



Gamification of walking in nature: A field experiment with Pokémon GO Routes

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There are numerous benefits from regularly walking in nature, and today's mobile technologies have the potential to encourage people to do so. Past research has showed that gamified map-based apps and location-based games (LBGs) have the capability to incentivize people to go to nature areas in cities and beyond. In this study, we explored LBGs' potential to bring people to nature by conducting a field experiment with a new mechanic called Routes in the popular LBG Pokémon GO. Prior to the Route feature's launch, we created altogether 13 Routes of various lengths in both city and nature landscapes. We collected numerical in-game data of how many times each Route was walked and deployed a survey ($n=67$) for Pokémon GO players in the area where the Routes were made. The findings suggest that proximity to population concentrations and in-game rewards are key drivers of Route popularity. Players' motivators to choose nature Routes over urban Routes were limited to outside-the-game factors such as scenery, and overall in our experiment the urban Routes turned out to be more popular.

CCS Concepts: • **Human-centered computing** → **Ubiquitous and mobile computing**; *Collaborative and social computing*; Interaction design; • **Information systems** → Geographic information systems.

Additional Key Words and Phrases: Gamification, mobility, nature, forests, Pokémon GO, Routes

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1 Introduction

Today, the majority of humans live in densely populated areas. According to The World Bank [9] and Our World in Data [70], roughly 4.4 billion people (more than half of the entire human population) live in cities. The trend of cities growing in population, discussed as urbanization [70, 84], is expected to increase until the year 2050, at which point roughly 70% of all humans will live in densely populated urban areas [9]. The difference between cities and rural areas is even greater

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when observing the gross domestic product (GDP), where cities today are responsible for as much as 80% of the global GDP [9]. The urbanization trend brings multiple challenges, such as availability of housing, road infrastructure to support the increasing (and changing forms of) traffic, having basic services for the growing population and so forth [9]. These issues are amplified by the cost and difficulty of changing existing land use patterns of a city. In fact, most large cities today have grown organically and the land use plans were not originally designed to cater to the millions of people that live in cities today. Research on forest-bathing, attention restoration theory and stress reduction theory suggests that the lack of nature scenery in people's daily lives might contribute to increased stress levels and attention deficits [5, 31, 52, 63, 80, 81]. Since the physical shape and form of cities is difficult to change, this turns our attention to how we could alleviate the rising issues of e.g., (1) lack of nature and natural elements; and (2) residents' sedentary behaviour; with other solutions, such as behavior change support systems [1, 64], extended reality exergames [34, 35] and location-based games (LBGs) [4, 14, 42] that subtly nudge users towards healthier, more sustainable behavior patterns.

Assuming based on previous research, that spending time in nature and areas with nature scenery are beneficial goals [31, 52, 63], in this study, we focus on the motivational force of LBGs to impact players' mobility patterns and moving to and in nature. LBGs are a genre of mobile gaming where the user's physical location is a central part of the gameplay [16, 65, 71]. Examples of popular LBGs include Pokémon GO, Jurassic World Alive and Dragonquest Walk [79]. These games have been studied, for example, as interventions for physical inactivity [4, 30], as they motivate mild exercise and incentivize people to leave their houses [10, 11, 37, 40]. They have been shown to have potential to foster people's nature connections [73, 74] by directing players to nature and simply prompting them to spend time outside [42]. Since LBGs have the potential to influence people's mobility patterns [14], the games are an interesting research target for (1) understanding the motivational dynamics related to moving to nature; and (2) designing behaviour change interventions for boosting nature visits and healthy walks in nature scenery. Relatedly, the field of research on gamification [29, 56] (i.e., the application of elements typically found in video games in non-game contexts) provides a theoretical lens through which to look at the motivational processes relating to LBGs' impact on travel to nature. Hence, we can consider LBGs as gamified mobility apps [23, 39].

Previous research has suggested that the in-game distribution of points of interest (PoIs) and playable content in LBGs favors cities and populated areas instead of rural nature areas [8, 33]. This has been attributed to the PoI criteria which focus on human-made objects [8, 33], but perhaps more importantly, players tend to move and play where they live and work, and LBGs have by and large adopted designs that support players' lives as opposed to trying to alter them [42]. In 2023 a new feature was added to Pokémon GO called Routes [62], which are paths that can be created by players, to (almost) anywhere. Now with the removal of the restrictions set by PoIs (Routes have to start and end to an in-game PoI, but can otherwise be anywhere), players could start expanding the playing area to rural nature areas and beyond. However, as most people live in cities, directing huge populations regularly outside city borders for nature walks might be counter-productive. There is in fact a lot of "nature" and "greenery" in most modern cities [86] such as parks (e.g., Hyde Park in London, UK or Central Park in New York, USA), and trees near side walks and river banks [68]. Since players can also enjoy nature within cities, in this work we created Routes of varying lengths to areas within and outside cities, some featuring nature and some urban scenery, and studied players' Route walking patterns and preferences. To guide this research, we propose the following research questions (RQs) to guide our study:

RQ1: *Do the physical landscapes (urban vs nature), Route length and proximity to the city center impact the popularity of Routes in Pokemon GO?*

RQ2: *What elements are important for players when thinking of creating and walking Routes in Pokémon GO?*

In order to address the two RQs, we created Routes to Pokémon GO in the aforementioned fashion in June 2023 in anticipation to the Route feature's launch. We followed numerically how often the Routes were walked from within the Pokémon GO app, and sent a survey (N=67) to those players who had been walking these Routes. With this research empirical research setting we contribute to the human-computer interaction (HCI) research on gamified human mobility and offer new insights into whether and how we could motivate people to spend more time in nature areas.

2 Background

2.1 Location-based gaming

Over the years we have seen various LBG designs. Currently the most popular LBGs are all massively multiplayer online games which focus on progression and the accumulation of statistics [79]. We can divide these LBGs further into two categories. First, we have games where POIs are distributed (pseudo-)randomly across a map interface and second, we have game where they correspond to real world objects [8]. Now discontinued games such as Draconius GO [17], The Witcher Monster Slayer [77] and The Walking Dead Our World [58] were examples of the former, and Pokémon GO [61] and Ingress [59] are examples of the latter. Already in 2015 prior to the launch of Pokémon GO, Moore show that Ingress (an LBG where the game POIs are tied to real world objects) re-purposes the real-world objects and attach additional meaning to them, effectively creating gameplay experiences that are connected to objects and events in the physical world [55]. Thus, locative gaming does not remain isolated from the practicalities and arrangements of the physical world, resulting in "hybrid play", where the game field and the playing environment jointly create the playing experience [44, 55].

Pokémon GO remains the most popular LBG to date. The game can be seen to have roots in two streams of developments. First, the Pokémon franchise has a long history of experimenting with narrative and practical elements relating to play in the physical world [7]. For example, the very first games in the franchise (Red/Blue/Yellow, released in Japan in 1996 [24]) were made for the handheld Nintendo GameBoy console and included elements such as link cable trading that required players to travel to each other physically to perform the in-game action. The second generation of Pokémon games included a mystery gift mechanic, requiring players to place their GameBoy Color devices against to each other to get a daily free gift. Later, Pokémon Soul Silver and Heart Gold [25] (released in 2009) were shipped with a device called Pokéwalker, which was essentially a digitally augmented pedometer counting steps and encouraging players to go out for walks to level up their pokémon creatures [45]. The second stream of developments, which was at first disconnected from the Pokémon franchise, relate to LBG design solutions. Once smartphones, mobile data and satellite navigation services had become available for consumers, games such as Shadow Cities [27] and Ingress [59] emerged. These pioneer products paved the way for the LBG design solutions and game infrastructure that were the foundation for the massively multiplayer online gameplay of Pokémon GO and similar games [47, 48]. The fusion of these two streams of development resulted in a massive success, and Pokémon Go has since become the most popular and most studied LBG of all time [15, 41, 49].

