'I would have Preferred an Ankle Tag': The Lived Experience of a Nationwide Quarantine App

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ABSTRACT

Due to recent technological advancements, governments can exercise an unprecedented amount of power over their citizens. It is vital to understand how governments impose restrictions on citizens through digital technologies, especially if those restrictions can save lives. Here, we look at the case of Home Quarantine—a Polish government-mandated smartphone application whose use has become mandatory during the COVID-19 crisis. Users in quarantine are legally required to use the application, reporting location and take selfie photographs. We conducted an autoethnographic diary study of one author using the app during quarantine and interviews with 23 users. We found that the app assisted in creating quarantine life routines and affected social interactions. Users connected with the world outside quarantine through selfies. We also uncovered key reservations our users had about using this app. Our work broadens the understanding of location-based apps and practices around surveillance technologies.

CCS CONCEPTS

• **Human-centered computing** → **Interactive systems and tools**.

KEYWORDS

location tracking; quarantine; government; mobile apps; privacy; COVID-19; pandemic

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1 INTRODUCTION

Recent technological advancements led to an unprecedented level of power which governments can exercise over their citizens. Non-democratic authorities make liberal use of digital surveillance to monitor people's whereabouts and limit their movement [36] or thwart protests [37]. In the time of a global pandemic, the possibility to use digital means to restrict the movements of citizens is attractive to any government focused on containing infection. Unpredictable times call for immediate solutions, which, in turn, require striking a balance between the freedom of the individual and the well-being of the society. When the public's behaviour needs to rapidly change in response to a crisis situation, governments need to use effective methods to enforce the desired behaviour. In a democratic society, these methods must be mandated by law and respect basic principles of human rights. The widespread availability of mobile technology offers unprecedented opportunities in communicating information to citizens and obtaining data from the users; however, it remains a challenge for them to do so while maintaining trust in the authorities and minimising the negative effect of the crisis situation [25].

We have observed many unprecedented decisions by governments throughout the course of the COVID-19 pandemic [46]. Identifying possible sources of infection and containing them is a key task for the authorities. This is often achieved through putting those with a high risk of being infected in government-regulated quarantine. Passengers arriving from high-risk locations or those who are likely to have had contact with a confirmed patient are also normally put in quarantine [46]. However, in such a widespread event, enforcing that the quarantined people stay at home becomes a challenge. Thus, an opportunity to track quarantined individuals using digital means presents itself.

This paper focuses on studying users who live in a country where the government decided to electronically enforce quarantine on

its citizens. We study the experiences, daily lives in quarantine and perceptions of surveillance technology of users of the Polish government smartphone application *Kwarantanna Domowa*[1]. All users in quarantine were legally required to install the app [4, 29]. Every day, they had to complete tasks which consisted of a location check and uploading a photo of one's face. Through a qualitative inquiry, we chart how the app affected the experience of quarantine for those people and the social dynamics around the application.

While Human-Computer Interaction (HCI) has a history of conceptualising location-based systems and understanding their values involved in such apps with respect to privacy, e.g. [53], surveillance in the face of a crisis is a less explored topic. Past studies [50] investigated continuous location disclosure of convicts and parolees through dedicated systems. In contrast, this work explores the consequences of a citizen outside of a corrections paradigm being forced to report regularly using their private device. It is a challenge for HCI to determine if and how mobile technology can be used to help users stay in a single location in order to protect themselves and others, and how users experience such an intervention. Especially at the time of a global pandemic, where applications are introduced to citizens at short notice, it is important for HCI's social role to study the implications of state-controlled apps on users. Studying QApp offers an opportunity to inform mobile and social computing research and to derive insights for designers of technologies for public safety. A clear account of the QApp can broaden our understanding of the ethics of new technologies. Finally, an accurate experience of living with a surveillance technology can offer insights to policymakers and designers working on the topics of surveillance, privacy, and location tracking.

To that end, this paper studies diverse accounts of using the Home Quarantine application. We conducted a diary study where one of the authors remained in quarantine for 14 days and used the application. Further, we held interviews with 23 users of the application who quarantined for different periods of time and different reasons. We conducted a thematic analysis of the gathered data. We report on how the application affected the users' lives in quarantine, their interactions with the world outside of their home and the ways in which they completed the app tasks. Based on our results, we contribute insights for future applications that limit a person's freedom when necessary in times of crisis.

This paper contributes the following: (1) an autoethnographic diary study of 14 days in quarantine; (2) an interview study of users who were in app-mediated quarantine; (3) four themes that describe the lived experienced of being quarantined with a location control smartphone app; and (4) insights for future location-based technologies and understanding interactions with location surveillance technology.

Here, we first provide background information on the context of our inquiry and the mobile application which prompted it. We then situate our contribution within related work. Next, we report on the method used in the two studies we conducted and present an analysis of the gathered data. Finally, we discuss our findings and present lessons learnt from our study.

[1]Home Quarantine. We call the application QApp in this paper.

2 BACKGROUND

The Polish government closed the borders of the country on March 14, 2020 as part of its COVID-19 prevention measures. For more than three months, only Polish citizens and their relatives could enter the country. They were then subject to an obligatory 14-day quarantine. For the next 15 days, anyone subject to quarantine was able to choose between two surveillance methods: daily police checks or using a dedicated smartphone app. However, on March 31, the QApp became compulsory. To be exempt from using the app, one would need to officially declare that they did not have access to a suitable device (an Android or iOS smartphone). A false declaration on this account was equated to perjury and subject to legal consequences[2]. Persons in quarantine could choose to quarantine at an address provided to the authorities. If their accommodation did not enable them to be alone or fully isolated from other people in the house, they were placed in a dedicated facility. There facilities were mainly adapted health resorts and out-of-town hotels.

There was a structured process in beginning to use the app. The health authorities registered phone numbers of those subject to quarantine along with a location where one wanted to be quarantined. Next, the user would receive a text message saying: 'You are not using the home quarantine application. We remind you that it is your duty. Install and activate it now.' Upon downloading the app, the user would enter their phone number to authenticate it. Then, QApp would send tasks to the user. The task was to remain in the location reported to the authorities and send a selfie of one's face in 'home conditions.' Users were instructed to maintain a neutral face expression. The app would announce the task with a text message and then allow the user 20 minutes to complete the task. After 10 minutes, QApp would notify the user again if they had not completed the task. Upon exceeding the time limit, the app would send another text saying: 'You did not complete the task in the required time frame. This information will be relayed to the system.' A typical flow of how a task is completed is shown in Figure 1.

