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Developing on Shifting Sands: A Case Study of a Workplace Safety Monitoring App During the COVID-19 Pandemic

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Drawing on Foucauldian perspectives, this article takes as a case study the workplace safety app Hygieia, which emerged in response to the COVID-19 pandemic. We explore how the app's users were positioned in relation to questions of responsibility, agency, potential surveillance, and the app's general features. We used qualitative, semistructured interviews with nine of Hygieia's developers and conducted an autoethnographic analysis of the app, drawing on the "walkthrough" method. This combination allowed for a robust analysis of envisioned and actual functionalities. Developers' own ideas about workplace safety were realized in their design choices, creating a network of actors and informational flows coordinated by the app. We argue that the app produces instances of responsabilization in which users are individualized, depersonalized, and encouraged to use the app in particular ways. We question this configuration by emphasizing potential implications for agency, accountability, and privacy, and highlight how ordinary employees appear to shoulder a burden of responsibility for workplace safety against a backdrop of uncertainty, heightened surveillance, and moral obligations. At the same time, some levels of responsabilization

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and surveillance were also necessary in the context of the pandemic. This article makes a novel contribution to digital surveillance and organization studies by applying Foucauldian perspectives to the new context of developing monitoring support technologies during the COVID-19 pandemic.

Keywords: apps, COVID-19 pandemic, workplace safety, developers, case study, surveillance

The COVID-19 pandemic has brought discussions about the use of digital technologies to the forefront of public consciousness. A range of mobile and web applications emerged to support the response to the pandemic (Mann, Mitchell, & Foth, 2022; Marelli, Kieslich, & Geiger, 2022). These included early detection and diagnosis, modeling contact patterns and disease spread, prediction of morbidity and mortality rates, and contact tracing (French et al., 2022; Mann et al., 2022). Although we may now be in a post-COVID world or have learned to live with the virus, the initial context of the COVID-19 pandemic was one of an unfolding crisis as needs, concerns, and requirements evolved. In that sense, the pandemic resulted in significant social, economic, and technological changes with lasting impacts. These included particular challenges within workplaces, such as how to keep workflow processes running, as well as challenges for developers building technologies to support organizations. The context was further influenced by acute time pressures, uncertainties, significant changes to working practices and norms, and valid concerns for the health and well-being of individuals working in organizations. Collectively, these factors necessitated working in crisis management mode with no clear or definitive end at the time (Adisa, Ogbonnaya, & Adekoya, 2021). The findings presented in this article stem from a research project that was carried out at the peak of the second wave of the COVID-19 pandemic in 2020. At the time, there was an urgency to research the developments listed above because they were unfolding in real-time across many parts of the world.

This article discusses an in-depth case study that analyzes the context and issues related to the development and usage of a particular workplace safety monitoring app called Hygieia (Digital Energy, 2021). This app's purpose is to monitor and support workplace activities within large-scale industrial organizations. The case study focuses mainly on the perspective of app developers, which is an under-researched perspective that is not often captured in the literature (Ekambaranathan, Zhao, & Van Kleek, 2020; Mhaidli, Zou, & Schaub, 2019). It is supplemented by data from the authors' own analyses of the app's features and processes and their experiences with using it.

Drawing on Foucauldian perspectives, this article contributes to app studies and fields, such as surveillance and organization studies, by providing insights into the application of monitoring support technologies during a crisis situation (Kondylakis et al., 2020; Li et al., 2020). Our findings are based on a four-month funded research project from September 1–December 31, 2020 that aimed to investigate trust in workplace safety monitoring apps. In this article, we do not primarily focus on the issue of trust, but instead are led by other themes that manifested themselves both in the authors' walkthroughs and in the

interview data.² In the following section, relevant literature is reviewed, followed by the methodology section. We then discuss selected themes from the interview data in combination with an analysis of the app's features, which reveals complex questions regarding the extent of the necessary responsabilization, depersonalization, and surveillance of users. Our main argument is that the app produces instances of responsabilization where users are individualized, depersonalized, and encouraged to use the app in particular ways. We question this configuration by emphasizing potential implications for agency, accountability, and privacy, and highlight how ordinary employees appeared to shoulder a burden of responsibility for workplace safety against a backdrop of uncertainty, heightened surveillance, and moral obligations. At the same time, some levels of responsabilization and surveillance were also necessary in the context of the pandemic.

Literature Review

Workplaces faced severe changes during the pandemic, with many affected by enforced closures, changing patterns of commerce, and interruptions in supply and delivery. Employers faced new challenges around workplace safety and making workplaces "COVID-secure" (Alsaad & Al-Okaily, 2021; Mangan, 2020; Metcalf, Irani, & del Águila, 2023; Suder & Siibak, 2022).

To reduce physical contact and enforce social distancing, the workforce began relying on technology to communicate, receive information, and record workflows. A range of tools (e.g., Freespace, Hygieia, Iotspot, Safe Workplace, & Work Safe) began emerging as potential solutions to support employers in performing their duties, some claiming to use advanced analytics to support and automate tasks such as tracking employee well-being, forecasting, and managing demand for resources (e.g., desk space), and contact tracing. While such tools were helpful, they warranted closer attention because they potentially created new ethical and legal challenges. The question of how to effectively balance individual rights against the wider public good has arguably been at the forefront of debates throughout the COVID-19 pandemic. The increasing workplace monitoring and surveillance of employees could be viewed as justifiable and necessary, not just in the name of ensuring workplace safety but also as part of the wider efforts to identify disease outbreaks (Alsaad & Al-Okaily, 2021; Andrejevic et al., 2021; Baker, 2021; Sekalala, Dagron, Forman, & Mason Meier, 2020). This requires a careful balance between the need to protect citizens without engaging in excessive surveillance and monitoring.

