension, and the other reported in a way that serves the negative pole. Even if this scale is intrinsically limited by the reduced number of questions (i.e., 2 for each Big Five trait), showing

no estimates on internal consistency (Woods & Hampson, 2005), such limitation is balanced by its clarity of language, ample cardinality norms (Gosling, Rentfrow, & Potter, 2014); measure convergence and easiness of administration (McCrae, Kurtz, Yamagata, & Terracciano, 2011; Witt, Massman, & Jackson, 2011; Tabacchi et al., 2017). Moreover, the TIPI exhibited reasonably acceptable psychometric properties for measuring the Big Five in terms of test-retest reliability, self-other agreement, factor structure, convergence with other personality questionnaires such as Big Five Inventory (r=.81) and NEO-PI-R (r=.73) and correlations with relevant criteria in the original validation study (Gosling, Rentfrow, & Swann, 2003), in the Spanish (Romero, Villar, Gómez-Fraguela, & López-Romero, 2012) and in the Italian one (Chiorri, Bracco, Piccinno, Modafferi, & Battini, 2015).

5. Results

5.1. Motivational needs

Table 1 reports descriptive statistics, indexes of skewness and kurtosis for each of the 13 PokeGOMS motivational need. Results showed that mean scores are all at the range between 1.73 (SD = 1.62) and 4.95 (SD = 1.65) and that the deviation of data from normality was not severe as the value of skewness and kurtosis indexes were below 3 and 10 respectively (Kline, 2011; Gravetter & Wallnau, 2014).

Table 1 about here

Data were preliminary studied with explorative factor analysis (principal axis factoring extraction with OBLIMIN rotation) and using successive confirmative factor analysis

to assess psychometric properties of the 13-items PokeGOMS. As suggested by Cabrera-Nguyen (2010), a good practice in scales development and validation is to start with an EFA to assess the underlying factor structure and refine the item pool, followed by CFA, using a different sample to evaluate the EFA-informed a priori theory about the measure's factor structure and psychometric properties (Costello & Osborne, 2005; Cabrera-Nguyen, 2010; Henson & Roberts, 2006).

5.2 Explorative factor analysis

The explorative factor analysis (EFA) for the 13-items PokeGOMS, using eigenvalues and scree plot as criteria for determining the number of factors performed on our data, suggested a three-factor solution that accounted for 69.6% of the variance with two items deleted (see Table 2). In line with Costello and Osborne (2005), we removed both items with factor weights <0.30, >0.30 on two or more factors, or not semantically consistent with the factor content.

Table 2 about here

Our three-factor solution overlapped the description of principal motives of using Pokémon GO reported by literature (e.g., Zsila et al., 2017; Kaczmarek et al., 2017; Yang CC, Liu, 2017). We labeled Personal Needs the first factor (26.7 percent of total variance), as it included four items related to individuals motives of using Pokémon GO such as "escaping from real life," "expressing aggression," "expressing sexuality," and "expressing hidden personality aspects." We named Social Needs the second factor (26.3 percent of total variance), as it refers to four items related to

social and cognitive motives associated with the Pokémon GO game experience such as: “I use Pokémon GO for managing a variety of social backgrounds”, “I use Pokémon GO for knowing new people”, “I use Pokémon GO for knowing cultures different from my own” and “I use Pokémon GO for expressing creativity”. Finally, we labeled Recreation the third factor (16.6 percent of total variance), as it includes the following three items: concerning the use of Pokémon GO for “spending spare time,” “making physical activity” and “meeting friends.” Cronbach's Alpha was calculated to test the reliability of variables retained in each factor, and coefficients greater than or equal to 0.50 were considered acceptable and a good indication of construct reliability (Nunnally, 1967). As shown in Table 3, in the present study, Cronbach’s alpha values were 0.88 for Personal Needs, 0.90 for Social Needs, 0.77 for Recreation, and 0.89 for the whole PokeGOMS scale. All values were within a satisfactory range (Van De Ven & Ferry, 1980). Considering that the three PokeGOMS factors presented high and significant positive intercorrelations (from .45 to .74), we hypothesize a second-order overall factor of Pokémon GO motivation that might account for the covariance of the first level.

