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Why playing augmented reality games feels meaningful to players? The roles of imagination and social experience

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ABSTRACT

Augmented reality (AR) games such as location-based games add virtual content on top of the real world. We investigate why playing these games feels meaningful to players by focusing on the dimensions of imagination and sociality. We theorise a structural model that we test with data collected from a global sample of players of the popular AR game Pokémon GO (N = 515). Our findings show that nostalgic feelings about Pokémon increased imagining AR content in the real world. Surprisingly, using imagination in this way was a much stronger predictor of affection towards the fictional pokémon creatures than nostalgia. The affection towards the fictional creatures, in turn, increased the meaningfulness of playing. Regarding the social factors, community identification and social self-efficacy increased players' sense of meaningfulness of playing. As our study's main design implications, we highlight the importance of socially shared narratives and harnessing the players' imagination to support a sense of meaningfulness of playing.

1. Introduction

Society is increasingly digitised with various cyber-physical systems, augmented reality (AR), sensors gathering data and online connectivity. AR technologies have been projected to have an increasingly significant, even disruptive, impact on our lives (Rauschnabel, 2021). Location-based AR games (LARGs) are examples of AR applications where digital content is tied to the player's geographical location. Since Pokémon GO's release in 2016, they have remained popular with new games and other AR products being released constantly. LARGs enable players to reimagine the world, adding digital content to everyday places. As LARGs mix fiction and reality to create the game world, they differ from movies and self-contained games (Liberati, 2018). Accordingly, LARGs can be conceptualised as AR layers that can be accessed with mobile devices (Jensen et al., 2019). Because technology is still limited and a believable fusion between the augmented world and our world is impossible, scholars have argued that for AR games to feel meaningful, players need to imagine and act as if the fictional game world was real (Waern et al., 2009). Surprisingly, the role of imagination has been unaddressed in several recent empirical studies on why players play LARGs (e.g. Alha et al., 2019; Ghazali et al., 2019; Hamari et al., 2019; Rauschnabel et al., 2017; Vaterlaus et al., 2019).

Using imagination while playing implies cognitive involvement, as players are actively thinking about the game world. They imagine fictional stories, and engaging with them while playing can also boost an emotional attachment to the game and its fictional world. Imagination can help ponder meaning-of-life questions by enabling exploration of the purpose of living through the playing experience, resulting in eudaimonic gratification (Oliver et al., 2016; Weise, 2004). Imagination is also connected to social processes and allows individuals to effortlessly cooperate with even those unfamiliar to them through shared fiction (Harari, 2014). To capture these aspects in AR games, in this study, we investigate how the games can create meaning for players. Individuals can find meaningfulness in utilitarian (Spreitzer, 1995) and hedonic (Oliver et al., 2016) activities. For understanding how social gameplay and players' imagination influence the meaningfulness of playing, we propose the following research question:

How can location-based AR games use imagination and social experience to increase the meaningfulness of playing them?

This study aims to fill the research gap of understanding the role of imagination and sociality in AR games by proposing a model for predicting meaningfulness in the context of the most popular LARG, Pokémon GO. The rest of this paper is structured as follows. First, we review the extant literature on meaningfulness in AR games and

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engagement with our case game Pokémon GO in particular. We present the theoretical perspective of the current study: how (1) imagination; and (2) sociality; are connected to the meaningfulness of playing. We then formalise our structural model and hypotheses, followed by the empirical study section that contains subsections on construct development, data collection and data validity and reliability. We present the results followed by a discussion section where we go through the theoretical, practical, and design implications of our findings, limitations, and future work.

2. Background

2.1. Meaningfulness in location-based AR games

Spreitzer (1995) defined meaning as a component of empowerment that describes a subjective sense of meaningfulness of an activity about the individual's pre-existing values and ideals. To understand an activity's meaningfulness, it needs to be observed in social, cultural and personal contexts (Weise, 2004). Oliver and Raney (2011) argue that meaning also has a eudaimonic dimension, connecting it to activities where life's purpose can be explored. Accordingly, meaningfulness is a broad concept. It is a subjective sense of activity being worthwhile and connects to hedonic, utilitarian and eudaimonic values. Out of these three values, hedonic and utilitarian values are most commonly present in predicting players' engagement in video games (Sharma et al., 2020). As an example, Shin (2019) used hedonic and utilitarian values to measure how AR-game players derive satisfaction, finding both to be significant predictors of satisfaction and playing intention. Some work has looked at eudaimonia in games as well (e.g. Daneels et al., 2020), but this component of meaningfulness (Oliver & Raney, 2011) has received less attention in the extant academic literature. Meaningfulness has been considered a feeling that predicts involvement (Montani et al., 2020) and engagement (Soane et al., 2013). Due to the broad definition of meaning (Spreitzer, 1995), multiple approaches for studying how games can scaffold it are needed.

One way AR games can create meaningful experiences for players is allowing them to immerse themselves in fictional worlds and impact events within that world (Oliver et al., 2016). A sense of meaning in games can also be connected to, for example, players' ability to identify with characters (Klimmt et al., 2007) and experience positive and negative emotions from their decisions within the game world (Grizzard et al., 2014; Oliver et al., 2016). According to the findings of Daneels et al. (2020), story is one of the key game elements that provides meaningful, eudaimonic experiences for players. Identification with characters in the game and story can be enhanced by imagination-supported experiencing of the consequences of the players' actions in the game world (Klimmt et al., 2007). In addition to the games' story, other real players and audiovisual experiences are important in scaffolding meaningful playing experiences (Daneels et al., 2020).

A few studies have looked into the meaningfulness of playing in the context of LARGs specifically. Arango-López et al. (2017) linked meaning in LARGs to players' experiences with the game Pokémon GO, and Wulf and Baldwin (2020) argued that a nostalgic predisposition to the Pokémon franchise (e.g. past experiences) were important in motivating players to play the game. These studies suggest that meaningfulness is connected to past experiences, way of playing, memories, and knowledge. When people are bored, nostalgia can act as an antidote to the lack of meaning (Van Tilburg et al., 2013). As nostalgia is, at its core, replaying memories and reminiscing, it has an intrinsic link to the use of imagination. This implies nostalgia can positively correlate with the meaningfulness of playing through imagination (Van Tilburg et al., 2013; Wulf & Baldwin, 2020). Contrary to video games that are contained entirely within a virtual world, the meaningfulness of playing LARGs does not limit to the LARG application itself. It is also shaped by real-world playing locations, social interactions, and playing time

(Arango-López et al., 2017). Therefore, both in-game factors (gameplay, achievements, progression) and real-world factors (playing location, sociality) need to be accounted for to understand the meaningfulness of playing LARGs.

