Location-based Games as Exergames - From Pokémon To The Wizarding World

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Abstract

Exergames, i.e. games which aim to increase player's physical activity, are a prominent sub-category of serious games (SGs). Recently, location-based games (LBGs) similar to Pokémon GO have gained the attention of exergame designers as they have been able to reach people who would otherwise not be motivated to exercise. Multiple studies have been conducted on Pokémon GO alone, identifying positive outcomes related to, for example, exercise and social well-being. However, with substantial findings derived from a single game, it is unclear whether the identified benefits of playing Pokémon GO are present in other similar games. In order to broaden the understanding of LBGs as exergames, this study investigates the gameplay features and initial reactions of early adopters to a game called Harry Potter: Wizards Unite (HPWU) which was launched in summer 2019. A questionnaire (N=346) was sent to HPWU players to measure the effects playing the game has on their physical activity. During the first week of play, an increase in mild physical activity was recorded among HPWU players, similar to what has been reported with Pokémon GO. Also almost half of respondents (46,82%) reported to play the game socially, showcasing how LBGs can generally have a positive impact also on players' social well-being.

Keywords: Harry Potter: Wizards Unite, exergame, location-based game, Pokémon GO, exercise, social well-being,

1 Introduction

Exergames are a prominent sub-category of serious games (SGs) and are developed with the aim to motivate personal exercise [1]. By definition, exergames are more than just gamified exercise [2] and are defined as a combination of exertion and video games [3]. As technology has evolved and the use of mobile devices, mobile data and location signals have become ubiquitous, several location-based exergames have emerged [4–7]. Location-based games (LBGs) are mobile games where the user's physical location influences the game world. Typical examples of such games are *Pokémon GO*, *Harry Potter: Wizards Unite*, *Ingress (Prime)* and *The Walking Dead: Our World*. LBGs can be played solely on mobile devices, but can incorporate wearable technology as well [8]. These games are sometimes also referred to as pervasive games, mixed-reality games and location-based AR games (i.e. [9, 10]) among others. It can

be argued that LBGs are automatically AR-games, as they augment a virtual world on top of the paramount reality [11]. Therefore, in this study we simply use the LBG term.

One of the goals of several exergames is to provide players an additional layer of motivation to move [12, 13]. For example, multiplayer elements have been proven good at this as they can increase players' engagement in the game and consequently their playing retention [14, 15]. Exergames can also be used to guide users towards more meaningful and effective physical activities [16, 17]. On the other hand, players can get bored on individual exergames quickly before significant improvements take place. One countermeasure for this is continuously updating the game [18]. Another issue is that typically exergames are mainly played by those who already have a strong intrinsic motivation to exercise and are seeking ways to supplement or to enhance their physical activity [19, 20].

In 2017, Leblanc and Chaput [21] published a conceptual discussion arguing that LBGs, such as *Pokémon GO*, can help in the global inactivity crisis, as contrary to other games, the playerbase of the games includes people with no prior motivation to move or exercise [7]. *Pokémon GO* was called *"the most successful population level physical activity program in modern history"* [21]. In fact, many prior studies have reported playing *Pokémon GO* to increase players' physical activity levels [7, 22–29], reduce sitting time [22, 30] and provide incentives to travel to new places [10, 31]. Playing *Pokémon GO* has also been found to have a positive impact on social well-being [32–37], make people less anxious to leave their house [38] and can thus potentially help people with social withdrawal issues [36]. Whatever positive outcomes *Pokémon GO* does have, the impacts on society are amplified by the enormous popularity of the game, having quickly reached over 500 million installations globally after its launch [39].

Pokémon GO did not remain the only LBG of its kind, as afterwards similar games such as *Draconius GO*, *The Walking Dead: Our World*, *Jurassic World: Alive*, and *Harry Potter: Wizards Unite* (HPWU) have been released [40]. Yet, *Pokémon GO* remains the most studied game out of all LBGs with, for example, Scopus currently, as of 21st of August 2019, having indexed over 200 scientific publications with "Pokémon GO" in the title. There even exists meta-studies and literature reviews on *Pokémon GO* studies [41, 42]. Despite the huge number of research conducted on a single game, it is unclear whether the observed effects on physical activity of playing *Pokémon GO* are present in other similar LBGs.