Table 3 about here

5.3. Confirmative Factor Analysis (CFA)

We computed a Confirmative Factor Analysis (CFA) using the asymptotically distribution-free method to verify the factor structure of PokeGOMS results (Fig. 1) on a restricted sample of cases randomly selected by our data (N=310; M:43%, F:57% Average Age: 24.5, SD: 7.39; range 18-51). We calculated Chi-square/df (Carmines

& McIver, 1981), Comparative fit index (CFI), Adjusted goodness of fit index (AGFI), Root of means square error of approximation (RMSEA) to evaluate the fit of the theoretical models, also using as acceptance criteria values between 1 and 2 for the Carmines-McIver Index, and the general criteria for adequacy assessment proposed by Hu and Bentler (1999): CFI >0.95, AGFI >0.90, and RMSEA <0.06. We tested by CFA three plausible models: a one-factor model (Model 1), a three-factor model isomorphic to the EFA solution (Model 2), and a three-factor model plus a second-order general factor model suggested by the significant correlation between factors in the EFA solution (Model 3). As reported in Table 4, Model 1 and Model 2 fit indices are not satisfactory. Model 3 showed the better fit as confirmed by AIC. All structural index were significant ($p < 0.001$).

Table 4 about here

5.4. Personality traits

Table 5 summarizes mean scores at each of the I-TIPI personality dimensions and Zeta Test values obtained by participants of the present study. Results evidenced that participants' scores on each of the Big Five traits are significantly ($p<.001$) at a medium-low level compared with TIPI norms (Gosling, Renfro & Swann, 2003).

Table 5 about here

5.5.Pokemon GO game habits

As regards, Pokémon GO usage by Italian gamers, our data showed that the average time of daily sessions is 3.57 (SD=1.84); the average number of captured Pokémon

is 3.59 (SD=1,84), whereas the average number of collected species is 6.29 (SD=3.43). Finally, the average level as a Trainer is 14.3 (SD=6.9) corresponding to a low-middle level of expertise, the maximum obtainable being 40.

5.6. Motivational needs, personality traits, and Pokemon GO Usage

In order to analyze individual differences on motivational needs, personality traits and Pokémon GO game habits, we first categorize participants based on high versus low scores both on each of the three motivational factors (i.e., PN, SN, and R) and on each of the five personality traits (i.e., E, A, C, ES and O), splitting the whole sample on the basis of the median value. Then, we performed a series of two-way factorial analyses of the variance (ANOVA) with two levels of the between-subjects variable Motivation (High vs. Low) and two levels of the between-subjects variable Personality traits (High vs. Low) on each of the Pokémon GO game habits as dependent variables (i.e., TIME, TRAINER, CAPTURES, SPECIES, and SESSIONS).

Results at ANOVAs tests showed a main effect for Extraversion, $F(1, 560) = 4.67$, $p < .05$, such that the average time usage was significantly higher for people scoring low on extraversion ($M = 4.61$, $SD = 2.32$) than for people scoring high ($M = 4.18$, $SD = 2,40$), $\eta = .008$. The main effect of Recreation was non-significant, $F(1, 560) = 0.83$, $p > .05$. However, the interaction effect was significant, $F(1, 560) = 4.52$, $p < .05$, $\eta = .008$, Cohen's $d = 2.85$, that people scoring low on Extraversion but higher on PokeGOMS Recreation scale are those who spend more time on using Pokémon GO, and the effect size is huge (Sawilowsky 2009). Moreover, results at ANOVAs showed that the interaction effect between Agreeableness and Personal Needs on time usage was significant, $F(1, 560) = 9.25$ $p < .01$, $\eta = .01$, Cohen's $d = 4.5$ indicating