2.2. Engagement with pokémon GO

A concept closely related to meaningfulness and its predicted direct consequence is engagement (Spreitzer, 1995). Several studies have been conducted on user engagement with LARGs, in particular with the game Pokémon GO. These studies are displayed in Table 1. The most popularly used theory for understanding engagement with the game was the uses and gratifications theory used in quantitative (e.g. Bueno et al., 2020; Hamari et al., 2019) and qualitative (Vaterlaus et al., 2019) studies. Most of the studies in Table 1 utilised cross-sectional data. Surprisingly, only a single study (Bueno et al., 2020) measured the role of imagination, operationalised as fantasy, despite earlier work suggesting it is a crucial component in engagement with LARGs (Waern et al., 2009). However, Bueno et al. (2020) found fantasy in playing was not linked with use continuance. Yet, in one study game knowledge was identified as the most significant predictor of Pokémon GO use continuance (Jang & Liu, 2019). This finding would suggest that immersing oneself in the game story is linked to continued play. In the current study, we can explore this finding in further detail.

Despite not appearing as a predictor of engagement or use continuance in more than one study (Bueno et al., 2020), meaningfulness has been discussed in several conceptual studies, in particular on Pokémon GO. Liberati (2018) argues that while the content Pokémon GO augments on top of our reality is not part of it; it still influences it. While the AR remains in the digital realm, it can still be perceived as meaningful by players and direct their actions (Liberati, 2018). Woods (2020) gives an example of a player named Victor, who says Pokémon has been a part of his life since childhood, and he perceives them to be more than just digital objects. Pokémon GO also enables the reimagination of familiar places, transforming them into a part of the fictional world of Pokémon (Woods, 2020). Together, these two findings suggest that imagination in Pokémon GO works via supporting a connection to the Pokémon fictional narrative and the re-imagination of the players' physical environment. In summary, despite imagination and meaningfulness having received little attention in the extant literature on engagement with Pokémon GO, conceptual work (e.g., Liberati, 2018; Woods, 2020) suggests they are connected to engagement. A strong relationship between meaningfulness and engagement has also been established in the field of occupation and workplace research (e.g., May et al., 2004; Soane et al., 2013).

2.3. Theoretical lens of the current study

To provide a theoretical foundation for our hypotheses and structural model, in this subsection, we go through the two identified aspects contributing to meaningfulness in LARGs: (1) imagination; and (2) social experience.

2.3.1. Harnessing imagination to scaffold meaningfulness

Human imagination has been shown to have at least four distinct aspects: frequency, emotional valence, complexity and directness (Zabelina & Condon, 2019). In this work, we focus in particular on the frequency of imagining the game world while playing. As discussed, most LARGs provide stories to support and engage the players' imagination. Additionally, the games support imagination by transforming real-world environments into playgrounds using AR (Jensen et al., 2019; Woods, 2020). Waern et al. (2009) stress the importance of encouraging players to pretend that the game world is real and act in the real world accordingly. This strategy harnesses the human imagination to work for the game world, fill in technology gaps, and suspend disbelief arising from unrealistic game-related content (Waern et al., 2009). Kruse (2020)

Table 1
Previous selected work on use intention and engagement with LARGs.

Authors	Theoretical approach	Data	Key findings related to engagement and intention to play the game.
Alha et al. (2019)	Exploratory analysis of reasons to start, continue and quit playing	Qualitative, cross-sectional	Previous experiences and curiosity were the main reasons to start playing, while progression was overwhelmingly the most popular reason to continue playing.
Bueno et al. (2020)	Uses & Gratifications	Quantitative, cross-sectional	Escapism, enjoyment, social interaction, social presence and achievement predict use continuance. Fantasy does not.
Butcher, Tucker, and Young (2020)	Path to discontinuance for pervasive mobile games (P2D_PMG)	Quantitative and qualitative, cross-sectional	Discontinuance is not merely the flip side of use continuance, and there are several stages in which discontinuance can occur. Furthermore, not all discontinuance is permanent.
Caci et al. (2019)	Exploratory analysis of personality and motivation	Quantitative, cross-sectional	Highly engaged Pokémon GO players are low in agreeableness, introverted and conscientious. Social and recreational needs increase engagement.
Ghazali et al. (2019)	Uses & Gratifications	Quantitative, cross-sectional	Enjoyment was the most essential factor in predicting use continuance. A unique construct missing from other studies, "need to collect," predicted continued use - suggesting players might exhibit compulsive behaviour and symptoms of addiction.
Hamari et al. (2019)	Uses & Gratifications	Quantitative, cross-sectional,	Enjoyment, challenge, outdoor activity, nostalgia and ease of use predicted intention to reuse.
Jang and Liu (2019)	Uses & Gratifications	Quantitative, cross-sectional	Catching pokémon, entertainment, game knowledge and game level predicted use continuance.
Rauschnabel et al. (2017)	Uses & Gratifications	Quantitative, cross-sectional	Enjoyment, nostalgia, physical activity, flow and image predicted a positive attitude towards Pokémon GO, which subsequently predicted use continuance.
Vaterlaus et al. (2019)	Uses & Gratifications	Qualitative, cross-sectional	The most commonly given motivations for playing Pokémon GO were exploring the neighbourhood while

Table 1 (*continued*)

Authors	Theoretical approach	Data	Key findings related to engagement and intention to play the game.
The current study	Meaningfulness, sociality and imagination	Quantitative, cross-sectional	getting exercise and accomplishing objectives. Nostalgia supports the use of imagination while playing. Imagination while playing, social self-efficacy and community identification are associated with the perceived meaningfulness of playing.

argues that imagination is an authentic experience, which games may stimulate. Through imagination, players can experience meaningful stories, events, thoughts and ideas related to their playing (Kruse, 2020). Thus, the use of imagination can provide added meaningfulness in playing. Hedonic and eudaimonic feelings are connected to an overall appraisal of the activity's meaningfulness (Løvoll, 2019). Following Kruse (2020), experiences governed by imagination are real experiences, and therefore capable of facilitating the same hedonic and eudaimonic feeling as, for example, glacier hikes (Løvoll, 2019). In LARGs, as players are actively engaging in playing with their imagination, the use of imagination may give added meaning and increase players' affection towards the in-game content.