In addition, the need to find solutions quickly may have added pressure to make trade-offs in terms of autonomy, privacy, and security (Harris, Bhatti, Buckley, & Sharma, 2020). In this context, Newlands et al. (2020) coined the term "rushed deployment" (p. 2). "The result is a rush to implement first and to continue to push ahead with deployments even when the shortcomings are evident," as Kitchin (2020) explains (p. 373). For example, whether intentional or not, many scholars have argued that the rise of remote working during the pandemic came with potentially increasing levels of surveillance (Andrejevic et al., 2021; Kitchin, 2020; Manokha, 2020; Sekalala et al., 2020).

² The primary research question was: "What are the affordances of trust in data-driven and AI-based tools for enabling COVID-safe workplaces?" This article does not focus on issues of trust.

Nonetheless, while concerns about digital technologies in the workplace may have become increasingly pertinent in the context of COVID-19, they are certainly not new. Sánchez-Monedero and Dencik (2019) have previously commented on increasing datafication in the workplace, arguing how it can lead to rising levels of monitoring and surveillance. While having a long history, such practices have specifically extended to the usage of tools and apps in recent years to monitor workflows as well as workers' well-being (Sánchez-Monedero & Dencik, 2019, p. 28). Manokha (2020) argues that it is only because of recent developments in workplace monitoring technology that workplaces have become truly panoptic, as employees rarely know when and how they are being tracked and monitored, and therefore constantly assume this to be the case.

To what extent employees had and have the agency to accept or reject these new tools, data flows, and uses remain an open question. Newlands et al. (2020) suggested that users should inform themselves about potential privacy issues when adopting such new technologies. Hafermalz (2021) argued that forms of digital surveillance were often actively adopted by workers for fear of being otherwise "left out, overlooked, ignored or banished" (p. 9) if they dare to resist the use of digital technologies. Drawing on Michel Foucault's (1977) work on surveillance and the panopticon as a scenario in which subjects are potentially continuously surveilled without knowing precisely when they are watched, Foucault coins the term "exile" to analyze the threat employees feel if they would not (fully) participate in the tools, devices, and technologies their organization uses. Indeed, the field of surveillance studies has often drawn on Foucault's work (Lyon, 2013) and the panopticon metaphor. Hafermalz (2021) argues that it is now outdated "because voluntary 'visibilizing' practices do not make sense from within the popular panopticon metaphor, yet are a logical response to a fear of exile" (p. 698). Foucault (2008) also went further in his thinking and stressed the active and voluntary workings of power that go beyond his notion of surveillance, whereby an individual or a group is subjected to practices that they obey because of fear or unequal power relationships. He argued that the neoliberal individual constantly engages in voluntary, active acts of self-discipline and surveillance. The individual accepts (or strategically resists) that it is their own task to manage risks and achieve certain goals in life. Neoliberalism, then, is about "the portrayal of personal choice and autonomy as the means through which responsibility is enacted" (Trnka & Trundle, 2014, p. 138). This line of argument has been extensively developed by scholars who have drawn on notions of surveillance, the panopticon, or discipline (among other paradigms) when analyzing contemporary forms of work that rely on digital technologies (Andrejevic, 2007; Caluya, 2010; Fulton & Kibby, 2017; Haggerty & Ericson, 2000; Irani, 2015; Lyon, 2013; Rosenblat & Stark, 2016). Some scholars (Clarke, 2005; Lemke, 2001; O'Malley, 2009; Shamir, 2008; Trnka & Trundle, 2014) have used the term "responsibilization" in this context to describe the "increased individualization of the responsibility for dealing with social risks and problems" (Ytre-Arne, Syvertsen, Moe, & Karlsen, 2020, p. 1719) today. We draw on this tradition, which highlights the need for the individual to adopt personal responsibility (Ferguson, 2012) when analyzing both the app's features and the developers' narratives about imagined users, responsibilities, and surveillance.

At the time of the research project, there was little work that covered the analysis of workplace monitoring apps in the context of the evolving pandemic. This is still the case at the time of publication (2023), as most research has focused on contact tracing apps rather than workplace safety apps (Metcalf et al., 2023; Suder & Siibak, 2022). Similarly, there has been little work in media and communication

studies, app studies, or organizational studies capturing the issues and contexts from app developers' perspectives (Ekambaranathan et al., 2020; Mhaidli et al., 2019). We therefore chose to conduct a case study of the Hygieia app (Digital Energy, 2021), an exemplar of a data-driven app developed for use in workplaces in response to the COVID-19 pandemic. In foregrounding the developers' perspectives on the app in conjunction with our own walkthrough analysis of its features, we highlight the complexities and contradictions between the developers' aims, the app's affordances, and the implications for users in the context of COVID-19.