The aim of this study is to derive characteristics of LBGs as exergames. Previously, some researchers have attempted to extrapolate their findings on *Pokémon GO* to cover other similar games [9]. However, practical evidence, that the results and theories developed by observing *Pokémon GO* players would translate to other similar games, is currently missing. To address this, the current study draws predictions from studies observing the physical activity of *Pokémon GO* players and uses the knowledge to form the hypothesis of the outcomes of other similar games. As a case study, *HPWU*, which was released in 2019, is observed. The game is an ideal comparison case as it is from the same developer as *Pokémon GO* and utilizes the same set of digital points of interest (PoIs) [43], but is clearly different in, for example, story, goals and multiplayer design. Accordingly, the following research question is formulated: *"How does a new LBG Harry Potter: Wizards Unite compare to Pokémon GO in terms of effects on physical activity?"*. Answering the research question will provide evidence towards a more generalized understanding of the characteristics of LBGs as exergames.

The rest of this paper is structured as follows: First, *HPWU* is compared to *Pokémon GO* with references to previous studies. Results of a survey sent to *HPWU* players (N=346), including the Godin-Shepard leisure time physical activity questionnaire [44], questions about player movement and social play, are then presented in the results section. This is followed by discussion and conclusions.

2 Comparison Between Harry Potter: Wizards Unite and Pokémon GO

In this section we analyze *HPWU* by comparing it to *Pokémon GO*. Readers unfamiliar with *Pokémon GO* or wishing to know more can refer, for example, to the following studies [9, 23, 24, 42, 45].

2.1 The Concept and Features of Harry Potter: Wizards Unite

HPWU is a location-based augmented reality (AR) game [9, 11] based on the Harry Potter franchise [46]. The game was co-developed by Niantic and Warner Brothers Games San Francisco [47] on top of Niantic's planet-scale real-world AR platform [48], which provides, for example, a peer reviewed global database of PoIs [49]. The PoIs represent real-world objects; however, similarly to *Pokémon GO*, *HPWU* includes only a subset of the PoIs available in the Niantic's database [43, 49, 50]. The chosen PoIs are transformed in *HPWU* into *greenhouses*, *inns* and *fortresses*, which are displayed on the game map user interface as seen in Figure 1 (left), with each type of building having its own unique functionality. In addition, *HPWU* has pseudo-randomly created PoIs labeled *traces* and *ingredients*, which, unlike PoIs based on real-world objects, appear and disappear quickly. Players can click traces to initiate minigames where they need to cast spells (Figure 1, right). Completing traces yields the player collectible items, which, in addition to expanding the players collection, are used to level up and to improve the player's character. These elements of collection and player progression have also been identified as the primary motivator for players to keep playing *Pokémon GO* [45, 51].

Clicking traces in the *HPWU* world map initiates a minigame where the player is tasked to draw a spell on the screen as quickly and accurately as possible. After a spell is cast, based on a server-side determined probability, the spell either succeeds or is resisted. Figure 2 (left) depicts the message that is displayed when *HPWU* players need to recast their spell. As a rule, the more common trace encounters have a higher chance of succeeding, whereas rare and powerful encounters often require multiple attempts to resolve. This draws obvious parallels to *Pokémon GO* and the ball throwing minigame [28]. Randomness and keeping the brain guessing have been linked to sustained player interest [52], and reusing the same effective psychological formula of *Pokémon GO* in *HPWU* should therefore provide similar positive effects on sustaining player engagement in the game. This choice, however, may have a negative impact on exercise, as players are forced to halt walking and wait for the magic animations to end in order to see the outcome of their spell. *Pokémon GO* players who were observed on a Greenway walking course for one hour and compared to non-players, were found to stop more, and the exercise they completed was not as effective as that of non-players' [53]. Arguably this phenomenon is amplified in *HPWU* were the animations last significantly longer.