AR's capability to transform real-world environments into playgrounds is a central component of LARGs (Jensen et al., 2019; Liberati, 2018; Woods, 2020). For example, in Walking Dead: Our World, the marketing material includes footage of zombies invading a birthday party, and the game itself has an AR -mode where zombies can be seen walking in the same environment the player is in. These aspects, (1) including augmented content to our world that build a fictional narrative; and (2) having a specific AR -mode, are common across popular LARGs such as Pokémon GO and Harry Potter: Wizards Unite. AR's core idea is to add something more to reality, and by doing so, AR technology supports the human imagination (Stapleton et al., 2002). Players may also find this aspect as one reason to play AR games, as demonstrated by research building off the "desired enhancement of reality" construct (Rauschnabel, 2018). LARGs can introduce novel and exciting content to the otherwise familiar and uninteresting environments. Players may therefore actively seek AR games to revitalise their interest in, for example, their daily commute and outdoor exercise (Rauschnabel, 2018).

2.3.2. Intersubjective beliefs and shared experience

The ability to imagine shared fictional worlds is unique to our species (Harari, 2014). We can discuss, defend and criticise a fictional universe that only exists in stories and our shared imagination. Popular franchise brands such as Pokémon, Star Wars and Harry Potter all include mostly the same physical laws as the reality we know. They have cities, cultures, schools, and many other things familiar with the human population and twists and tweaks that make the worlds unique. We can learn the rules of these fictional universes and even criticise franchise games, movies and books that do not align with these rules. Our imagination enables us to discuss fictional worlds and imagine ourselves in them (Gotz et al., 2014). With the help of technology, we can experience audiovisual content about fictional worlds, supporting our imagination.

In prior studies, the role of social experience in player engagement has been operationalised as "socializing" (Hamari et al., 2019) and "community involvement", and "network externality" (Ghazali et al.,

2019). In the more recent study social influence was found to be a strong predictor of use continuance (Ghazali et al., 2019), while data collected from 2016 showed an insignificant relationship (Hamari et al., 2019). In LARGs with static teams, players can exhibit altruistic behaviour towards their teammates (Riar et al., 2020) and harbour negative feelings towards the opposing team members (Laato, Inaba, et al., 2021). Fear of missing out (Przybylski et al., 2013) has been found to increase players' playing intensity, and subsequently, increase their intention to play socially (Laato et al., 2020). Bhattacharya et al. (2019) conducted an in-depth analysis of temporally and geographically aligned LARG playing, which demonstrated the complexity of the technology-mediated group interactions in the context of raids in Pokémon GO. Together, these studies speak of social networking's complexity in LARGs, being a mix of technology-assisted face-to-face synchronous communication and online asynchronous communication. In this complex field of research, one aspect that has yet to receive attention is the concept of intersubjective beliefs and the construction of the socially shared game world (Harari, 2014). One measure for holistically understanding social involvement in this context is community identification (Kordyaka et al., 2020; Mael & Ashforth, 1992).

The Pokémon fictional world is controlled, regulated, and monitored by the Pokémon Company, ensuring that the brand stays logical and high quality. This world can support social collaboration better than a confusing fictional world, as logic enables players to predict others' behaviours, share experiences and connect in a harmonious way (Harari, 2014). As the logic of fictional worlds is tied to social collaboration, franchises' fans produce a strong emotional response to franchise products that go against this logic. As an example, Star Wars Episode 8: The Last Jedi was popular among new fans to the franchise, breaking stereotypes and being in many ways a fresh take on the series. However, it also broke the established laws of the fictional universe, causing outrage among older fans. Based on the concept of shared subjective worlds and intersubjective beliefs (Harari, 2014), this was primarily caused by the illogicalities in the fictional worlds having negative consequences on the unity and social identity of fans.

3. Research hypotheses

3.1. The role of imagination, nostalgia and love for nature

Nostalgia in games arises from past experiences (Harborth & Pape, 2019, pp. 1–21). These may be related to earlier games, or other experiences with the franchise. Nostalgia directs the expectations players have for new and upcoming games, and influences the way they perceive them. As the Pokémon franchise has been around since 1996 and was a global craze, especially during 1999–2001 and afterwards (Elza, 2009), a significant number of players can be predicted to feel nostalgic about it. This effect is amplified by a significant number of Pokémon GO players who reported having started playing the game precisely because of past experiences with the franchise or other AR games (Alha et al., 2019). Consequently, studies have discovered an association between engagement with the game and nostalgia (Hamari et al., 2019; Rauschnabel et al., 2017).

Nostalgia also manifests as knowledge about the game and related stories. With AR applications, nostalgia has been shown to be a stronger predictor of behavioral inspiration than, for example, the wow-effect of being impressed by the technology (Hinsch et al., 2020). This finding highlights the importance of nostalgia, and subsequently the fictional game world in LARGs. In Pokémon GO, players can have prior knowledge about, for example, the pokémon creatures and the lore of the fictional world. We postulate that this translates into increased ability and willingness to imagine pokémon creatures in the real world while playing Pokémon GO, as players have existing thought patterns which may inspire their imagination. Gomez et al. (2019) showed that having played Pokémon games in childhood correlated with brain activity in a specific region when shown pokémon creatures' images. This activity

was not present with those unfamiliar with Pokémon, providing evidence for the argument that nostalgia and previous experiences with the franchise support imagination (Gomez et al., 2019). At the same time, fond memories from childhood time spent with Pokémon can help players form affection towards the pokémon creatures in Pokémon GO, or translate already formed affections into the new Pokémon game. Thus, we propose the following two hypotheses:

H1. Childhood brand nostalgia increases imagining the Pokémon world while playing.

