

A Review of Studies on Location-based Live Service Games During the COVID-19 Pandemic: Players' Behaviour and Reluctance to Return to the Pre-pandemic State

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Introduction

When the World Health Organization (WHO) declared COVID-19 a global pandemic on March 11, 2020, multiple nations announced limitations to their citizens' movements in order to restrict the spread of the disease. The movement restrictions were a particular challenge for location-based games (LBGs), as the core idea of these games is to play by moving in the real world, explore new places and meet other people (Laato et al. 2020a; Laato et al. 2020b; Dunham et al. 2022). We saw LBG developers react quickly by introducing a wide variety of mechanisms that better accommodate remote and solo play. For example, in NextGames' LBG, *Walking Dead: Our World* (NextGames 2018), players were given the option to explore the map on the back of a motorcycle, effectively replacing walking in the real world with a joystick interface; in *Ingress Prime* (Niantic 2013), players were given the option to remotely scan key areas called portals, allowing play from home. The currently most popular LBG, *Pokémon GO*, saw multiple changes, such as: cancelled community days, halved egg hatch distance requirements, increased spawn rates, doubled PokéStop interaction radius, remote raids (see Figure 7.1) and removal of walking requirements for the game's player vs player (PvP) battles (Dunham et al. 2022). While LBG players in general respected the

pandemic safety measures, a handful of individuals made news by breaking lockdown restrictions to play *Pokémon GO* (Niantic 2016) (see e.g., Anis 2020; Walker 2020).

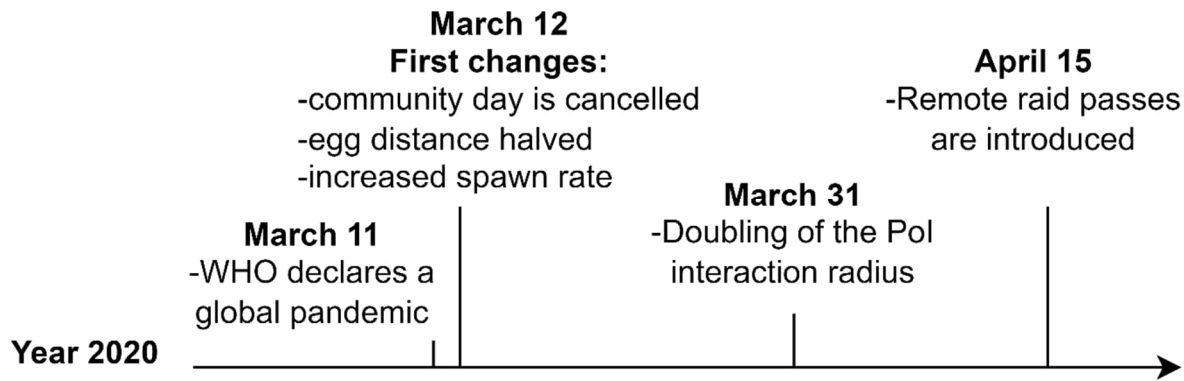


Figure 7.1 A Timeline of Key Events Related to In-game Changes in Pokémon GO Due to the COVID-19 Pandemic (Dunham et al. 2022; Pokémon GO live 2023)

Once the most dangerous waves of the pandemic were over, governments began lifting movement and social meeting restrictions. Simultaneously we saw attempts from LBG developers to revert some of the changes they had implemented to help players play during the restrictions (Kacurov 2021). However, many of these changes did not go smoothly. For example, the world’s most popular LBG *Pokémon GO* reverted the point of interest (PoI) interaction radius back to pre-pandemic levels, which caused an uproar among the player community, and ultimately led the developer to reinstate the expanded interaction radius introduced during COVID-19 (Laato and Rauti 2021; Silberling 2021). Players were reportedly unsatisfied with the decision to roll back the pandemic safety measures implemented to the game, not only due to health issues, but also because they saw many of the changes as “*quality-of-life*” improvements (Silberling 2021). This is interesting, as it suggests that active *Pokémon GO* players wish for less intensive location-elements in the game, *prima facie* contradicting the fundamental tenets of the LBG genre. To investigate this

matter, we conducted a systematic literature review of the academic studies on LBGs during the pandemic. To guide our literature search process and data extraction we propose the following research questions (RQ):

RQ1: *What effects did the pandemic and related in-game changes have on LBG players' behaviour according to the academic literature?*

RQ2: *What evidence does the academic literature offer regarding players' reluctance to return to normal after the primary pandemic threat was over?*

Through addressing the RQs, we synthesise the academic knowledge on the role of LBGs during the pandemic, and also provide insights into LBGs in general by invoking the context of the pandemic to understand player behaviour. The remainder of this study is structured as follows. First, we discuss the background literature leading up to our literature review. We then detail our research methods followed up by the main findings. Finally, we discuss the implications and limitations of this research, and propose avenues for future research.