In addition to travelling to PoIs and interacting them, *HPWU* offers a variety of other gameplay features. One of these is opening *Portkey Portmanteaus*, which can be found on the ground whenever the player has room for them in their inventory. This gameplay feature is movement-based, as Portmanteaus require 2km, 5km, 7km or 10km of walking in order to open. This feature is similar to hatching eggs in *Pokémon GO*, and movement-based exergames such as *Zombies, Run!* [54]. The game also contains things to do while stationary, including a potion-brewing minigame, glancing through collections, inventory management and customization options for the player's avatar and profile. All the game activities are tied to the Wizarding World created by JK Rowling, boosting the immersive effect of the game [55]. Even though the story and the world behind the game are completely different from *Pokémon*

Figure 1: *Two screenshots from HPWU*

Figure 2: *Screenshots from HPWU showing the trace minigame and a progression pop-up*

GO, the games share a lot of similarities in their design. These similarities include:

- Main UI based on a real world map

- Main gameplay consists of navigating to PoIs
- Spawns/traces trigger an encounter minigame
- Walk to hatch/open things
- Friend lists
- Lures and dark detectors
- Multiplayer, shared game world with others
- Daily tasks and special tasks
- Inventory management
- Challenge raids/fortresses with friends

2.2 Why People Play Location-based Games

Even though there are many observed health benefits in playing *Pokémon GO*, few studies have linked these positive effects to concrete game design decisions. Alha et al., [45] and Rasche et al., [51] look at why people play LBGs by dividing the problem into three categories: (1) reasons to start playing (2) reasons to continue playing, and, (3) reasons to stop playing. In order to evaluate the sustain of health benefits of playing LBGs, the most interesting part to understand is why players keep on playing LBGs. Both studies found that a sense of progression was the highest contributing factor in why players kept on playing *Pokémon GO* [45, 51]. However, Alha et al., [45] list 11 additional general reasons why players keep on playing LBGs, which can be further split into smaller segments. This speaks of the complexity of the motivational issues, and simplifying motivational theories too much, especially on intrinsic motivation, can be harmful for the understanding of the phenomenon [56]. Also other approaches have been used to explain player engagement in LBGs such as intentions to reuse and gratifications derived from playing [9].

2.3 The Role of the Brand

Harry Potter and Pokémon are both huge global brands, however, they are quite different from one another, providing different story elements and affordances for immersive gameplay [57]. The Pokémon franchise is all about traveling from place to place by foot, collecting Pokémon, and continuously meeting new people [58]. The main target audience of the brand is young people [59]. However, as evident with *Pokémon GO*, a big proportion of the players are adults [45]. The Wizarding World of Harry Potter does not share all these characteristics, as the story concentrates on the school of Hogwarts and does not really promote any sort of physical exercise [46]. Therefore, it is likely that the brand and the story behind *Pokémon GO* seems to spur people to exercise more effectively than the Wizarding World, thus, *HPWU* might not offer as strong an incentive for players to walk long distances as *Pokémon GO*.

2.4 Differences Between Social Features and Motivation for Exercise

Social elements in games can foster relationships [60–62] and also provide incentives for exercise [2]. With regards to social features, what is interesting is the omission of player vs player conflict in *HPWU*. Firstly, there are no teams unlike in *Pokémon GO*, and secondly, all multiplayer elements can be classified as harmonious. This kind of a design prevents the birth

of ingroup and outgroup thinking and emergence of prejudice towards other players [61, 63–65]. On the other hand, the game might lack some of the motivational factors caused by the challenge given by having human opponents [9, 45, 62].

Evidence was found that *HPWU* emphasizes physical activity less compared to *Pokémon GO*. *Pokémon GO* awards walking over 50km during a week, whereas *HPWU* has a daily task of walking 250m, accumulating to 1.75km during a week. Additionally, the trace encounter animations in *HPWU* are longer than the animations of *Pokémon GO*, and the animations can be prolonged by magic resisted messages shown in 2, thus forcing *HPWU* players to stop more while playing.