The official narrative [40] that accompanied the application focused on helping the relevant authorities deal with the task of managing mass quarantine. The government also informed users that it needed to gather more data about those affected by COVID-19. Additionally, users were offered the possibility to use QApp to request services, e.g. help with shopping. A journalist investigation later uncovered that the application was a modified *mystery shopping* tool, i.e. a way for chain companies to monitor if franchisees were conforming to the chain's rules. The original app was used to, among other things, control the state of coffee machines at petrol stations [57]. The original application assigned particular locations to users. The job of the user was to travel to that location and take pictures of a given specified retail outlet. QApp was implemented by permanently setting the location to the reported quarantine location.

This paper focuses on the lived experience of using the QApp. It is not the intention of the authors of this work to judge the ethics or condone the legality of the solution. This work assumes

[2]The actual legal consequences of not using QApp are unknown at the time of writing as trials are still in progress. The Polish government cited fines of up to USD 7000 in their media communications about the application [39].

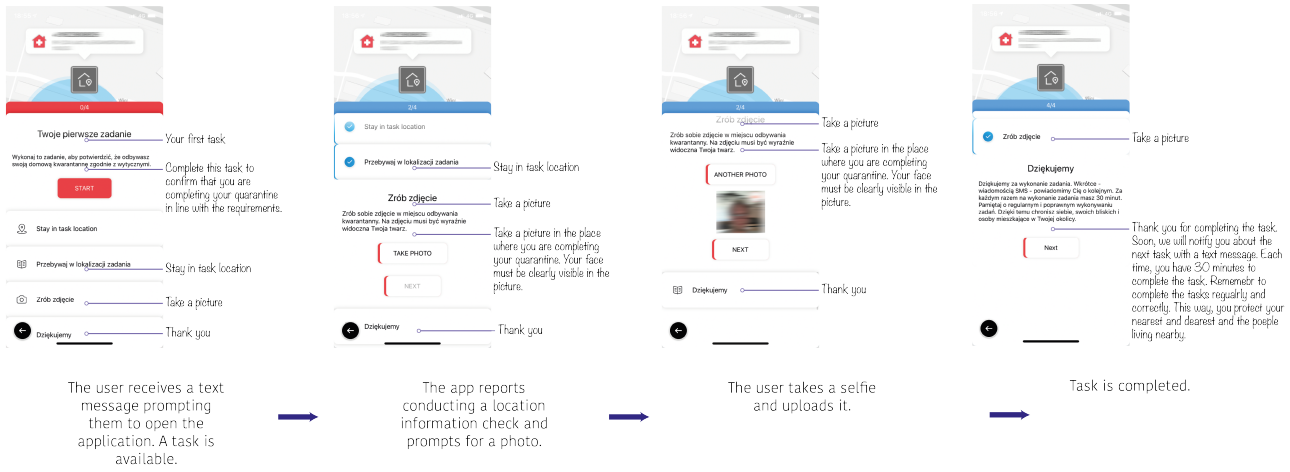


Figure 1: A typical sequence of actions in completing a QApp task. Upon receiving a text message, the user is required to access QApp. Then, the user's GPS position is verified, and a photo prompt appears. Uploading a selfie completes the task. Note that while the task completion message states that the next task will have a 30-minute time limit, all the participants reported the limit to be 20 minutes.

that quarantine is a required and socially beneficial action that contributes to minimising the harm caused by the pandemic. Quarantine is a means of preventing the spread of infectious diseases mandated by Polish law [8] and must be observed in all times. This is in contrast to other European countries where quarantine was only strongly advised [24]. We take an empiricist stance and refrain from assessing the political or business contexts of the app.

3 RELATED WORK

The QApp was used for surveying citizens and enforcing quarantine. The app required citizens to take a selfie in home conditions. Based on the knowledge we had about the functionalities of the quarantine app, our study was informed by three complementary areas of research. We first introduce the reader to related work about location-based systems and studies of surveillance in HCI. We then review past work on selfie-related behaviour.

3.1 Location-based Applications

A large array of past research efforts explored location-based systems such as systems to locate your friends [6] or to find restaurants in your proximity [9]. Another strain of research inquired how location-based systems could be used to benefit the society. For instance, Dombrowski et al. [15] studied the intricacies of location-based technologies to donate and distribute food to people in need. Concurrently, HCI started to build an understanding of when and how users were willing to share their location. Consolvo et al. [11] identified three reasons when people complied with location sharing: the relationship with the person requesting the location, the reasons for the request and the level of detail of the data that was requested. Notably, similar to the majority of previous work, the participants in the study of Consolvo et al. [11] had agency (i.e. they had the freedom to decide if they would share information about their location or not). In contrast, since QApp was a government-enforced app, our participants did not have agency in that sense, meaning that they were not able to decide if they were willing to share location information with the authorities. This constitutes a previously unexplored context in the study of location-based applications.

3.2 Studies of Surveillance

With the help of new technical means, areas of life that were long considered private could now be under surveillance [42]. Consequently, scholars began to study different aspects of location-based systems and surveillance. For instance, Mancini et al. [34] conducted a qualitative study with two families. They showed that tracking can be perceived as a threat to privacy, especially when it crosses the boundaries of ones' personal space in a literal as well as figurative sense (e.g. personal social norms). On another note, Shklovski et al. [50] and Troshynski et al. [53] studied the communication dynamics between parolees and parole officers. They reported on users whose movements were tracked with a satellite-tracked ankle tag as part of their parole conditions. Troshynski et al. [53] reported the need for location-based systems to require involvement on a social and a cultural level. They found that their study participants (i.e. paroled sex offenders) were anxious about how their change of location would be perceived by the authorities (i.e. parole officers). Similar to the tracking system studied in the work from Troshynski et al. [53], the topic studied in this paper, the QApp, is asymmetric. In other words, the system does not communicate to the person tracked (i.e. the paroled offender or the person in quarantine), if their activities are problematic. QApp belongs to the same category of systems as the examples above—solutions that explicitly track users, violating their privacy in the interest of an assumed higher value.