that people scoring low on Agreeableness and high on PokeGOMS Personal Needs scale also tend to spend time playing Pokémon GO. Also, in this case, the effect size is huge (Sawilowsky 2009). Furthermore, results at ANOVAs showed a main effect for Agreeableness, $F(1, 560) = 11.16$, $p < .001$, $\eta = .02$, Cohen's $d = 0.2$ such that the numbers of sessions was significantly higher for people scoring low on Agreeableness ($M = 3.85$, $SD = 1.70$) than for people scoring high ($M = 3.32$, $SD = 1.91$), but the effect size is quite small (Cohen, 1988). The main effect of Personal Needs was non-significant, $F(1, 560) = 0.71$, $p > .05$. However, the interaction effect was significant, $F(1, 560) = 4.30$, $p < .05$, $\eta = .008$, Cohen's $d = 2.5$ indicating that people scoring low on Agreeableness but higher on PokeGOMS Personal Needs scale are those who tend to access Pokémon GO more frequently having more game sessions, and the effect size is huge (Sawilowsky 2009). Finally, results at ANOVAs showed that the interaction effect between Conscientiousness and Social Needs on numbers of captured Pokemon (i.e., CAPTURES) was significant, $F(1, 560) = 8.80$ $p < .01$, $\eta = .016$, Cohen's $d = 4.11$ indicating that people scoring low on Conscientiousness and high on PokeGOMS Social Needs scale also tend to capture more Pokemon creatures, and the effect size is huge (Sawilowsky 2009).

6. Discussion and Conclusion

Starting from the recent mass media exposure of Pokémon GO, the present paper was aimed both at analyzing motivations of playing Pokémon GO in Italian users and at linking their different motivational dimensions to personality traits and gaming habits.

Results at EFA and CFA showed three dimensions for primary motives for using Pokémon GO: Personal Needs, Social Needs and Recreation. Specifically, Personal Needs include expressing aggression, sexuality and hidden aspects of the gamer personality. Social Needs involve managing a variety of social experiences, knowing new people and cultural worlds different from their own or expressing creativity. Recreational needs are related to spending free time, performing physical activities and meeting friends. As demonstrated by CFA, this three-factor model accounted for a percentage of variance consistent with the explained variance in the literature (Hair, Anderson, Tatham, & Black, 1995; Pett, Lackey, & Sullivan, 2003). Moreover, CFA results from Model 3 corroborated the existence of a general higher-order factor, in line with the assumption that human behavior is in essence goal oriented, driven by physical, psychological and social needs (Maslow, 1943; 1954). Results of the present study are in line with the literature on AR gaming and corroborate the idea that Pokémon GO usage improves both personal needs (Rauschnabel et al., 2017) and social benefits (Das et al., 2017; Herodotou, Winters, & Kambouri, 2013). Furthermore, our results evidence that individuals tend to use Pokémon GO for its health benefits, driving them to play this AR game to improve their physical activity by rewarding the most straightforward useful exercise of walking (Kamboj & Krishna, 2017; Yang & Liu, 2017). However, if compared with current models of Pokémon GO motivation including several factors, as the 10-factors model of Zsila et al. (2017), or the 7-factors model reported by Yang and Liu (2017), this three-factor model is quite parsimonious and captures the primary motives of playing Pokémon GO.

Our data showed that motivations for playing Pokémon GO are related to personality traits and game habits too. In line with the literature on Pokémon GO motives (Zsila

et al., 2017; Yang & Liu, 2017), we found that different motivations for playing Pokémon GO are related to specific personality traits and trends in-game habits. Indeed, more introverted gamers driven by their recreational needs tend to spend more time using Pokémon GO. Such results are consistent with previous literature showing that Pokémon GO early adopters are quite introvert people (Tabacchi et al., 2017). As well, less agreeable people driven by personal needs tend not only to spend time on playing Pokémon GO but also to have more game sessions on a day. People who tend to be competitive and not compassionate with others (McCrae & Costa, 1999) find the Pokémon GO a breeding ground to express their personality traits using the virtual environment of the game. Consistently with the literature on personality traits of video-games (e.g., Skippon & Garwood, 2011), our data showed that low conscientiousness people, who usually tend to neglect daily activities related to work or family (Wolfradt & Doll, 2001), play Pokémon GO capturing a high number of Pokemon creatures, but they are driven explicitly by their social needs.