H2. Childhood brand nostalgia increases affection towards the fictional pokémon creatures.

In 2002, Balmford et al. proposed that biophilia, the inner human desire to recognise, catalogue and spend time with other lifeforms, might explain engagement with the Pokémon franchise. In this work, we measure biophilia with love and care for nature scale (Perkins, 2010), which measures feeling closeness to nature and being content when among nature. As Pokémon GO was marketed as an AR game where people walk in nature exploring the wild to find fictional creatures, the game seems to intentionally invoke the feelings of biophilia and love for nature (Laato & Rauti, 2021). In fact, following Balmford et al. (2002), love and care for nature could direct players to imagine pokémon creatures as real living creatures while playing. Perkins (2010) proposed that humans have a varying desire to spend time in nature and care for it. People higher on the love and care for nature scale could, in addition to imagining pokémon creatures in the real world, also form an affection towards them as they imagine them as real creatures (Balmford et al., 2002). Accordingly, we propose the following two hypotheses.

H3. Love and care for nature increases imagining the Pokémon world while playing.

H4. Love and care for nature increases affection towards the fictional pokémon creatures.

People are actively engaging with their imagination while playing games (Kruse, 2020). The more frequently players engage their imagination with the fictional world, the more they think about it, and the more engaged they are (Waern et al., 2009). As proposed, in Pokémon GO this could lead to an increased affection towards the pokémon creatures. However, many other factors are also present in players' forming an affection towards games, for example, the sunk cost fallacy (Lohse, 2019), which is the human ability to perceive something as necessary simply because they have spent resources on it. Still, with imagination, players can create additional meaning to the digital creatures. Koskinen et al. (2019) showed that the memorable early moments of Pokémon GO players were often related to specific pokémon rather than rare, new or strong pokémon. Players can map the creatures to the real world, create additional stories to connect memories to specific creatures and distinguish individual pokémon from others (Koskinen et al., 2019). Pokémon GO supports the individualisation of pokémon in four ways: (1) each pokémon can be given a unique nickname; (2) each pokémon has three random individual values between 0 and 16 and a level (1–50); (3) pokémon species can be shiny or regular; and (4) some pokémon can have permanent clothing or decorations on them. Together these three factors make pokémon feel unique and allow players' imagination to further associate specific creatures with stories and experiences during play. Thus, we propose our fifth hypothesis.

H5. Imagining the Pokémon world while playing increases affection towards the pokémon creatures.

3.2. Predicting the meaningfulness of playing

Players' social perceptions and connections influence meaningfulness; it is linked to social norms, social responsibility, and the surrounding community's behaviour (Aguinis & Glavas, 2019; Chaudhary,

2019). The social aspect of meaningfulness can be approached, for example, by looking at the salaries of top athletes. The world's top football players earn millions per season because many people enjoy watching football and respect highly skilled players. By contrast, professional curling players are paid significantly less, with a rough correlation to the number of people valuing and enjoying curling as a sport. The value people give to a skill or achievement is not only monetary, and relates to social capital as well (Bourdieu, 1986). It follows that people gravitate towards activities and skills that give them social capital and other gratifications. Whether an activity feels meaningful is linked to the surrounding community and intersubjective beliefs regarding what is valuable (Aguinis & Glavas, 2019).

Previous work on Pokémon GO has discovered social interaction to lead to use continuance (Bueno et al., 2020) and sociality to increase engagement (Caci et al., 2019). However, the "socializing" construct showed a non-significant association with intention to reuse in one study (Hamari et al., 2019). For these reasons, a more detailed look into social factors is warranted. A player playing socially and being involved with the playing community can receive praise and support for playing. In contrast, a player disconnected from this community does not enjoy these social benefits (Rauti et al., 2020). Similarly, players who have high social self-efficacy and the ability to form social connections are increasingly likely to form social bonds and get praise and support for playing, leading to the increased attachment to video games and even addiction (Jeong & Kim, 2011). By contrast, if players high on social self-efficacy do not find the company from other players, the self-efficacy trait may direct them to other activities. Subsequently, they may perceive playing to be less meaningful.

While some work has differentiated between social self-efficacy in real and virtual space (Jeong & Kim, 2011), in LARGs, these abilities are intertwined while playing. Therefore, social self-efficacy and being involved with the player community in Pokémon GO can enjoy both online and offline social benefits. Simultaneously, being involved with a playing community can increase meaningfulness through shared playing experience (Daneels et al., 2020). This allows players to discuss the game with each other and have a shared activity. Furthermore, community identification enables players to form the desired self-representation of themselves, which also increases purchasing behaviour (Kordyaka & Hribersek, 2019). Because of these predicted impacts, we propose the following.

H6. Social self-efficacy increases the meaningfulness of playing.

H7. Community identification increases the meaningfulness of playing.

An emotional bond with specific pokémon and an overall affection towards pokémon creatures gives players positive emotion when engaging with Pokémon games. Players can recall events and occurrences associated with specific pokémon (Koskinen et al., 2019) and even desire to associate themselves with pokémon as they would with real-world wildlife (Balmford et al., 2002). Affectionate feelings help boost the meaningfulness of an activity (Løvoll, 2019). In Pokémon GO, this means that caring for the fictional creatures in the game makes playing feel more meaningful. It also offers gameplay mechanics that enable players to take screenshots of pokémon in various places, allowing players to showcase their favourites to others on social media (Alavesa & Xu, 2020). Having the ability to share affection socially can also boost its meaningfulness. For these reasons, we propose the following.

H8. Affection towards the fictional pokémon creatures increases the meaningfulness of playing.

The final proposed research model displaying all the constructs, hypotheses and control variables is displayed in Fig. 1.

