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Territorial or nomadic? Geo-social determinants of location-based IT use: a study in Pokémon GO

Samuli Laato
Gamification Group, Tampere University, Tampere, Finland and Department of Computing, University of Turku, Turku, Finland
Bastian Kordyaka
University of Siegen, Siegen, Germany
A.K.M. Najmul Islam
LUT University, Lappeenranta, Finland
Konstantinos Papangelis
Niantic x RIT Geo Games and Media Lab, Rochester Institute of Technology, Rochester, New York, USA, and
Juho Hamari
Gamification Group, Tampere University, Tampere, Finland

Abstract

Purpose – Location-based games (LBGs) have afforded novel information technology (IT) developments in how people interact with the physical world. Namely, LBGs have spurred a wave of territoriality (i.e. controlling) and exploration (i.e. discovering) of augmented physical space that are driven by different social dynamics related to group formation, social connectivity and altruism. The aim of this study is to investigate this dynamic and how it is further related to the use intensity of location-based IT.

Design/methodology/approach – This work presents a structural equation model that connects social dimensions of play to territorial control and exploration, and playing intensity. The model was tested with psychometric data gathered from a global sample of Pokémon GO players ($N = 515$).

Findings – In the tested sample, players' social self-efficacy and altruism were positively associated with team identification. Team identification, in turn, was positively associated with both territorial control and exploration tendency. Territorial control had a significant relationship with playing intensity; however, exploration tendency did not. This implies territorial control is the stronger predictor of playing intensity.

Practical implications – The findings suggest that human primal urges to conquer and control geographical territory may surface in the digital reimagination of physical space. LBGs offer opportunities for making use of new forms of play (territorial control and exploration) in motivating locative behaviours.

Originality/value – This research quantifies the relationships between a social predisposition, team identification, territorial control, exploration tendency and playing intensity in the context of Pokémon GO.

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It contributes new knowledge to the understanding of territorial behaviour (control and exploration) in location-based IT.

Keywords Augmented reality, Location-based games, Locative media, Location-based IT, Territory, Territoriality, Exploration

Paper type Research paper

1. Introduction

Location-based information technologies (IT) capture the users' physical location and create a representation of it in the digital realm (Liberati, 2018). The development and use of these types of technologies have proliferated as a consequence of technological developments in (1) smartphone technology; (2) satellite navigation and (3) availability of the Internet. Already various applications exist in this field, which Huang *et al.* (2018) divide into the following: navigational systems for cars and pedestrians, mobile (tourist) guides, location-based social networking applications, assistive systems for the elderly and people with disabilities, (public) transportation applications, fitness and health monitoring applications, locative adverts, educational applications and location-based games (LBGs). LBGs are unique among video games in that moving in them is tied to movement in the physical world. Players navigate to specific real world locations to access content in the game, connecting LBGs to geographical locations (Colley *et al.*, 2017; de Souza e Silva *et al.*, 2021; Schaal, 2020; Tregel *et al.*, 2021, 2022). LBGs such as Pokémon GO also have multiplayer game mechanics, which influence player behaviour (Riar *et al.*, 2020; Laato *et al.*, 2021a). According to Cho *et al.* (2011), social networks shape, transform and direct human geographical movement, and thus, location-related movement in LBGs and location-based IT should be understood in the social context (Fonseca *et al.*, 2022; Saker and Evans, 2020).

In addition to social drivers (Cho *et al.*, 2011), geographical movement can be conceptualised to be motivated by a wide range of factors, among them exploration for new areas and territorial control (Malmberg, 1980). Exploration is about seeking improvement to one's circumstances, and is connected to discovery, curiosity, innovation and novelty. By contrast, territorial control is about trying to maintain what is already achieved, and is connected to protectionism, preservation and conservatism. In human evolutionary history, if a tribe started depleting the resources of an area, there was a survival benefit from having the urge to explore new areas (Grove, 2009). Similarly, if a tribe found an area bountiful with food, it was beneficial for them to preserve and protect that area from competitors (Varga *et al.*, 2020). Against this backdrop, understanding the sociality-driven territorial behaviour of players in LBGs may provide new evidence on human territoriality, and help understand users' engagement with location-based IT.

Previous research on territoriality in LBGs have highlighted that as the games are played by walking in the physical world, players' behaviours are mediated and controlled by real world practicalities (e.g. the players' living area, job situation and whether they own a car or not) and social networks (Papangelis *et al.*, 2017a, b). Hence territorial playing is connected to aspects such as players' social contacts, player assemblages, their geographical location and capability to interact with the digital environment (Laato *et al.*, 2021c; Papangelis *et al.*, 2017b; Woods, 2021). It is noteworthy that past work has primarily utilised qualitative data to understand these phenomena (e.g. Papangelis *et al.*, 2017b; Woods, 2021), and there is a lack of quantitative evidence on the relationships between social and territorial dynamics and playing intensity. Quantifying these relationships is important to estimate how relevant territoriality is for location-based IT in general. As an increasing amount of time in society is spent interacting with augmented and digital environments, it is crucial to understand human behavioural tendencies in the physical-digital hybrid space. Therefore, in this study, we investigate the drivers of social LBG play, engagement with territorial control and

exploration game mechanics, and playing intensity with quantitative data. Consequently, we formulate the following research questions (RQs) to guide this study:

RQ1. How do social factors relate to territoriality in LBGs?

RQ2. Do territorial control and exploration correlate with playing intensity among LBG players?

The rest of this study is structured as follows. First, we review the extant literature on location-based IT, locative media and LBGs with regards to territoriality and mobility. Subsequently, we present theoretical approaches for understanding territoriality, followed by the formulation of seven hypotheses, which we test with quantitative data ($n = 515$) collected from Pokémon GO players through a global online channel. Then we present our results followed by discussion on the implications of our findings, limitations and future work.

2. Background

2.1 Territoriality in location-based games

The current research tradition in location-based IT applications can be divided into research concerning LBGs (e.g. Ayers *et al.*, 2016; Colley *et al.*, 2017; Hamari *et al.*, 2018; Koivisto *et al.*, 2019; Laato *et al.*, 2022; Papangelis *et al.*, 2017b; Riar *et al.*, 2020), social media applications that make use of location data such as Foursquare (Saker and Evans, 2016, 2020) and other geography-based media applications and technologies such as satellite-navigation, geo-art and geo-surveillance (Thielmann, 2010). LBGs have recently gained a lot of traction in popular use as well as in the scientific community for their popularity (Hamari *et al.*, 2018) and how they are able to redefine the relationships that people have with geographical space (de Souza e Silva *et al.*, 2021; Papangelis *et al.*, 2020; Saker and Evans, 2020).