The Hygieia App

Hygieia (Digital Energy, 2021) is a workplace safety monitoring app developed by Digital Energy (<https://digitalenergy.ai>). It is aimed at three different types of users: employers, managers, and employees. Employers set the requirements for what data are to be collected, by whom, and how often. Managers are responsible for creating and assigning checklists, ensuring training is up-to-date, monitoring and interpreting incoming data, and acting on data and/or risk alerts. Employees are responsible for following procedures and completing checklists accordingly. This may include providing accurate and timely data regarding training, activities, and adherence to procedures and safety incidents.

Hygieia (Digital Energy, 2021) is a suite of three software tools. The first is the mobile application Hygieia, the main function of which is to digitize workplace checklists relating to organizational procedures and workflows. A series of exemplar screenshots of the mobile app are provided in Figure 1. Checklists may be created for any purpose (e.g., intensive cleaning procedures) and then distributed by managers to individual employees or teams. The app then supports managers in using these checklists to track and monitor compliance with safety procedures and/or resulting outcomes. In addition to checklists, the app enables managers to create teams and upload and/or update guidelines. Employees can document their interactions with each other and record relevant training, certificates, and/or permits. An overview of a typical use cycle is provided in Figure 2.

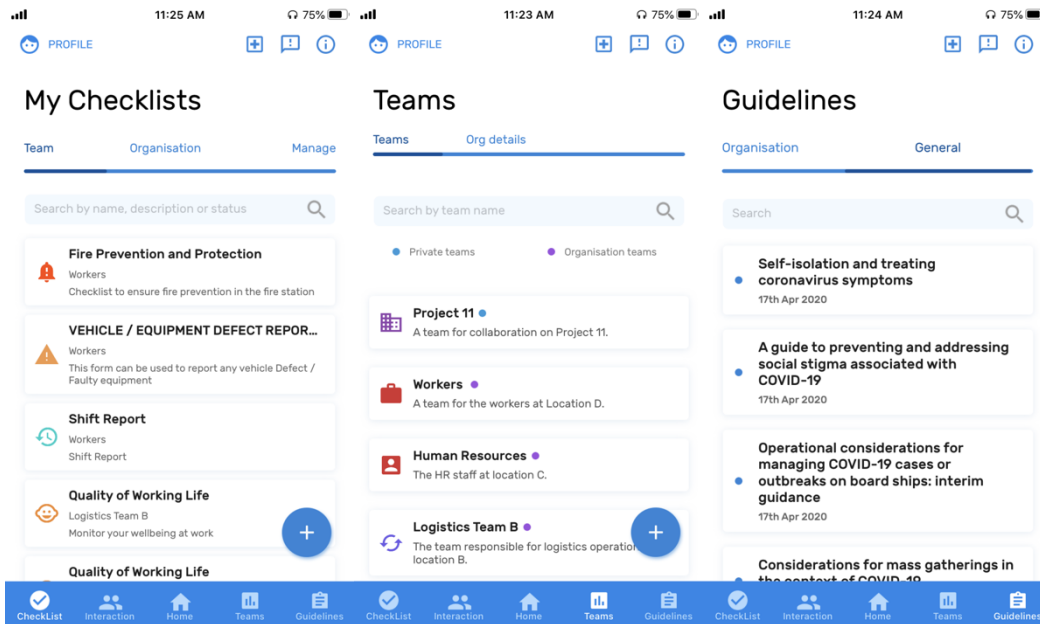


Figure 1. User interface for the Hygieia app: Example screenshots.

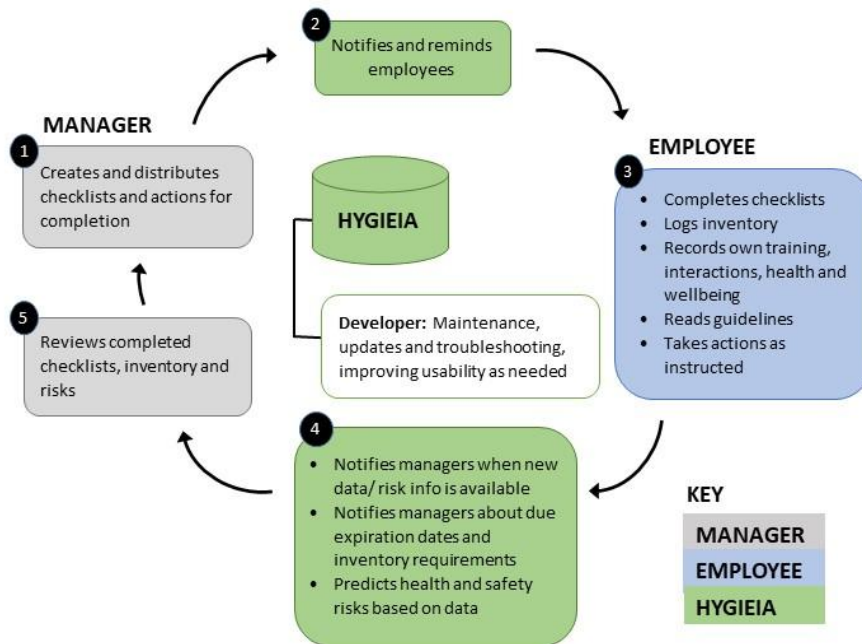


Figure 2. Overview of main roles, responsibilities, and processes when using the Hygieia app.