Further, Troshynski et al. [53] noted the issue that the tracking system in their study was too close to the body. Thus, parolees were not able to wear shorts to do the physical activities they would have liked to do. Our work is interestingly different as it looks specifically

at a government-enforced mobile application for home quarantine which is not limited to a specific user group. We endeavour to build a holistic understanding of the whole experience of using such an app. This includes the perception of the surveillance system (i.e. QApp) as well as the socio-psychological dynamics between the users of QApp and the authorities. In this context, studying QApp is of particular relevance as it enables us to study consequences of digital surveillance of users in a preventive, rather than punitive context.

A different strain of research focused on the perception of video communication in private contexts and its potential intrusiveness. Baishya and Neustaedter [3] designed a video communication prototype which allowed couples to see what their partner was doing at any time. While not being designed as surveillance technology, in the study by Baishya and Neustaedter [3], some participants perceived the technology as intrusive, while another couple perceived the "continuous presence" of their partner as intimate. The authors discussed moral aspects of their prototype such as the lack of autonomy regarding the timing of interactions. Similarly, Buhler et al. [10] found that video chat was used by teenagers for social and intimate communication. Interestingly, their results showed that, in contrast to their assumptions, privacy concerns were low because the teenagers could autonomously decide when and with whom to talk. A sense of control, autonomy and predictability are also relevant topics in the field of learning and behaviour modification. For instance, Fletcher et al. [19] showed that the way the human frontal cortex reacts to surprising (i.e. unpredictable) events can be predicted by behaviour modification theories, i.e. associative learning theory. These findings emphasise the need to build an in-depth understanding about the interplay between users of the QApp and the authorities with a particular consideration of communication processes and the users' perceived agency.

Many accounts and critical reflections on location-based systems engaged with Foucault's [20] work (e.g. [50, 53]. However, the current pandemic situation calls for reinterpreting Foucault's premise that 'the few see the many' [20]. In the context of the QApp one might go as far as to say 'the few' need to see (i.e. monitor) themselves (with the means of selfies) to ensure the safety of the many. Consequently, a study of the QApp offers a unique perspective to observe new dynamics in the values related to location sharing.

3.3 Selfies and Self-awareness

Research in social psychology discussed the effect of cameras on human behaviour. Geller and Shaver [22] manipulated self-focused attention with the means of mirrors and cameras. They showed that the presence of a camera or a mirror increased self-evaluative thoughts. Lassiter [30] showed that pointing a camera directly on the suspect compared to other camera angles led jury-eligible individuals to believe that the suspects were more likely to have been guilty. Van Rompay et al. [54] found that people showed more pro-social behaviour in the presence of security cameras. In contrast, Ariel et al. [1] found paradoxical effects of police body-worn-cameras on the number of assaults against police officers. These findings illustrate the effect cameras can have on self-awareness in serious contexts. In contrast, selfie-related practices are most often connected to social media use. Our work explores an interestingly different form of surveillance, selfie requests at times unknown to the user, and its effects on those being controlled.

A selfie is a picture a person is taking of themselves, usually with the intention to share it on a social media platform [13]. A large array of past research efforts in HCI and beyond explored the practical and emotional intricacies of selfie-related practices. For instance, previous work in HCI derived design implications for selfie booths [44] inquired about the usability of selfie sticks [2] and studied selfie posting behaviours of teenagers and adults [26].

Another strain of research focuses on studying motivations of selfie-taking and selfie-sharing. Sung et al. [52] determined four motives for posting selfies: attention seeking, communication, archiving and entertainment. They found that all motives apart from entertainment predicted the intention to post selfies. Furthermore, their results showed that narcissism predicted the selfie-posting intention and frequency. On a similar note, Sorokowski et al. [51]studied the interplay between narcissism and selfie-related activities. Their results showed a significant correlation between narcissism and selfie-posting behaviours.

In contrast, Rutledge [49] and Ehlin [16] emphasised that there could be other reasons for selfie-related behaviours beyond egoistic or narcissistic motives. Rutledge [49] postulated that selfies can, among other things, be a means for identity exploration and self-reflection or provide a live narrative of emotions. Ehlin [16] noted that selfies may have been a transformative experience that fostered inner dialogue and communication with the world.

Another strain of research focused on biometric identity verification [47], now used by many commerical services, e.g. in banks. Even though it is not a classic surveillance technology, some aspects related to this area are highly relevant for our study. For instance, McGuire [35] discussed potential privacy threats in connection with biometric methods used by banks and other services. On another note, White et al. [55] discussed that correctly assessing the likeness of one's own face compared to other pictures of oneself might have been determined by social considerations such as the assessment of one's attractiveness. While sending a picture of one's face to a system has become a commercially used means of identifying oneself, systems which support such identification were so far only used on a discretionary basis. In contrast, the system studied in our paper forces users to take selfies.

However, apart from some notable exceptions, such as the work on medical selfies from Diethei et al. [14], previous work mainly focused on taking selfies to share them on social media platforms or the technical intricacies of photo identification. In contrast, our work focuses on the socio-psychological intricacies of taking selfies in the context of a freedom-limiting mobile app. We study the practices around taking selfies in an application explicitly not designed for social interaction. Consequently, our goal is to build an in-depth understanding of the lived experience of the QApp encompassing selfie-related activities within the app.

4 METHOD

We decided to conduct a qualitative inquiry to explore users' experiences with the quarantine application. Gathering qualitative insight was our method of choice as alternative data gathering methods were largely limited. The QApp was only usable by those

in quarantine, and most users deleted it immediately at the end of their quarantine. This limited user base suggested focusing on obtaining rich individual accounts of using the app. In order to understand the functionalities of QApp, we first conducted an autoethnographic [33] diary study [48] where one of the authors entered quarantine for 14 days and used the QApp. We used the data gathered in the diary study to inform the design of the semi-structured interviews with users who installed the application during their quarantine.