LBGs employ the physical world as part of the playing experience. Thus, aspects such as (1) the playing location, (2) weather, (3) time of day, (4) time of year and the rest of the full complexity of the real world all influence the LBG playing experience. Some LBGs also use this data as part of the game. For example, the popular LBG, Pokémon GO, alters game content based on all four aspects, increasing the convergence between the game and the physical world (Laato *et al.*, 2021b). By contrast, other LBGs may only loosely tie game mechanics to the physical world. Examples of these types of games include the Witcher: Monster Slayer, Zombies, Run! (Southerton, 2014) and the recently launched Pikmin Bloom (Laato *et al.*, 2022), which rewards players primarily from moving – no matter where. Hence, among contemporary LBGs, there is variance in how they direct players to think about space and the playing locations.

With the placement of digital points of interest (PoIs), LBG designers can influence where players move and play (Colley *et al.*, 2017; Juhász and Hochmair, 2017; Schaal, 2020; Tregel *et al.*, 2021). With random or insufficiently controlled PoI placement, the games may nudge players to trespass on private property (Papangelis *et al.*, 2017b) or behave recklessly amidst traffic (Ayers *et al.*, 2016). Contemporary LBGs have adopted various strategies to resolve the issues of motivating unwanted movement. For example, games based on Google Maps only place PoIs next to public roads, games based on the Niantic Lightship platform have crowd sourced the PoI development to ensure each static PoI matches an accessible real world location [1] and games such as Orna have implemented a large interaction radius that enables players to access in-game content from far away. However, despite the LBGs' ability to influence movement, recent studies have shown that players also consider the real world environment when choosing where to play, avoiding, for example, places with reported high rates of theft (de Souza e Silva *et al.*, 2021).

Depending on the game mechanics, in-game PoIs can be utilised in various ways. They can act as places for social meet-ups (Bhattacharya *et al.*, 2019), be places that players can capture and control (Papangelis *et al.*, 2017b) or act as waypoints for players to navigate to. In Table 1 we have gathered game mechanics related to territory from three popular contemporary LBGs: Pokémon GO, Orna and Ingress Prime [2]. These give some insight into the types of behaviours that players may be motivated towards by LBGs and location-based IT in general. In all the three games depicted in Table 1, players accumulate resources by discovering PoIs and navigating to them and are also shown statistics of how many PoIs they have visited. In these games players explore to find areas and capture them, after which they can either seek to control their existing areas or explore for new ones.

Property and land are expensive in the physical world. However, in the digital realm, the same territory can be contested, captured and owned in a playful setting. In the LBGs depicted in Table 1, players balance between nomadic playing (exploring for new PoIs) and territorial control (holding on to PoIs they have already captured). These two behaviours are interlinked with the player's life outside the game. For example, a permanent residency and workplace significantly influence the player's movement also in-game (Laato *et al.*, 2021b). As playing mostly occurs as part of the players' regular lives (Dunham, 2021; Laato *et al.*, 2021b), a purely nomadic approach to playing is only possible if the player practises that lifestyle also in the real world, or refrains from playing unless in extraordinary situations such as vocational travelling or holidays.

Most contemporary LBGs have chosen to implement a limited number of controllable PoIs. The scarcity of controllable objects directs people to specific locations and can make the PoIs that exist feel more meaningful (Bhattacharya *et al.*, 2019; Papangelis *et al.*, 2020). This also means that not all players may be able to participate in control-related gameplay if the areas they are playing at are already saturated with top level players, drawing parallels to real world territorial conflict (Varga *et al.*, 2020). LBG developers have attempted to resolve the issue of players being left outside territorial conflict with various approaches. In Pokémon GO players are currently only able to control 20 PoIs simultaneously, and in both Orna and Pokémon GO the longer the player holds a PoI, the easier it becomes for others to take that PoI from them. In Draconius GO, players were divided into "weight classes" based on their level, with high level players fighting over territory with each other leaving room for lower level players to partake in PoI control gameplay.

Based on this review as well as past work on player orientations in LBGs (Koivisto *et al.*, 2019), there are likely individual differences in the playstyles with regards to the tendency to

Game name	Game mechanic	Goals and rewards
Pokémon GO	Capture and hold gyms (virtual PoIs that correspond to objects or buildings in the physical world)	Gain points for gym badges. Get in-game currency (50 coins per day). Accumulate statistics and numbers in medals. Assert territorial dominance
	Deploy lures on PokéStops (virtual PoIs that correspond to objects or buildings in the physical world)	Benefits the player and other nearby players by letting them capture pokémon creatures. Accumulates a number in a badge
Orna	Controllable areas (virtual areas of roughly 100 m in diameter that are overlaid on top of the physical world)	Get daily in-game rewards. Assert territorial dominance
Ingress Prime	Portals (virtual PoIs that correspond to objects or buildings in the physical world)	Enable linking portals. Get (action) points. Assert territorial dominance

Table 1. Exemplar territorial multiplayer game mechanics in three contemporary LBGs: Pokémon GO, Orna and Ingress Prime. In addition to these games, there exist some other LBGs with territorial mechanics such as Draconius GO or Turf Wars

explore new areas (i.e. nomadic playstyle) and controlling areas (i.e. controlling playstyle). Understanding the antecedents and consequences of control and exploration are important, as it can help designers develop more engaging LBGs and locative media applications.

2.2 Approaches for understanding social territorial play

2.2.1 The social identity approach. To understand players' social behaviour and team identification in LBGs we draw from the social identity approach (SIA) (Haslam *et al.*, 1999; Tajfel and Turner, 1986). SIA is formed around the concept of identity, which is the collection of beliefs related to the defining characteristics of an individual (Aronson *et al.*, 2010). Individuals' identity, i.e. their self-identity is constructed of personal and social aspects in a given situation (Aronson *et al.*, 2010), where a person can view themselves as an individual or as part of an innumerable amount of possible groups. Since identity is dependent on the context, the salient part of the self varies across situations. SIA makes the assumption that individuals always strive for a positive self through comparisons between in- and out-group members, trying to increase self-esteem (Aronson *et al.*, 2010). Individuals attach themselves to specific groups in a given situation and identification with a group gives rise to in-group favouritism (Brewer, 1999).

SIA, and more specifically social identification, have been used to explain outcomes in the context of video games with social communities, such as players' purchase behaviour (Kordyaka and Hribersek, 2019) and engagement with eSports (Kordyaka *et al.*, 2020). A recent study observing static teams in two LBGs, Ingress and Pokémon GO, revealed that the use of game slang as well as friendships between players could be predicted using SIA (Laato *et al.*, 2021a). When comparing location based social networks to other technically mediated networks such as online social media or digital platforms (see Cheung *et al.*, 2011), the main difference is the inclusion of the spatial or geographical dimension (Saker and Evans, 2016). Still, even in traditional video games, social interaction has been found to be a strong predictor of psychological engagement (Cheung *et al.*, 2015).

Consulting previous literature, it is evident that social identity is connected to territorial behaviour. According to Edney (1974), territory is controlled for the benefit of a group of people, and by a group of people. Humans have evolved under circumstances where they travelled the world in tribes, actively communicating with their in-group and leveraging strong social bonds and trust to benefit the tribe (Harari, 2014). For this reason, social involvement and identification are crucial in understanding territorial behaviour. For the context of LBGs with static teams, we adopt the definition for team identification from the work of Mael and Ashforth (1992) to be a sense of belonging with one's chosen team.