The second and third elements of Hygieia (Digital Energy, 2021) were still under development at the time of the research project. These included an AI application whose model was trained on workplace safety data from the oil and gas industry and customized to the specific context of COVID-19.

Methodology

The case study method was chosen because it allows for the generation of rich and contextualized data and lends itself to mixed-methods and multidisciplinary analysis (Creswell, 2009; Miles, Huberman, & Saldaña, 2018). The project received ethical approval from the research team PI's university ethics committee. We combined qualitative semistructured interviews with app developers with an autoethnographic walkthrough of the Hygieia app (Digital Energy, 2021) to form a robust analysis of the app's envisioned and actual functionalities and features. This allowed for different analytical perspectives in terms of gathering and analyzing interview data, as well as through the analysis of the app itself via the walkthrough method. Choosing a single site and application to which we already had access guaranteed the feasibility of executing the project within a limited time and resources and against the backdrop of wider global uncertainty.

The Walkthrough Method and Procedure

Drawing on the walkthrough method (Light, Burgess, & Dugauy, 2016), we conducted a qualitative autoethnography of the app's user experience. The method is grounded in actor-network theory (ANT; Latour, 1999). From this perspective, apps are not neutral, but rather consist of specific constraints, routines, and features that position users in relation to the app and to which users respond in different ways (Stanfill, 2015). Specifically, the method encourages examination from the perspective of affordance theories (Gibson, 1977; McGrenere & Ho, 2000; Rogers, Sharp, & Preece, 2011). Apps are viewed as examples of technology that have specific features and functions that enable and constrain users' agency. These offer specific possibilities of action whereby the user can affect the app in a certain way. In turn, the app can affect the user in a particular way. This approach was useful for the research team because it allowed us to conceptualize and research the abilities of both users and the app to affect each other.

Practically, the walkthrough method was conducted in two phases: the environment walkthrough and the technical walkthrough. The environment walkthrough directed the research team toward three pivotal focal areas: *vision* (how the app is being described in terms of its functions, user base, and purpose in app stores, websites, or other external materials); *operating model* (the business strategy and revenue sources of the organization behind the app); and *modes of governance* (how the developers regulate user activity to achieve the app's vision). For the environment walkthrough, the authors worked in pairs to analyze the app in terms of vision, data governance, and operating model, using the guidance described by Light et al. (2016). Detailed reflections were recorded throughout, along with supporting evidence (e.g., screenshots, personal memos, and group notes). The authors then held a series of meetings at which notes were exchanged, and common themes were extracted.

The second part of the walkthrough, the technical walkthrough, was conducted as the central data gathering procedure used “to systematically and forensically step through the various stages of app registration and entry, everyday use and discontinuation of use” (Light et al., 2016, p. 881). Each author downloaded the app on a device of their choice, and then, following a proforma designed for the study³, individually conducted an in-depth analysis of their own installation and usage of the app. After using the app and all its features daily for one week, each team member wrote down detailed reflections on the usage of the app, its features, its interface, and what thoughts and feelings they had upon its usage. Following individual analysis, a group meeting was convened among all authors, after which the individuals were offered the opportunity to revise their notes based on discussions.

Interview Procedure

Because the perspective of app developers is under-researched, nine semistructured interviews were conducted with the digital energy staff involved in developing the app from September to December 2020. Contact with the company was established through one member of the research team who knew its managing director. To guarantee reliability and transparency, that member of the research team was not involved in carrying out the interviews. Interviewees were invited to voluntarily participate, and their written informed consent was documented. The interviews were held to establish their motivations for developing the app and their thoughts on technology and workplace apps in the context of the COVID-19 pandemic. A topic guide was used to guide discussions, ensuring that key focal areas were addressed while allowing sufficient flexibility for interviewees to introduce unforeseen topics (Clark, Foster, Bryman, & Sloan, 2021). Two authors conducted individual interviews via video conferencing software, partly because of interviewers and interviewees being located in different countries and partly because of travel restrictions imposed by the pandemic. Interviews were audio recorded and transcribed verbatim. The sample consisted of the following interviewees who had specific roles within the developer company (Table 1).

Table 1. Descriptions of Interviewees.

Interviewee number	Role in the company	Gender
#1	Management of the company	Male
#2	Management of the company	Male
#3	Data science and AI	Male
#4	Data science and AI	Male
#5	Software engineering	Male
#6	Data science and AI	Male
#7	Front end development	Male
#8	Design / testing of the app	Female
#9	Social media management / testing of the app	Female

³ See https://docs.google.com/document/d/16hWjMG6MUDP1bjA1WZWukW_NeqGabXNo/edit walkthrough proforma and interview codes:

Data Analysis Procedure

Transcripts, individual walkthrough notes, other materials generated during data collection, and activities were imported into NVivo for analysis. The merged dataset was then analyzed thematically, following the procedures described by Braun and Clarke (2021). Briefly, after familiarization with the data, the data were coded using a series of 29 predetermined codes, which broadly mirrored the content of the interview questions and walkthrough principles. The interviews were divided among three members of the research team and coded individually. Upon completion of coding, a subset of coded interviews was compared and cross-checked to guarantee intercoder reliability. This was done through interpersonal discussions among the three coders of the research team. Although the coders were instructed to add additional codes if needed, none were required. Codes were discussed by all authors and developed further before being organized into candidate themes, with continual reference to the transcripts. After several iterations and discussions, the strongest themes that best accounted for the data were agreed upon by all authors and selected for inclusion in this article. Themes were named and described, and illustrative quotations were selected to indicate the nature and breadth of perspectives (Braun & Clarke, 2021). The interview and walkthrough data were deliberately integrated, consistent with our mixed-methods approach. Before submitting the article, it was sent to the developers so that they could read about the main findings and arguments presented here (no changes were requested as a result). We integrated the presentation of the data and discussion to provide in-depth insight into the topic of the article.