4.1 Participants

The author who participated in the diary study was a 32-year old male. He spent 14 days in quarantine alone, in a flat rented specifically for that purpose. The researcher elected to spend the 14 days alone to minimise infection risk for his family. His experience of the app covered the whole quarantine period. QApp was activated immediately upon reaching the place of quarantine.

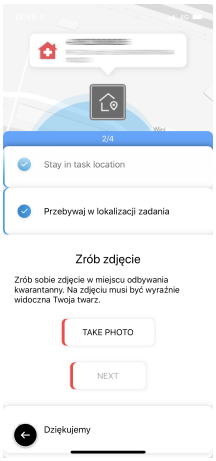
We used two strategies to recruit interview participants. Early in the COVID-19 pandemic, the majority of potential QApp users were in quarantine due to international travel (arrival from abroad necessitated a quarantine until June 2020). We used our university network to contact students and alumni returning home from international exchange. In order to recruit a diverse participant sample, we later changed our recruitment strategy and used social media posts and connections through research project partners to reach older users, focusing on those who had been in quarantine due to possible exposure to infected individuals. This strategy allowed us to gather accounts of using the app from users of different ages and professions who quarantined in different social contexts. Table 1 shows a detailed profile of the participants.

All interviews were conducted using online video call software with audio-only recording upon receiving consent from participants. We opted to contact users directly after the quarantine, but not during the experience. As quarantine could be an emotionally challenging time, which is also apparent in our results, we refrained from interviewing users actively in quarantine. Each participant received an online shopping voucher for PLN 40 (USD 11) as remuneration for the interview.

4.2 Diary Study Protocol

We decided to conduct an autoethnographic diary study as past work has shown that this method provides reliable accounts of non-standard device use and extreme circumstances [38]. For example, O'Kane et al. [41] emphasised the utility of this method for gaining user empathy for users, while Lucero [32] effectively charted life without a mobile phone through a long-term diary study. Here, we use the diary study to build a preliminary understanding of the users' perspective, as suggested by O'Kane et al. [41], which we later use to deepen our inquiry. Contrary to typical autoethnographies [17], which usually are extensive retrospectives based on material not created for a study, our data collection was planned before the quarantine began.

Before one of the authors of this paper began their quarantine, we (i.e. the author who was the subject in the study and two additional researchers) held a discussion in which we agreed on the format of the diary to be kept throughout the quarantine process as well as other data to be collected. The diary was kept using Evernote[3] note-taking software. One researcher would have access to the Evernote notebook to remind the person in quarantine about adding a diary entry every day. The notebook contained prompts about the activities in quarantine, app actions, feelings and an assessment of health. Additionally, the author in quarantine took screenshots of all their interactions with the applications, including the text messages received and selfies taken. Figure 2 shows an excerpt of a diary entry.



I got a text at 8 today. I finished unpacking and finding stuff super late so I slept a bit longer. So I guess the police will come now? It's 6.30 pm and still no other app activity. Police was here to tell people they shouldn't be social earlier with a megaphone, but didn't talk to me. Also the message they sent is not grammatical and I am unsure how to interpret this.

Figure 2: An excerpt of the autoethnographic diary entry for day one. An overview of the activities of the day is illustrated with an app screenshot. With the author's smartphone language set to English, the application provided prompts in mixed languages.

4.3 Interview Protocol

Based on the empathy gained through the diary study, we designed a semi-structured interview protocol for users to retrospectively reflect on their experience with the quarantine application. We chose an open-ended design to foster storytelling and accommodate diverse perspectives of quarantine. We began the interview by reiterating the aim of the study and data protection. Further, we informed participants that they had the right to terminate the interview at any time without providing any explanation, while still receiving their remuneration. Due to the potentially emotionally-charged or sensitive nature of topics connected to the COVID-19 pandemic, we emphasised that participants could disregard questions without providing any explanation. After asking the participants if they had any further questions, we continued by obtaining consent for recording. Further, we explicitly asked users to not mention any names during the audio recording. This way, we could anonymise the interview directly after transcription and remove any links to the particular participant. This procedure was important as the data set also included accounts of breaking quarantine, which may have been interpreted as a misdemeanour. We then inquired about the participant's momentary health. We asked them for the reasons for entering quarantine and downloading QApp. We prompted them

[3]https://www.evernote.com

Table 1: An overview of the participants interviewed in the study. The table reports basic demographic data, the number of days in which the users were in quarantine, how long they used QApp and the size of the household in which they quarantined. Three participants, marked with an asterisk (*), were members of the same household. P14, marked with a dagger (†) was not in quarantine, but in isolation, i.e. a strictly enforced quarantine for people confirmed to have had direct contact with an infected person. Contrary to quarantine, which automatically terminated after 14 days, isolation required testing negatively for COVID-19 twice for the person to be allowed to leave their home.

PID	Gender	Age	Profession	Quarantine	QApp Usage	Household Size
P1	M	21	student	14 days	6 days	3
P2	F	20	student	14 days	14 days	1
P3	M	24	architect	14 days	12 days	1
P4	F	21	student	14 days	14 days	1
P5	M	21	student	14 days	10 days	1
P6	M	26	software engineer	14 days	5 days	2
P7	M	22	student	14 days	14 days	1
P8	F	22	student	14 days	11 days	2
P9	F	23	student	14 days	14 days	1
P10	M	22	student	14 days	14 days	2
P11	M	27	engineer	14 days	14 days	1
P12*	F	20	student	4 days	4 days	5
P13*	F	48	civil servant	4 days	4 days	5
P14†	M	47	marketing	30 days	28 days	1
P15	F	54	teacher	21 days	14 days	2
P16*	M	53	business owner	14 days	14 days	1
P17	F	36	office manager	12 days	11 days	3
P18	F	44	police officer	9 days	9 days	4
P19	M	24	paramedic & firefighter	30 days	30 days	3
P20	F	32	customer service specialist	14 days	12 days	2
P21	F	22	student	14 days	14 days	2
P22	M	26	customer service specialist	9 days	9 days	4
P23	M	42	surgeon	8 days	8 days	2

to tell us stories of their days in quarantine, and whenever the quarantine application was featured in the story, we would inquire for more detail. We also discussed their perception of risk and how their routines were different from non-quarantine days. Further, we investigated changes in their smartphone or tablet usage.