Scholars in HCI and beyond have investigated the movement and mobility patterns of Pokémon GO players. For example, nursing and health scientists have focused more on the impacts of the game on physical activity, discovering that the game increased mild exercise [4, 10], while scholars in geography and urban planning have focused on mobility patterns. The stream of research

on LBGs' impact on player mobility suggests that Pokémon GO primarily reinforces existing geographic biases, and only slightly alters players' movement patterns [14, 26]. Similar findings have been discovered e.g., in the work of Tonetto et al., who show that while Pokémon GO players move more compared to non-players, they do so primarily in their local neighborhood instead of visiting new areas [82]. The qualitative work of Laato et al. introduced several mechanisms in Pokémon GO and LBGs more generally which have nudged players to travel to nature [42], but in light of the previous scholarship, the impacts of these mechanisms remains small [14, 28, 82]. For example, in the survey of Pokémon GO players deployed by Guo et al. roughly half of the participants at least sometimes alter their commute routes slightly to interact e.g., with gyms in Pokémon GO [28]. However, implicit throughout the study of Guo et al. [28] is that players play LBGs as they go about their daily lives, and purposeful visits to more remote areas remain scarce. Therefore, to summarize, prior to the launch of the Routes feature, Pokémon GO offered players with some incentives to go to nature an rural areas [42], but the overwhelming majority of players played the game during and in-between their daily lives. As Routes are paths that players have to follow precisely to complete, this offered us an interesting research setup to contribute to the existing research on Pokémon GO's impact on players' mobility.

2.2 Perils of the contemporary urban lifestyle and how LBGs can help

The modern urban sedentary lifestyle comes with various perils such as increased potential for social and physical inactivity [36, 37]. LBGs have shown potential to assist in both, as (1) they can facilitate in-person social playing [12, 83, 89], offering players some fun social activities and providing opportunities to meet new people [19, 20]; and they can also (2) promote mild exercise [4, 11] and offer reasons to go outdoors [42]. While reviews have shown that almost all contemporary LBGs provide mild exercise in the form of walking [43], only a few focus on more strenuous activities such as running. One example application that does that is *Zombies, Run!* [88]. Similarly, regarding social interaction, we see perhaps even greater differences among contemporary LBGs [19]. For example, the now discontinued Spokko's *The Witcher: Monster Slayer* [77] had close to no social features, games such as *Pikmin Bloom* and *Orna* [21, 60] have a few social features, and games such as Pokémon GO contain a multitude of social elements from raids [89] to gym control, trading, player vs player battles, party play and gifting to mention a few [61].

Living in high-density cities might also expose people to poor air quality [90] and stress [52]. While the effects here might be less severe and more circumstantial, there is a large body of research suggesting various minor improvements for urban residents from regular forest walks and forest bathing [6, 67, 87]. On the side of theory, these benefits are explained through e.g., stress reduction theory and attention restoration theory which, as their names suggest, deal with the benefits of nature and natural element exposure for relieving stress and restoring attention [32]. Regarding LBGs, we have studies suggesting that they have the potential to bring people to nature, and even improve players' nature connections while there, (see e.g., [42, 50, 72–74]), but the practical work has shown that this is oftentimes not the case, and that players prefer to play near where they live instead [14, 26, 28, 82].

The research on human-nature-technology interplay has explored these issues under the term "nature-centric technologies" which, in addition to LBGs, may include various other map systems, sustainability apps and exercise supporting applications [78]. For example, there is an application called *AllTrails* from the company *AllTrails* [3] that focuses specifically on supporting outdoor recreational activities in nature, such as hiking. The recently launched Routes feature in Pokémon GO [62] *prima facie* seems ideal specifically for hiking and walking nature trails. The feature requires the start and end position of a Route to be a PokéStop or a gym (i.e., an existing point of

interest in Pokémon GO), but other than that the Route creator is free to trace the path of the Route at will.

2.3 Gamification of human movement

To understand the dynamics in LBGs and the Pokémon GO Route feature, it is important to also review research in other movement games and gamified mobility applications. Movement-based games and gamified activities beyond LBGs are often thought of as taking place in a fixed indoor space [34], such as playing Ring Fit Adventure [51] or fitness boxing apps [54] in the living room. However, there are no limitations with the aforementioned applications to be played outdoors. Live action role playing (LARP) is a more classic example of an outdoor game activity, which involves several participants taking on the role of characters and interacting with each other to achieve goals in a fictional setting. Geocaching is another type of recreational activity, more similar to LBGs, which involves interacting with and having fun in the outdoors. It is a treasure-hunting game that makes use of map data and satellite navigation to find Geocaches hidden outdoors by other players [57]. In geocaching, the main mechanic of the game is for players to move from one point to another in an outdoor space to find items and earn a sense of accomplishment as a reward. This is similar to the way LBGs are played.

In addition to outdoor games, there have been attempts to apply gamification as a design method to improve the quality of human movement and mobility experience in open environments. Much of the research in this area focuses on the context of use in urban spaces rather than in nature. Examples include the use of gamified mobile applications to promote environmentally friendly modes of transport such as walking and cycling within a city [38, 53], or to improve the quality and loyalty of bike-sharing services [69]. They found that incorporating functional elements of games, such as scores and badges, into the application design had a positive impact on solving urban mobility problems [38, 53, 69]. While the above studies apply the functional elements of games to products or services, Wallius et al. [85] focus on the experiential element of games, playfulness. Their research presents a framework for evaluating and understanding playful urban mobility based on Floch's semiotic square of valorisations [18]. They investigated the case of electric scooters as an example of playful mobility, and were able to identify the values and practical issues of playful and gamified forms of mobility in response to this framework [85].

Some outdoor mobility services and products incorporate elements of gamification. One such service is Strava, which uses GPS data to track outdoor cycling, running and hiking activities. Strava encourages people to be active outdoors through features such as challenges, competitions, segments, logs and followers [22]. Strava motivates users, helps them improve their performance, supports active lifestyles and creates and maintains social connections [22]. Recent reviews have shown that while these sports and fitness apps can help with performance and regular activity, they can also be sources of obsession, addiction and frustration [75]. While there are examples of games and gamification in both urban and outdoor physical activity, unfortunately there is little use of gamification to facilitate movement towards and connection with nature. We need to develop a deeper understanding of how technology can motivate people to enjoy and improve their experience of being in nature, given the many benefits that visiting nature and healthy walking bring to people. As nature is connected to many aspects of people's lives, promoting nature visits and enhancing nature experiences through gamification requires a holistic approach to the social, cultural and practical context of nature visits, based on an empathetic understanding of individual people's lived experiences.

3 Materials and methods

3.1 Empirical research overview

In order to address **RQ1**: *Do the physical landscapes (urban vs nature), Route length and proximity to the city center impact the popularity of Routes in Pokémon GO?* and **RQ2**: *"What elements are important for players when thinking of creating and walking Routes in Pokémon GO?"*, we relied on two key sources of data. First, we created Routes in nature and city landscapes and urban, rural and suburban areas, and recorded how many times they were completed over the course of a 154-day period (July 20 -December 20, 2023) with altogether 8 measurement points over this period. Second, we deployed a survey (n=67) to players (who lived in the city where our Routes were created) to understand their preferences and Route completion habits. We offer an overview of our research design in Figure 1. Next, we describe our methods in detail.