Findings and Discussion

Four interwoven themes from our blended analysis of interview and walkthrough data form the basis of this article: an evolving vision, responsabilization of users, depersonalization and organizational objectives, and normalizing surveillance.

An Evolving Vision

Hygieia's website portrays safety at work as the predictable outcome of defining, distributing, and tracking adherence to a series of processes using the app. It said on the website, "Leaders can manage and coordinate teams to respond appropriately and to mitigate risk through a collaborative environment. This intelligent, focused response ensures a safe work environment and reliable continuity of business" (Digital Energy, 2020, para. 6).

This was specifically operationalized through the checklist feature outlined earlier. The importance of this feature was immediately apparent because of its priority positioning within the introductory app tour and the app interface (Figure 1). Several interviewees discussed how this feature enabled managers to allocate tasks to individuals and teams and track their completion.

Probably the least sexy part of the app is the most essential and probably also the most revolutionary. It's the checklists, it's a simple way of creating checklists, creating groups around those checklists, sharing the checklists, updating each other's checklists. (Interviewee #1)

Another interviewee said, "So you can actually do things like divide people into teams, create checklists, forms, inspections ... So that actually helps build an environment where teams are tracked and a, sort of, live status is maintained" (Interviewee #5).

While the purpose of the checklist feature was clearly and consistently described, our experience during the walkthrough highlighted some discordance in terms of other intended functions and the broader rationale for the app. The website situates the app in the specific context of the COVID-19 pandemic. Indeed, several interviewees spoke about the app's primary purpose of enabling a safer work environment in COVID-19 times. Relatedly, the interview narratives below introduced themes of health and safety: "Yeah, there's no doubt, COVID was the motivating force behind the development of this, no doubt" (Interviewee #4).

Interviewee #6 said,

It is the perfect time right now to get started on something creative about how we could help businesses get back into a workplace which is much more controlled and much more effective, in a sense. Because, of course, with the whole set of regulations you're now going to have a lot of compliance that wasn't there before.

However, the walkthrough revealed that the COVID-19 narrative did not appear to hold up in terms of prioritization of specific features within the interface of the app itself. For example, the app's focus on the completion of checklists or the creation of teams within an organization emphasized the more general functions of the app in terms of process management.

Many of the interviewees echoed the website's descriptions of the app when they remarked that because of AI-based datafication, the app would almost automatically make workplaces safer. Such narratives imply a form of automatic behavior that is seen across the industry and in big data practices. Kitchin (2020) argues that many actors, including governments and businesses, have "been amenable to the solutionist proposition that mass surveillance or tech-mediated control should be a primary means for beating the disease" (p. 373). Large datasets quantify, for instance, user behavior and provide patterns for analysis. Many believe that this will automatically lead to better, in this case safer, results. Such perspectives often risk ignoring blindspots in relation to bias, discrimination, or imprecise results, especially in times of rushed deployment. At the same time, the different characterizations of the app may also be because of the dynamic nature of the app development itself. One interviewee's account sheds light on how shifting priorities may have shaped development:

So, first we started with promoting it as a COVID app but I think people are a little bit tired of this whole subject and of the situation...people just got fed up, right? They want to forget about this whole situation. So we are promoting it as a health and safety app but not only a COVID app. (Interviewee #9)

The above narratives point to the dynamics of developing on shifting sands during the pandemic. Both health, safety, and workplace monitoring were emphasized by interviewees, as the app's vision was

articulated on its website and in the app itself. This led to the question of who the intended users of the app and its domains of usage were. In the next section, we discuss the way the app positions the user.

Responsibilization of Users

The app situates and coordinates a network of actors involved in producing workplace safety—including employers, employees, managers, and the app itself, which is supported by app developers. We argue that the overall effect of this particular framing and hierarchical arrangement of roles is to place the moral burden of responsibility for use (and misuse) on the customer while moving responsibility away from the developers of Hygieia (Digital Energy, 2021). We analyze this through the concept of responsibilization (Foucault, 1977), as discussed in the literature review.

In the pursuit of workplace safety, employees, employers, and managers are held jointly, though unequally, responsible for adhering to procedures and recording this. The burden on the employee is notable; this group of users is expected to perform actions exactly as instructed and provide the right data at the right time in the name of “safety.” However, the app puts them in a relatively reactive position, granting them little agency or right to question and limited transparency about information flows (Chun, 2011). This left us with several questions during the walkthrough. “What are the mechanisms for customer feedback (to Hygieia)? Are there any mechanisms for employee users to raise issues to their managers?” (Walkthrough notes, #1).