Background

Academic research on LBGs dates to early 2000's (Nicklas et al. 2001) but the genre saw significant commercial and mainstream success only 15 years later in the summer of 2016, when smartphone technology, internet access, game technology and satellite navigation had evolved to a point where the megahit *Pokémon GO* was ripe to be launched. This marked a boom in both the academic literature on the topic (Wang et al. 2021) as well as interest towards the LBG genre among the general population (Laato et al. 2019). Inspired by the design of games such as *Shadow Cities* (Grey Area 2010), *Ingress Prime* and *Pokémon GO*, most of the currently popular LBGs are multiplayer live service games. This means the game

world is shared with other players, and that the same game is maintained and steadily updated for years. For example, most of the popular LBGs listed by Baer et al. (2022) are such games: they have been released between prior to 2018, and are still around and actively maintained.

LBG research prior to the COVID-19 pandemic focused on understanding how the game influences players' movement and exercise (e.g., Gabbiadini et al. 2018), social interactions and connections (e.g., Fonseca et al. 2021; Fonseca et al. 2022; Vella et al. 2019), and relationships with place and space (Low et al. 2022; Oleksy and Wnuk 2017) among other things. Interestingly, within these domains, research had already identified how for several players, LBG playing was integrated into their daily lives. For example, according to Gabbiadini et al. (2018) *Pokémon GO* players were only more active than a comparison group due to game-related physical activity, meaning the health effects players got from the game were tied to that context. Similarly, Colley et al. (2017) demonstrated that *Pokémon GO* directs and influences players' movement, and Bhattacharya et al. (2019) showed that the game facilitates social interaction and group formation for players in the form of raiding.

In 2020 when the pandemic hit, due to quarantine measures and movement restrictions, live service LBGs were pressured to change the way the games are played. However, they were also in the position of doing so, since the games were regularly updated in any case and actively maintained (Dunham et al. 2022; Laato et al. 2020b). One of these updates were remote raids, which as the name implies, offered players to play remotely as opposed to having to attend specific locations in-person. Players were appreciative of the changes that LBG developers made in response to the pandemic (Ellis et al. 2020a; Laato et al. 2020a), and, for example, *Pokémon GO* proceeded to generate lifetime records of in-game revenue in both 2020 and 2021 respectively (Statista 2023). However, as commented on by Hjorth and de Souza e Silva (2023), moving from the pandemic circumstances back to normal or a new normal is “*the challenge of the decade*” and this also applies to LBG

developers. In Figure 7.2 we show a timeline of key events pertaining to Niantic’s (i.e., the developer of *Pokémon GO*) endeavours to revert one of the changes they implemented in *Pokémon GO* during the pandemic, namely, the increased point of interest (PoI) interaction radius. After Niantic announced that they were reducing the interaction radius back to normal (*Pokémon GO* live 2023), players first voiced their concerns and then went as far as organising a “Pokémon NO day” on August 5, coupled with several highly liked and shared social media posts and videos protesting the change. Ultimately on August 25, Niantic announced that they would keep the PoI interaction radius the same (Laato and Rauti 2021).

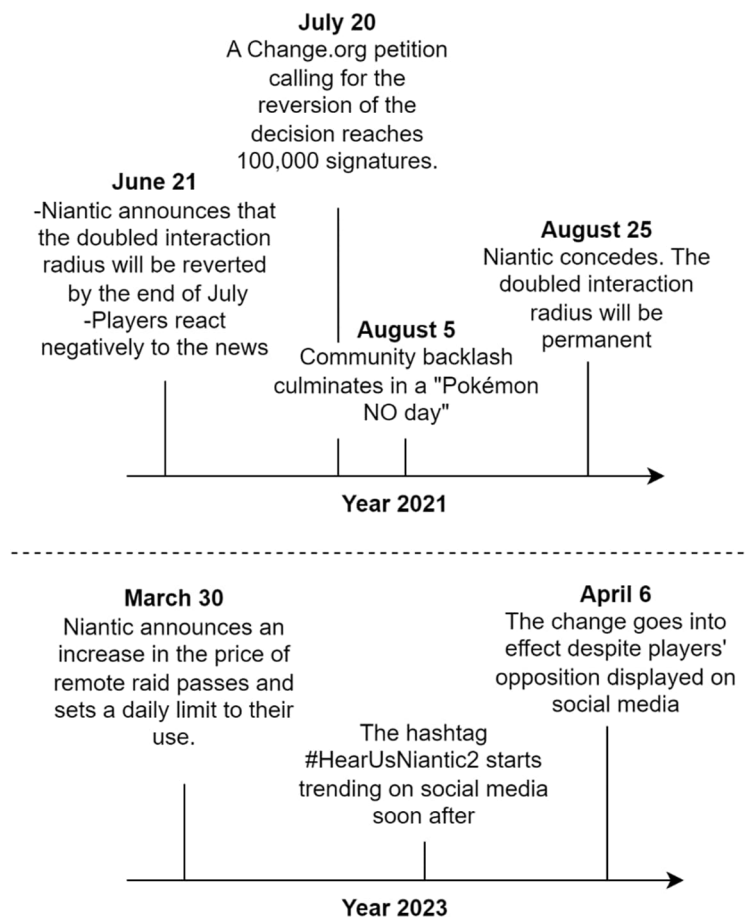


Figure 7.2 Showing Two Events Where Players Expressed Their Dissatisfaction With Reverting Pandemic Changes (First in 2021 players protested against the reduction of the PoI interaction radius to pre-pandemic levels, and as an outcome, Niantic made the pandemic