Summarily, according to Nilsen et al. (2014), the present study evidenced that motivational involvement, personality traits, and game habits are reciprocally related influencing and being influenced by all the physical, emotional, social, and mental aspects of the user's experience of AR gaming. Indeed, the more involved Pokémon GO players, who are also introverts, low agreeableness, and conscientiousness people, decline their game habits differently from the personal, social or recreational needs they would satisfy. In turn, we can assume that game habits influence motivational involvement and personality traits. To conclude, results of the present paper demonstrate that behind the apparent simplicity of playful entertainment

offered by AR gaming such Pokémon GO there is a plurality of motivations that change according to the personality of gamers and their gaming habits.

7. Limitations and future research

Some limitations should be recognized when interpreting our findings. First, even if Mullinix, Leeper, Druckman, and Freese (2015) found that convenience samples play a valuable role in social science research, our data were collected from a convenience sample of Italian gamers, so further studies are necessary for corroborating results also in cross-cultural domains. Second, we used self-report measures of Pokémon GO motivation and game habits. Despite evidence to the contrary (Dishman, Washburn, & Schoeller, 2001), self-reports might affect participants' disclosure of some sensitive information. A social desirability scale may be added to a future version of the questionnaire to reduce this bias. Third, it would be worthwhile to explore moderating effects of age and gender, as a supplement for the current findings regarding individual differences and causal relationships between motivation, personality, and game habits through SEM models. Finally, this research has been focused on motivation and personality exclusively. It would, however, be of interest to analyze the increased risks associated with Pokémon GO usage as recently outlined in the media (Joseph & Armstrong, 2016; Bumgardner, 2018). Despite these limitations, the present paper depicts individual differences in Pokémon GO motivations and personality traits considering their relationships with game habits and also opens to further studies aimed to accustom AR gaming (i.e., in our case Pokémon GO) to users' needs.

References

Anthony, S. (2017). A year in, millions still play Pokémon Go (and will likely attend its festival). Retrieved June 20, 2018 from https://arstechnica.com/gaming/2017/07/a-year-in-millions-still-play-pokemon-go-and-will-likely-attend-its-festival/

Azuma, R.T. (2017). Making Augmented Reality a Reality. Imaging and Applied Optics 2017 (3D, AIO, COSI, IS, MATH, pcAOP), OSA Technical Digest (online) (Optical Society of America, 2017), paper JTu1F.1, doi: https://doi.org/10.1364/3D.2017.JTu1F.1

Ajzen, I. (2011). The Theory of Planned Behaviour Reactions and Reflections. *Psychology and Health*, 26, 1113–1127, doi: 10.1080/08870446.2011.613995

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice-Hall

Baranowski, T. (2016). Pokemon Go, go, go, gone? *Games for Health Journal,* 5(5), 293–294, doi: https://doi.org/10.1089/g4h.2016.01055.tbp

Barrick, M.R., Mount, M.K. & Strauss, J.P. (1993). Conscientiousness and performance of sales representatives: Test for the mediating effect of goal setting. *Journal of Applied Psychology*, 78, 715-722.

Cabrera-Nguyen, P. (2010). Author guidelines for reporting scale development and validation results in the Journal of the Society for Social Work and Research. *Journal of the Society for Social Work and Research*, 1, 99–103, doi:https://doi.org/10.5243/jsswr.2010.8

Carmines, E. G., McIver, J. P. (1981). *Analyzing models with unobserved variables*. In Bohrnstedt GW, Borgatta EF, eds. *Social measurement: Current issues*. Beverly Hills, CA: Sage

Chiorri, C., Bracco, F., Piccinno, T., Modafferi C., & Battini, V. (2014). Psychometric Properties of a Revised Version of the Ten Item Personality Inventory. *European Journal of Psychological Assessment*, DOI: 10.1027/1015-5759/a000215.