Simultaneously, the inherent customizability of the Hygieia app—particularly checklists (see the previous section)—arguably functions to distance Hygieia from decisions about what actions to measure, when, and by whom. Though our interviews with app developers indicated that they had “good” intentions, they were also keen to resist notions of responsibility for how others might use the technology they had created. Ultimately, users are responsible for customizing and using the app in the correct way. Two interviewees remarked in this context:

Now if you have a big organization out there that buys it, then even with our disclaimers then they might start using it differently, because it will be their data, it will be their app. Because Microsoft has invented Word, they cannot guarantee that everyone using Word will only write nice things. (Interviewee #1)

Now, could the app be misused? Yes. Right. I can tell you a very simple way to misuse it, you can create a checklist that says, I don't know, maybe create a checklist that says, go and clean this area, and you're mad at somebody, so you assign that to them every hour, on the hour, and it's going to ping them, and then you follow up and see if they did it. Yeah, this is misusing the app, you can misuse Microsoft Teams the same way, or SharePoint, or anything. (Interviewee #5)

While the above quotes acknowledge responsibility, they discursively shift it toward the end users and away from the developers. Given that there are different user types who use the app (managers and employees) with different modification rights and privileges, the question of who is responsible for workplace

safety and in what way is critical. Both through the app's features and in the interview narratives, emphasis was placed on employees who were responsible for the day-to-day completion of checklists in the right way. "It's the same as a hammer, it's a tool that you have to use for the right scenario or the right things" (#6), as one app developer put it. While responsibility may actually lie with the app's developers as well as its users, the context of the COVID-19 pandemic adds further complexity to our discussion because it shows "how neoliberal 'responsible' subjects exist within a matrix of dependencies, reciprocities, and obligations" (Trnka & Trundle, 2014, p. 150). In that sense, all parties involved in the same app, from developers to employees, bear some level of responsibility.

In her discussion of the notion of exile, Hafermalz (2021) conceptualizes it as an existential fear that constantly hangs over employees if they do not participate implicitly and explicitly in using digital technologies at work. In this scenario, "a sense of uncertainty is reinforced by individualization, competition and radical responsabilization" (p. 699). While Hafermalz (2021), similar to most Foucauldian scholars working in surveillance and organizational studies, focuses on exile as a threat tightly interwoven with employee surveillance, we wish to use her concept in a slightly different way. While surveillance and questions of subjectivity were key themes in our project as well, as we discuss in the next two sections, responsabilization in light of COVID-19 presents us with complex questions that cannot only be critiqued as new regimes of power or new forms of surveillance or discipline. The prospect of being exiled within a company points to existential issues introduced by COVID-19 and its associated health risks through transmission. It is therefore important to discuss responsabilization with some nuance rather than merely using it to contribute to a feeling of suspicion in light of excessive monitoring.

"A fear of being exiled is therefore perhaps an inevitable counterpart to the organization becoming the heart of identity, belonging and security in the face of increased experiences of precarization of work," Hafermalz (2021) writes (p. 705). Yet, in the context of COVID-19, this fear of being exiled suddenly acquires a different urgency. If an employee fails to comply with the processes and workflows of Hygieia (Digital Energy, 2021), for example, they may be exiled in the sense of not being allowed to enter the workplace because they pose a health and safety risk. If they had been exposed to someone who had been infected, the app would automatically alert them (a feature in development at the time of interviewing). Writing about contact tracing apps, Milan (2020) notes,

for instance, does failing to install a given app exclude one from the polity by, e.g., precluding participation to economic activities? These fixes might end up allowing (and dis-allowing) belonging to a community, albeit temporarily, ultimately impinging on key identity dynamics. (p. 5)

While it may be a relatively easy task to critique the manifold instances of neoliberal responsabilization that often go against someone's interests, deprive them of agency, and provide diminished forms of support, the COVID-19 pandemic complicates such a critique. In a crisis context, developers and employers (prospective Hygieia customers) are busy navigating "shifting sands," where there are moments of uncertainty, changing needs, time pressures, and external influences dictating activity.

During the early stages of the pandemic, the need to monitor where the pandemic was spreading quickly arose. Governments brought out track and trace systems for monitoring purposes. Richardson, Hjorth, Strengers, and Balmford (2017) have termed similar measures "careful surveillance," whereby surveillance is perceived as useful and legitimate if it is trusted by citizens and used with care by governments or corporations. Nonetheless, there may be tension or unease in what measures are considered necessary or excessive, for instance, by different groups. Writing about careful surveillance during the pandemic, Andrejevic et al. (2021) point to a similar tension we discuss in this article: "Even those who recognise the legitimate role of state representatives in contact tracing, for example, may be inclined to view the implementation of a contact tracing app with suspicion" (p. 580).

Employees, as much as managers, also wanted to ensure that they operated a COVID-safe workplace, and this required monitoring health information and location data. Employers needed to exercise a duty of care to protect their employees within the workplace and ensure that employees had appropriate training to continue working. In that sense, a process of responsabilization may appear unavoidable, but it is the extent to which employees are responsabilized by the app that is problematic. This becomes more apparent when discussed in conjunction with two other themes that emerged from the data.

Depersonalization and Organizational Objectives

In light of the previous theme of responsabilization, we consider the nature of activities that are being measured and recorded and by whom. With Hygieia (Digital Energy, 2021), the focus of observation and datafication appears to be adherence (and nonadherence) to defined processes by distinct user groups. The app is seen as a tool that helps larger organizations manage assets (e.g., in this case, groups of users and inventory) via processes that they define (i.e., set routines and regulations).