change permanent. A second case was seen in 2023, where players this time protested against a price hike and use reduction of remote raiding. However, this time Niantic did go through with the change).

A similar situation was seen again in April 2023 (See Figure 7.2) when Niantic announced that they were moving away from remote raiding and increased the cost of remote raid passes and put a limit on how many can be used per day. Again, some players expressed that they were displeased with the situation. In order to understand these events and to address the RQs, we conducted a systematic literature review of the academic studies on the topic. Next, we describe these processes followed up by our findings.

Materials and Method

Literature search processes

Methodologically this work is divided into two parts: (1) academic literature search; and (2) data extraction and analysis. We followed the ROSES method (Haddaway et al. 2018) for the literature search process as suggested by recent literature reviews in the video game context (e.g., Krath et al. 2021).

We began by screening for relevant literature on Elsevier's Scopus research metadatabase. This database was selected since it is a robust and versatile collection of peer-reviewed research from major academic publishers such as Elsevier, IEEE, ACM, Wiley, Springer, Taylor & Francis and Emerald. We began by gathering keywords related to both location-based gaming and the COVID-19 pandemic which was done through our initial reading to the topic. These keywords are listed in Table 7.1. With these keywords we conducted a search in February 2023 in Scopus by chaining keywords in the same topic with the "OR" operator and combining the two sets of keywords together with the "AND"

operator. This search resulted in 28 documents. The relatively low number of documents can be explained by the novelty of the topic and the accuracy of our keywords. As an example, including generic keywords such as “games” and “play” exploded the number of search results in February 2023 to over twenty thousand items (20707 to be exact), making a manual screening process extremely challenging. For this reason, we opted for accurate as opposed to broad search keywords.

Table 7.1 Keywords Used in the Initial Search for Academic Literature

Topic	Search Keywords
The COVID-19 pandemic	COVID-19, pandemic, global health crisis
Location-based games	Pokémon GO, Ingress Prime, locative games, location-based games, pervasive games, location-based AR games, GPS-games

Table 7.1 Keywords Used in the Initial Search for Academic Literature

Due to the manageable number of initially discovered documents (n=28), we read each of them in full and applied the following inclusion criteria:

- The study had to be written in English.
- The study had to be peer-reviewed (book chapter, conference paper or journal article).
- The study had to focus specifically on LBGs during the pandemic.

After applying the inclusion/exclusion criteria, we were left with eight studies (Bhattacharya et al. 2021; Dunham et al. 2022; Ellis et al. 2020; Jumareng et al. 2020; Laato et al. 2020a; Laato et al. 2020b; Peaty and Leaver 2020; Saaty et al. 2022). To add robustness to the search, we then performed forward and backward citation-chaining on these eight studies to ensure we did not miss any relevant studies. First, we screened the references of the

eight studies for any potentially relevant studies, and then we used Google Scholar to probe whether there are newer relevant studies that cite one or more of the eight papers. The forward citation chaining resulted in the discovery of Chen et al. (2022) and Hjorth and de Souza e Silva (2023) and Andrade and Nery Filho (2023). We then continued the process of forward citation chaining for these three articles but did not discover any new relevant studies. All three studies were published in journals by SAGE publishing. The entire literature search process is summarised in Figure 7.3.

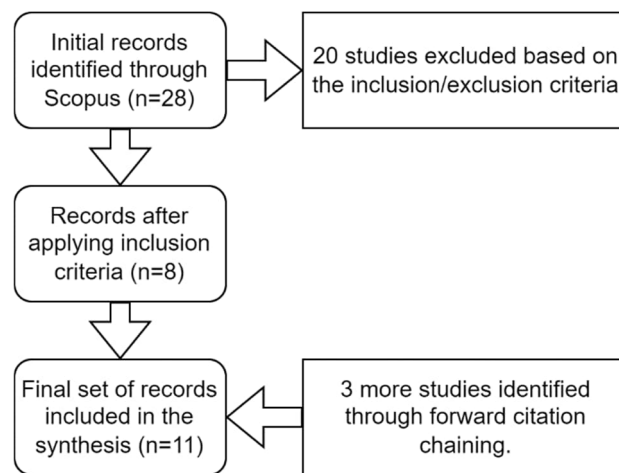


Figure 7.3 Summary of the Literature Search Process

To connect the academic literature with concrete events, we referred to the official websites of the LBGs dealt in the academic literature, such as the pokemongolive website (Pokémon GO live 2023).