Cohen, J. (1988). *Statistical power analysis for the behavioural sciences* (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum & Associates.

Costello, A. B., Osborne, J. (2005). Best practices in exploratory factor analysis: four recommendations for getting the most from your analysis. *Practical Assessment Research and Evaluation,* 10, 1–9.

Das, P., Zhu, M., McLaughlin, L., Bilgrami, Z., & Milanaik, R.L. (2017). Augmented Reality Video Games: New Possibilities and Implications for Children and Adolescents. *Multimodal Technologies Interactio*n, 1 (2), 8, doi:10.3390/mti1020008

Demetrovics, Z., Urbán, R., Nagygyörgy, K., et al. (2011). Why do you play? The development of the motives for online gaming questionnaire (MOGQ). *Behavior Research Methods,* 43(3):814–825. doi: http://dx.doi.org/10. 3758/s13428-011-0091-y

Dishman R.K., Washburn R.A., Schoeller D.A. (2001). Measurement of physical activity. *Quest*, 53 (3), 295–309. doi: 10.1080/00336297.2001.10491746.

Gellatly, I. R. (1996). Conscientiousness and task performance: Test of cognitive process model. J*ournal of Applied Psychology*, 81, 474–482

Gist, M. E., & Mitchell, T. R. (1992). Self-Efficacy A Theoretical Analysis of Its Determinants and Malleability. *Academy of Management Review*, 17, 183-211

Gosling, S. D., Rentfrow, P. J., & Potter, J. (2014). Norms for the Ten Item Personality Inventory. Unpublished Data.

Gosling, S. D., Rentfrow, P. J., & Swann, W. B., Jr. (2003). A Very Brief Measure of the Big Five Personality Domains. *Journal of Research in Personality*, 37, 504-528

Gravetter, F. & Wallnau, L. (2014). *Essentials of Statistics for the Behavioral Sciences*. 8th Edition, Wadsworth, Belmont, CA

Hair J., Anderson R. E., Tatham R. L., & Black W. C. (1995). *Multivariate data analysis*. 4th ed. Englewood cliffs, NJ: Prentice-Hall, Inc.

Henson R.,& Roberts J. (2006). Use of exploratory factor analysis in published research: common errors and some comment on improved practice. *Educational and Psychological Measurement*, 66, 393–416.

Herodotou, C. & Winters, N. & Kambouri, M. (2013). An Iterative, Multidisciplinary Approach to Studying Digital Play Motivation: The Model of Game Motivation. Games and Culture. 10. 1-20. 10.1177/1555412014557633.,

Hu L. T., & Bentler P. M., (1999). Cutoff Criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. *Structural Equation Modeling* 6, 1–55, doi: https://doi.org/10.1080/10705519909540118

Javomik A., (2016). Augmented reality: Research agenda for studying the impact of its media characteristics on consumer behavior. *Journal of Retailing and Consumer Services*, 30, 252-261, doi: 10.1016/j.jretconser.2016.02.004

Joseph, B., & Armstrong, D. G. (2016). Potential perils of peri-Pokémon perambulation: The dark reality of augmented reality? *Oxford Medical Case Reports,* 10, doi: http://doi.org/10.1093/omcr/omw080

Kaczmarek L. D., Misiak M., Behnke M., Dziekan M., & Guzik P. (2017). The Pikachu effect: Social and health gaming motivations lead to greater benefits of Pokemon GO use. *Computers in Human Behavior*, 75, 356–363, doi: 10.1016/j.chb.2017.05.031

Kamboj, A. K., Krishna, S. G. (2017). Pokémon GO: An innovative smartphone gaming application with health benefits. *Primary Care Diabetes*, 1(1), 397–399, doi: http://dx.doi.org/10.1016/j.pcd.2017.03.008