Big groups of people, whether it's factory workers, whether it's industrial workers, as I have, on my site, whether it's nurses and doctors, where you have large groups of people where they interconnect, they meet each other, they need to be managed against work checklists or workflows, they need to be managed against calendars, routines, that's the organisations where Hygieia works the best. (Interviewee #1)

One of the ways that you can easily use this application to provide a better, safer workplace is by simply using the application to provide, to use something like the observations, the incidents...that will help you as well as your organisation to track and maybe create better guidelines for people. (Interviewee #5)

This mechanistic, "top-down" view of organizations and the nature of "the work to be done" effectively constructs the typical worker as one in a hierarchy who is used to performing tasks as part of large, structured processes with little room for deviation—the stereotypical "cog in the machine." This characterization echoes the origins of the app, which was originally designed for supply chain optimization purposes:

[The app was initially] built to do supply chain optimization for capital-intensive industries, so moving complex assets around in an efficient way, and behind that, we have a number of algorithms, workflows, checklists, et cetera. When we were faced with the pandemic, we could see that some of that knowledge could be used for managing workforce-intensive or workforce-complex set-ups. (Interviewee #1)

Positioning employees within organizations as assets (or data points) has the effect of depersonalizing the users and reducing them to anonymous workers who need to be responsabilized and reminded to complete tasks. Such a perspective arguably places goods or objects first and individuals second. However, while the app may be controlling the "flow of people," as one interviewee put it, it is still used by an individual human being. One member of the team recorded a similar observation in the walkthrough notes:

The app is also built upon the premise that some workplaces can / should remain open in the pandemic and seems to suggest that by following specific data-driven procedures workplaces themselves can be made safer. This may well be the case but such ways of framing the app also position it [...]. This view discounts the fact that e.g., checklists can be forged or that completing a checklist would not stop me from becoming infected with Covid. (Walkthrough notes, #3)

A similar point to depersonalization was discussed by Hafermalz (2021), who details how her interviewees navigated the digital tools their workplaces used (e.g., internal social media, messaging, or video conferencing platforms). To avoid becoming exiled, they actively affirmed the depersonalizing dimensions of such tools and became data points so as to be "seen" by management. "This self-disclosure may result in surveillance, and it certainly places restrictions on their lives, for example, by feeling 'chained' to a desk. Yet the trade-off makes sense in light of a fear of exile" (Hafermalz, 2021, p. 707). In the context of Hygieia (Digital Energy, 2021), this trade-off can only be managed by users who accept certain levels of responsabilization and depersonalization. The tension between structures and individual agency is further revealed when we contrast the way the developers spoke about the app's ideal users and how we, as the research team, felt when we used the app as part of the walkthrough method. One interviewee described the app's users as follows:

For the users, of course the end-user is what I would call the sharp end, so it's the workers in the front line, whether it's the nurses in hospitals, or whether it's the people in jumpsuits at the industrial sites, they would more easily receive the routines of the day, the tasks of the day and all of that was meant to make their work efficient but also mitigate or keep them as safe as possible from any connection or overexposure. And then for the team leaders to of course control their teams in a more efficient way and for the senior managers to push out these routines and ways of working in a more efficient way. (Interviewee #1)

We supplement this with a note from an individual walkthrough: "The vision of the app was not immediately clear from using it: was it about assigning checklists? Was it about designating tasks? Was it about checking up on my health and well-being?" (Walkthrough notes, #2).

While this particular framing of the user may not necessarily be problematic from a data analytics perspective, it underplays the importance of human factors in technology acceptance. Various influential models have postulated how users come to accept and use technologies, acknowledging the complexity of individual users as human beings with particular attitudes, beliefs, and subjective norms that interact to predict intentions and actual usage. Milan (2020) has argued that policymakers and app developers had, in the context of the pandemic, “a certain type of user in mind—suitably digital literate and sufficiently wealthy to own a state-of-the-art smartphone” (p. 3). While companies that use workplace monitoring apps may provide their employees with smartphones, they nonetheless construct ideal users, as discussed.

Thus, beyond the fulfillment of business objectives, it would seem justified to consider employees as cognizant users rather than anonymous data points among hundreds or thousands of others.

Normalizing Surveillance

The COVID-19 pandemic formed part of the narrative, presenting Hygieia (Digital Energy, 2021) as a solution to enable businesses to introduce new safety processes, delegating additional tasks, and further responsabilizing workers to reduce the spread of the virus within workplaces. As we have seen, others have pointed to the dangers of using digital technologies to normalize increased surveillance in the wake of the pandemic. While the app envisions the ideal user as one who smoothly blends in with particular organizational structures, many interviewees simultaneously recognized that users needed to be tracked, observed, responsabilized, or disciplined into behaving in the safest possible manner: “You can use those features to record observations, people maybe not observing social distancing maybe or something like that” (Interviewee #5).

In this context, interviewees acknowledged the issue of surveillance but viewed it as justifiable under certain circumstances.