4.4 Data Analysis

The entire audio material (total recording length: $9:25h$) was transcribed verbatim. Three authors analysed the data using the pragmatic approach to thematic analysis in line with Blandford et al. [7]. We conducted an initial coding round where three coders open-coded data from five randomly chosen interviews. We used an inductive coding strategy to obtain an initial set of codes to construct coding trees. We then held a code adjustment session where we discussed an initial coding tree and distributed the remaining material among the three coders. At this stage, we also decided to include the diary entries and pictures in the analysis to build a richer perspective of interacting with the application. The autoethnographic material (i.e. diary entries, pictures and screenshots) were coded by one of the authors who was not in quarantine. Having coded the entire data set, we had iterative discussions with axial coding where we refined the final coding tree and identified common patterns in the data. Based on this process, we derived four themes that described the lived experience of using QApp. Given the exploratory nature of our work and the fact the theoretical basis for understanding QApp, we chose that an open-ended Thematic Analysis approach as described by Blandford et al. [7] was the most suitable analysis choice. This choice of an analysis paradigm is highly interpretivist and often practised in the HCI field. Consequently, counting instances of particular statements or introducing scales could be misleading [7, p.64].

5 FINDINGS

Here, we present the findings of our inquiry organised in the four themes: Data duties, Outside world, Routines and Social. We illustrate our results with quotes from the interviews, marked with the participant ID, the autoethnographic journal, marked 'Author's journal' and the day of quarantine on which the entry was made.

5.1 Data Duties: Collecting and Sharing Data Under Stress

This theme describes users of the quarantine app perceiving how they reported to QApp using data collection methods. We discuss accounts of storing, processing and understanding data in quarantine. The users reported completing almost all the tasks in QApp. Nine out of 23 users reported missing tasks and no user missed

more than three tasks. We observed that the user shared a prevalent view that it was not only their duty to be in quarantine, but also to be subject to possible checks. Sharing location data and photos in the application constitute a form of giving legitimacy to one's quarantine experience. As a consequence, users reported being careful about their data being 'in order' and their quarantine information dutifully reported to the authorities. One user explicitly ensured that his records were correct before exiting their house after quarantine despite QApp informing him that the quarantine had ended:

We were surprised that no one was going to check on us. We just stayed at one place, and I had to call (...) the sanepid [National Sanitary Inspection] (...) because I wasn't sure if I was allowed to go out on the day on which I assumed that I could... I just wasn't sure. (...) I just politely asked her, "Maybe could you just check in the database." Then she asked someone and they told me that, basically, my quarantine ended on the day I assumed it ended. I didn't want to break the law or something. (P8)

Despite many users desiring to report on their quarantine, they also expressed worries and uncertainty about how their data was being processed. Participants often expressed doubt about the effectiveness of the quarantine monitoring system and wondered about possible misuse of their data. They remarked that QApp did not communicate in what way it enforced quarantine and whether or not it had other functionalities. A lack of knowledge about the thinking behind the application and its data processing prompted users to not only doubt its utility, but also question if quarantine was the primary purpose of the system:

It was a bit off... I wondered how they could use these photos for something else. I was wondering if this was fully legal, if this was not a hoax. Sort of a cover-up, a quarantine app, but the data or photos could be used for something else. That puzzled me. (P19)

Quarantined users expected that their quarantine would be rigorously enforced and identified QApp as a means of reminding them to adhere to the regulations in place. The random times at which task notifications were received created unpredictability, which the users interpreted as a reminder to be responsible. One user reported that they needed to leave their home to dispose of litter. In his case, the application contributed to psychological pressure and negative feelings associated with breaking the rules of quarantine:

There is a certain rigour to this isolation [...], because you might feel you can do what you want otherwise. It's hard to predict when this application will send you a message and you'll have a task to complete. We did approach this quarantine with a high degree of responsibility, but we had to take the bins out twice. This was psychologically taxing, sneaking out in the middle of the night to avoid meeting and infecting people. (P23)

The users expected a certain level of sophistication from QApp. The desire to accurately report on their activities led participants to attempt to provide quality data to the system. This way, they intended to assure that the system correctly recognised the fact that they were fulfilling their duty. This concept is best illustrated by the account of one user who was dissatisfied by the properties of the front-facing camera of her phone. The participant assumed that the system was able to recognise if she had been the person taking the selfie:

The app was wrong because the zoom in the camera was too large. They should have given you more space for your head. I guess it's face recognition. (P18)

We also observed that not knowing about the internal functioning of QApp led to a perception of mystery among the users. Here, the users experienced a conflict between being legally obliged to use the application and having reservations about its handling of their data. This conflict led to users eagerly imagining possible misuse of their data, the government using the application for political purposes or imagining technically impossible malicious functionalities. P14 was initially reluctant to install QApp, but he was later convinced to download it through multiple calls from the health authority. He felt that the application was inherently malicious and performed unauthorised, covert actions on his phone. This perception stemmed from the fact that the application was initially imposed on the user:

I initially treated that as simply complying with an order. In the beginning, I wouldn't want to do that. Later I would just do it to forget about it. When I finished the isolation, I removed the app, but the app is still on my phone, for sure. I'm convinced about that. (P14)

5.2 Outside World: Communicating Through Limited Means

Another recurrent theme in the collected data describes users' perceptions of the communication activity in QApp. The users reported that QApp was a means of communicating with the outside world. Further, they reflected on how the app managed their relationships with people outside of quarantine and wondered about possible ways to circumvent QApp's presence verification.