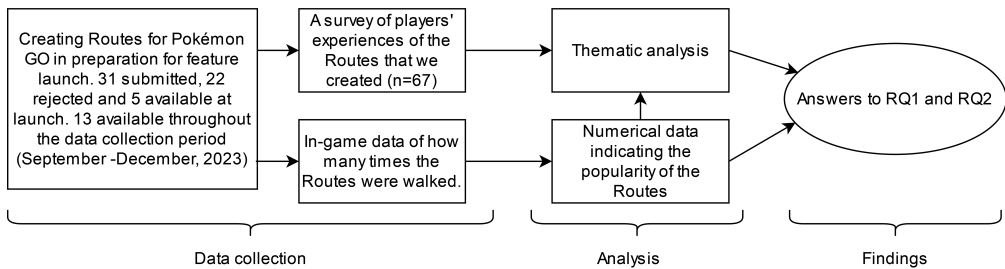


Fig. 1. An overview of the research methods

3.2 Setting up the experiment: Route creation and in-app data

We got access to the Route creation feature in June 2023, before the Routes feature was launched to the player population of Pokémon GO. In anticipation of the launch of Pokémon GO Routes and to prepare for this research, we submitted altogether 31 Routes of various lengths in various places. Out of the submitted routes, 22 were rejected or never made it out of review, and 9 were made available in a northern European city upon launch of the Routes feature on July 20, 2023. When the feature was released to players, no one else in the case city besides our research team could create Routes, and furthermore, the only Routes available in the game were the ones our team had created. During the next month, we managed to get 4 more Routes accepted while 4 others were rejected. Thus, altogether we had 13 Routes of various lengths and locations in the chosen European city (see Table 1). We continued the data collection until December 20, 2023 at which point other players had already started getting their Routes in the game, mixing up the experimental setup to the point that it made no sense to continue tracking Route completions quantitatively. For each Route, we recorded their length, elevation change and whether it was available to players at launch in June 2023. We also extracted the start coordinates of the Routes from the Pokémon GO app and used Google Maps' "measure distance" tool to obtain the distance of the Route start position to the city center. Since in the city where the research was conducted the most populous areas are near the city center, this provided us a crude estimate of how far the Route is from the most densely populated areas. Furthermore, in the city where the experiment took place the city centre remains a popular hub, e.g., most bus routes go through the city centre and multiple people go there for work, shopping or other activities. Finally, we generated an estimate of the scenery along the Route which we categorized into urban or nature. More details regarding the Routes and the scenery along them is available in the Appendix in Table 6.

Table 1. The 13 Routes tracked in this study and basic information of them.

ID	Route name	Route length	Elevation change	Distance from the city center	Estimated scenery	Available at launch
1	Snorlax is rolling	818m	35.5m	1.1km	urban	Yes
2	Chill Walk	468m	6.6m	3.2km	urban	No
3	Portsan rinkki	1.612m	14.4m	1.1km	urban	Yes
4	Räntämäen rinkki	1.111m	23.7m	3.5km	urban	Yes
5	Wallacelta rantaan	1.022m	8.5m	2.1km	urban	No
6	Rantauitto	826m	4.0m	2.4km	urban	No
7	Halisten koski	790m	14.1m	3.1km	nature	Yes
8	Äkölän krotti hidden path	889m	32.9m	8.9km	nature	Yes
9	Parkkipaikalta Uimaan!!	175m	3.9m	11.6km	nature	Yes
10	Yläkentältä pääkentälle	372m	18.0m	1.1km	nature	No
11	Halisten koski minitour	413m	16.1m	2.6km	nature	No
12	Urban forest walk	1.008m	19m	2.4km	nature	No
13	Suikkilan kuntorata	1.501m	16.2m	2.3km	nature	No

Starting from an update launched in early September, 2023, Pokémon GO started displaying players statistics of how many times each of their Routes was walked on a weekly basis, and all time. Unfortunately for us, we could not obtain these statistics from July-August, and furthermore, we could not see statistics of four published Routes which were removed from the game after launch (these were also subsequently removed from Table 1). These included one rural Route, one suburban Route and two city Routes, all with nature landscapes around them. For example, a city Route that showcased the nature around the city called "Fuschia city beaches" was removed, as was a suburban nature Route called "Hamaro less traveled paths" which was in the game for two months, and which purely imitated a city-maintained pedestrian exercise path (see Figure 2).

While unique, this experiment had limitations. First, more than half of the proposed Routes were rejected either before or during the experiment. We could not obtain statistics from these Routes. Second, as an experiment taking place in the real world, there were a wide range of variables that we could not control for. For example, it proved to be difficult to create Routes in nature vs city areas that would be identical in other respects (such as duration, elevation etc.). Third, it appeared to us that the Route walk counts did not always update on a weekly basis. For example, a Route called "Yläkentältä pääkentälle" remained at 166 completions for three weeks before jumping to 227. We kept these limitations in mind when analyzing the data.

3.2.1 A survey with players who had completed Routes. Since the data collection took place in a rather confined area of a single European city, we were in a position to use that city's Pokémon GO channels on WhatsApp, Telegram and Facebook do distribute a survey to the players in that area. We included questions about the players' background, their Route travel habits and what kinds of Routes they prefer. The questions were based on the first and second authors' experiences of Routes and Pokémon GO in the city, as well as the RQs set for this study. The structure of the online survey is given in 2. We deployed the survey using the professional online survey tool Webropol. The survey was online in August 2023 for roughly two weeks, during which time it was opened by 394 participants of whom 99 started responding to the survey. After checking the data for partial, incomplete and incomprehensible responses, we were left with 67 accepted responses.

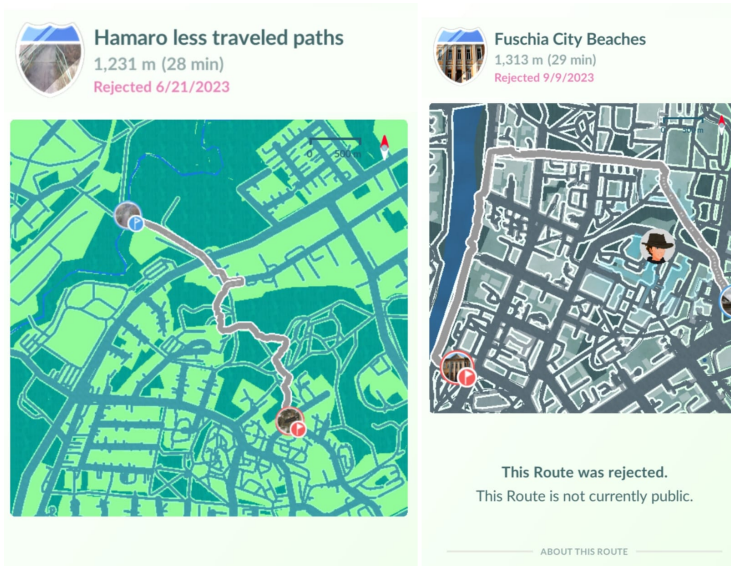


Fig. 2. Displaying two Routes that were not accepted to the game, and therefore were removed from the experiment. The suburban nature Route on the left was never accepted while the urban nature Route on the right was removed during the experiment.

We display the participant profile in Table 3. All participants in the table gave their permission to use their responses anonymously for research. The majority of participants were female (61.2%) and most gravitated towards the higher in-game levels (45+ when the maximum level is 50). The overwhelmingly most common means of traveling Routes was by walking (93% of participants) followed by cycling (13%), car or bus (12%) and running (6%). Participants were mostly within the age range of 26-60 (85%) with more concentration towards the older side of 41-60 (57%). All in all, the participants can be regarded as representative of the more active player population in the selected European city.