2.2.2 Human territoriality. To draw connections between territoriality and SIA we look at the literature on human territoriality. Julian Edney (1974) describes territorial behaviour to be composed of three parts: (1) defending an area; (2) reserving the area for the exclusive use of a perceived in-group and (3) space-related intolerance. According to another popular definition by Sack (1983), territoriality aims to *"affect, influence, or control actions and interactions (of people, things, and relationships) by asserting and attempting to enforce control over a geographic area."* Both definitions are similar in that territorial control is tied to geographical locations and enforced. Territory is defended from any external force trying to invade it, including other humans and animals. When reflecting these definitions against the territorial conflict in LBGs, we notice great similarity (Papangelis *et al.*, 2017b). Hence, we consider LBGs to implement gamified multiplayer territorial conflict.

Territoriality can be regarded as a form of primal behaviour, as it is observed universally independent of culture and location (Malmberg, 1980). It is a behaviour shared with several other mammalian species; however, there is discussion on to what extent human and animal territoriality overlap, indicating that animal territorial behaviour should not be considered

directly parallel to that of humans, but there are undisputed similarities as well (Malmberg, 1980). Research in the field of evolutionary psychology suggests that human territorial behaviour, especially territory control, evolved as there was a survival benefit from controlling resourceful areas (Varga *et al.*, 2020). From this perspective, territoriality is linked to safety as well as resource control (Edney, 1974; Varga *et al.*, 2020). It can be argued that primal territorial control tendencies have not disappeared from society, rather they have transformed to new forms in processes parallel with industrialization and digitization (Cupers, 2017; Malmberg, 1980).

The nomadic lifestyle of seeking new areas is an instinctive response for avoiding depletion of local resources (Grove, 2009). There are costs related to territorial control which come in the forms of energy spent on patrolling the area (Varga *et al.*, 2020), and stress required to anticipate and react to potential territorial invasions. Hence, in particular in the hunter-gatherer lifestyle, movement and seeking new areas was frequent and a necessary survival strategy (Grove, 2009). In fact, humans could only become stationary once agriculture was discovered and optimised (Harari, 2014). The primal desire to seek, explore and discover is strongly visible in the mammalian brain, orchestrating learning and producing the positive emotion of enthusiasm (Panksepp, 2013). The human need and desire to seek new things can manifest in different forms, for example, in the desire to acquire knowledge, discover food, find good opportunities in the stock market or in the context of LBGs, find new PoIs to control.

Schwartz and Halegoua (2015) argue that with location-based IT, individuals document their location-related activities online, taking their physical presence online in the process. As such, the manifestation of the spatial self is connected to the affordances of the locative IT application. The interplay between the physical world and the online world connected to it, can take many shapes and sizes, but the central components of locations and social connections remain (Papangelis *et al.*, 2020; Schwartz and Halegoua, 2015; Tussyadiah, 2012). In LBGs it is crucial to have sensor-data of the players' real world location so it can be represented in the digital realm (Laato *et al.*, 2021b). The digital world then becomes a parallel and additional layer of reality (Jensen *et al.*, 2019), and while the territorial conflict takes place in this realm, it influences player behaviour, movement and attitudes in the physical world as well (Liberati, 2018).

3. Hypotheses development

3.1 Altruism and social self-efficacy

LBGs can encourage collaboration between players in several different ways. For example, in Pokémon GO, cooperative mechanics include (non-remote) raids and trading, which both bring players to the physical proximity of one another and nudge towards social interaction (Bhattacharya *et al.*, 2019). Engagement with cooperative mechanics in the LBG Ingress has been shown to be associated with players' altruistic behaviour (Riar *et al.*, 2020), which can be defined as *"the motivation to increase another person's welfare"* (MacIntyre, 1967). One approach to understand why people behave altruistically is to draw from collectivism, that is, the postulation that humans instinctively seek to benefit the welfare of their collective group more so than themselves (Batson and Powell, 2003). Similarly, through SIA, we understand altruism to be a behaviour that supports the actions of the perceived in-group. In LBGs, altruism was further associated with increased we-intention (Riar *et al.*, 2020), which subsequently, has been found to strongly correlate with social identity (e.g. Cheung and Lee, 2010). Accordingly, altruism can lead to social bonding and identification with associated player groups. Thus, we propose the following:

H1. Altruism is positively associated with team identification

Jeong and Kim (2011) defined social self-efficacy as the ability to make friends and the willingness to participate in community events and activities, and since, LBGs are a mixture of online and offline play, both online and offline social self-efficacy are relevant (Jeong and Kim, 2011). LBGs contain several multiplayer game mechanics (Riar *et al.*, 2020; Söbke *et al.*, 2017), which allow players to manifest their identity (e.g. Laato *et al.*, 2021a; Papangelis *et al.*, 2020). Due to the communal nature of LBGs such as Pokémon GO and Ingress (Söbke *et al.*, 2017), and self-efficacy being defined as willingness to participate in community events (Jeong and Kim, 2011), it is reasonable to propose that in the context of LBGs, social self-efficacy could have a positive impact on identifying with the player communities, in this case, the players' selected team. Therefore, we propose the following:

H2. Social self-efficacy is positively associated with team identification.

3.2 Team identification, territorial control and expiration tendency

Mael and Ashforth (1992) demonstrated that identification with alma mater organisations' community was linked to increased alumni support. From the perspective of SIA, this suggests that social identification increases engagement and commitment to the community, and further translates into participation in group activities (Haslam *et al.*, 1999; Tajfel and Turner, 1986). Team identification can boost engagement in online multiplayer games (Kaye, 2014), and in LBGs, the players' chosen team influences stratification into player sub-groups (Laato *et al.*, 2021a). A recent study observing player identity in multiplayer online games found the desire for social/collaborative online gaming to lead to self-regulation deficiency and playing habits, which ultimately led to gaming addiction (Gong *et al.*, 2019). Thus, team identification can have positive and negative consequences, but both are related to increased importance of the game due to the importance of the player community.

Past work shows that territorial control is a strongly social endeavour (Varga *et al.*, 2020). When humans still lived in hunter-gatherer tribes, these tribes reserved territorial resources for the exclusive use of their in-group (Edney, 1974). Since teams in many LBGs are static, they can be perceived as such in-groups in the game setting. It follows that in location-based IT such as Pokémon GO and Ingress where territorial control is implemented as a social endeavour, players with a strong team identity could be more likely to participate in the territorial control-related activities of the team. Thus, we propose the following:

H3. Team identification is positively associated with increased engagement with territorial control.