Table 1: *Comparison of the game mechanics of Pokémon GO and HPWU motivating physical activity and social interaction*

	Harry Potter:Wizards Unite	**Pokémon GO**
Game Mechanics Motivating Physical Activity	-Walking to open portmanteaus -Travelling to PoIs -Rewards from walking certain distances	-Walking to hatch eggs -Travelling to PoIs -Rewards from walking certain distances -In-game research tasks and events that encourage to travel to new areas -The in-game scanner showing nearby Pokémon encourages to travel to them
Game Mechanics Supporting Social Play	Fortress battles, friendlists	trades, communicating spawns, PvP battles, friendslists, gifts, gyms, raids

Table 1 summarizes the information discussed above into the game mechanics in *HPWU* and *Pokémon GO* for motivating physical activity and social interaction. The two games are almost identical by technical implementation, which is unsurprising as they are based on Niantic's platform [48]. Both games share many of the same PoIs, however, there is more variance on where traces (*HPWU*) and Pokémon (*Pokémon GO*) spawn. Even though the minigames are different from one another (i.e. catching Pokémon versus spellcasting) they are both played by swiping the screen with one finger. This simple interaction makes physical exercise easier; the design decision to allow playing with only one hand is undoubtedly intentional, allowing players more focus to the real world instead of the screen. The main differences between the games seem to be on the intensity of the supported physical activity and on the affordances for social interaction. While *HPWU* has fewer game mechanics supporting social interaction, the game has no divisive teams nor mechanics which allow players to harm each other in the game world unlike *Pokémon GO*. Still, both games have a shared game-world with activities that motivate cooperation. These include lures/dark detectors, fortress battles/raid battles, and sharing trace/Pokémon spawn information. It is therefore beneficial for players to get in touch with other players. This leads to players forming chat groups and meeting each other in real life to play the game, thus potentially creating real life friendships.

2.5 Extracting Characteristics of Location-based Games as Exergames

Based on studies on *Pokémon GO*, scholars have been able to make several predictions of what the characteristics of LBGs which revolve around navigating to points of interests via

using smartphones, such as *Pokémon GO*, *Ingress (Prime)*, *The Walking Dead: Our World* and *HPWU*, are. These characteristics are listed below with references:

- Playing increases mild exercise [7, 66]
- Can be a gateway for exercise for inactive people [7, 21]
- Provides multi-layered motivation for exercise, including in-game rewards and social features [9, 45]
- Playing can be integrated as part of daily commute and other travelling [49, 67]
- Shows promise of other health benefits besides exercise, such as social well-being [33, 37]

The current study focuses on LBGs as exergames, and thus, the first prediction is used to form the hypothesis that *HPWU* should also increase mild physical exercise for its players, but not moderate or strenuous exercise [7, 42, 66].

3 Survey Design

In order to empirically measure the impacts that playing *HPWU* has on exercise, a questionnaire was designed including the Godin-Shepard leisure-time physical activity questionnaire [44], which has also been utilized in studies with *Pokémon GO* [51, 66, 68], questions concerning how players move while playing LBGs, some questions about social play and several background questions. Altogether the questionnaire contained 17 questions. The Godin-Shepard pre- and post-test results were analyzed using the paired samples T-test. Other data is presented as descriptive statistics and graphs. The questionnaire was written in Finnish, but an English translation of it is available in Appendix A.

The questionnaire was sent to Finnish *HPWU* players a week after launch, and was available online between the 28-29th of June, 2019, and received 346 acceptable responses. Player anonymity was protected and all research data was safely stored at secured hard drives and is available in anonymized form upon request. The principles of the Declaration of Helsinki [69] were followed in data collection and handling, and only those participants who gave consent to use their data in research were included in the study. The platform through which the questionnaire was sent took technical measures to prevent the same person from answering twice.

4 Results

A total of 346 players in Finland responded and fully completed the questionnaire. Table 2 shows the gender and age distributions of the participants.