3.3 Data analysis

The analysis proceeded in a non-linear fashion and the numerical data and the survey data informed our analysis for both RQs. For RQ1 we focused on the numerical in-game data, but interpreted this through the lens of the survey and our own topical knowledge of the Routes feature and the Routes themselves. We looked at the data descriptively, and addressed RQ1 by considering not only the numerical data, but also the intrinsic limitations it contained. For addressing RQ2, we engaged in a reflexive thematic analysis approach [13], since it allowed us to draw from our own expertise accumulated in playing Pokémon GO, studying the game, submitting Routes and testing them out. Since we were responsible for creating all the Routes to begin with (see Figure 3), we were already rather familiar with the research context when the study started. As we continued to follow the Route statistics, complete Routes ourselves and read responses to the survey, our understanding of the topic become more precise. The analysis process was non-linear and the themes were revised multiple times until all authors were satisfied with the findings, and were confident that they accurately represent the data. Despite the non-linearity, the following three key steps can be enumerated to describe the analysis process: (1) familiarization with the data; (2) generating codes; and (3) coming up with a thematic framework to describe the data.

Table 2. The survey questions (N=67) translated into English by the first author. The survey was initially distributed in the participants' native tongue to encourage participation and remove potential language barriers.

Explanation	Questions
Part 1: Introduction	Do you give us your permission to use your responses anonymously for research?
Part 2: Background factors	Age, gender, occupation? Experience with Pokémon GO? Which of the following Routes have you walked? Have you walked some Routes more than once? Which ones? Please elaborate
Part 3: Route travel	Which Route was your favorite and why? Answer in as detailed a fashion as you can. Have Routes directed you to areas where you otherwise would not have gone? Elaborate with examples.
Part 4: Design and implementation	Which of the following bugs have you experienced with Routes? Describe in detail what you feel would be a good Route? Would you be interested in making Routes yourself? Why? What kinds of Routes would you wish to have in the game if you could influence the situation? If you were given the opportunity to create a Route, what kind of a Route would you create and why? was there something related to Routes we did not ask about? Please elaborate.

Table 3. Demographic information of the research participants. All participants played Pokémon GO in the same Northern European city and had completed at least one of the Routes created for this study. Note that in the modes of travel category, the participants could select multiple options.

Game level	Gender	Age (yrs)	Modes of travel
below 30	2% Male	35.8% 18-25	5% Walking 93%
31-40	7% Female	61.2% 26-40	28% Running 6%
41-45	28% Non-binary	3% 41-60	57% By car 12%
46-49	30%	over 60	10% By bike 13%
Max 50	33%		

These three steps proceeded as follows. In the first part, we revisited the collected numerical data and read all of the participants' survey responses. Next, we continued to generate codes and identifying things relevant to the RQs such as (1) justifications why certain Routes were fun; and (2) what aspects of Routes had motivated players to go to new places and why. We then brought the codes together and started generating themes to describe the data [13]. The analysis and coding were taken care of the first author, refined by the second and third author, and the themes were further refined and revised with the contributions from all the authors.

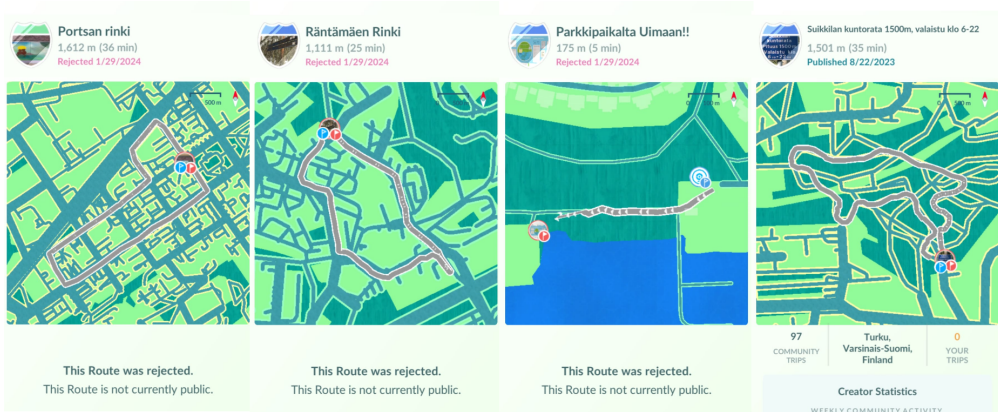


Fig. 3. A screenshot displaying four Routes that were included in this study. From the left to right we have Route #3, Route #4, Route #9 and Route #13. As can be seen from the screenshot, three of the Routes were removed from the game on January 29, 2024.

4 Findings

4.1 Numerical examination of the popularity of the Routes

The walk counts of the 13 Routes are displayed in Table 4. Altogether, the 13 Routes were walked 7743 times during the time period of July 20 – December 20, 2023. The most popular Route in terms of number of completed walks was "Portsan rinki", which was completed 2524 times by the end of the data collection, followed up by "Snorlax is rolling" with 1457 total completions and "Halisten Koski" with 1281 completions. The least walked Route was "Äkölään krotti", which was walked only 28 times. We also include in Table 4 the user-given ratings for the Routes for reference, but the rating functionality was not available at launch, and only provides a vague hint of players' sentiment towards the Route.

To bring more insights into Route walking patterns, we observed Routes under four sets of characteristics. First, we checked for bias resulting from some Routes not being available at launch, by measuring the daily rates of Routes available at launch and those added later during t1 and t2. Here the daily rate fell for Routes available at launch from 12.1 to 2.3 but for Routes added later the rate climbed from 1.4 to 1.9. Accordingly, the t2 walks and daily rate are the more accurate metrics for understanding the popularity of the Routes. We display the data supporting this in Table 5.

Next, regarding the Route landscape (see Table 6 in the Appendix), the data suggests that both initially from July 20 to September 26 (t1) and later on from September 26 until December 20 (t2), Routes with urban scenery were more popular. The difference is more than twofold in both periods. However, there are important confounding variables which we must account for. First, the distance from the city center (DfCC) metric suggests that both in t1 and t2 Routes closer to the city center were more popular, and Routes closer to the city center more typically featured urban as opposed to nature scenery. Second, looking at the DfCC metric, we notice that the drop in popularity as we move away from the city center is non-linear. This is due to the player population being unevenly distributed, and factors such as roads, parking spots and where players are used to play having impact on their playing patterns. These same issues can be regarded as confounding variables for the scenery metric. Since the real world is complex, there are also all kinds of other variables which we cannot account for in this data ranging from where players live to where they work. Therefore, in order to understand the role of scenery in players' Route preferences, we need alternative data.

Table 4. The 13 Routes tracked during this study and the number of times they were walked according to in-game data between the three month period of September 19 – December 20, 2023. The tracking was not available upon the feature launch, and thus, we do not have data from this period. The columns (Sep 19 – Dec 20) present the cumulative sum of the number of times the Route has been walked, recorded on the days specified in the column heading. The "New travels" columns sums up the total number of new full completions of the Route during the period of Sept 19 -Dec 20, 2023. The rating is taken from the Pokémon GO app and shows player-given scores to the Route, which range from 1 to 5 (5 being the highest). The number of reviews is indicated in brackets after the score.