4. Materials and methods

4.1. Construct development

Most of the constructs and their measurement items for this study were derived from prior literature and slightly adapted to Pokémon GO's context (see Appendix 1). We chose these measurement items, as multiple prior studies found these scales reliable. However, we could not find adequate survey items or scales for some critical phenomena, so we engaged in developing them ourselves. In doing so, we followed the construct development guidelines of Moore and Benbasat (1991). For this study two constructs were developed: (1) Imagining the fictional world (pokémon world) while playing; and (2) affection towards the fictional world (pokémon creatures).

We initially formulated five survey items per construct based on our extensive experience of playing Pokémon GO and previous Pokémon games and discussion with fellow players. Our other survey items influenced these items' wordings not to make any items stand out because of the language. After the items were drafted, we asked an
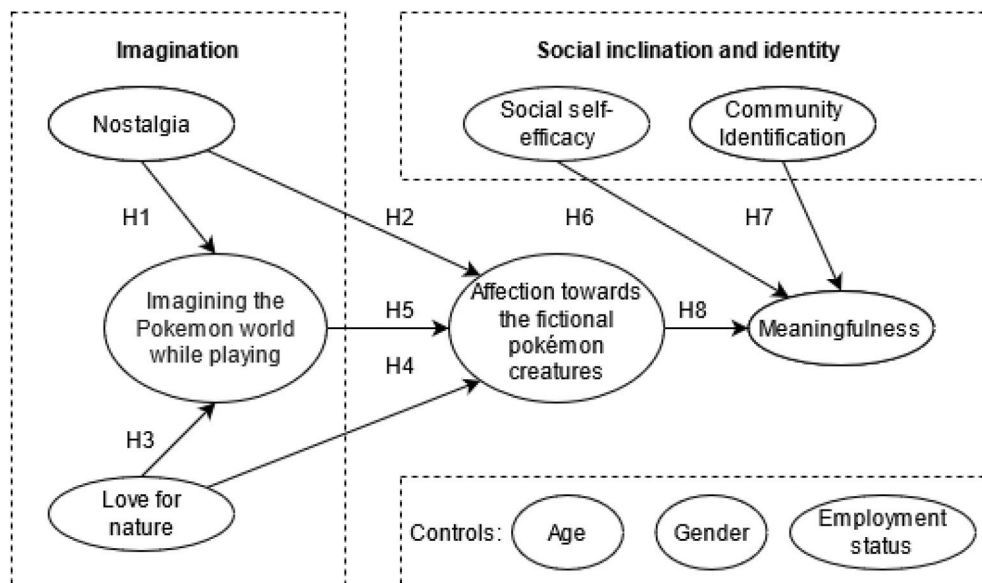

Fig. 1. Proposed research model.

experienced information systems researcher and two LARG researchers to comment on the items. Based on this feedback, significant changes were made to the items, particularly addressing items that were not accurately measuring the same thing. We removed items that were not describing the construct, reworded some items making them more accurate and included new items to replace the removed ones. Following the construct development guidelines (Moore & Benbasat, 1991) next, we proceeded to perform a card-sorting exercise among Pokémon GO players. We included the ten developed items and five extra items concerning territoriality and gave them to players in two small chat groups, asking them to sort the items into clusters based on what they were measuring. Four players responded, and at this stage, the only items that were always placed together were the extra five items. Because of the variance in how players viewed the items, we decided to rework these items to be more narrow and precise.

After consulting a senior information systems scholar again and discussing the card-sorting exercise with participants about the items, another card-sorting exercise was performed with Pokémon GO players who did not participate in the first round. This time, the five extra items were removed. Thus, ten new revised items were included. Three Pokémon GO players participated in sorting the items, and this time, two groups emerged among two of the participants (full agreement) while the third formed three categories. The items were again reworked together with the experienced scholar and renamed a little until the constructs' final five survey items were agreed upon. The rest of the constructs we adopted from previous literature: love and care for nature (Perkins, 2010), childhood brand nostalgia (Harborth & Pape, 2019, pp. 1–21), meaningfulness (Spreitzer, 1995), social self-efficacy (Jeong & Kim, 2011), community identification (Mael & Ashforth, 1992).

4.2. Data collection

The survey containing the items of the constructs was implemented using a professional online questionnaire service, Webropol. Additionally to the survey items (available inAppendix A) for our constructs, we included a small introduction to the beginning of the survey, explaining to respondents why the study was carried out and what we would do with their data. Before distributing the survey further, we sent it to a small (n = 15) Pokémon GO group. We asked participants to comment on the understandability of the survey and point out any mistakes they could find. The group's minor adjustment recommendations were taken into account, and afterwards we proceeded to the main data collection.

To get reliable global data from Pokémon GO players, the popular/r/ pokemongo subreddit was chosen as a suitable venue. We contacted the moderators and kindly requested them to pin our survey to their front-page for increased visibility. We explained the study's purpose and offered to answer any question they might have regarding the survey. The moderators complied with our requests and assisted us by pinning the survey to the/r/pokemongo subreddit on June 24th, 2020. The survey remained pinned until June 29th, 2020. During this data collection period, we replied to whatever questions Redditors had on the survey to the best of our ability. We also upvoted all comments to encourage commenting. Our post concerning the survey was upvoted by 96% of Reddit users who gave either an upvote or a downvote, indicating wide community acceptance. Responses with incomplete data were removed, and finally, we were left with 515 responses. The demographic data of participants are shown in Table 2.

4.3. Validity and reliability

Once the data was collected, we proceeded to test the convergent and discriminant validity. First, we calculated the average variance extracted (AVE) and composite reliability of the constructs for measuring convergent validity. Following the widely accepted criteria of Fornell and Larcker (1981), AVEs have to be above 0.5 and CRs above 0.7. These analysis results are shown in Appendix 1, together with the construct

Table 2
Demographic data of participants.

Gender		Employment status	
Male	66%	Employed	52%
Female	31%	Student	32%
Non-binary	2%	Unemployed	12%
Prefer not to tell	1%	Stay-at-home parent	1%
		Other	1%
Age		**Country of residence**	
18–25	48%	USA	43%
26–34	36%	UK	12%
35–44	10%	Finland	10%
45–64	5%	Canada	6%
Over 65	15	Germany	3%
		Other	26%

items and their loadings. All our constructs fulfilled the criteria of convergent validity. We then measured the discriminant validity of the data by calculating the square root of the AVEs of our constructs. Following Fornell and Larcker (1981), we checked that the square root values of the constructs' AVEs are greater than any correlations between constructs. Table 3 displays the results of this analysis. Based on these analyses, we confirm that our data fills the criteria for convergent and discriminant validity.