Among the respondents, 99% (n=343) reported to have played *HPWU* and 96% (n=333) to have played *Pokémon GO*. Many other games were present as well, which shows that LBG players are likely to try out new games of the genre with similar gameplay, e.g. such which includes walking and navigating via a real map -based interface. The results are shown in Table 3. The large proportion of *HPWU* players who had also tried playing *Pokémon GO* (96%) highlights the fact that LBGs seem to attract a certain group of people and previous experiences with LBGs can be a predictor of future engagement in the games of that genre. This is further supported by findings from previous studies. For example, the study of Alha et

Table 2: *Descriptive Statistics*

Gender	Number of participants	Percentage
Female	271	78,3%
Male	68	19,7%
Other	7	2,0%
Age		
Less than 18	2	0,6%
18-24	38	11,0%
25-34	161	46,5%
35-44	85	24,6%
45-60	57	16,5%
Over 60	3	1,0%

Table 3: *Which LBGs have you played?*

	n of replies)	Percentage
Harry Potter: Wizards Unite	343	99,13%
Pokémon GO	333	96,24%
Ingress	124	35,84%
Jurassic World: Alive	64	18,5%
Draconius GO	61	17,63%
The Walking Dead: Our World	50	14,45%
Landlord Tycoon	6	1,73%
Other	24	6,94%

al. [45] found that the main reason for players starting to play LBGs was previous experiences with either the brand of the game or other similar games.

When respondents were asked what LBG they have played the most during the first week after the *HPWU* launch, only 85 % replied *HPWU*. The 15% of players quickly after trying the game moved back to other LBGs with 10% playing more *Pokémon GO*, 3% playing more *Ingress* and 1% of players going back to *Jurassic World: Alive* and *The Walking Dead: Our World*. Consequently, 91 % of players reported to have played *Pokémon GO* simultaneously with *HPWU*, 20 % reported to play *Ingress* simultaneously with *HPWU*, and 5 % reported to play *The Walking Dead: Our World* simultaneously as shown in Figure 3. These results provide further evidence that a social group is forming among these games that goes beyond a single game, that is, LBG players. These are people who gravitate towards LBGs and play several games, jumping to new games as they are released and communicate with other players via already established social networks of players.

4.1 Effects of HPWU on Physical Activity

Interestingly, when those who also play *Pokémon GO* were asked to compare the two games and their effect on physical activity, 46 % replied to move more with *Pokémon GO*, 31 % saw no difference and 23 % said to move more when playing *HPWU* as seen in Table 4. The slight preference for *Pokémon GO* can be explained by the game providing wearable devices to allow playing without having to look at smart phone screen all the time, but also by the faster tempo of Pokémon GO gameplay.

In the question about player's primary method of moving while playing, 75 % responded "walking", whereas 17 % responded a primary moving method which does not include exer-

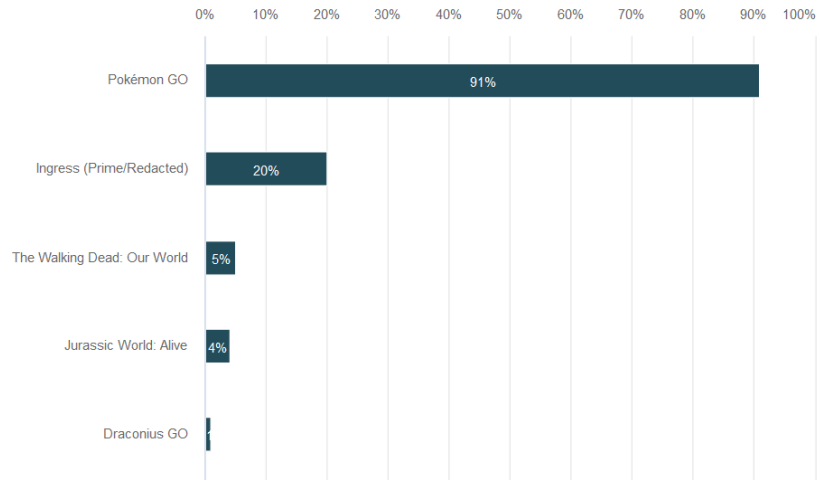

Figure 3: *What other LBGs do you play simultaneously with HPWU?*

Table 4: *When comparing HPWU and Pokémon GO, which game causes you to exercise more?*

	n of replies)	Percentage
Pokémon GO	149	45,29%
HPWU	75	22,8%
No difference	105	31,91%

cise (i.e. "by car" and "stationary"). Previous studies have identified the exercise that LBGs provide to be mainly mild (walking or cycling) [7, 41, 42, 68], however, these results indicate that there is also a relatively large proportion of playing which happens while being stationary. This can either happen, for example, as a passenger in public transport or by playing while sitting at home. Thus, not all LBG play can be considered being exercise, even though players who primarily play while stationary might still occasionally exercise with the game.