People are not going to feel more monitored than they already do, because of the culture that we’re in now because of COVID, the COVID environment. Everyone is observing everything at all times anyway, so instead of writing it down on paper, it’s all digitized, so we can have several guidelines uploaded even to ensure that certain safety protocols and guidelines are being followed. (Interviewee #5)

But the other aspect is, you know, will employees feel monitored at work, and when you look in the industrial environment, and these guys are monitored all the time, okay. Why are they monitored? Because they’re working in a hazardous environment. (Interviewee #4)

These statements were repeated in different ways throughout the interviews. In its reliance on observing the completion of checklists, as many interviewees pointed out, the app merely moved paper-based processes into the digital realm. Viewed through this lens, the interviewees did not immediately consider that the app itself raised any new privacy concerns. However, this view arguably underplays the significance of the new data flows (intended and unintended) created by this configuration. The

implications of previously locally accessible information giving way to remotely accessible, easily searchable databases are not purely administrative and cannot be brushed over, as we have discussed by pointing to the wider implications.

On further probing, some interviewees acknowledged the potential for conflicting agendas between users; however, there were mixed views on where responsibility lay for mitigating this.

So only your organization has access to your checklist, your responses, your guidelines, and your user data. We don't have that, you know? If your manager's making you fill out a checklist that you find intrusive, it's not Hygieia's fault, it's your organization, and you should query that with your HR. (Interviewee #3)

For example, compliance measures, right, they want to make sure that, you know, like the workers are following specific processes and procedures, and they want to have accountability for it. So some features might come out of that, and there might be like conflict with like normal users, where they don't want to have like that strict control when using the app and things like that, yeah. So yeah, that happens where there's like conflict of interest between like the different target audiences, I guess, or target users. And generally, yeah, we try to make it as usable by both parties as possible. (Interviewee #7)

On reflecting on our own sense of privacy during the walkthrough, we noted that the sense of "being watched" was partly amplified by the one-way flow of information; the individual worker knows little about actions taken by others who have delegated tasks to them or what happens to their own completed checklists following submission. "It also wasn't clear who would receive my health data (sensitive personal data) in the health check, so I didn't fill it out" (Walkthrough notes, #2); "What happens to a checklist when it is submitted? I would expect some kind of response" (Walkthrough notes, #3).

While this may seem unremarkable when considering responsibility for checking inventory (e.g., stocks of cleaning equipment), sensitivity undoubtedly increases when submitting location data or answering personal questions about health and/or well-being. This 'one-way mirror' effect, which may be an artifact from the app's origins in supply chain management, arguably reduces transparency. Moreover, it omits the possibility of providing feedback loops to encourage self-learning and self-correction; rather, such insights are only viewable by those with additional rights (i.e., managers).

Workplace monitoring apps may thus lead to a feeling of activity on the part of users, which is coupled with the sentiment that they are being tracked by passive management in the background (Irani, 2015; Rosenblat & Stark, 2016). If employees fail to use the app 'effectively to display themselves to management and the organization, they remain "invisible" and therefore "unknown"' (Hafermalz, 2021, p. 707). In that sense, the panopticon metaphor is perhaps not quite as outdated as Hafermalz (2021) makes it to be, as the anonymous watcher still hovers over everyone without being seen. Our analysis has implications for surveillance studies in the context of COVID-19, which accounts for the difficulty of balancing "justified" or "necessary" means of surveillance, tracking, and tracing with intrusive or excessive forms (French et al., 2022; Mann et al., 2022; Marelli et al., 2022; Suder & Siibak, 2022), especially when it comes

to 'careful surveillance' (Andrejevic et al., 2021; Richardson et al., 2017). The 'right' amount of surveillance may seem like a difficult, yet necessary, balancing act.

Conclusion

The case of Hygieia (Digital Energy, 2021) is an exemplar of how particular discourses about the power of technology and big data were and are being drawn on as solutions for maintaining safety and productivity in the workplace in the context of COVID-19. Our interview data analysis shows how developers' own ideas about the nature of workplace safety were realized in their design choices, creating a network of actors and informational flows coordinated by the app. Moreover, drawing on the autoethnographic walkthrough method, we have problematized developers' claims of neutrality and highlighted how actors in the lowest position of the hierarchy (employees) appeared to shoulder a disproportionate burden of responsibility for workplace safety against the backdrop of heightened surveillance and moral obligations.

It may be expected that Hygieia (Digital Energy, 2021) has to delegate responsibility for how the app is used to its customers. Similarly, employers have a duty of care to protect their employees within the workplace, as well as other responsibilities. Under the configuration of the roles and responsibilities enabled by Hygieia, individuals are both made responsible for and are checked if they follow rules and regulations. Indeed, in the context of the pandemic, responsabilization and surveillance may be seen as a matter of life or death when it comes to observing social distancing, wearing face coverings, or following hand hygiene. We recognize the importance of public health and yet conclude that there are tensions around questions of agency, accountability, and privacy that cannot be fully resolved.

This project was an in-depth case study with a relatively small sample size that focused on one exemplary app. A larger sample may have been beneficial, but the short duration of the funded research project (four months) allowed only developers of one app to be included. While the themes discussed may be relevant to others considering introducing data-driven technologies into the workplace to improve safety, we cannot claim generalizability. This could be seen as a limitation of the study. Future research could adopt a comparative approach and compare different apps using the walkthrough method. In particular, it could also include interviews with end users in different companies to give voice to their thoughts and experiences of app usage.

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