#	Route name	Rating	New travels	Sep 19	Sep 26	Oct 3	Oct 12	Oct 19	Oct 30	Dec 20
1	Snorlax is rolling	4.2 (28)	260	1197	1223	1257	1330	1365	1409	1457
2	Chill walk	4.0 (11)	495	N/A	128	197	291	330	377	495
3	Portsan rinki	4.6 (15)	578	1946	1993	2087	2227	2263	2345	2524
4	Räntämäen rinki	5.0 (3)	80	348	352	376	376	376	406	428
5	Wallacelta rantaan	4.4 (25)	243	52	81	125	125	125	233	295
6	Rantauitto	4.3 (15)	244	107	139	181	239	266	325	351
7	Halisten koski	4.6 (20)	164	1093	1117	1146	1209	1226	1258	1281
8	Äkölän krotti	1.0 (1)	3	25	25	25	27	27	27	28
9	Parkkipaikalta uimaan	3.0 (1)	172	68	80	95	120	120	157	240
10	Yläkentältä pääkentälle	4.3 (3)	134	110	133	166	166	166	227	244
11	Halisten koski minitour	4.6 (18)	290	N/A	108	130	186	210	249	290
12	Urban forest walk	4.0 (1)	10	6	9	11	13	13	15	16
13	Suikkilan kuntorata	4.3 (6)	60	34	38	54	67	68	84	94

Table 5. Route completion numbers (travels) from the launch July 20 until December 20, 2023. We look at two time periods: t1 = July 20 – September 25 (66 days) and t2 = September 26 – December 20, 2023 (87 days). To make up for the different duration of t1 and t2, we calculated daily travel rates (total travels divided by days divided by number of Routes in the category) for these time periods. We produced these calculations for Routes available at launch and those added later, Routes in urban vs nature scenery, Routes with varying distance from the city center (DfCC), and Routes in three length categories: below 500m, between 500m and 1km and over 1km.

Route characteristic	N	Total travels	t2 travels	Daily rate t1	Daily rate t2
Added at launch	6	5958	1168	12.1	2.3
Added later	7	1785	1149	1.4	1.9
Urban scenery	6	5550	1634	9.9	3.2
Nature scenery	7	2190	683	3.3	1.1
DfCC<1.2km	3	4225	876	16.9	3.4
1.2km<DfCC<2.5km	4	756	489	1.0	1.4
2.5km<DfCC<3.3km	3	2066	713	7.0	2.8
3.3km<DfCC	3	696	239	2.3	0.9
Length<500m	4	1269	820	1.7	2.4
500m<Length<1km	4	3117	613	9.5	1.8
1km<Length	5	3357	884	7.5	2.1

Next, we looked whether the length of the Route (measured in meters and provided by the Pokémon GO application) would have an observable effect on Route popularity. We organized the Routes into three categories based on their length, and here the short Routes appeared to be the most popular during t2 (walk rate = 2.4), whilst the medium length Routes were the least popular (walk rate = 1.8). The radical decline in walk rates from t1 and t2 for medium length and long

Routes can be explained by all of the short ones (4/4) being added to the game some time only after launch. We assume that the popularity of Routes of different lengths could also be influenced by the in-game rewards associated with Routes. During the experiment, the players had the chance to find Zygarde Cells anywhere along Routes, and received only minor rewards at the end of the Route. This meant players had an incentive to walk Routes (for the chance to find Zygarde Cells), but not necessarily to complete them. Unfortunately, we do not have data regarding how many participants started walking a Route but never completed it.

When we compare the numbers in Table 4 to those in the survey, we notice similarities. The most popular Route in the survey, similarly to the in-game data, was "Portsan Rinki", having been walked by 46% of the participants. The second and third most popular Routes were reversed, since in the survey "Halisten Koski" was more popular than "Snorlax is Rolling while Gengar is Trolling". The least popular Route in both the survey and the telemetry data was "Äkölän krotti". We display the survey participants' (N=67) self-reported Route frequencies in Figure 4. While we cannot exactly compare the completion frequencies in the survey with the walk counts in the in-game data, we do get an indication of the same Routes being popular both in-game and among the survey participants.

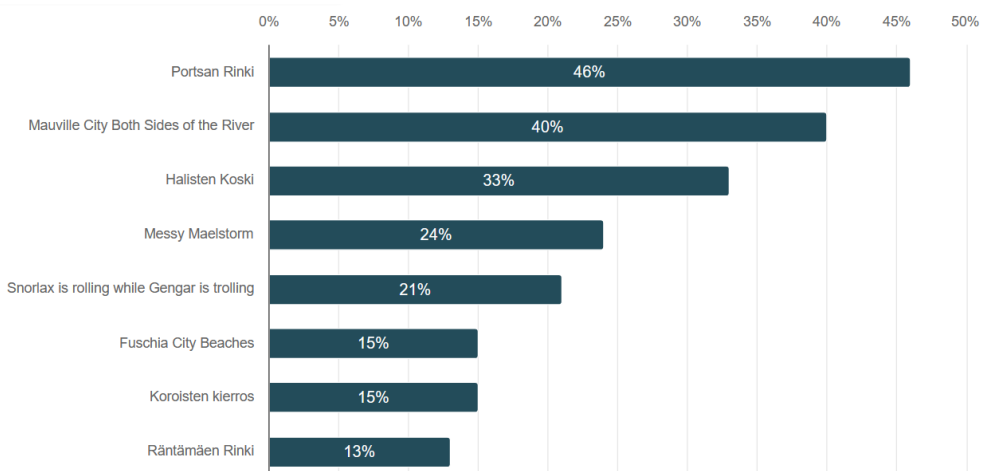


Fig. 4. The Routes that the survey respondents (N=67) reported to have walked. Each participant could select more than one Route. "Mauville city", "Fuschia city" and "Messy Maelstrom" were originally part of our experiment, but were removed from the game by the developer, and thus, excluded from the numerical analysis.

Overall, based on the numerical in-game data, we observe that Routes were more popular at launch than later on, which might be explained by the novelty factor (players trying out the new feature), and in-game tasks (special research, Zygarde cell collection) motivating players to walk Routes. Once these additional layers of motivation were depleted, the daily walk rate for the Routes in our study settled to a steady, or perhaps slowly diminishing rate. We found the distance from the city center to appear to have some impact on Route popularity, which confounded with the measurement of the impact of scenery. We submitted Routes of varying lengths to various places, but when looking whether Route length had an effect on Route popularity, we saw no such evidence. However, the difference between the shortest and longest Route was only 1437m, meaning the differences were not large to begin with. A larger variance in Route length might have yielded visible differences. To bring further nuance and understanding to Route popularity and players' preferences, next we focus on the findings from the thematic analysis of the survey data (N=67). By

doing so we address particularly RQ2: "What elements are important for players when thinking of creating and walking Routes in Pokémon GO?"

4.2 Themes related to players' preferences towards certain kinds of Routes

Here we discuss the findings from the thematic analysis [13] that we performed on the survey data (N=67), informed by knowledge derived from our own experiences and the in-app numerical data. As stated in RQ2, the goal was to understand what elements were important for players in walking and creating specific Routes.

Before we dive into the themes, it needs to be noted that several participants expressed wishes in the survey to create Routes in rural and nature areas. While Routes near population concentrations were more popular in our data, the following quotes offer support for the goal of providing gameful solutions and dynamics for engaging players with locative play through Routes in nature areas:

"[We need Routes] everywhere, the aim being away from the city center" (P22")

"Anywhere else but the city center!" (P17)

"[I would create them] to the more rural areas, outside the city center, and in places that were easily accessible by car (and which have a parking spot for the car)." (P8)

"If I could make one, I would go to the [retracted rural nature area], but not in the full forest though." (P38)

Altogether we generated three broad themes that arose from the data: (1) Improving discoverability of Routes would drive participation (2) In-game rewards appear to be more compelling for players than outside-the-game rewards; and (3) Players want to create Routes that support their daily lives and existing playing patterns. Next we elaborate on these three themes.

4.2.1 Improving discoverability of Routes would drive participation. The participants' ability to find and locate Routes appeared to be limited in light of the survey data. Also looking at the in-game affordances for discovering Routes [62], players had trouble visualizing the Routes beforehand and relied on local social media groups to share with each other which places even had Routes to begin with. Regarding rural and nature trail Routes, this can be regarded as a critical issue, as these are the types of Routes that players would have to specifically know to travel to. The following quotes illustrate how some participants experienced difficulties in locating where Routes were.