Team identification directs the formation of players' relationships with one another (Laato *et al.*, 2021a), which can provide several practical benefits for LBG players who have a tendency to explore territory, such as (1) ride-sharing to reach distant locations; (2) tips from teammates regarding new prospective areas; (3) help in defending newly acquired areas and (4) finding company. Team identification can also boost players' motivation to participate in community activities (Mael and Ashforth, 1992). The presence and support of the community may make players more daring to travel to unknown territory (Aronson *et al.*, 2010). Hence, players who identify with their team may feel empowered and wish to explore new territories in the hopes of discovering new PoIs. However, simultaneously, players who are playing alone can have more freedom to explore new areas, and they may wish to do so as they lack social support to defend heavily contested territory (Varga *et al.*, 2020). This indicates that the relationship between team identification and exploration tendency is complex. The strength and even the direction of the relationship may depend on the mechanics of the location-based IT. In our case we look at LBGs where territorial control and exploration are both possible individually, and hence, we posit that the benefits of ride-sharing, tips from teammates about

new locations and having company to travel to new areas outweigh the freedom to explore obtained by solo play. Hence, we propose the following:

H4. Team identification is positively associated with exploration tendency.

3.3 Playing intensity

A significant body of prior literature has focused on the role of social play in LBGs (e.g. Bhattacharya *et al.*, 2019; Fonseca *et al.*, 2022; Laato *et al.*, 2021a; Riar *et al.*, 2020; Vella *et al.*, 2019). The studies have investigated specific social phenomena within the games, demonstrating how players get together to cooperate (Bhattacharya *et al.*, 2019), how the players' team influences their social play and communication (Fonseca *et al.*, 2021, 2022; Laato *et al.*, 2021a) and how playing can scaffold a sense of social connectedness (Vella *et al.*, 2019). Social interaction has been connected to enjoyment of LBGs (Ghazali *et al.*, 2019) and to have a positive association with use continuance (Bueno *et al.*, 2020). It follows from SIA that team identification is formed with respect to the players' actions, and intensive playing can scaffold team identification similarly as team identification can boost the players' playing intensity. For these reasons, we propose the following:

H5. Team identification is positively associated with playing intensity.

Playing intensity, understood as the importance and significance of the game in a player's life (Whelan *et al.*, 2020), should be positively associated with the different forms of play. However, it remains unclear whether intensive playing is equally associated with all forms of play, or whether intensive playing is in particular associated with a specific form of playing. In our case, we look at both territorial control (Abdullah *et al.*, 2014; Papangelis *et al.*, 2017b) and exploration – styles of playing. Controlling is related to patrolling behaviour (Varga *et al.*, 2020) along with observing who else is playing in the same area (Abdullah *et al.*, 2014). It also involves staying alert and reacting to territorial invasions. Exploration being connected to seeking, discovery, finding new things and being enthusiastic scaffolds positive emotion, and similarly to territorial control, could be a driving force in boosting playing intensity. Furthermore, a recent study suggests LBG players are motivated to play by the exploration aspect of the games (Vaterlaus *et al.*, 2019). Thus, we propose the following:

H6. Territorial control is positively associated with playing intensity.

H7. Exploration tendency is positively associated with playing intensity.

The final proposed research model is displayed in Figure 1. In addition to the proposed hypotheses, we include three control variables: (1) age; (2) gender and (3) players' level.

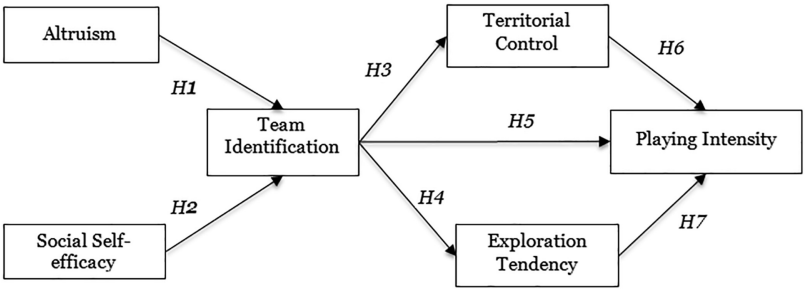


Figure 1.
The proposed research model, including seven hypotheses across six constructs

Controlling for age is relevant as it is linked to situations in life, available time and many other aspects. A recent study identified differences between age and gender in Pokémon GO (Malik *et al.*, 2019), which implies that controlling for gender is crucial. The level in the game is a rough in-game measure of how much time a player has spent on the game, and thus, controlling for its effects is also important.

4. Empirical study

4.1 Study context: the case game Pokémon GO

We chose the most popular contemporary LBG, Pokémon GO, as the study context due to its popularity and that it features both territorial control and exploration related game mechanics. Early on in the game players choose a team, which can be considered a stable entity throughout the playing experience. Territorial conflict in the game revolves primarily around virtual geographically distributed PoIs called gyms. Gyms are owned by a specific team, until an opposing team takes them over. This can lead players to disproportionately associate positive experiences to their own team members and negative to their opponents (Laato *et al.*, 2021a).

Prior to July 2017, players received a daily reward (up to 100 coins) for holding gyms. From summer 2017 onward, players have been only rewarded with coins (up to 50) once an opposing team takes down their Pokémon from gyms. Even after this change, some incentives to control gyms persist in the game. This is important, since past work has shown that LBG players use territory-linked game mechanics for self-presentation and manifestation of identity (Papangelis *et al.*, 2020). Exploration in Pokémon GO is motivated by the discovery of new gyms for the players to control but also by a plethora of other aspects such as the discovery of new pokémon creature species and their rare (100% IV and shiny) forms. In summary, while territorial control is limited to the gyms, exploration is also connected to a wide variety of other mechanics.

4.2 Survey design and construct development

We used validated scales from prior literature for the following constructs: (1) altruism; (2) social self-efficacy; (3) team identification; (4) territorial control and (5) playing intensity. However, they had to be adapted to the context of Pokémon GO. To do so, the first author formulated the adopted survey items and then asked two senior scholars for feedback. The items were revised based on the received feedback. Thereafter, the first author collected feedback from Pokémon GO players in a small private group of 15 members. A few minor tweaks were made to the items, after which they were finalised for the survey. The final measurement items and their sources are available in Appendix 1, and the construct descriptions are given in Appendix 2.

The construct *"exploration tendency"* was developed for this study. The construct development procedure was carried out following established guidelines, to ensure the items would have sufficient internal and external validity (Gilliam and Voss, 2013; Moore and Benbasat, 1991). We began the construct development process with a working definition and by formulating five initial items that focused on exploration tendencies in LBGs. These items were initially drafted by the first author who had extensive experience from playing LBGs including Pokémon GO. We proceeded to ask a senior researcher and two Pokémon GO players to comment on the items, asking them what they felt the items measured. We revised the items and ensured they all measured the same thing (i.e. "exploration tendency").

We then conducted a card sorting exercise (Moore and Benbasat, 1991). We gave participants the five items of exploration tendency and ten additional items in a randomised order, and asked them to place them into categories based on what the items measure. We also

asked participants to name the categories. Four Pokémon GO players participated in the exercise, and all placed the five items of exploration tendency into the same category. After these processes, we decided that the construct was mature enough to be included in the survey for further validation.