In order to see how well the proposed structural model fits the data, we calculated the goodness-of-fit (GoF) and standardized root mean square residual (SRMR) statistics (Henseler et al., 2013). With regards to GoF, we followed the formula and thresholds provided by Wetzels et al. (2009). Here, a GoF value above 0.36 can be considered a good fit. With our data, GoF was 0.44, indicating a great fit. According toHu and Bentler (1999), SRMR should be below 0.08 for the model to be a good fit for the data. The SRMR value in this case was 0.07. Subsequently, following the validity, reliability and model fit tests, we proceeded to calculate the structural model results.
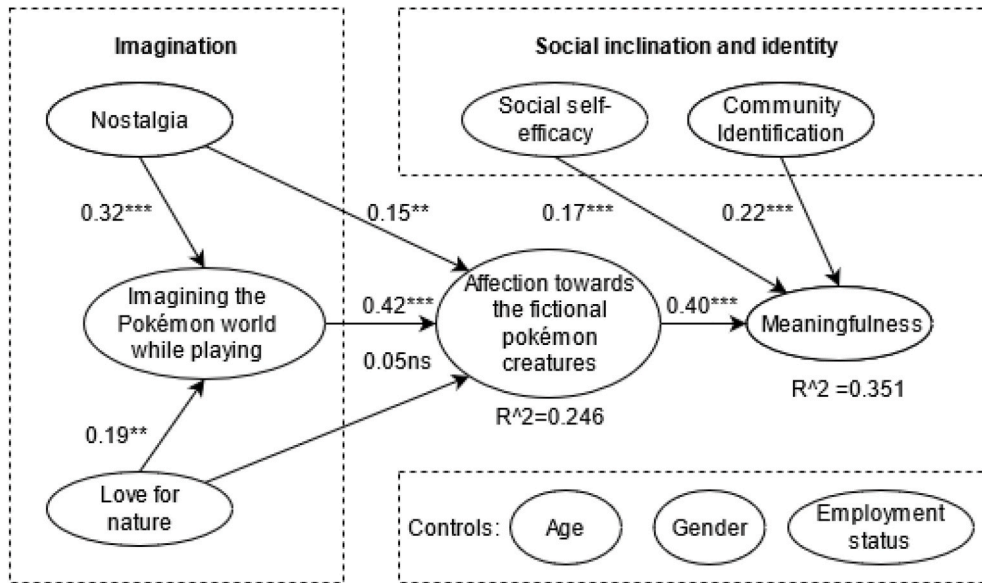
5. Results

The structural model results are displayed in Fig. 2. Childhood brand nostalgia (Harborth & Pape, 2019, pp. 1–21), operationalised as having played Pokémon games, played with Pokémon figures or watched Pokémon movies as a child, had significant relationships on both imagination while playing (beta = 0.32; p < 0.001) and affection towards the fictional pokémon creatures creatures (beta = 0.15; p < 0.001), thus supporting H1 and H2. Love and care for nature (Perkins, 2010) had a significant relationship on imagining the Pokémon world while playing (beta = 0.19; p < 0.001) but no direct relationship with affection towards the pokémon creatures (beta = 0.05; p > 0.05). The support for H3 but lack of support for H4 suggests that enjoying nature and caring for it enables players to better imagine pokémon in the real world environment, but does not directly lead to the formation of affection towards these virtual creatures. This seems to contradict Balmford et al. (2002), who postulated that the Pokémon franchise invokes biophilia and the love for nature in humans by presenting them with creatures to identify, collect and catalogue. Instead, our findings suggest that a love for nature enables players to imagine the location-based fictional world of Pokémon better and develop affection towards pokémon only through imagination.

While playing, imagining the Pokémon world had a strong significant impact on forming an affection with the pokémon creatures (Beta = 0.42; p < 0.001), supporting H5. This aligns with Waern et al. (2009). They postulated that in the context of LARGs, one of the essential elements for creating engaging location-based AR gameplay is harnessing the players' imagination by motivating players to pretend as if the game they were playing was real.

With regards to the social aspects of location-based gaming, social self-efficacy (beta = 0.17; p > 0.001) and identification with the players'

Table 3

Latent variable correlations (Square roots of AVEs).

	Affection towards the fictional pokémon creatures	Childhood brand nostalgia	Imagining the Pokemon world while playing	Love and care for nature	Meaningfulness	Social self-efficacy	Team identification
Affection towards the fictional pokémon creatures	0.824						
Childhood brand nostalgia	0.283	0.942					
Imagining the Pokemon world while playing	0.475	0.325	0.808				
Love and care for nature	0.130	0.008	0.193	0.847			
Meaningfulness	0.493	0.138	0.374	0.073	0.843		
Social self-efficacy	0.179	0.090	0.187	0.086	0.337	0.817	
CommunityIdentification	0.325	0.211	0.283	0.108	0.410	0.430	0.778

Fig. 2. Results of the structural model. (***p < 0.001; **p < 0.01; *p < 0.05, ns = non-significant).

team/community (beta = 0.22; p > 0.001) had substantial effects on the meaningfulness of playing. Thus, H6 and H7 were supported. Based on our theoretical reasoning, these findings can be partially attributed to the social sharing of the fictional stories and ideas relating to the Pokémon world. In the same way, as money gets its value from people believing in it (Harari, 2014), Pokémon GO gains additional meaning in the eyes of players due to other real players playing it. This finding is in line with Daneels et al. (2020).

Finally, affection towards the pokémon creatures had a strong significant effect on the meaningfulness of playing (beta = 0.40; p < 0.001). Therefore, H8 was supported. This finding shows that being emotionally invested in caring about one aspect of the game (the pokémon creatures) translates to an overall increase in playing's meaningfulness. Out of the control variables, only age had an impact in that an older age was positively associated with the meaningfulness of playing (beta = 0.12; p < 0.05). The rest of the control variables' effects were insignificant.