"Would appreciate it, particularly if [Routes] would start appearing at more rural areas too. The Route start positions were, at least for me for the first time, difficult to find" (P6)

"It would be nice if the Routes would be visible for a longer distance, for example in a 10–20 km radius, when I could from the city center every now and then start walking a Route [a bit further away]. The announcements for Routes could be expanded inside the game (I would not want to download additional applications [for this purpose])." (P13)

"It would be nice, if I could find the Routes in the game more easily. Now one has to be very close for the Routes to start appearing, and randomly going to places is not motivating for a lazy adult to start going to find Routes." (P28)

"You should see all available Routes and their start and end positions at once. Now it is difficult to conceptualize the Routes." (P38)

There was also some criticism towards the kinds of Routes that were available, and their naming policy. According to e.g., P31 it was difficult to understand where exactly the Routes were with an unclear arbitrary naming policy. Additionally, some participants found issues in the types of

Routes, suggesting that Routes would have to be loops instead of "from a to b" types of unidirectional experiences. While not shared by all participants, these sentiments suggest that there was some confusion resulting from the overall heterogeneity of available Routes. The following quote illustrates these issues:

"It should be a loop, not some trip that you go back and forth. The Route should also be named in a sensible way so it can be recognized. Now some of the Routes have unbelievable names, so that it is not possible to deduce from them where we even are." (P31)

Another issue relating to discoverability was that some Routes got removed from the game. We, the authors, struggled with this issue quite extensively, as it interfered with the planned experiment. This was also noted by participants such as P28 who similarly to the researchers, did not quite understand why some Routes had been removed from the game:

"One disappointing element is that Routes seem to disappear out of nowhere. For example, yesterday in the city center I saw multiple Routes, now some of them had disappeared." (P28)

Regarding the reward mechanisms for discoverability, we have one example of how this can be done from Pokémon GO. Back in 2016 players had a monetary incentives to seek and discover remote gyms, since deploying a Pokémon there would reward them with daily coins (in-game currency). This feature was reworked in 2017, but even today, players' are motivated to find remote gyms in the hopes of "making them golden". In our data we did not see similar mechanisms that would reward players from discovery. Each Route had a unique badge, but there was no in-game bonus or incentive associated with collecting these badges.

4.2.2 In-game rewards appear to be more compelling for players than outside-the-game rewards. In general, we could conceptualize two sets of drivers for meaningfulness and motivation regarding Routes: (1) in-game rewards; and (2) outside-the-game rewards. In-game rewards refer to things such as Zygarde Cells that players can collect while on Routes or the completion rewards that players received after successfully traveling the Route from start to finish. Outside-the-game rewards refer to things such as being able to walk in a nice or fun area, or seeing beautiful scenery while walking. When players are walking Routes, they can have various other in-game goals in mind as well, simultaneously, such as catching Pokémon, spinning PokéStops, fighting Team Rocket Grunts and completing field research tasks. These other goals drove players to select Routes and areas to play where they knew they can complete the other goals as well. The focus on these other connected in-game reward systems was visible, for example, in the following quotes:

"Portsan Rinki" Route is in a good spot, it is easy to get a parking spot for the car, and there are a lot of PokéStops along the Route and a few gyms." (P19)

"I would prefer to have a Route that would follow my busy day's daily walking path, which leaves from my closest PokéStop. It would be a bit less than a kilometer and would have three gyms and eight PokéStops, and with the help of it I could ensure I can maintain my daily Route streak also in those days where I otherwise do not have the time to play." (P34)

"The sports park jogging trail is at least one where it would be nice to have a Route. There are a lot of PokéStops, spawns and such a large Pokémon nest that it has a lot of playability." (P55)

At the same time, the outside-the-game rewards related to e.g., walking in nice scenery appeared to be secondary motivators. While also worthy considerations for players, they did not appear to be the main drivers of players' Route preferences. These aspects were brought forward in occasional

comments, but not equally as often as the in-game rewards. Furthermore, most participants (60%) reported to have walked some Route more than once, suggesting that perhaps the in-game rewards bring some additional meaning to the places and spaces where people walk in their day-to-day lives.

The in-game reward systems also got some criticism from the players in our survey. Players were unsatisfied with e.g., there being the Zygarde cell mechanic (which some players refer to "soul collecting" in the survey), where randomly a Zygarde cell would appear on the ground while players were walking Routes, and they had to look at their device constantly in order not to miss them. These types of frustrations speak of players' perceiving a mismatch between the in-game reward systems and their intuitive understanding of what Pokémon GO Routes should feel like. The following quotes illustrate this:

"The reward system should be changed, so that you would get souls as a reward, not collect them while walking. The only soul I saw disappeared when I was tapping it."
(P8)

"I was going the same Route two times in the hopes of a Zygarde cell. Then my phone's battery ran out and I had to go home, if I had remembered to bring a spare battery, then I would have walked it a third time. Because I am in the middle of doing the special research." (P19)

Finally, the participants' appeared to lack in-game motivators to go to nature and rural areas. Similarly to gyms, players also get medals for walking a Route. But while gyms are based on real world objects and locations, Routes are arbitrary. Walking a specific Route would reward players with a medal, there is an infinite number of the medals and therefore players felt they are not worth collecting. None of the participants reported to have collected Route medals. With the in-game reward systems being more important for meaningfulness and motivation than the outside-the-game rewards, and the in-game rewards not supporting going to rural and nature areas, it is no surprise that the numerical data shows players preferring practical Routes that are close to their living area and which have plenty of PokéStops and gyms as opposed to nature Routes with more beautiful scenery. While nature and nature scenery are by no means negative in players' eyes, these motivators appeared to be secondary when considering Route travel preferences specifically.

4.2.3 Players want to create Routes that support their daily lives and existing playing patterns. When asked what kinds of Routes players would make, the overwhelming percentage of responses focused on practical matters such as the Route's location and the area where it would be. Participants explicitly mentioned the names of the areas where they lived and spent their daily lives in, and that they would make Routes that mimicked their already existing daily travels. This highlights that for many participants, it was more important to support their daily mundane lives than to create touristic recreational activities. However, there were also quotes in favor of the latter, as illustrated below:

"I would surely prefer a Route somewhere in the middle of nature, somewhere with nice scenery, for example, the [retracted] peninsula." (P9)

"One should be made at the [retracted] rapids. Maybe just one which goes around the hiking trail there." (P20)

When asked if the participants had gone to some new place due to Routes, 57% responded to the negative, further suggesting that for the majority of players, Routes aligned with their existing plans and playing strategies, and did not manage to motivate players to alter their existing playing and movement patterns. This applied also to the mode of traversing the Route, meaning that the participants did not report changing e.g., from walking to cycling or vice-versa, but continued to

travel the Routes in the same way they played the game otherwise, as exemplified by the following quote.

"Routes does not in itself change the way I play, since I have always played by walking."
(P13)

However, 43% of players reported to have gone to new places. Thus, at least in the short term, the Routes that players create impact the movement of a substantial portion of the playerbase. This was also hinted in the verbal responses of the participants, where some indicated explicitly that Routes had taken them to new places. The following quote illustrates this.

"Exercise is good for you, and it is fun to walk sometimes somewhere else than always the same paths." (P16)

Most participants traveled the Routes on foot, even when other transportation was used to get to the Route start location. "On foot" was mentioned as the primary means of walking Routes in all but 5 participants (i.e. 93% of the participant population). Considering that walking is the main means for Route travel, we have to consider the hurdles of getting to Routes in rural and remote areas. This not only takes time, but possibly also money. From a sustainability perspective, while reconnecting with nature can be considered a beneficial goal, having people drive around with their cars on a daily basis to reach remote destinations might be counter-productive.