4.3 Participants and data collection

We implemented the survey using a professional online survey tool called Webropol, which has built-in measures against survey abuse such as multiple answers or botting. In the beginning of the survey, we explained to the participants how the survey data was going to be used for research, how it is stored, who has access to the data and that no individuals can be identified from the reporting. We asked participants for their permission to use their responses for the explained purpose. Participants were also given a link to the privacy policy and the opportunity to write open feedback to the researchers in the survey. We included a few check questions to make sure the participants were answering the survey carefully and honestly. During the testing with a small group of players ($n = 15$), we received comments regarding a few grammatical issues, the length and pacing of the survey and an implementation error. After fixing the reported issues we proceeded to the main data collection.

We contacted the moderators of the popular/r/pokemongo subreddit which has 2.5 million subscribers and asked for permission to distribute our survey in their subreddit. The moderators assisted our project by pinning the survey to the frontpage of the subreddit for six days, June 24–29th, 2020. We replied to all comments and upvoted them to further encourage participation. All together 894 participants started responding, out of whom 619 completed the survey. After removing incomplete responses and those which did not pass implemented quality checks, we were left with 515 responses. The data collection took place roughly four years after the initial release of Pokémon GO. Compared to the originally released version, significant changes to the game had been made such as a rework of the gym system, addition of raids, addition of trades and player vs player battles and addition of hundreds of new pokémon creatures for players to capture. Despite these differences in the game itself as well as players' adoption stage, the core game remains the same and hence, we estimate the findings to be comparable to early studies conducted with the game. The main consideration with regards to the current study is the rework of the gym system in summer 2017. For this reason, findings related to territoriality in Pokémon GO before that date may not be directly comparable to those in the current study.

Basic demographic data of respondents is displayed in Table 2. The majority of the respondents were male, and the largest age group was young adults. In comparison to recent studies among Pokémon GO players (Bueno *et al.*, 2020; Wang and Skjervold, 2021), this

Level in Pokémon GO	*N*	Age	*N*
0–20	6 (1.2%)	Less than 18	38 (7.4%)
21–30	67 (13.0%)	18–25	212 (41.1%)
31–35	113 (21.9%)	26–34	185 (35.9%)
36–39	203 (39.4%)	35–44	53 (10.3%)
40	126 (24.5%)	Over 45	27 (5.3%)
Gender		*Employment status*	
Male	339 (65.8%)	Employed	270 (52.4%)
Female	160 (31.1%)	Unemployed	60 (11.6%)
Other	11 (2.1%)	Student	163 (31.7%)
Prefer not to tell	5 (1.0%)	Other	22 (4.3%)

Table 2. Demographic information of the participants ($N = 515$)

sample can be considered to be fairly representative of the player population in terms of gender and employment status. However, the players in our data were more experienced (at a higher level). This may be explained by the fact that Pokémon GO was released in summer 2016, and at the time of the data collection, the game was four years old. This gives even non-intensive players enough time to reach level 40, and therefore there likely existed large variance in playing activity among the level 40 players.

4.4 Validity and reliability

Henson and Roberts (2006) suggest that when construct survey items are taken largely from literature, scholars may proceed directly to confirmatory factor analysis. To this end, we used the partial least squares structural equation modelling (PLS-SEM) regression analysis with SmartPLS version 3.3.3. Before proceeding to test our hypotheses, the validity and reliability of the data had to be ensured (Fornell and Larcker, 1981). As the first step in this procedure, we ensured that the loadings for each construct item are above the recommended threshold of 0.7. Two items of territorial control (TP2 and TP4), one item of social self-efficacy (SSE4), and one item of exploration tendency (ET2) did not reach this threshold. We removed these items (Fornell and Larcker, 1981). Second, we checked that the composite reliabilities of our constructs were above the threshold value of 0.8. All constructs in our data met this criterion. Third, we ensured that the average variance extracted (AVE) values of the constructs were above the threshold value of 0.5. This condition was also met across the data. The loadings, AVEs and composite reliability values are presented in Appendix 1.

For testing discriminant validity, we compared the square roots values of the AVEs of each construct to all correlation between the construct itself and all other constructs. As can be seen in Table 3, the square roots of the AVEs were greater than any of the correlations between the constructs. Furthermore, the loadings and cross-loadings presented in Appendix 3 show that the loadings are higher than the cross-loadings, which ensures discriminant validity. Finally, we looked at the Heterotrait–Monotrait (HTMT) matrix (see Appendix 4), and made sure that the values were below the threshold value 0.85 set by Henseler *et al.* (2015). Consequently, we conclude that our data has sufficient validity and reliability to be used in PLS-SEM regression analysis.

5. Results

Following the confirmation that our data fulfilled the criteria for validity and reliability, we proceeded to evaluate the proposed structural model. For the significance testing we ran a

	Altruism	Team identification	Exploration tendency	Social self-efficacy	Territorial control	Playing intensity
Altruism	*0.895*					
Team identification	0.474	*0.778*				
Exploration tendency	0.240	0.162	*0.815*			
Social Self-efficacy	0.526	0.432	0.161	*0.817*		
Territorial control	0.299	0.365	0.033	0.404	*0.793*	
Playing intensity	0.235	0.310	0.051	0.281	0.408	*0.817*

Table 3.
Construct correlations

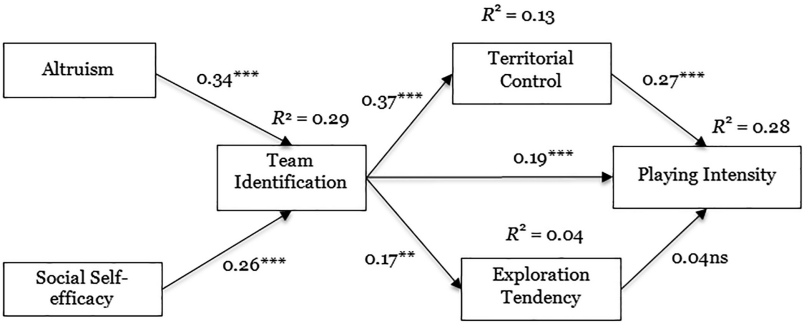
Note(s): The square roots of AVEs are italicized

complete bootstrapping with 10,000 sub-samples. The structural model results are displayed in Figure 2.

Answering the hypotheses in a chronological order, altruism was positively associated with team identification ($\beta = 0.34, p < 0.001$). Therefore, H1 was supported. The relationship between social self-efficacy and team identification (H2) was also supported ($\beta = 0.26$, $p < 0.001$). Together with the control variables, the model explains 29% of the variance on team identification. Team identification and territorial control had a strong significant positive relationship ($\beta = 0.37, p < 0.001$), supporting H3. Team identification and exploration tendency (H4) also had a significant positive association ($\beta = 0.17, p < 0.01$). Together with the control variables, team identification explained 13% of the variance of territorial control and 4% of the variance in exploration tendency. Regarding the remaining hypotheses, team identification had a positive relationship with playing intensity ($\beta = 0.19$, $p < 0.001$), supporting H5. Likewise, territorial control had a strong positive association with playing intensity ($\beta = 0.27$, $p < 0.001$), supporting H6. However, exploration tendency had a non-significant relationship with playing intensity ($\beta = 0.04$, $p > 0.05$), rejecting H7. The model explained 28% of the variance of playing intensity.