Our participants speculated about the possibility of other people checking their location. Further, they wondered who was processing their selfies (i.e. a person or an algorithm). In line with that, many users reported their desire to look respectable in their selfies or described how they staged their background comparable to selfies posted on social media. As they were uncertain about the identity of the recipient of the selfie, the participants ensured that the setting of the picture was pleasant:

You were supposed to take the photo in 'home conditions', so I always strove for the photo to be in front of a painting, in the kitchen, or something, not next to a white wall. I wanted for someone to be sure that I was taking the picture at home. If someone was reading (sic) this picture. Someone or some machine. (P13)

We observed that the way users engaged with the QApp and how their approach to taking selfies during the quarantine changed. Initially, most users desired to appear attractive and respectable. Later in the quarantine, selfie taking became a leisure activity. Participants began to make faces or funny poses. Concurrently, users questioned if the app used an algorithm or if real people were looking at their selfies. This sense of wonder often led to experimentation:

Oh, I'm starting to make faces in the app. I wonder if someone's actually seeing this. I guess they have an office full of people browsing selfies? I don't think they have an algorithm... (Author's journal, Day 7)

Some users speculated about the way the QApp was enforcing quarantine and how one could avoid detection when leaving their house. For instance, one participant assumed that the app would not check users' location regularly. Instead, P6 assumed that the app ensured quarantine by making people feel that they had to stay at home since they had to take the selfies, thus, creating an intangible psychological barrier instead of an actual location-based restriction:

The way I feel about it is: No, no-one will check, or maybe they will check your location. From time to time, they will fetch this data once you've logged in into the app or once you open the app. (...) Since the people feel obliged to make the selfie at home, they will be less prone to go outside and do something that they should not do, just in case (P6)

Similarly, another participant stated that she thought it was possible to trick the QApp. She described a scenario where she would leave her mobile phone at home and rush to the supermarket, while making sure to be back within the 20 minute time window to make a selfie if required:

I am not fully sure if the app would have still checked my location if I had left the phone and gone out of the house. Not necessarily, I think. Theoretically, it's a system you could circumvent. If I pop into the grocery store for 20 minutes and still get a notification to take a picture within those 20 minutes, I will still make it. I had a feeling that it was not fully effective. (P12)

While most participants described how their attitudes towards their selfies changed during quarantine, some interviewees described how the way they approached their selfie activity changed again when their quarantine came to an end. Some participants started to approach it in a way similar to how they had done at the beginning of their quarantine. We observed that some selfie-activities reported by users mirrored a process one could describe as getting back to reality. This process is highlighted by a statement of one of the authors in his autoethnographic account. His selfie journey transformed from respectable selfies to humorous selfies back to respectable selfies when he neared the end of his quarantine:

App control before lunch. I was a bit embarrassed because I didn't have a shirt on. I didn't have meetings in the morning. (Author's journal, Day 13)

5.3 Routines: Building Everyday Experiences Around QApp

This theme describes how the daily routines of our participants were affected by using QApp. We observed that participants perceived it as their duty to report their status to QApp. Hence, their lives started to focus on the completion of the tasks provided by QApp, as they felt obliged to report their status and tasks back as fast as possible since they feared unknown consequences:

One issue is that you really need to hear those text messages incoming to react quickly. I'm a task-oriented person, so I tried to glance if there were any tasks all the time to take a picture fast and not exceed the time limit. That's because I had no idea about the consequences of not taking the photo. (P17)

The fear of missing a task was a source of anxiety. Participants reported that they would often fail to fully engage in everyday actions as part of their attention was directed to thinking about a QApp task to be completed. At times, this disrupted interactions with others. One participant specifically mentioned being under permanent pressure during daily activities, such as social conversations. She feared that a prolonged call could have led to missing a task, and stated that the unclear consequences of missing the 20-minute time limit put additional stress on her daily life:

When many people called me, I had this anxiety that a conversation would go on for too long, say half an hour, and I would get the info to complete a task in the meantime. I was simply nervous that the 20 mins I had to take the photo could pass during the phone conversation. This never happened, but it theoretically could, because many conversations were longer than half an hour. This stressed me. I never missed a task. I'm curious about what would have happened if I had exceeded the 20 min limit. Would it ask me to take the photo again or would the policeman knock on my door immediately? (P13)

In this context, another participant drew a metaphor of not putting only the user but also the smartphone under arrest. Participants felt compelled to observe the notifications on the smartphone. This was perceived as an extra burden in addition to the quarantine. The participant describes, in a tongue-in-cheek manner, that an ankle tag (used for convicts and parolees) would have been a preferred solution as it did not require an active participation of the user:

Everyone is addicted to some device now. I'm trying to limit this, so I don't have all the notifications turned on. I don't react to every notification. And here, you are required to use your device. I would've preferred an ankle tag. If the police put it on me, they would know that I'm a prisoner in my own house and that's it! But, here, not only do I have to react, but also my devices are under arrest. (P14)

Participants reported that the QApp became an increasingly tolerable part of their lives as the quarantine progressed. Users reported being initially stressed until they noticed that no more than two tasks needed to be completed per day, after which one did not have to constantly monitor their phone. This shows how users desired to understand the inner workings behind QApp. Knowing how to optimise the use of the app, one could resume regular daily activities and routines:

When I completed the first or second task, this was an unusual situation. I was curious what would happen next. After several tasks and multiple days, it was all routine. The only thing was that you really had only 20 mins to complete the task, so you had to watch and keep your phone with you all the time. This was stressful until the second message came. Then, I knew that there wouldn't be a third one on the same day, so I was no longer interested. I would leave the phone in my room, sometimes in silent mode. So if I had gone to the garden or bathroom I wouldn't have heard the text message. That was no longer stressful. The

Figure 3: A COVID-19 screening test performed at P13's home. The test was a significant social event in the household. The participant shared the picture in the online chat window during the interview unprompted, and suggested that we use it in our research. We did not request that participants send us any photographic material.

first couple of days were learning to live with your phone by your side. (P20)

5.4 Social: How QApp Moderated Social Interactions

The last theme describes changes within the social aspects of daily life. The use of QApp was advertised as a means of preventing regular visits by the police to check if households were adhering to quarantine regulations. However, completing tasks did not fully exclude police checks. Participants who wanted to help the authorities in a crisis situation were disappointed at police visits:

This was a modern application that was supposed to make me not have to wave to the policemen from the eight floor. The idea was that it was easier to use, checking if the person is in quarantine. (P7)

Others perceived the police visits positively. QApp augmented the effect of the participants perceiving that their primary means of contact with the world outside quarantine was through the authorities. In households where multiple people were in quarantine together, contacts with the authorities through QApp and other means became a central element of communal living. When asked about how QApp affected the social dynamic in the home, P13 shared a picture of a test being conducted at her home (see Figure 3). She was proud about how the family effectively helped the authorities.