Some of the design features also appeared to be in conflict with the goal of enabling players to enjoy nature and the landscapes around them. These were the following. First, players had to look at their screen to be able to stay on the Route and know where it leads. Second, players experienced bugs such as the Route tracking going on pause for no apparent reason, and players had to therefore focus on their screen to stay alert for these bugs. Third and finally, Routes were launched together with the Zygarde cell mechanic where randomly cells would appear along the Route, which players had to tap in order to collect. This third mechanic, which we also discuss in the second theme, was brought forward by multiple participants as something annoying that interfered with their enjoyment of the landscapes around them:

"Yes but it is odd that if you want to get the most out of Routes, you cannot watch the scenery, but you have to walk with your face glued to the screen. Otherwise you miss out on the cells and the spawns." (P22)

"Being on the watch for the cells to spawn makes my neck hurt." (P27)

Returning to the topic of players wanting to create Routes that support their existing player patterns, we also found evidence that the participants wished to create Routes that support existing patterns in their environment. For example, hiking trails, jogging trails and other pre-existing real world Routes were a popular suggested targets for Routes. In our set of 13 Routes we also had a few that followed partially or fully an existing trail. These included "Äkölän Krotti hidden path", half of which followed an existing nature trail, and "Suikkilan kuntorata", which in its entirety followed a jogging trail maintained by the city. The following two quotes suggest that players were also interested in making the digital world match real world elements i.e., by creating a Route that matched existing trails:

"[I would make] a circular Route that goes around the outdoor jogging trail in [retracted place name]" (P3)

"I would make my morning's daily trail, roughly the length of the daily incense with 5 gyms and a lot of PokéStops" (P7)

5 Discussion

5.1 Key Findings

We summarize our key findings as follows:

- We reaffirmed findings from previous research [14, 26] that players tended to play primarily in areas where they live and spend their daily lives.
- Unique in-game rewards specific to real world locations would boost players' motivation to go to specific places such as nature.
- Better tools for discovering Routes and other playable content would help players gravitate towards more rural and nature locations.
- The practicalities, such as time and effort required to get to remote locations, are significant hurdles for day-to-day rural nature Route travel. Designers could look into motivating urban nature travel instead.

Altogether the Routes feature appeared to follow the same types of playing patterns (i.e., players mostly play in the areas they live in) that scholars have observed with Pokémon GO players before [14, 26, 28, 82]. According to previous research, this is due to LBGs being played as part of players' daily lives [44] and PoI placement, which reinforces urban populated areas as "most profitable in-game locations to play in" [8, 33]. We also found that the popularity of the Routes feature peaked at launch. This was driven by factors such as curiosity towards the feature and an in-game "special research task" and other goals associated with walking Routes. Once the in-game incentives to walk Routes were depleted, players' interest radically slowed down.

5.2 Theoretical contributions

Our work has theoretical contributions for LBG design, LBG research and nature-centric health technologies. Next we discuss these contributions.

Regarding LBG design, previous research looking at how LBGs incentivize movement [42] has not included Routes or pathing. However, this type of a feature has been to a degree present in games such as Ingress [59] which have "missions" where players walk from PoI to another in order. A feature like Pokémon GO Routes also exists ubiquitously in satellite navigation applications such as Google Maps and Apple Maps which offer users guidelines for getting from point a to point b. Yet, Pokémon GO Routes is the first of its kind in contemporary locative gaming, expanding game design from a point-of-interest focused approach [8] to include paths and even elevation information as part of the paths [62]. The contributions of this study relate to exploring this feature with a unique field experiment design that allowed us to focus on how Pokémon GO players within an European city approach the feature, and what kinds of Routes they prefer.

Regarding LBG research, the field has had various seminal and successful papers drawing from self-reports (e.g., [2, 30, 83, 89]). However, studies that work with telemetry or in-app data have been more scarce. One such study is the seminal paper of Althoff et al. [4] who looked at data from Microsoft Band wearables and how the launch of Pokémon GO could be seen in people's physical activity. While in-app numerical data and telemetry data have been used in the broader gaming research, until this in-app data of popularity of specific PoIs or Routes in LBGs has been unavailable to the public. Therefore, one contribution of our work on LBG research is the introduction of in-app data on Route popularity to offer a telemetry-based point of reference e.g., for triangulating survey data. We believe that as the Route feature grows in popularity and is developed further, more larger scale analyses can be made off the data. For example, the research on Pokémon GO and player mobility [26, 82] might draw from similar in-game data in LBGs for additional insights and validity.

Regarding nature-centric health technologies [78], we contribute to the study of gamified mobility [23, 39] in the form of LBGs as way to motivate people to travel to nature through mechanisms

such as Pokémon GO Routes. While our findings show that Routes close to the city center are more popular than rural Routes, this does not rule out that a major subset of the player population were traveling the nature Routes we created. Furthermore, our study sheds lights on the factors that lead to Routes in urban areas being more popular, opening avenues for future research in developing similar dynamics as Routes for nature-visit purposes. Through the analysis of the Pokémon GO Route mechanics, we also support the more general areas of research of gamification [29, 56] of human movement in analysing whether, how and to what degree such a mechanic directs players' mobility patterns.

5.3 Practical implications

In our empirical study, we had one Route (see Fig. 5) that was in a rural nature reserve, and that Route was consequently the last popular Route in both the survey (N=67) as well as the in-app numerical data. Based on our findings the lack of popularity of this Route would be explained as follows. First, there were issues in discoverability, meaning many players did not know about the Route. Second, there is no public transportation to the place, and players would most likely have to have access to a car to get there. Third, there were no in-game rewards specific to walking this Route, meaning players lacked in-game incentives to visit the place. In addition to these three reasons there may be others, such as the Route going off the beaten path causing issues to those without hiking shoes. Accordingly, we are able to provide the following design suggestions for practitioners looking to motivate people to go to nature with LBG dynamics such as Routes: (1) ensure the Routes are discoverable and support players' planning ahead; (2) consider creating nature Routes in areas that are easily accessible to players; and (3) provide unique in-game rewards to players for traveling nature Routes.

Another practical implication relates to discussion on where is it acceptable to create Routes. This discussion has two key dimensions. First, it is unclear whether we should aim to direct player populations to nature en masse. While walking in nature does appear to have several benefits [52, 63], there are costs involved in transporting people to rural areas. Thus, it can be argued that it is more reasonable to create Routes in cities and urban areas which support players' existing lives, making them more meaningful, as opposed to trying to radically alter them. The second dimension relates to the laws and regulations concerning place ownership and territory. Indeed, previous research in LBGs has highlighted trespassing as one potential issue of the genre [46, 66]. During our experiment, we had more than 2/3 of the Routes that we created rejected or removed from the game, but in light of the issues of trespassing and safety [46], it is possible that the rejected and removed Routes are collateral damage resulting from a "better safe than sorry" trust and safety policy by the developer, Niantic. Although this type of strategy results in various false positives, it has the advantage of protecting players, the reputation of Pokémon GO players and landowners.

Finally, one of the challenges that players encountered in our data was that the Route gameplay was screen-interaction heavy, and required players to focus on their phone to spot Zygarde cells and follow the Route. These issues were identified already more than a decade ago by Soute et al. [76] who proposed the concept of Head Up Games, a series of pervasive game designs that enable players to focus more on their physical surroundings. Indeed, multiple pre-existing features in Pokémon GO such as gym battles and raids have minimal screen interaction, and players are able to effectively interact with each other or the environment, since the gameplay is reduced to tapping the screen [12]. However, a feature like Routes forces players to look at their screen more, since they have to mimic the pre-drawn path precisely with their movement. While the issue of Zygarde cells can be fixed easily, for example by adding sound cues when a cell spawns, the requirement to look at the map to trace the Route is a more wicked problem.