Regarding the control variables, age had a significant negative association with team identification ($\beta = -0.14, p < 0.01$) but a non-significant relationship with the other variables. This means that the younger the player, the more likely they are to associate themselves and feel a part of their team in Pokémon GO. Being female had a positive impact on playing intensity ($\beta = 0.14, p < 0.001$) and the players' level in Pokémon GO was positively associated with playing intensity ($\beta = 0.25$, $p < 0.001$) and negatively associated with exploration tendency ($\beta = -0.12$, $p < 0.05$).

Finally, we conducted a post-hoc test to investigate the effect sizes of the mediated relationships as well as direct effects of the latent constructs, altruism and social self-efficacy. The results of this analysis show that altruism did not have any significant effect on territorial control ($\beta = 0.04, p > 0.05$) and playing intensity ($\beta = 0.00, p > 0.05$), whereas it had a significant effect on exploration tendency ($\beta = 0.22$, $p < 0.01$). Social self-efficacy did not have any effect on exploration tendency ($\beta = 0.08, p > 0.05$) and playing intensity ($\beta = 0.05$, $p > 0.05$) but it had a significant effect on territorial control ($\beta = 0.31, p < 0.001$). The mediated effects are presented in Appendix 5. Collectively, these findings suggest that team



Note(s): *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$

Figure 2.
Structural model results

identification partially mediates the effects of altruism and social self-efficacy on exploration tendency and territorial control. When adding the direct effects on top of the hypothesised effects, the model explained 9% variance of exploration tendency, 22% variance of territorial control and the explained variance (28%) of playing intensity remained unchanged.

6. Discussion

6.1 Key findings

In this study we investigated how group-related social tendencies and group identification may lead into either or both territorial or nomadic behaviours when it comes to interacting with locative media and location-based IT (such as Pokémon GO) as well as how it further may affect use intensity. Our results indicate that territorial control was a better predictor than exploration tendency of team identification and playing intensity. This finding brings insight into social territorial control (Edney, 1974; Varga *et al.*, 2020) by showcasing that LBGs can leverage social territorial control to increase playing intensity.

Regarding the other discovered relationships; we found altruism and social self-efficacy to be positively associated with team identification in Pokémon GO. This suggests that players who have a pre-existing social disposition are more likely to form an identity based on their chosen team in Pokémon GO. Following SIA, this can be explained by socially inclined players having more intra-team interactions, which subsequently, contribute to the formation of their team identity (Haslam *et al.*, 1999; Kordyaka *et al.*, 2020; Tajfel and Turner, 1986). This explanation is aligned with a previous study that discovered engagement with cooperative features and altruism to be positively correlated (Riar *et al.*, 2020). It is noteworthy that while an altruistic stance increases the player's engagement with the game, altruistic behaviour can also make the game more fun for all the other players. Hence, scaffolding altruism in LBGs has benefits that go beyond those shown in our research model.

Exploration tendency had a non-significant relationship with playing intensity. This finding goes against our hypothesis derived from SIA, as well as a recent study on Pokémon GO that found many players are motivated to play due to the exploration aspect (Vaterlaus *et al.*, 2019). One potential explanation for this comes from our sample, where most players were highly active, which can be seen as an indicator that they are performance and progression oriented. However, it could also be explained via prospect theory and the mechanism of loss aversion. The idea of loss aversion in prospect theory is that people assess their potential losses and gains in an asymmetric manner, i.e. loss avoidance being given more emphasis than potential gains (Abdellaoui *et al.*, 2007). Related to this finding was the significant negative relationship between the control variable of level in Pokémon GO and exploration tendency. This indicates that players who want to explore new areas in playing, may be less interested in progression and grinding, providing evidence for the existence of individual differences among LBG players (see, e.g. Hamari and Tuunanen, 2014; Koivisto *et al.*, 2019).

The post hoc analysis of direct relationships showed a positive relationship between altruism and exploration tendency. This could be explained by altruism leading to conflict-avoidance, and hence towards peaceful playstyles such as nomadic exploration. The other interesting discovery in the post hoc analysis was that social self-efficacy and territorial control had a positive relationship. This may be explained through understanding how territorial control is implemented in Pokémon GO. First, effectively controlling gyms requires a great deal of cooperation, which may be easier for those with high social self-efficacy. Second, territorial control produces conflict between players (Laato *et al.*, 2021a). Past work has shown that social self-efficacy has a significant role in adopting positive conflict resolution strategies (Field *et al.*, 2014) which may consequently help players maintain a long-term healthy approach to social playing despite participation in territorial conflict.

Regarding the control variables, age had a negative impact on team identification. A possible reason for this is that older people would be less likely to attach themselves to new communities. Other established entities such as family or a job may become more meaningful, which altogether decreases the importance of new potential emerging social communities. Age had no correlation with playing intensity, which aligns with previous studies which have shown Pokémon GO to be a game enjoyed by all age groups (Malik *et al.*, 2019). Finally, the finding that females were playing more compared to their male counterparts differs from a recent study which found no connection between gender and playing intensity (Laato *et al.*, 2020). The difference may be explained by the data being collected through a male-dominant platform, Reddit (Wang *et al.*, 2015). Thus, women who gravitate there are likely intensive players. In fact, we notice that more of our women participants were also at level 40 in Pokémon GO (27%) compared to male players (24%), supporting this postulation.

6.2 Theoretical contributions

With our study we make three key theoretical contributions: (1) we connected social identity to territorial playing in LBGs both theoretically and empirically, (2) we provided evidence that a pre-existing social disposition (both online and offline self-efficacy and altruistic tendencies) can boost players' team identification and (3) based on our findings we suggest that territoriality should be considered as a factor when looking at use intensity of location-based IT apps. Next, we explain these contributions in further detail.

First, our work contributes to understanding the social aspects of territorial behaviour in location-based IT. Recent work has demonstrated how in LBGs similar to Pokémon GO, territorial behaviour and expression are linked to self-identity (Papangelis *et al.*, 2020). SIA postulates that individuals' identity is the result of both (1) personal (self as an individual) and (2) group (self as a member of a group); components (Aronson *et al.*, 2010). LBGs such as Pokémon GO provide team vs team territorial control mechanics, which connects social identity to territorial conflict. This parallels how territorial control worked in hunter-gatherer societies (Edney, 1974; Varga *et al.*, 2020). With our model and results, we expand the recent work on territoriality in LBGs (Laato *et al.*, 2021c; Papangelis *et al.*, 2020) by showing that territorial behaviour is, in addition to personal aspects of identity, connected to players' social identity through team identification. The use of SIA offers a theoretical grounding to these phenomena that have also recently been discussed from the perspective of territorial power (Woods, 2021). The findings also have implications more broadly on location-based IT, as they frame identity as a key predictor of participation in territory-related activities.