Table 5: *Godin-Shephard leisure time physical activity questionnaire results (N=312) for change in physical activity before and after playing Harry Potter: Wizards Unite*

	Mean (Pre)	Mean (post)	Sig. 2-tailed
Mild	8,019	10,503	P<0,001
Moderate	2,854	2,929	P=0,804
Strenous	0,413	0,423	P = 0,918

Godin-Shepard leisure-time physical activity questionnaire measures the number of times people exercise for more than 15 minutes during a 7-day period [44]. The questionnaire categorizes physical activity to mild, moderate and strenuous, and gives examples of multiple kinds of forms of exercise and to which category they belong to. In the current study, the questionnaire was adopted by asking players to fill in their typical week of exercise before *HPWU*, and their current week after the launch of *HPWU*. A 2-tailed paired samples T-test was then used to calculate the effects *HPWU* has had on players physical activity during the first week after launch (Table 5). Mild exercise i.e. casual walking increased by 23,7 % for *HPWU* players. Moderate and strenuous exercise had no statistically significant change. The results on the increased mild exercise are aligned with previous *Pokémon GO* studies [7, 42, 66, 68, 70, 71].

Table 6: *Compared to your normal walking speed, how does playing HPWU influence your movement?*

	n of replies)	Percentage
I walk as fast as always, or faster	28	8,09%
A little bit slower	116	33,53%
Half slower	52	15,03%
I have to stop all the time	150	43,35%

Despite the observed increase in mild exercise, also a seemingly contradicting result was given when asking participants about their walking speed while playing *HPWU* shown in Table 6. Almost half (43,35%) of respondents replied they need to stop all the time while playing and only 8,09% said to walk equally fast or faster. This would indicate that compared to regular exercise, *HPWU* actually has a negative effect. A similar result was also observed in a study of *Pokémon GO* by Beach et al., in 2019 [53]. Thus, when out exercising, it would seem to be better not to play LBG such as *HPWU* or *Pokémon GO*. On the other hand, if the option is to remain at home, LBGs can be the healthier option as they provide at least some exercise.

4.2 Effects of HPWU on Social Interaction

As only the early adopters of *HPWU* were observed, the effects the game has on social interaction could only be lightly touched. The social interaction with other players has been in major role in Niantic's past LBGs, *Ingress* and *Pokémon GO*. However, in *HPWU* playing with friends did not give major advantage in the early players' levels. Thus, the result seen in Table 7 that 53% players play *HPWU* alone is not surprising. In *HPWU* when leveling up, playing with the friends will eventually give some advantage in fortress battles, but overall adding friends and playing with them does not have as an important role in *HPWU* as it does in *Ingress* and *Pokémon GO*. Yet, social interaction overall with other LGB players has created communities around the games and this could also be seen in *HPWU* – Players do have their own online forum, Telegram and Facebook groups where they can discuss the issues related to the game.

Table 7: *With regards to social company, how do you play HPWU?*

	n of replies)	Percentage
Always with my friends	5	1,44%
Mostly with my friends	55	15,90%
Every now and then with my friends	102	29,48%
Almost always alone	184	53,18%

Based on the frequent update cycle of *Pokémon GO* and other popular contemporary multiplayer online games, it can be speculated that *HPWU* could receive updates in the future adding more social features and rewards from cooperative play. The current results of social play, shown in Table 7, are most likely influenced by players' prior connections, as an overwhelming majority of the respondents reported to have prior experiences with LBGs. Most players also reported to simultaneously playing at least one other LBG in addition to *HPWU*. On the other hand, one peculiar property of LBGs is that as players move outside, they encounter people, prompting interactions with people who are not playing. Thus, a generalized statement can be summarized that playing *HPWU* outside does, at least to some degree depending on the social attitude and playing location of the player, increase social well-being.