Khalis, A., & Mikami, A.Y. (2018). Who's Gotta Catch'Em All?: Individual differences in Pokèmon Go gameplay behaviors. *Personality and Individual Differences*, 124, 35-38, doi: https://doi.org/10.1016/j.paid.2017.11.049

Király O., Urbán R., Griffiths M. D., et al. (2015). The mediating effect of gaming motivation between psychiatric symptoms and problematic online gaming: An online survey. *Journal of Medical Internet Research*, 17(4), doi: http://dx.doi.org/10.2196/jmir.3515.

Kline, R.B. (2011). *Principles and practice of structural equation modelling*. (3rd. Ed.). New York: Guilford Press

Koo, C., Choi, K., Ham, J., & Chung, N., (2018), *Empirical Study About the PokémonGo Game and Destination Engagement. In* B. Stangl and J. Pesonen (Eds.), Information and Communication Technologies in Tourism 2018, (pp. 17-28), https://doi.org/10.1007/978-3-319-72923-7_2

Liszio, S., Masuch, M. (2016). *Designing shared virtual reality gaming experiences in local multi-platform games* (pp. 235-240). Cham: Springer International Publishing.

Maslow, A. H. (1954). *Motivation and personality*. New York: Harper.

Maslow, A. H. A theory of human motivation. *Psychological Review*, 1943; 50:370–396

McCrae, R. R., & Costa, P. T. (1999). *A five-factor theory of personality*. In L. A. Pervin & O. P. John (Eds.), *Handbook of personality* (pp. 139–153). New York: Guilford

McCrae, R. R., Kurtz, J. E., Yamagata, S., & Terracciano, A. (2011). Internal consistency, retest reliability, and their implications for personality scale validity. *Personality and Social Psychology Review*, 15(1), 28-50. doi: 10.1177/1088868310366253

Mendes, WB., Park, J. (2014). Neurobiological concomitants of motivational states. *Advances in Motivation Science,* 1, 233–270.

Mullinix, K. J., Leeper, T. L., Druckman, J. N., & Freese, J. (2015). The Generalizability of Survey Experiments, Journal of Experimental Political Science, Volume 2 (2), Winter 2015, 109-138, doi: https://doi.org/10.1017/XPS.2015.19

Nilsen, T., Linton, S. & Looser, J. (2004). Motivations for AR Gaming. P*roceedings of Fuse'04 New Zealand Game Developers Conference*, pp. 86-93.

Nunnally, J. C. (1967). *Psychometric Theory*. New York: McGraw-Hill

Pett M. A., Lackey N. R., and Sullivan J. J. (2003). *Making sense of factor analysis: the use of factor analysis for instrument development in health care research.* Thousand Oaks, CA: Sage Publications, Inc.

Piekarski, W., & Thomas, B. (2002). ARQuake: The outdoor augmented reality gaming system. *Communication of the ACM*, 45, 36–38, doi 10.1145/502269.502291.

Rauschnabel, P.A., Brem, A., Ivens, B.S. (2015), Who will buy smart glasses? Empirical results of two pre-market-entry studies on the role of personality in individual awareness and intended adaption of Google Glass. *Computers in Human*

*Behavio*r, 49, 635-647, doi http://dx.doi.org/10.1016/j.chb.2015.03.003

Rauschnabel, P.A., Rossmann, A., tom Dieck, C.M. (2017). An Adoption Framework for Mobile Augmented Reality Games: The Case of Pokémon Go. *Computers in Human Behavior,* 76, 276-286, doi: https://doi.org/10.1016/j.chb.2017.07.030

Romero, E., Villar, P., Gomez-Fraguela, J. A. & Lopez-Romero, L. (2012) Measuring personality traits with ultrashort scales: A study of the Ten Item Personality Inventory (TIPI) in a Spanish sample. *Personality and Individual Differences*, 53, 289-293. http://dx.doi.org/10.1016/j.paid.2012.03.03

Sawilowsky, S. S. (2009). New effect size rules of thumb. *Journal of Modern Applied Statistical Methods*, 8(2), 597 – 599.