Second, previous work has suggested LBGs to increase social connectedness (e.g. Bhattacharya *et al.*, 2019; Riar *et al.*, 2020; Vella *et al.*, 2019). Our findings suggest this may be enhanced by a pre-existing social stance (e.g. altruism and social self-efficacy). We further argue that the presence of a human enemy (i.e. opposite team members and perceived out-groups) increases the saliency of altruism and territorial control (Laato *et al.*, 2021a; Woods, 2021), due to phenomena arising from team identification (Kordyaka *et al.*, 2020). Hence, territoriality-related game mechanics may also offer players additional nudges towards engaging in cooperation. This supports previous literature on how LBGs scaffold cooperation (Riar *et al.*, 2020).

Third, previous work on engagement with location-based IT have used both quantitative (Bueno *et al.*, 2020; Ghazali *et al.*, 2019; Hamari *et al.*, 2018) and qualitative (Alha *et al.*, 2019; Tussyadiah, 2012) approaches to understand why people engage with the technologies, but none of the studies accounted for territoriality. The studies on territoriality (e.g. Papangelis *et al.*, 2017a, b; Tussyadiah, 2012; Woods, 2021) have primarily drawn from qualitative data, but empirical studies have been scarce. Our results address this gap with quantitative evidence on the importance of territoriality in LBGs, connecting it to social aspects and

playing intensity. Thus, we contribute to the previous work on engagement with location-based IT (Alha *et al.*, 2019; Ghazali *et al.*, 2019; Hamari *et al.*, 2018) by providing an estimate of the importance of territoriality in location-based IT. Tussyadiah (2012) showed that when location-based IT apps implement a social competition over territory, it can make the playing experience more fun and engaging. The study further argued that when users are engaged with visiting and controlling PoIs, the app influences their movement in the physical world. Our quantitative approach supports this work and further add nuance through the distinction of territorial activities into control and exploration types of behaviours.

6.3 Practical implications

With our findings on location-based IT derived from the context of the LBG Pokémon GO, we have practical implications for (1) location-based IT and LBG development and for (2) intervention designers using locative technologies to scaffold positive outcomes.

First, our findings help location-based IT and in particular LBG designers to understand how technologies can shape the social and territorial dimensions of human behaviour. LBGs differ from other multiplayer online games (Gong *et al.*, 2019) in that social interaction occurs (also) face-to-face in the real world and is tied to the players' physical location (Bhattacharya *et al.*, 2019; Liberati, 2018). Our findings suggest that with certain game design elements, such as providing players a team-based gamified territorial conflict landscape, designers are able to motivate social interaction and playing intensity. From the currently existing LBGs, only a few such as Ingress and Pokémon GO have implemented this kind of a design. Some LBGs such as Orna include territorial control mechanics, but they lack the social aspect, and consequently, inter-group territorial conflict, which can reinforce a divide into social in- and out-groups (Brewer, 1999; Laato *et al.*, 2021a). In Orna, members of the same team can claim areas from each other, meaning team identification is not likely to boost territorial control as suggested in our study. As gamification elements are increasingly implemented as part of a broad range of information systems (Hamari, 2019), these recommendations on LBG design may be applicable more widely to location-based IT systems. However, we encourage careful appraisal of the specific use context when applying the findings of this study into practice due to the large variance in location-based IT solutions.

Second, our findings may be of interest for population level health interventions. There is a body of evidence regarding the positive effects of playing LBGs for social, mental and physical well-being (e.g. Koivisto *et al.*, 2019). Our work highlights the relationships between social aspects of playing and the location-tied mechanics and suggests that territorial control can be hugely motivating. However, territorial control can also be very consuming for those who partake in it (Varga *et al.*, 2020), meaning that at worst, it can lead to addiction and other issues among players. Nevertheless, implementing territorial control mechanics in LBGs may help alleviate some of the reported issues that LBG players' interest to play falls rapidly and hence the benefits on well-being are short lived and no permanent improvements take place (Althoff *et al.*, 2016). Other locative media and location-based IT apps besides LBGs can also enable users to take control of virtual locations tied to the physical world, and hence motivate individuals to use the product and interact with their surroundings in a new way.

6.4 Limitations and future work

Among the limitations of this work is that our participants were self-selected. Data were collected through Reddit, which may have introduced some bias in the sample. One concern is that only highly active players would participate in the survey through Reddit. To test this, we looked at the participants' reported level to see whether they were exclusively at level 40, the max level in the game at the time. However, the reported median level was 35–39 (39%)

followed by level 40 (25%) and 31–34 (22%). This suggests that while the sample is slightly biased towards more active players, it can still be considered representative of the playerbase.

Regarding the development of the "exploration tendency" construct, we encourage further experimentation and validation of the measurement items. Previous studies (e.g. MacKenzie *et al.*, 2011) provide guidelines for a more strict process for construct development, which offers a fruitful starting point for future research. Another implication for future research comes from the finding that prospect theory could explain why we observed a strong positive association between territorial control and playing intensity, but no relationship between exploration tendency and playing intensity. Hence, we encourage future studies to look into the use of prospect theory (Abdellaoui *et al.*, 2007) for understanding territoriality in technology-mediated contexts such as LBG play. Another possible reason for the non-significant relationship between exploration tendency and playing intensity is the presence of possible moderating effects. Future research could explore possible moderating variables and test their effects on the proposed relationships.

Qualitative work such as ethnography and interviews could provide further details regarding the observed phenomena. For example, since our model explained a relatively low percentage of variance within territorial exploration and exploration tendency construct, future work could identify more relevant antecedents. Studies on territoriality predict depletion of resources and increased competition over them as antecedents for exploring for new areas (Varga *et al.*, 2020), and hence we encourage future research to look at how these aspects could be present in location-based IT. Our findings also indicate that exploration and controlling are not mutually exclusive activities. Future research may explore to what degree players' control over virtual territory depends on their individual strength, the strength of their social bonds, their available free time and perceptions of meaningfulness of the activity. The model explained 29% of the variance in team identification, meaning that additional antecedents such as extroversion and interpersonal attachment among others are still needed to fully explain variance within the construct. The model explained 28% of the variance in playing intensity, and past work has shown that, for example, fear of missing out and deficient self-regulation are relevant additional predictors of the construct (Laato *et al.*, 2020). In addition, we only tested the model in the context of a single LBG, Pokémon GO. Future work could conduct similar studies on multiple location-based IT applications to see which findings remain and which are universal.