6. Discussion

6.1. Theoretical implications

Our findings provide empirical support for the previous work on LARGs which suggest that imagination is a key factor in making playing feel more meaningful (Waern et al. (2009). We demonstrated that projecting oneself to the game world (through imagination) was significantly associated with affection towards in-game creatures, which

subsequently led to increased meaningfulness of playing. Among the predictors of meaningfulness, affection towards the fictional pokémon creatures was the strongest. This may be explained by Pokémon GO being fully focused on the pokémon creatures, with all activities being somehow tied to collecting or training them, or battling with them. The social component of the game is voluntary for players, and that too mostly serves to help players collect more powerful pokémon and win more difficult gym and raid battles (Bhattacharya et al., 2019).

Van Tilburg et al. (2013) suggested that nostalgia can act as an antidote to boredom by creating meaningfulness. Similar findings have also been reported in the context of Pokémon GO (Wulf & Baldwin, 2020). Relatedly, Jang and Liu (2019) found that knowledge of the Pokémon world is the most significant predictor of continued use. Our model contributes to these works by showing that nostalgia leads to increased ability and willingness to imagine the AR world while playing. Hence, imagination in playing is a crucial component that connects players' knowledge about the game world and prior experiences (nostalgia) to the meaningfulness of playing (Jang & Liu, 2019; Van Tilburg et al., 2013; Wulf & Baldwin, 2020).

Previous work on engagement with LARGs have used the uses & gratifications theoretical approach (Bueno et al., 2020; Ghazali et al., 2019; Hamari et al., 2019; Rauschnabel et al., 2017) and qualitative exploratory analysis (Alha et al., 2019). While these approaches have accounted for the role of nostalgia (e.g. Hamari et al., 2019), they directly measure its relationship to use continuance intention. We propose and show that nostalgia, at least in the Pokémon franchise context, has effects on meaningfulness through imagination and increased

affection towards the game content. Previous work (e.g. May et al., 2004; Soane et al., 2013) have demonstrated that meaningfulness and engagement are strongly correlated. Accordingly, our work may be compared to the literature on engagement with LARGs. This comparison is shown in Table 1, where the findings of the current study are depicted as the last row. Furthermore, we extend the previous work on engagement with LARGs by suggesting meaningfulness as an essential variable for predicting engagement in AR games.

6.2. Practical implications

The finding that meaningfulness of playing can be scaffolded via social factors and imagination has practical implications for stakeholders who wish to increase player engagement with their products. Players themselves may wish to voluntarily increase their engagement with LARGs, as previous research has identified several benefits of playing these games including mild exercise (Hino et al., 2019), social interaction (Bhattacharya et al., 2019; Laato et al., 2020; Vella et al., 2019), learning about local geography (Laato, Rauti, et al., 2021) and supporting cartographic knowledge and navigation skills (Colley et al., 2017). Studies have further suggested that LARGs could help with social withdrawal and increase wellbeing (Ewell et al., 2020). Therefore, voluntarily increasing engagement with LARGs might be recommendable, and for this, our model provides two recommendations. First, players can actively seek social relationships among fellow players and engage with the community. Second, players can engage in the game more with their imagination.

One implication of the finding that social self-efficacy increased meaningfulness of playing is that introverted people and others uninterested in the social aspect of LARGs might perceive the games to be less meaningful. However, because LARGs mix online and offline social self-efficacy (Jeong & Kim, 2011), players may decide to be active either in live situations or online. Viewing our findings together with previous work on sociality in LARGs, which universally report the games to increase social connectedness (e.g. Bhattacharya et al., 2019; Laato, Inaba, et al., 2021; Riar et al., 2020; Vella et al., 2019); we suggest that the shared subjective belief and understanding of the Pokémon world is an essential component that brings players together and makes playing feel more meaningful. This, together with our findings, highlight the importance of sharing game experiences with others, and implies that this can be supported with a coherent and logical fictional narrative. As is the case with the Pokémon, this narrative can be part of a larger cross-media experience where various franchise products from movies to merchandise extend and build the fictional world.

6.3. Design implications

Our findings support game design and contribute to the debate about what we are missing in our current society compared to the hunter-gatherer societies and how game design could address this. This was evidenced by our findings on the love and care for nature scale and the affection towards the pokémon creatures. Previous work has also suggested that the Pokémon franchise utilises the hunting and gathering aspects of the hunter-gatherer society (Laato & Rauti, 2021). Another thing oftentimes missing from urban life is natural physical activity and travelling to new places, which Pokémon GO also addresses (Colley et al., 2017). While this was not in particular focus in our empirical work, the summary of previous literature on engagement with the game (Table 1) suggests that these factors are deemed valuable by the players (Hamari et al., 2019; Rauschnabel et al., 2017; Vaterlaus et al., 2019).

For game designers, to engage players, LARG should focus on scaffolding an emotional bond between the game and the players. To do so, designers can make use of, for example, evolutionary psychology by harnessing players' love and care for nature (Perkins et al., 2010; Balmford et al., 2002) and imagination (Kruse, 2020) to fill in gaps in the game world. This can make the game feel real despite limitations in

technology. As a consequence and as AR technology develops, it may start to replace physical objects (Rauschnabel, 2021). Designers can make use of new technology, but ensure it does not get in the way of a logical narrative, players' imagination and their social relationships. Thus, at least in the current stage, AR should be used to support, not replace human imagination.

6.4. Limitations

Our empirical study has the following limitations. To study our research topic, we had to narrow the study to a single LARG, which we decided to be Pokémon GO. This brings into question whether the findings can be generalised to cover other similar games. While earlier work has suggested this can be done to some extent (e.g. Hamari et al., 2019), there are specificities to Pokémon GO that need to be disclosed. First, the Pokémon brand and narrative fits particularly well with adventure and exercise. Second, as a long-standing popular franchise, Pokémon is unique in invoking nostalgic feelings in players (Harborth & Pape, 2019, pp. 1–21). Third and finally, the Pokémon world uniquely leverages primal human instincts (Laato & Rauti, 2021), such as biophilia (Balmford et al., 2002). To address the limitation of generalisation, we encourage future work on the topic of imagination and perceived significance in LARGs to study a wider variety of games.