Police visits were particularly problematic for some participants, particularly ones living in close-knit communities. One participant, who lived in a small town, expected that the quarantine app would prevent regular police visits, hence limiting social attention. Here, the participant assumed that the app would prevent social stigma as regular police visits indicated to others that a household was under quarantine:

We liked the app, because we thought that the police patrol would not visit us because of it. That was cool, because we assumed that no one would know that we had been quarantined. But, after three or four days we were both under surveillance by the app and the police. Later, we started interpreting this as more of a joke. I didn't feel tracked. No strong feelings. (P18)

Changes in how users of QApp were treated in their social environment continued even after quarantine. One participant explained that the daily routines and inclusion into social activities were affected during quarantine. He spent his quarantine locked in his room and was only allowed to eat food looking at his family over a flight of stairs. His inclusion into communal family activities was affected. At the end of quarantine, despite QApp no longer requesting task completion, he had to convince his family to allow him to join them for a meal:

The first five days were quite normal because I was still remembering my student exchange, I was completing my routine. I didn't have any duties so maybe it was even nice, but, afterwards, I felt alone. You know how it is, I could only see them (the family) through the stairs even when they were watching TV or eating dinner. Usually, we eat together and then, I could only sit at the stairs. It wasn't the same. At the very end of my quarantine, I asked them, "Oh, can I come downstairs? You can see I'm not sick, come on." but they wanted to be sure that nothing will happen. (P7)

6 DISCUSSION

In this section, we summarise our findings and consider how our results impact our understanding of how applications can effectively help users isolate for their and other people's safety.

6.1 QApp Supported a Community Effort Despite a Punitive Rhetoric

We observed that the users in our study were affected by the language of communication used by the mobile app, which focused on threat and duty as observed in the Data Duties. This caused the participants to doubt the effectiveness of QApp in enforcing isolation. This, however, did not lead to the users being unmotivated to use the application as they wanted to aid the police in their tasks during a pandemic. Consequently, QApp changed from what many users initially perceived as a government-enforced means of control to a technology that facilitated community effort. This effect can be partly attributed to the media campaigns surrounding the application stressing helping the police [29]. However, this motivation was not strongly present in the design of QApp. Our results suggest that *future apps which help users adhere to rules for social good should stress the social importance of enforcing rules and avoid punitive language.*

QApp constitutes a novel way of imposing surveillance on citizen, which relies primarily on users willingly subjecting themselves to inspection. QApp requests a number of explicit actions by the user so that they can be controlled in exchange for the promise of a good deed. QApp users are constantly reminded of the surveillance and their lack of active participation results in QApp scorning them for being passive. Thus, QApp organised the everyday lives of the participants in an authoritarian design. This is significantly

different from past studies, where surveillance was imposed on the users, but required no active reporting [53]. A future challenge for HCI that stems from our work is how to effectively and transparently communicate the values behind the design of applications where one is expected to relinquish some privileges (and specifically location privacy) for the benefit of the society.

6.2 Users Developed Daily Routines Around the Rhythm of QApp

Our study reported on numerous user stories where the quarantine application became an element of organising quarantine life (Routines). Despite the tasks arriving at different times each day, the users developed routines that enabled them to complete the tasks efficiently. As a consequence, the quarantine application was an important factor in how users in quarantine planned their day. Our results in the Social theme show reports of loneliness, anger and boredom, which the users usually addressed by organising a number of activities. At times, QApp disrupted these activities thus having a negative impact on the well-being of its users. In their unprecedented situation, users found themselves organising their lives around an unknown algorithm. While parolees in Toshynshki et al.'s [53] work found that the tracking technology affected their bodies and the range of activities they could perform, QApp affected the users' time by altering their routines.

Interestingly, despite the randomness involved in the application and it potentially disrupting important activities, the majority of the users completed all their tasks. This might imply that, from a purely functional point of view, QApp fulfilled its purpose—the users completed the requested action. However, from a user experience and, most importantly, ethical perspective, *improved forms of quarantine monitoring should be designed to ensure that the impact on the life of its users is minimised.* This could be manifested in simple design elements such as persistent alarms instead of one-off notifications. Further, our results suggest that solutions similar to QApp should feature explicit means of reassuring users of fulfilling their duty. QApp required users to keep their smartphones in close proximity, which is different to behaviours observed in past work [45]. While this is a design issue, it is also an issue of technology, scale and speed. As user attention and interaction becomes more distributed among multiple smart devices [43], focusing their attention on the smartphone is disruptive. Thus, technologies for fulfilling civic duties should offer interaction beyond smartphone-only systems. The solution studied in this paper was developed rapidly and it was required to function on a wide range of handsets. Alternative devices, sensing modalities or application designs would require significantly more engineering work. Our work shows that designing mobile users' experience for potential crisis-specific application should become part of crisis plans made in advance.

6.3 Uncertainty as a Means of Control

Another observation from our study is that the users were particularly unnerved by their lack of knowledge of how the application worked and how it was connected to the government authorities tasked with monitoring quarantine, as seen in the Data Duties theme. In the case of apps which are not legally required, this would be a simple case of bad design for privacy—users who felt they did not have enough information about how QApp worked and how their data was processed (i.e. they pereceived it as a creepy technology [56]) would simply abandon the software. In our case, however, that was an illegal solution. The uncertainty of how the application enforced quarantine made users feel that their devices were held hostage (Routines). As a consequence, users tried to identify alternative means to regain control over QApp and understand the underlying infrastructure. Participants in our study made various assumptions about how the application functioned, ranging from assuming it was very simple to ascribing almost magical properties to the software. These assumptions enabled users to operationalise what QApp required them to do and act effectively. Building a personal understanding of the application, enabled the participants to focus on completing the tasks.