Scholz, J., & Smith, A. N. (2016). Augmented Reality: Designing Immersive Experiences That Maximize Consumer Engagement, *Business Horizons*, 59 (2), 149-161.

Skippon, S., & Garwood, M. (2011). Responses to battery electric vehicles: UK consumer attitudes and attributions of symbolic meaning following direct experience to reduce psychological distance. Transportation Research D, *Transport and Environmen*t, 16(7), 525-531.

Smith, C. (2016). Hot game: Amazing Pokémon Go statistics. *DMR* (Retrieved on August 26, 2016, from http://expandedramblings.com/index.php/pokemon-go-statistics/)

Tabacchi, M. E., Caci, B., Cardaci, M., & Perticone, V. (2017). Early usage of Pokémon Go and its personality correlates. *Computers in Human Behavior*, 72, 163–169. doi: http://dx.doi.org/10.1016/j.chb.2017.02.047

Tang, A.K.Y. (2017). Key factors in the triumph of Pokémon GO. *Business Horizons*, 60 (5), 725-728

tom Dieck, M.,C., Jung, T. & Han, D.I. (2016). Mapping requirements for the wearable smart glasses augmented reality museum application. J*ournal of Hospitality and Tourism Technology,* 7 (3), 230 – 253, https://doi.org/10.1108/JHTT-09-2015-0036

Van De Ven AH, Ferry D. (1980). *Measuring and assessing organizations*. New York: Wiley Interscience.

Vaterlaus, J.M. Frantz, K., & Robecker, T. (2018). "Reliving my Childhood Dream of being a Pokémon Trainer": An Exploratory Study of College Student Uses and Gratifications Related to Pokémon Go. *International Journal of Human–Computer Interaction,* 1. doi: https://doi.org/10.1080/10447318.2018.1480911

Witt, E. A., Massman, A. J., & Jackson, L. A. (2011). Trends in youth's videogame playing, overall computer use, and communication technology use: The impact of self-esteem and the big five personality factors. *Computers in Human Behavior*, 27, 763-769

Wolfradt, U. & Doll, J. (2001). Motives of Adolescents To Use the Internet as a Function of Personality Traits, Personal and Social Factors. J*ournal of Educational Computing Research*, 24(1), 13-27

Woods, S. A., & Hampson, S. E. (2005). Measuring the Big Five with single items using a bipolar response scale. *European Journal of Personality*, 19(5), 373-390. doi: 10.1002/per.542

Yang C.C, & Liu, D. (2017). Motives Matter: Motives for Playing Pokémon Go and Implications for Well-Being, *Cyberpsychology, Behavior and Social Networks,* 20(1), 52-57, doi: 10.1089/cyber.2016.0562

Yee, N. (2006). Motivations for play in online games. *CyberPsychology & Behavior*, 9, 772–775, doi: https://doi.org/10.1089/cpb.2006.9.772

Yee, N., Ducheneaut, N., & Nelson, L. (2012). Online gaming motivations scale: Development and validation. In *Proceedings of the SIGCHI conference on human factors in computing systems*, Austin, Texas, USA — May 05 - 10, 2012, pp. 2803-2806, doi: 10.1145/2207676.2208681

Zach, F. J. & Tussyadiah, I. (2017). To Catch Them All—The (Un)intended Consequences of Pokémon GO on Mobility, Consumption, and Wellbeing. *Information and Communication Technologies in Tourism*, 24-26 Jan 2017, Rome, Italy, pp. 217-222.

Zsila A., Orosz G., Bőthe B., et al. (2017). An empirical study on the motivations underlying augmented reality games: The case of Pokémon Go during and after Pokémon fever. *Personality and Individual Differences*, doi: http://dx.doi.org/10.1016/j.paid.2017.06.024

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