Data extraction and analysis

We began the analysis of the sample of academic research (n=11), by reading through all the articles to familiarise ourselves with the studies. We noticed that all of them dealt with *Pokémon GO* to some degree, and many studies (e.g., Dunham et al. 2022; Ellis et al. 2020; Saaty et al. 2022) focused specifically on *Pokémon GO* alone. Thus, we adjusted our focus towards *Pokémon GO*, using it as an example for analysis and drawing from the other LBGs

to triangulate the findings and assist in understanding whether the findings within the academic studies are generalizable. We extracted information regarding the main research approach, whether the research was conceptual or empirical, study sample(s) (if relevant) and main findings. Regarding the two RQs, we recorded all the information from the studies that was related to LBG play during the pandemic. We made notes regarding the main findings and methods used to reach these findings. Finally, we extracted the limitations and future work sections from the studies, and processed the findings of this study and the limitations within, to derive the future research agenda for this topic.

As we read through the academic literature, we observed a dearth of studies concerning the aspect of returning to pre-COVID normalcy. While some works (Hjorth and de Souza e Silva 2023) discussed this matter, these studies were conceptual in nature rather than empirical. Regardless, the discovered studies offered a firm foundation for understanding how players reacted to the in-game pandemic changes, and a backdrop against which the subsequent struggles to return to pre-COVID normalcy can be understood. The literature search and data extraction processes were carried out by the first author, supervised by the last author, and commented on by the second author. All authors participated in data interpretation and sense-making regarding the final findings.

Findings

As stated, the discovered academic literature on LBGs during the COVID-19 pandemic (n=11) was overwhelmingly focused on the most popular LBG in terms of monthly active users and generated revenue, *Pokémon GO*. Furthermore, the studies mostly used *Pokémon GO* as a vehicle for understanding human behaviour during the pandemic times, as opposed to focusing on phenomena that would be completely unique to *Pokémon GO*. There was only one exception, a study which developed their own LBG and tested user reactions to that

(Chen et al. 2022). The studies drew mostly from data collected at the beginning of the pandemic (e.g., Ellis et al. 2020; Laato et al. 2020a; Laato et al. 2020b; Peaty and Leaver 2020; Jumareng et al. 2020) and during the pandemic (Andrade and Nery Filho 2023; Dunham et al. 2022; Hjorth and de Souza e Silva 2023). One study conducted a comparison of before the pandemic vs after the pandemic (Saaty et al. 2022) (see Table 7.2).

Study	Research Approach	Sample	Summary of Key Findings
Andrade and Nery Filho 2023	Understand through an online survey how players engage in LBGs during the pandemic.	74 Brazilian locative game players	Players were able to play remotely through multiple means. First, they could spend real money on remote raid passes in Pokémon GO, or similar features in other locative games. Second, they could also engage in location spoofing.
Bhattacharya et al. 2021	A 2-week diary study with Pokémon GO players regarding their experiences of play during the pandemic, followed up by co-design sessions.	11 North American players participated in the diary study and 10 participants in subsequent co-design sessions.	During the pandemic Pokémon GO players sought to maintain their connection to the community by shifting from in-person meetings more to asynchronous online communication. Many players relied on Pokémon GO for mental and physical health. LBG design could benefit from creating opportunities from social construction of space and accommodating multiple playstyles.
Chen et al. 2022	The work presents the design and preliminary evaluation of an LBG called MeetDurian.	18 student participants, 21 responses to a survey.	The LBG MeetDurian was successful in the preliminary evaluation in teaching about hygiene habits and understanding the COVID-19 pandemic counter measures. The designed game achieved these learning outcomes through an immersive design.
Dunham et al. 2022	Players interviews of their experiences of play during the pandemic.	30 Pokémon GO players.	The experiences of players can be broadly described within four themes: (1) socialisation around the game; (2) play with family and friends; (3) relationships to place and space; and (4) coping with the pandemic via LBGs.
Ellis et al. 2020	A mixed-methods survey approach probing players' physical and mental health during the pandemic.	A global sample (n=2002) of Pokémon GO players recruited through social media posts.	Players' physical activity decreased due to movement restrictions, and over half of the survey participants reported having poor mental health as measured by the WHO well-being index score. 77,2% of participants indicated that video games (not LBGs specifically) had a positive impact on their mental well-being during the pandemic.