5 Discussion

5.1 Key Findings

Observations made from the survey can be summarized in the following three points:

1. With regards to physical activity, *HPWU* showed a statistically significant increase in mild exercise but no change in moderate or strenuous exercise. However, when playing *HPWU* players moved slower than normal.

2. With regards to social activity, almost half of respondents reported to at least sometimes play the game socially. Furthermore, *HPWU* made players play in the real world, thus affording spontaneous interaction with bystanders who are not playing the game.

3. The results are aligned with studies on *Pokémon GO*, and, thus provide evidence towards a more general characterization of LBGs as exergames.

5.2 Implications of Findings

Despite differences in story and some differences in gameplay and implementation, *HPWU* and *Pokémon GO* are currently much alike. Together with games such as *Jurassic World: Alive*, *The Walking Dead: Our World*, *Ingress*, *Orna* and *Draconius GO*, the games have formed their own sub-genre of LBGs which uses a real life map as a navigational interface and main game window. The empirical evidence from the survey indicates that the several studies conducted on the effects *Pokémon GO* has on physical activity levels translate to other LBGs. However, the magnitude of the effects on physical activity can vary. Because LBGs seem to increase mild exercise, they have been proposed as a gateway to a physically active lifestyle, which can be especially important for those who have no prior motivation to exercise [7, 21]. Therefore the role of LBGs as exergames can be seen that of promoting light, casual exercise.

But even though we are discussing exergames, there are many connected potential benefits of playing LBGs besides exercise such as social well-being and being a healthy outdoor activity. Almost half of the respondents reported to sometimes play the game socially. The social features of *HPWU* and *Pokémon GO* are currently quite different, and thus, some of the studies on the social aspects of *Pokémon GO* are unlikely to translate to *HPWU* [33, 37, 61]. The social effects of *HPWU* were also difficult to observe on their own, as an overwhelming majority of *HPWU* players reported to have played or were still playing *Pokémon GO* and other LBGs. This indicates that many of the new *HPWU* players were already connected with each other via experiences with previous LBGs.

The social interaction that LBGs support can have value on its own, but it can also be a motivating mechanism for exercise [2]. This is important, as a common challenge for exergames is how to maintain user interest [12]. *Pokémon GO* studies reported players' initial enthusiasm diminishing over the course of a time period of one month [25, 70]. This can be countered to some degree by updating the game [18], but completely new LBGs such as *HPWU*, which we focused on, can also have a role in rekindling the motivation to move in players. The majority of LBG players seem to prefer *Pokémon GO* over *HPWU*. There was big hype for the game, as the initial report showed *HPWU* created 28 million dollars during the first four days after launch, which has since quickly shrunk to a couple of million dollars per month [72]. When compared to the 180 million dollars *Pokémon GO* made at launch and the tens of millions it is still making over three years later, it is evident *HPWU* never managed to reach the popularity of *Pokémon GO* and is also losing interest more quickly. Besides revenue generated via in-app purchases, the amount of downloads and active installs show the success of *Pokémon GO* compared to *HPWU*. There are multiple possible reasons for this,

including: (1) Affordances of the brand (2) Better utilization of PoIs (3) Pokémon GO has faster-paced and more fluent gameplay (4) *Pokémon GO* has the possibility to use wearable devices (5) *Pokémon GO* provides more diverse gameplay opportunities (6) *HPWU* requires a high-end smartphone to work at all (7) *HPWU* lacks competitive multiplayer elements and thus challenge (8) *HPWU* minigames force players to halt walking with long animations and constant "magic resisted" messages (9) *HPWU* is more aggressive than *Pokémon GO* in marketing in-app purchases and (10) *HPWU* has monetized the basic gameplay, forcing players to purchase spell energy in order to play unless they live next to inns. These theorized reasons could be further explored in future work, as it is interesting how two seemingly similar games can be received so differently by players.