7. Conclusion

This study worked towards connecting two bodies of previous research in the context of location-based IT: social identity (Aronson *et al.*, 2010; Haslam *et al.*, 1999; Kaye, 2014; Kordyaka and Hribersek, 2019; Kordyaka *et al.*, 2020; Tajfel and Turner, 1986) and territoriality (Edney, 1974; Papangelis *et al.*, 2020; Varga *et al.*, 2020). Our results highlighted team identification and engagement with territorial control as powerful predictors of playing intensity, while there was no connection between exploration tendency and playing intensity. These findings have implications for our understanding of location-based technologies which transform space with augmented digital content, and subsequently, alter how people interact with their environment. While not all location-based IT applications contain affordances for territorial control and expression, our findings provide design insights into how technology can shape human social geographical behaviour.

Notes

1. For more information, see https://lightship.dev/ accessed on the 10th of November 2021.

2. By using the number of reviews on Google Play Store in April 2022 as an estimate of app popularity, we approximate that Pokémon GO is 10 times more popular than Ingress Prime which is 10 times more popular than Orna.

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Appendix 1

Construct	Corresponding items	Loadings
Exploration tendency	ET1: I get excited when I get to explore new areas	0.721
CR: 0.888	ET2: I'd rather not always play the game in the same physical location	Removed
AVE: 0.665	ET3: Playing is more fun in new and unexplored areas	0.861
(self-developed)	ET4: If I'm able to choose, I'd rather play in a new place than a place I've visited already before	0.841
	ET5: I usually prefer to play in a new area rather than a familiar area if I have the choice	0.830
Territorial control	TC1: Watch: I keep an eye on my gyms daily	0.809
CR: 0.836	TC2: Recognize: I like to know who took down my gyms	Removed
AVE: 0.629	TC3: Know: I know who are playing in the same area as I am and battling for the same gyms	0.779
From Abdullah *et al.* (2014)	TC4: Responsible: I feel responsible for protecting my gyms and making sure they belong to the right team	Removed
	TC5: Belong: I feel that I have a home turf in the game where I belong	0.791
Social Self-efficacy	SSE1: I can easily become friends with other Pokémon GO players	0.868
CR: 0.857	SSE2: I often participate in community activities such as legendary raids	0.759
AVE: 0.667	SSE3: I love to meet unfamiliar people while playing Pokémon GO	0.819
From Jeong and Kim (2011)	SSE4: It is not important for me to meet other people while playing Pokémon GO (reversed)	Removed
Altruism	ALT1: I like helping other Pokémon GO players.	0.872
CR: 0.942	ALT2: It feels good to help other Pokémon GO players.	0.898
AVE: 0.802	ALT3: I enjoy helping my teammates in Pokémon GO	0.918
From Riar *et al.* (2020)	ALT4: I find it pleasurable to help my teammates in Pokémon GO	0.893
Team identification	TI1: When someone praises my Pokémon GO team, it feels like a personal compliment	0.770
CR: 0.821	TI2: I feel I am a typical member of my Pokémon GO team	0.735
AVE: 0.605	TI3: My Pokémon GO team's successes are my successes	0.826
From Mael and Ashforth (1992)		
Playing intensity	INT1: Playing Pokémon GO is part of my everyday activity	0.786
CR: 0.857	INT2: I feel out of touch when I have not played Pokémon GO for a while	0.864
AVE: 0.667	INT3: I would be frustrated if I could not play Pokémon GO	0.798
From Whelan *et al.* (2020)		

Table A1. Survey items, CRs, AVEs and the item loadings

Appendix 2

Construct	Description
Exploration tendency (in Pokémon GO)	Players' tendency to go play in new areas as opposed to playing in the same places
Territorial control (in Pokémon GO)	Players' tendency to keep watch over the geography-tied digital playground in Pokémon GO
Social Self-efficacy	The disposition and capability to meet new players, make friends and play games socially
Altruism	The capability to enjoy and derive pleasure from helping other players
Team identification (in Pokémon GO)	The degree to which the player feels they are part of their selected team in Pokémon GO
Playing intensity (of Pokémon GO)	The degree to which playing Pokémon GO has become a part of the players' life, where a higher playing intensity means that the player is not only playing more, but the game is also a larger part of their life in general

Table A2. Survey construct definitions

Appendix 3

	Exploration tendency	Territorial control	Social self-efficacy	Altruism	Team identification	Playing intensity
ET1	0.721	0.050	0.151	0.248	0.168	0.112
ET3	0.861	0.055	0.151	0.193	0.137	0.022
ET4	0.841	−0.006	0.111	0.178	0.125	0.007
ET5	0.830	−0.000	0.097	0.137	0.079	0.003
TC1	0.055	0.809	0.214	0.202	0.266	0.388
TC3	−0.013	0.779	0.436	0.278	0.258	0.292
TC5	0.031	0.791	0.331	0.239	0.344	0.283
SSE1	0.150	0.327	0.868	0.442	0.377	0.196
SSE2	0.005	0.392	0.759	0.358	0.318	0.307
SSE3	0.224	0.279	0.819	0.483	0.360	0.199
ALT1	0.196	0.244	0.495	0.872	0.357	0.197
ALT2	0.238	0.235	0.491	0.898	0.401	0.211
ALT3	0.217	0.313	0.503	0.918	0.476	0.225
ALT4	0.208	0.270	0.404	0.893	0.447	0.205
TI1	0.128	0.234	0.318	0.388	0.770	0.236
TI2	0.076	0.333	0.346	0.306	0.735	0.233
TI3	0.169	0.288	0.345	0.408	0.826	0.254
INT1	0.021	0.362	0.253	0.213	0.211	0.786
INT2	0.056	0.339	0.257	0.163	0.317	0.864
INT3	0.050	0.290	0.168	0.202	0.225	0.798

Table A3.
Loading and cross-loadings

Appendix 4

	Altruism	Team identification	Exploration tendency	Social self-efficacy	Territorial control	Playing intensity
Altruism						
Team identification	0.595					
Exploration tendency	0.265	0.206				
Social Self-efficacy	0.634	0.608	0.195			
Territorial control	0.372	0.531	0.066	0.573		
Playing intensity	0.283	0.432	0.069	0.376	0.551	

Table A4.
The HTMT matrix

Appendix 5

Table A5. Indirect (mediated) effects of the model constructs

Indirect effects	Effect size	*T*-statistic	*p*-value
Altruism → Team identification → Playing intensity	0.066	3.646	0.000
Altruism → Team identification → Exploration Tendency	0.012	0.607	0.544
Altruism → Team identification → Territorial control	0.071	3.736	0.000
Social self-efficacy → Team identification → Exploration Tendency	0.010	0.583	0.560
Social self-efficacy → Team identification → Playing intensity	0.052	3.203	0.001
Social self-efficacy → Team identification → Territorial control	0.056	3.249	0.001
Team identification → Exploration Tendency → Playing intensity	0.002	0.409	0.683
Team identification → Territorial control → Playing intensity	0.055	3.595	0.000

Corresponding author
Samuli Laato can be contacted at: sadala@utu.fi