Hjorth and de Souza e Silva 2023	An overview of the role and potential of LBGs during the COVID-19 pandemic.	A conceptual/theoretical study.	During the pandemic, various alternatives LBGs for Pokémon GO were designed, such as a “social distancing game” and a mobile game aiming to activate older adults and their pets.
Jumareng et al. 2020	An intervention group playing Pokémon GO vs a control group. Measured effects on physical activity.	94 teenagers from three high schools in Indonesia	Pokémon GO provided an effective means of promoting physical activity among teenagers in high school during the COVID-19 pandemic. In this study playing Pokémon GO significantly increased walking, moderate and even vigorous physical activity.
Laato et al. 2020a	A cross-sectional survey measuring the impacts of LBGs on socialising.	855 Finnish Pokémon GO players.	Intensive Pokémon GO players had a small but significant relationship with playing the game socially. Players who rated the pandemic as severe, and players who were accepting movement restrictions, were less likely to play Pokémon GO socially.
Laato et al. 2020b	Observation of changes made to LBGs due to the pandemic and players' reactions.	Reactions to social media posts (n=20). Raiding activity in Finland.	All observed LBGs made changes to their game, providing more affordances for remote play. LBGs impacted player movement during the pandemic also through changing the available raid bosses in game.
Peaty and Leaver 2020	Examination of how Pokémon GO changed during the COVID-19 pandemic through the lens of nostalgia.	A conceptual/theoretical study.	Pokémon GO served a purpose of being more than a game - a way of life. Much of the “ <i>Pokémon nostalgia</i> ” which Pokémon GO initially drew from, revolves around physical movement, in-person social relationships and outdoor exploration, all of which were negatively impacted by the pandemic.
Saaty et al. 2022	Reddit data scraping using Pushshift.io. Analysis with the LDA machine learning technique.	114076 pre-pandemic comments and 96620 post-pandemic comments on the r/pokemongo subreddit.	Social media comments could be viewed in three main topics: socialisation, exploration, and exercise. During the pandemic, players gravitated towards virtual rather than in-person socialisation. The pandemic moved the LBG experiences more from in-person towards the virtual, making LBGs resemble “traditional” non-locative video games.

Table 7.2 Summary of the Research Approach, Methods and Main Findings from the 11 Academic Studies Focusing on LBGs in the Pandemic Context

Several studies recruited participants through social media and ended up having global samples (Dunham et al. 2022; Ellis et al. 2020; Laato et al. 2020a; Laato et al. 2020b; Saaty et al. 2022). However, none of these samples were likely globally representative, due to the bias of collecting data through specific game-related social media channels. There were studies which collected data from one specific country, one from the USA (Bhattacharya et al. 2021) and one from Brazil (Andrade and Nery Filho 2023). Overall, the samples in all studies were skewed due to the recruitment avenues and methods. Thus, one future research avenue is testing the generalizability of the discoveries of the studies with globally representative samples.

Transformation of playing habits during the pandemic

The inductive work within the discovered studies offered ways to categorise the effects of the pandemic on players. Dunham et al. (2022) proposed four categories relating to (1) social play; (2) playing with one’s family; (3) relationships with place and space; and (4) coping with the pandemic. The social media content analysis of Saaty et al. (2022) went with three categories: (1) social play; (2) exploration; and (3) exercise; which echo the work of Peaty and Leaver (2020) who discussed the same dimensions in their conceptual study regarding the effects of the pandemic on Pokémon GO players. Partially overlapping between these two conceptualisations was that of Bhattacharya et al. (2021) who focused on (1) exploration; (2) health; and (3) social play. In addition, there were studies looking at more specific effects of the pandemic on LBG playing, such as a study focusing on the effects on physical and mental well-being (Ellis et al. 2020); and a study focusing on players’ intention to play LBGs socially despite encouragements for self-isolation (Laato et al. 2020a). We have summarised the areas of investigation in the extant literature in Table 7.3.

#	Effect Areas of the Pandemic and In-game Changes on LBG Players	Sources
1.	Social play, and socialisation	Andrade and Nery Filho 2023; Bhattacharya

		et al. 2021; Dunham et al. 2022; Laato et al. 2020a; Saaty et al. 2022
2.	Exercise and movement	Ellis et al. 2020; Jumareng et al. 2020; Laato et al. 2020b; Saaty et al. 2022
3.	Exploration	Bhattacharya et al. 2021; Peaty and Leaver 2020; Saaty et al. 2022
4.	Health, well-being and coping with the pandemic	Bhattachaya et al. 2021; Dunham et al. 2022; Ellis et al. 2020
5.	Place and space relationships	Dunham et al. 2022

Table 7.3 High Level Categories of Areas of LBG Play which were Impacted by the

Pandemic and Subsequent In-game Changes

Effects on social play and socialisation. Social play was the most discussed dimension among the discovered studies, being in the focus of empirical work in five studies (Andrade and Nery Filho 2023; Bhattacharya et al. 2021; Dunham et al. 2022; Laato et al. 2020a; Saaty et al. 2022) and mentioned in the others. First, it is critical to distinguish the effects of LBGs from the effects of government-imposed measures restricting social interaction. Governments were responsible for lockdowns, promoting or mandating the use of facemasks and encouraging people to stay in isolation (Farooq et al. 2021). There were restrictions to the number of people that could stay simultaneously in public places, and some businesses also set their own rules regarding social interaction. In this setting, it was natural that LBG developers also unanimously reacted by pivoting away from gameplay that require social interactions (Laato et al. 2020b). By doing so, LBGs enabled players to restructure and refocus their social LBG playing, not only from offline to online, but also from synchronous towards asynchronous (Bhattacharya et al. 2020; Dunham et al. 2022). While in the case of Pokémon GO some remote synchronous play opportunities, primarily remote raids were available from April 15, 2020, onward; much of the communication, chatter and banter that players had previously experienced in-person now switched to online forums, and WhatsApp, Telegram and Discord groups (Bhattacharya et al. 2021).