5.3 Limitations

Many studies have extrapolated findings on single LBGs to consider a larger set of LBGs [9, 45]. This study compared two similar games and provided evidence supporting this extrapolation. However, there are multiple aspects this study did not cover and as games tend to be unique and highly complex. For example, the gameplay experience and flow experience have been mentioned in previous studies to impact engagement [12]. Most likely studies of individual games will always be needed regardless of identified general characteristics of the game's sub-genre.

The survey this study conducted also had its own unique limitations. Firstly, the participants most likely represent early adopters and enthusiasts, and are not as such representative of the overall playing population. In addition, longitudinal studies are needed, as have been conducted with *Pokémon GO* [24], as studies have found beneficial effects of *Pokémon GO* on physical activity to decrease [73], or even completely diminish [70] over time. The respondents were self-selected and an extremely large proportion (over 95%) had played *Pokémon GO* before, which might also be caused by the distribution channels chosen for the survey. Because of this, for example, the activating effects and sense of novelty [74] in playing LBGs might have already been used up by *Pokémon GO*.

The self-reported nature of the questionnaire arguably makes it less reliable than sensor data-based information, however, in studies of *Pokémon GO*, both questionnaire data i.e. [51, 68] and sensor data i.e. [7, 29] have been utilized with similar results. Finally, as LBGs are subject to be updated with new features, findings which are specific to a certain version of the game (i.e. *HPWU* release version in this case) might become outdated at some point. The large proportion of female (76,7%) participants in the survey was peculiar, however other LBG studies have also had a female majority in participants [23, 45]. Then again, other studies reported roughly equal numbers of male and female players [28]. The large number of female participants can also be explained by the chosen questionnaire distribution method.

5.4 Future Directions

Health and welfare sector practitioners looking for exergames to activate physically inactive individuals can look for solutions from LBGs beyond *Pokémon GO*. Meaningful multiplayer gameplay seems to be important for player retention in LBGs, as evident from studies observing why people play LBGs [9, 45]. The games currently seem to support mild exercise, thus, an important topic for future research will be to come up with gameplay that supports also strenuous physical activity and other forms of exercise besides walking. To that end, it is important to reflect in which other ways than those currently present in *HPWU* and *Pokémon GO* could LBGs incorporate exergame attributes in their design. Hence, four strategies are proposed:

- Look into what other similar games have done. For example, *Zombies, Run!* has sound-based gameplay which is ideal for running and interval practise [54].
- Derive inspiration from what personal trainers and physiotherapists are utilizing and try to gamify or adapt the used approaches to fit the currently available exergames. For example, currently the games mainly feature walking as the form of physical activity. Could some gameplay be created that supports muscle training? An example of this could be fitness boxing games or the new Nintendo Switch game *Ring Fit Adventure* [75].
- Look at the affordances of the brands and franchises in question. For example, a major part of the Pokémon franchise is throwing pokéballs. Yet, this is not harnessed in the game design of *Pokémon GO*. If incorporated, it could provide opportunities for gameplay which provides muscle training.
- Use design techniques such as co-design with stakeholders to come up with new inspiring gameplay [76].

6 Conclusion

The aim of this study was to derive characteristics of LBGs as exergames. This was investigated by comparing the effects of playing *Pokémon GO* on physical activity to another similar game, *HPWU*. The launch of the game in 2019 provided a unique opportunity to measure before and after physical activity levels of players. 346 *HPWU* players responded to a survey and a statistically significant increase in mild physical activity (23,7%) was observed via the Godin-Shepard instrument. The increase in physical activity was similar to that which was observed at the launch of *Pokémon GO* in 2016. This indicates that similar LBGs, not only *Pokémon GO*, can be regarded as games playing of which increase and support mild physical exercise i.e. walking or slow cycling. Furthermore, the results revealed that almost half of the players were playing the game socially with others. One important benefit of LBGs such as *Pokémon GO* and *HPWU* seems to be that of a gateway towards exercise and social life for physically and socially inactive people. For others, they provide a healthy and fun social outdoor activity.

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