These facts show that designing an app for quarantine involves a certain power play. On the one hand, the authorities want to enforce quarantine as efficiently as possible and intimidate users into staying at home. A certain level of mystery behind the *system* could be perceived as a means of enforcement. Further, users knowing how QApp works could facilitate cheating and many users thought about that, cf. Outside world. On the other hand, users knowing about the infrastructure behind the application would improve the user experience and help those truly committed to quarantine feel that they have reported their quarantine in a responsible way. Our work shows that *the mystery strategy might be ineffective for long-term engagement and apps which require users to limit their activities should be transparent about their inner functioning.*

Understanding QApp showcases how the use of ambiguity in the design of a mobile application can go beyond how ambiguity was conceptualised in HCI work thus far. In QApp, ambiguity is neither a design issue [12] nor is it a means of encouraging close personal engagement with the system [21]. Instead, QApp uses ambiguity as a high-level dark pattern [23] to keep the user in check and *exercise implicit control.* Consequently, QApp shows how a government-mandated application re-frames the design of the app and puts design elements in a different context. In our data, we observed how usability issues can be interpreted as cover schemes.

6.4 Selfies Were Just Selfies Despite Not Being Just Selfies

Our study featured a number of varying behaviours in uploading photos to the application in the Outside world theme. A key observation is that all users had their own way of taking the required selfies and all adopted a specific strategy. Further, the role of the photos went beyond simply documenting one's presence at home. Irrespective of whether users assumed that human beings or algorithms checked their photos, they were careful to take high quality photos with good backgrounds. As the quarantine progressed, taking photos became a fun activity and the users wanted to find positive sides to the chore of completing app tasks. As observed in the Outside world theme, despite the uncertainty about how the selfies were used, participants still took selfies similar to what they would do if asked to take a selfie outside of a quarantine context. Further, many assumed that the photos were a form of communicating with the authorities, cf. Data Duties. This implies that *despite being a form of reporting, the selfies also became a form of*

communicating with the world outside quarantine. Through taking photos which were processed in unknown ways, the participants indicated that they were personally fulfilling their civic duty.

The multifaceted role which selfies played in QApp resonated with the inherently social role of selfies as observed in previous HCI research [5]. Similarly to Feuston and Piper [18], we observed how selfies were used to implicitly communicate intimate stories. What makes the experience of QApp different is that the selfies retained their role despite no longer being used in social media. The selfie taking led to changes in social behaviour at home, similarly to how digital photos changed the notion of a family snapshot [31]. This implies that selfies can profoundly impact users and caution should be exercised if selfie taking is controlled by any authority. Yet, the fact that many users reported enjoying taking selfies and, for some, they became a form of communication implies that there could be benefits to using selfies as a means of control. Future designs could investigate how the experience could be rendered more playful or include positive feedback. Users could be empowered to make the experience socially playful to turn difficulties into communal challenges to the benefit of their wellbeing, similarly to systems which support highly strenuous physical activity [27].

6.5 Designing for Non-Mobility

The design of QApp involved a trade-off in terms of effectiveness and user experience. While we can conclude that QApp was effective in making users stay at home, it has caused stress, mental fatigue, and mistrust in its users due to the excessive ambiguity present in the interface. Interestingly, the civil duty rhetoric which persuaded users to stay at home was primarily present in the media and QApp focused on possible punishment.

While the participants were dissatisfied with QApp's lack of transparency, the design may have been primarily motivated by pragmatic concerns. Given shortages in manpower and the unexpected need to create a country-wide quarantine system, creating an atmosphere of uncertainty may have been an effective way of quarantine enforcement. In the Data duties theme, we observed that the participants wondered about how they were being controlled and assumed strict scenarios. Consequently, the ambiguity involved in QApp served as an intermediate means of exercising control. While transparency in such technologies is the preferred design choice, emergency situations may require policymakers to use ambiguity again. In the case of QApp, it is likely that many design choices were made based on the need to rapidly release the software. Our work shows that using uncertainty should be limited as much as possible, and only used until transparent routines could be established. Even if the uncertainty in QApp could not have been avoided, a justification for its mandatory nature should have been provided. This could have been done through a quick user tutorial just after the app installation.

6.6 Limitations

The work presented in this paper was conducted in a dynamic situation. We identified the unique features of the quarantine app and endeavoured to study the experience of its users in as much detail as possible. We recognise that this inquiry is prone to certain limitations. First, an understanding of the application could have built using a faster instrument, e.g. a survey and a larger user sample. However, as being in quarantine was a sensitive topic for many users, recruiting a large enough sample may have been impossible. Second, as rapid recruitment was required, we used our personal networks to find participants. While we would prefer a more objective approach, an alternative form of recruitment would have taken more time possibly resulting in many participants forgetting their quarantine experience. Our approach enabled us to interview participants at different stages of the pandemic, which contributes to the diversity of the sample. Further, our sample consisted of users that quarantined in different life circumstances and reasons, from foreign travel to a COVID-19-related death of a relative. The participants had diverse backgrounds and included both those without specialist knowledge and those actively involved in combating the pandemic: paramedics, surgeons and police officers. Future studies should investigate app-mediated quarantine experiences in specific contexts. We also remark that the study took place in the initial stage of the COVID-19 pandemic, where the majority of those quarantined were affected due to foreign travel (the first wave of the pandemic in Poland occurred with relatively low infection counts [28]). This implies that our study favoured users with a socioeconomic status which enabled them to travel internationally. Lastly, this study is limited to Poland as this was where the app was enforced. To mitigate this bias and generate insights beyond a Polish perspective, this study was conducted by an international team with members of four nationalities and interviews conducted in three languages.

7 CONCLUSION

In this paper, we reported on a qualitative inquiry about the experiences of using a quarantine mobile application. Users in quarantine were legally required to install QApp and complete task which consisted of uploading pictures and reporting location multiple times a day. Through conducting interviews with 23 participants who lived in application-enforced quarantine and conducting an autoethnographic diary study, we built an account of their experience in four themes: Data duties, Outside world, Routines and Social. Our findings show that QApp supported a community effort and highly affected the participants' daily routines. We also observed that the uncertainty of how QApp worked was negatively perceived by the participants and that they used selfies as a purported means of communication. We hope that the insights of this study can be useful for building other applications that limit users' freedoms as a community effort. However, we sincerely hope that the need for using such applications will be as limited as possible.

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