In summary, there were two key effects on players: (1) the switch from in-person playing to remote playing; and (2) the change from synchronous communication towards asynchronous. The switch to remote playing was partially forced by restrictions, and partially enabled by in-game changes to LBGs such as remote raiding (Dunham et al. 2022; Laato et al. 2020a) The partial shift from synchronous meetings towards asynchronous communication can be understood as a direct consequence of the lack of in-person meetings. The affordances of modern digital communication technologies nudge communication towards the asynchronous direction. These shifts created a new kind of social experience for Pokémon GO players, one Saaty et al. (2022) argue resembles more *traditional* video games and no longer makes best use of the locative elements of LBGs.

Effects on exercise and movement. Prior to the pandemic, the impacts of LBGs on exercise were one of the most studied research topics, with multiple literature reviews (e.g., Baranowski and Lyons, 2020; Khamzina et al. 2020; Lee et al. 2021) conducted on the topic. These studies indicate that LBGs such as Pokémon GO in general provide a significant increase in mild exercise in the form of walking, but do not increase moderate or strenuous physical activity. The work of Ellis et al. (2020) demonstrates that early in the pandemic players globally reported significant decreases in their physical activity, whilst reporting to play more video games. This makes sense as people were encouraged, or in some countries even forced to self-isolate (Farooq et al. 2021). Furthermore, as people in many professions and activities transitioned towards remote work and participation, daily activities such as commutes and travel become less frequent.

Interestingly, Laato et al. (2020b) showed that in countries such as Finland which have a low population density and had no restrictions on outdoor movement, players kept on participating in in-person raiding also during the early stages of the pandemic, even increasingly so than prior to the pandemic. This highlights how while on the global scale the

effects of the pandemic on LBG players' physical activity were largely negative, there existed differences between countries. Indeed, Jumareng et al. (2020) demonstrated that during the pandemic LBGs could be used to increase players' physical activity when leveraged to do so, and demonstrated this in the context of Brazilian students. Saaty et al. (2022) also note that there were differences in the impacts of the pandemic (and related in-game changes) on players in urban and rural areas, as well as between able-bodied and disabled players. To summarise, the effects of the pandemic changes on movement likely varied from region to region and player to player depending on a multitude of factors. The pandemic can be framed as a gigantic stir of the soup, where statistically players exercised less (Ellis et al. 2020) but there were significant individual differences that are worth considering.

Effects on exploration. Without externally imposed movement restrictions, exploration is one of the key implicit activities facilitated by LBGs (see e.g., Laato et al. 2022), but during quarantine, players were handicapped and could no longer move around at will. Saaty et al. (2022) and Peaty and Leaver (2020) both bring up exploration, arguing along these same lines that it is a central part of the experience, particularly in Pokémon GO. While not explicitly measured, there is circumstantial evidence within the 11 studies that the pandemic may have actually increased players' exploration of novel areas. The mechanism is that since many players transitioned to remote working, studying etc., they no longer travelled typical routine paths. Instead, they were freer to explore novel locations, and locations with fewer people. However, future research is needed to confirm this.

Bhattacharya et al. (2021) report on the findings of a co-design workshop on exploration, illustrating multiple ways in which Pokémon GO could be improved to better scaffold exploration. Among the suggestions were virtual exploration and the sharing of location history, presenting remote and asynchronous forms of exploration respectively (Bhattacharya et al. 2021). This demonstrates that while LBGs may prima facie be all about

in-person synchronous exploration, the pandemic provided a catalyst for reimagining exploration by utilising both asynchronous and remote mechanics, while still being tied to the core ideas of the genre.

Effects on health, well-being and coping with the pandemic. In the study of Ellis et al. (2020), more than half of the participants reported that they were suffering from poor mental health. While this may be alarming, descriptions of declining mental well-being were reported among the general population during the pandemic (e.g., Panchal et al. 2021; Samji et al. 2022; Vindegaard and Benros 2020) meaning this is not a problem specific to LBGs and Pokémon GO. In fact, a central theme in the work of Dunham et al. (2022) was that Pokémon GO offered players a way to cope with the pandemic. There were multiple mechanisms through which this occurred. First, Pokémon GO offered players goals to strive for and meaning. It was a fictional world where players could escape the worries of the world into. Second, Pokémon GO offered a structure to players' daily lives. There were certain tasks and activities players could do daily, and this structure was important to e.g., family-oriented players who now had a reason to leave their house. All-in-all, while players' mental well-being declined during the pandemic (Ellis et al. 2020), LBGs such as Pokémon GO continued to offer structure and meaning to players' lives.