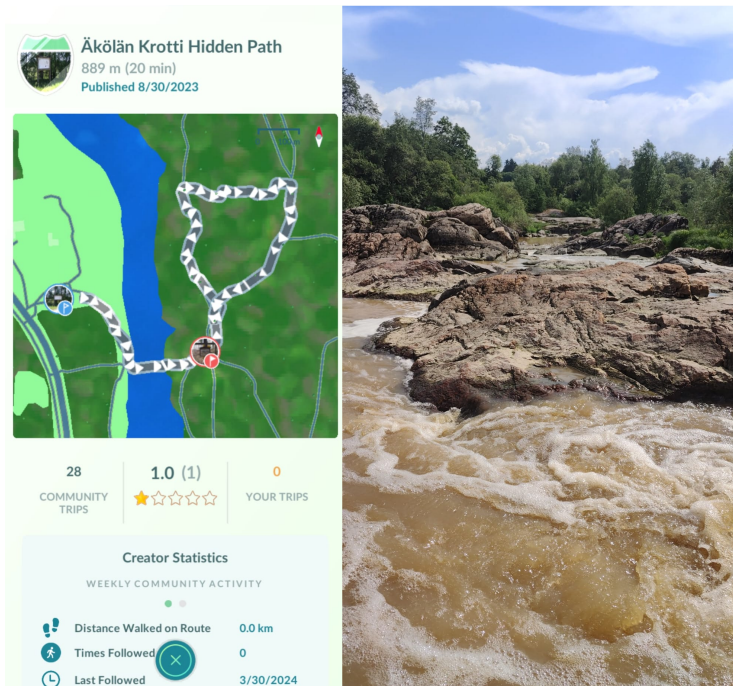


Fig. 5. The most rural "Äkölään Krotti" nature Route viewed from the Pokémon GO app (left) and the real world scenery during summer right). Screenshot and picture taken by the authors.

5.4 Limitations and future work

This study has various limitations that should be considered. First, due to us conducting the experiment with the very first wave of Routes in the chosen city, we were unfortunately faced with various bugs and issues. One of the most impactful issues was that many of our Routes were rejected or removed from the game. Our Route creation was also hindered by bugs, as some of the Routes that we walked never got through review or we could not finish them due to a bug. The participants also struggled with various usability issues and bugs, which led to some of them providing rather harsh comments about the feature. The Routes feature has been since worked on and improved substantially, and we encourage researchers to keep on studying the feature and related phenomena.

Second, the numerical data we collected for Routes contained biases and weaknesses that warrant discussion. For example, the Route travel counts were not regularly updated for all Routes. Sometimes we saw some Routes "being stuck" in a certain number for a couple of weeks. Thus, following the evolution of Route travel on a weekly basis proved to be impossible. While we could control multiple variables such as Route length, elevation change of Route and where they were located, there were multiple factors that we could not account for due to the complexity of the real world. For example, the type of scenery along the Route was varied and our division of scenery into urban and nature scenery was a simplification. Furthermore, factors such as the number of gyms, PokéStops and Pokémon spawns along the Route likely had an impact on Route popularity, but we did not consider this in our analysis. Taken together, the numerical data offered some indication towards trends, but our analysis based on this data should not be treated as the entire picture.

Regarding future research, we see pathing-based locative game features such as Pokémon GO Routes as a fresh innovative approach in the LBG design space. Previous successful LBGs including Orna [21], Ingress [59] and The Walking Dead: Our World [58] have so far been focused on map-based PoIs, and players' interactions with them [8]. Despite being novel, the Routes feature and associated navigation mechanisms still appear to be at their infancy, and it is likely that the feature and others like it will be developed and refined more in the near future. Thus, we encourage additional experiments and inquiries on this topic, also with other products besides Pokémon GO, such as the gamified mobility applications Strava and AllTrails or locative media including navigation services, user reviews and suggestions such as Google Maps.

6 Conclusions

In this work, we set out to address two RQs based on a field experiment with Pokémon GO Routes. First, we wanted to know if the proximity to city center, Route length and the physical landscape elements (city vs nature) had an effect on Route preferences and popularity (RQ1). The numerical data suggests that the proximity to urban population concentration was linked to the number of times a Route was walked. The survey data (N=67) seemed to counter these trends slightly, as multiple participants reported that they wished for more Routes on rural areas and with more nature scenery. However, issues in discoverability of nature Routes, lack of unique in-game rewards specific to nature Routes and practical challenges such as time and effort required to go to nature Routes proved to be inhibitors for nature Route travel. Second, we wanted to understand what elements were important for player for creating and walking Routes in Pokémon GO (RQ2). We discovered that in-game rewards and practicality appeared as more important drivers of Route popularity than outside-the-game rewards (such as nice scenery). This was supported by the participants stressing the importance of the in-game playability of the area where the Route was located and them discussing and criticizing the existing reward systems. Players in our data appeared to be more motivated by what rewards they get than the playing itself being fun.

Overall, this study should be seen as a preliminary look into the novel type of path-and route-based gamified mobility and LBG-supported travel. While our findings suggest that Pokémon GO Routes were more popular in urban areas, the nature Routes we created were still regularly traveled by players, particularly those nature Routes that were near the city centre and accessible to players. We also offered suggestions for designers looking to engage people more with nature through mechanisms such as the Routes feature. First, more focus is needed on discoverability. Second, rural nature Routes should offer players rewards unobtainable elsewhere, making them unique and meaningful. Third, it should be accepted that players' practical arrangements in life (living area, time, money, available transportation) inadvertently lead them to spend more time in urban environments, but more focus could be put on encouraging travel around nature scenery within urban environments.

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Appendix

Table 6. Brief descriptions of the 13 Routes tracked in this study and the scenery along them.

ID	Description
1	This Route starts at the local University campus and follows paved walking paths. There are some trees nearby, but the scenery is mostly urban.
2	This Route is located near a river and follows a paved walking path. On the left side travelers see the river and buildings on the other side of it, and on their left they see buildings. Thus, the scenery can be considered urban.
3	This Route starts at an urban residential area and makes a loop. It was created to resemble an existing playing path preferred by hardcore active players. It contains a lot of PokéStops alongside it. The scenery is urban.
4	This Route starts in a suburban area and the Route is paved road all the way. The houses along this road are 2-3 stories high, and the Route follows a concrete road. Despite the presence of some trees, the scenery can be described as urban.
5	This Route starts at an urban industrial area and ends up at the riverbank. The Route is paved road all the way and the scenery is mostly urban.
6	This route goes along the riverbank in an urban scenery. It is a bit further away from the city center, and in addition to concrete buildings there are some sailboats that can be observed.
7	This Route starts in a suburban neighborhood and goes along a walking path next to a field, ultimately arriving at Halinen rapids, a popular nature destination next to the city. The scenery is a mix of concrete houses, a field, water and a forest.
8	This Route is deep in the woods. While it is "only" roughly 9km from the city center, getting there requires a car and the scenery is mostly trees and a small river. No buildings are visible.
9	This Route is located in a suburban housing area far away from the city center. It starts from a public parking lot and goes on a gravel walking path next to the ocean to a public beach. The scenery is mostly ocean-side nature.
10	This Route is located within a large urban park. It takes place entirely within this park, and the scenery consists of trees and sports fields.
11	This Route is located in the same nature area as Route #7, but starts directly at this area instead of the nearby suburban neighborhood. The scenery consists of a river and a well-maintained park with trees and gravel walking paths.
12	This Route is located in a small public forest within the city. There is a wooden walk path and wooden stairs that take the player up on a mountain and back.
13	Similarly to Route #12, this Route is also located within a public small forest within the city, and follows a maintained gravel path. The scenery along this Route consists mostly of trees.

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