Another limitation is that the cross-sectional data to test the research model was collected from self-selected participants through the/r/ pokemongo subreddit. This might have introduced some bias to our findings despite tests on the validity and reliability of the data and the use of standard control variables (age, gender, education level). To address this limitation, longitudinal field data could be collected. Our structural model was heavily contextualised to Pokémon GO in order to account for nostalgia and imagination. While similar phenomena are sure to be present in other LARGs, the structural model itself should not be generalised into other contexts without review. Still, our findings pinpoint essential aspects that have been widely dismissed in the extant literature on engagement with LARGs.

6.5. Future work

The measure of meaning used as a dependent variable in our model is particularly interesting in studying engagement and gratification with video games. In addition to utilitarian and functional value, it encompasses eudaimonic gratification (Weise, 2004). Meaningfulness can be regarded as a particularly tricky question for unemployed or otherwise marginalised groups. In our sample, 12% of participants were unemployed. While employment did not significantly correlate with meaningfulness, future work may explore how LARGs could create meaning to those players who have none. While we measured meaning as a whole, aspects of it could be studied separately. For example, the concept of eudaimonic gratification can be used to study how games create meaning that extends beyond temporary value.

Another dimension for future work arising from our findings is the role of imagination in engagement (related to meaningfulness) with LARGs. In their exploratory factor analysis of imagination items, Zabelina and Condon (2019) arrived at four distinct clusters: (1) frequency; (2) emotional valence; (3) complexity; and (4) directness. Based on their findings, they argue that imagination should not be measured as a single construct. Instead, specific aspects of imagination should be measured (Zabelina & Condon, 2019). As our scale for imagination captures the first dimension, frequency, in the context of playing the AR game Pokémon GO, future work could explore the remaining three dimensions' roles. Future work studying the role of imagination could also draw from a more comprehensive AR-games sample to provide more generalisable findings. As LARGs remain popular, new implementations are constantly released and new technological innovations are developed, scholars need to see how findings from previous research translate into the new contexts.

7. Conclusion

In this work, we investigated social factors' and imagination's role in scaffolding the meaningfulness of playing AR -games. Our work suggests that the human ability to imagine is boosted by nostalgic experiences and a predisposition (such as the love and care for nature trait in our case) towards the AR content. We further show that nostalgia and imagination while playing increased affection towards the in-game fictional content. This affection and the measured social factors all significantly predicted the meaningfulness of playing. However, as our model explains, 35,1% of the meaningfulness construct variance, further work on perceived meaningfulness in AR games is warranted. In the near future, as new technological developments occur, we may see an increasing amount of physical objects replaced with AR technology and completely new AR experiences and games. Amidst these developments, we posit that AR technology should aim to support human imagination and build experiences that can be socially shared and understood.

Appendix 1. constructs, corresponding items, CRs, AVEs and loadings/weights

Construct	Corresponding items	Loadings
Love and care for nature scale (Perkins, 2010)	LCN1: I feel joy, just being in nature.	removed
CR: 0.884	LCN2: I feel that closeness to nature is important for my well-being.	0.704
AVE: 0.718	LCN3: I feel content and somehow at home when I am in unspoilt nature.	0.919
	LCN4: When in natural settings, I feel emotionally close to nature.	0.884
	LCN5: I feel spiritually bound to the rest of nature.	removed
Affection towards fictional pokémon creatures (self-developed)	PHB1: The pokémon I've trained and battled with have no special meaning to me. (reversed)	0.811
	PHB2: I have formed a bond with the pokémon I've trained.	0.889
CR: 0.894	PHB3: There are some pokémon I would rather not trade away because I have an emotional attachment to them.	0.788
AVE: 0.680	PHB4: I feel that the pokémon I've trained and used are unique individuals.	0.805
	PHB5: I have memories related to specific pokémon I've collected.	removed
Childhood brand nostalgia (Harborth & Pape, 2019, pp. 1–21)	CBN1: I have fond memories of Pokémon from my childhood.	0.940
	CBN2: Pokémon features in happy memories of when I was younger.	0.949
CR: 0.969	CBN3: I still feel positive about Pokémon today because it reminds me of my childhood.	0.939
AVE: 0.888	CBN4: Pokémon is one of my favourite brands from my childhood.	0.940
Imagining the game world while playing (self-developed)	IMG1: I often visualise pokémon living in the real world environment I am playing in.	0.837
CR: 0.904	IMG2: Imagination is a big part of my Pokémon GO playing experience.	0.821
AVE: 0.653	IMG3: I view myself as a pokémon trainer when I'm playing.	0.818
	IMG4: I sometimes imagine my buddy pokémon walking beside me.	0.812
	IMG5: I don't think about nor immerse myself in the pokémon world when I'm playing. (reversed)	0.750
Community identification (Mael & Ashforth, 1992)	CI1: When someone praises my Pokémon GO team, it feels like a personal compliment	0.786
CR: 0.821	CI2: I feel I am a typical member of my Pokémon GO team.	0.718
AVE: 0.605	CI3: My Pokémon GO team's successes are my successes.	0.825
Social Self-efficacy (Jeong & Kim, 2011)	SSE1: I can easily become friends with other Pokémon GO players.	0.828
CR: 0.857	SSE2: I often participate in community activities such as legendary raids.	0.757
AVE: 0.667	SSE3: I love to meet unfamiliar people while playing Pokémon GO.	0.811
	SSE4: It is not important for me to meet other people while playing Pokémon GO. (reversed)	removed
Meaningfulness (Spreitzer, 1995)	P_SIG1: Playing Pokémon GO is meaningful to me.	0.867
CR: 0.881	P_SIG2: My playing and how I play Pokémon GO is personally meaningful to me.	0.863
AVE: 0.711	P_SIG3: I am doing something meaningful when I play Pokémon GO.	0.797
	P_SIG4: I feel levelling up and collecting things in Pokémon GO is worth my time.	removed

Credit author statement

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