Effects on place and space relationships. The only study in the sample that empirically explored space and place relationships specifically was Dunham et al. (2022). In their paper, Dunham et al. (2022) provide examples from player interviews demonstrating that in addition to quarantines and restrictions, players were restricted from going to public places through social unspoken rules. As players were hence restricted in their movement, their daily routines disintegrated, players found new ways and areas to play at. Dunham et al. (2022) highlight how people around the world experienced the changes differently. Some were completely denied from leaving their home for extended time periods while others were

freer to find exercise and solitude in new areas such as forest and nature. Ultimately, the pandemic significantly altered the way people experience their surroundings, and nudged some to find new elements and insights in the places around them.

Other effects and potential effects. There were two studies (Chen et al. 2022; Hjorth and de Souza e Silva 2023) which presented ad hoc new LBGs for addressing some of the pandemic concerns. These included LBGs for social distancing and exercise (Hjorth and de Souza e Silva 2023) and a game for improving players' hygiene habits (Chen et al. 2022). These studies demonstrate the versatility and potential of the LBG genre and show how both (1) behavioural, and (2) learning goals can be reached by combining elements intrinsic to the LBG genre such as movement in the real world with the intervention goals such as educational information about hygiene habits.

Understanding the reluctance to return to the pre-pandemic game mechanics

Many of the discovered studies (Bhattacharya et al. 2021; Dunham et al. 2022; Laato et al. 2020a; Laato et al. 2020b; Peaty and Leaver 2020; Saaty et al. 2022) highlighted the importance of in-person socialisation and physical activity for Pokémon GO players prior to the pandemic and showed that the movement and socialisation restricted imposed by governments fundamentally changed the status quo for LBG players. It is clear from Statista (2023) that players continued to play roughly the same amount during the pandemic, and hence, learned to structure their playing around the new mechanics and in-game rules. From previous research on consumer behaviour, we find that there is a cost, sometimes discussed as inertia or status quo bias, when switching from one way of operating to another (Talukder et al. 2021). Since we found from the literature that players are structuring their entire family

activities, exercise, social interaction among others (Dunham et al. 2022) around the game, this cost can feel huge to players. From this, we can form our first implication:

Implication 1: Players reoriented their playing around the new mechanics of the pandemic. The reversion of these mechanics would have required players to again renegotiate their playing.

Another factor explaining Pokémon GO players' reluctance to revert the increased stop interaction radius, is that the pandemic change made playing more convenient (Dunham et al. 2022). Prior research has shown that players sometimes change their movement patterns due to LBGs (Colley et al. 2017), but with a larger PoI interaction radius players were less often required to do so. This made playing while walking to a specific location smoother, and also helped players to play more optimally while in the company of other people. Thus, we form our second postulation:

Implication 2: Players were reluctant towards reverting those pandemic changes which made their playing more convenient.

Lastly, prior research has shown that Pokémon GO players are driven largely by a need to progress in the game (Alha et al., 2019). Many of the pandemic changes accelerated this progression. Furthermore, the increased Stop interaction radius enabled players to more easily stock up on Poké Balls, items that are needed to participate in the primary game loop of Pokémon GO which is catching Pokémon. If players run out of Poké Balls, they can purchase more with the in-game currency. This relates particularly to the dimension of exploration (Bhattacharya et al. 2021; Peaty and Leaver 2020; Saaty et al. 2022), since

stocking up on Poké Balls is often a requirement to go out into new uncharted territory such as nature trails. Thus, the pandemic changes offered players a concrete monetary benefit:

Implication 3: The increased PoI interaction radius offered faster progression which even in some instances could be measured in in-game currency.

On top of these three implications, it is worth examining briefly the reasons why players initially were more positive towards the pandemic changes. First, the quarantines and restrictions originated from governments, not LBG developers. Thus rage, if any, was directed towards governments and not LBG developers. In fact, the literature shows that LBG players were largely positive and accepting towards LBG developers' initial changes (Laato et al. 2020a). Second, the initial changes were justified by protecting people's health. Thus, there was a strong reason to make the changes. Third, as discussed, the changes made playing more convenient (increased stop interaction radius) and accelerated progression (e.g., remote raids). From here on, it remains a huge challenge for LBG developers to return back towards in-person interaction and synchronous communication, as noted by Hjorth and de Souza e Silva (2023).

Discussion

Implications of the findings

Our study has theoretical and practical implications on LBG design and on furthering our understanding of human behaviour during and after the pandemic. Next, we discuss these implications.

Regarding LBG design we summarise the key implications as follows. First, Pokémon GO players mostly play the game while they go about their daily real-world activities. It is

important to allow players freedom to move without the need to accurately navigate to specific locations. This suggests that the increased PokéStop interaction radius was a good design choice, even without the pandemic context. Second, the social elements appear significant to players throughout the academic literature on Pokémon GO during COVID-19 (see e.g., Bhattacharya et al. 2021; Laato et al. 2020a; Saaty et al. 2022), highlighting the importance of creating gameplay where players can meet each other for various meaningful activities. Third and finally, the progression-focused design of Pokémon GO (Alha et al. 2019) creates a dynamic where players are incentivized to arrange their playing in a way where they get to spin the most PokéStops, raid the most gyms and catch the most Pokémon, as opposed to focusing on, for example, the real-world environment or the game experiences. We argue that while goals and progression can be motivating, Pokémon GO and other LBGs should constantly try to also direct players' attention to the real-world environments, story and play.

Regarding the implications on human behaviour during and after the pandemic, our main contribution is offering a synthesis of the entire LBG research literature during this time. We contribute to the literature discussing “the new normal” (Barnett et al. 2021) after the pandemic by demonstrating the existence of friction towards reverting to the status quo that existed prior to the pandemic, and attributing this to changes that made people's lives more convenient. This study also offers perspectives on the literature surrounding games during the COVID-19 pandemic by elucidating the unique position that the LBG genre had among all video games.

Limitations and future work

The future research directions proposed in the 11 studies revolved largely around addressing the limitations of their work. Examples include studying the situation with other LBGs

besides Pokémon GO (Saaty et al. 2022), increasing the number of participants and other sampling methods for better reliability and for exploring cultural differences (Bhattacharya et al., 2021; Ellis et al. 2020; Laato et al. 2020a), improving the rigour of the research setting (Andrade and Nery Filho 2023; Ellis et al. 2020; Laato et al. 2020b) and simply studying the topics further with alternative methods (Dunham et al. 2022; Laato et al. 2020b). Taken together, it seems clear there are limitations in the extant research, and we summarise addressing these in future research in Table 7.4. Furthermore, there were also a few unique ideas arising from the research, which we also list in Table 7.4.

#	Proposed Future Research Direction	Source
1.	Explore hybrid LBG options that mix synchronous communication with asynchronous, and remote participation with in-person experiences	Saaty et al. 2022
2.	Further explore the mechanisms through which LBGs are used by players to cope with stressors in their lives and improve mental health.	Dunham et al. 2022
3.	Empirically test the implications derived in this study regarding players' reluctance to revert the pandemic changes	The literature review conducted in this study
4.	Study whether the pandemic increased players' exploration of new areas since they were freed from their daily routines to a degree.	The literature review conducted in this study
5.	There is a lack of research focusing on the transition from the pandemic situation back to normal in terms of LBGs	The literature review conducted in this study
6.	The findings in the discovered literature drew from samples recruited through social media. Future work should test whether similar findings emerge with other samples.	The literature review conducted in this study

Table 7.4 The Future Research Agenda on this Topic Based on the Literature Review

It is also important to note that players' expectations of what their game "ought to be like" are shaped by various external factors. For example, in the case of the Cyberpunk 2077 news agencies propagated hype for the game, and the lack of a critical attitude created unrealistic positive expectations, which then ultimately led to player dissatisfaction with the final product (Siuda et al. 2023). In the case of Pokémon GO players' response to rolling back the pandemic changes it is likely that social media and news agencies played a

significant role in shaping the narrative and story surrounding players' sentiments. Thus, we also encourage future research to focus on these aspects.

Conclusion

The key lesson to be learned from LBGs during the pandemic is that these games have become intertwined with players' social lives, daily routines and habits. For example, alterations to Pokémon GO forces players to reorient their lives, exercising and socialisation, and in some circumstances in-game changes can cause friction. Further negative sentiment when attempting to revert pandemic changes may have been caused by the fact that Pokémon GO players are primarily motivated by progression (see e.g., Alha et al. 2019) and rolling back pandemic in-game changes slowed down players' pace in achieving their goals. In other words, the initial changes were better accepted since they were both convenient and necessary for players. By contrast, the later attempts to roll back the changes meant the reintroduction of some inconvenience for the players. To mitigate players' reluctance towards rolling back features or even introducing new content, LBG developers could observe their players' lived experiences from the perspectives of convenience and the integration of playing into the players' daily lives. In practice, we propose to pay attention to particularly two things. First, location-based live service game developers should accept some of the "power creep" in their game and introduce new mechanics with slightly bigger rewards. For example, Pokémon GO developers could shift their attention to developing new mechanics that require in-person socialisation and exercise, as opposed to simply removing mechanics that do not. Second, location-based live service game developers should carefully consider whether some of the changes made to their game (such as the doubled PokéStop interaction radius in the case of Pokémon GO) improved the playing experience. Equally important is to

know when it is possible to get rid of mechanics that did not improve the playing experience for the overall player population in the long run.

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