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The workers strike back- A literature survey of digital circumvention tools used by online gig workers

Runar Sæther and Babak A. Farshchian
Norwegian University of Science and Technology (NTNU), Trondheim, Norway
runarsae@stud.ntnu.no; babak.farshchian@ntnu.no

Abstract. Most studies of digital labor platforms –also known as gig platforms –investigate how workers are affected by platforms through algorithmic control and governance models implemented by platform owners. We draw on the platform boundary resource model to review an emerging body of literature that looks at how platform workers cope with this platform-enforced governance through an array of digital circumvention tools. We find that workers make use of several types of such tools including social media, chat groups, and various forms of specialized software. We show what this type of digital circumvention tools are used for and discuss their challenges and potential impact on labor platform ecosystems.

Introduction

Labor platforms are a specific type of multi-sided digital platform that facilitate a market for buying and selling of labor. They are also called gig platforms as they often support gig work. These platforms are popular in many countries because they provide an additional source of income for many, and because they help freelance workers get access to often large pools of potential customers. Labor platforms are used to trade anything from the so-called micro-tasks –e.g. filling in a form in Amazon Mechanical Turk (AMT) –to standardized errands such as delivering food

to more interactive and creative freelance work such as photography gigs or designing a web site. International Labour Organization (ILO) distinguishes between platforms that facilitate online location-independent work –e.g. AMT –and platforms that facilitate physical work in specific locations –e.g. Uber (International Labour Organization 2021). Surveys in Europe and North America between 2015 and 2019 suggests that 0.3 to 22 percent of the adult population has performed platform work. These figures have probably increased after pandemic (International Labour Organization 2021).

Research involving gig workers and in particular labor platform workers often uncovers a wide set of challenges faced by the workers (Kittur et al. 2013; Martin et al. 2014). Gig workers can struggle to remain viable, organize themselves, develop and maintain professional identities, cope emotionally, and build networks (Ashford et al. 2018). These challenges are different from those faced by long-term employees in permanent employment relationships (Caza et al. 2022). Regulatory bodies, labor unions, and workers' interest organizations continuously monitor and propose or implement new regulations (International Labour Organization 2021; Alsos and Dølvik 2021).

At the same time, there is a growing body of research that shows platform workers themselves develop tools that allow them to overcome platform-related challenges. Such approaches are interesting because they can be seen as worker-initiated attempts to improve platform ecosystem well-being. We therefore present in this paper the initial results of an ongoing systematic literature review to better understand this emerging phenomenon that we call *digital circumvention* by workers in labor and gig platforms. By digital circumvention we mean any individual or collective use of digital tools by platform workers to cope with what the workers perceive as labor-related restrictions implemented by digital platforms.

Our systematic literature review tries to answer the following research question: What do we know about digital circumvention among digital labor platform workers based on existing research literature? We did a systematic search in Scopus for related concepts. This resulted in 41 relevant papers that we then analyzed qualitatively.

In our analysis, we perceive digital circumvention tools as platform boundary resources (Ghazawneh and Henfridsson 2013). Platform boundary resources include application programmer's interfaces (APIs), contracts, apps and other digital or non-digital tools that support interaction and data exchange between a platform core and its periphery. While such resources are often developed and offered by platform owners, earlier research has shown that platform boundary resources are often developed in various forms of collaboration between platform owners/designers and end-users (Eaton et al. 2015; Farshchian and Thomassen 2019; Islind et al. 2019). Our study shows a range of platform boundary resources that are mainly developed and owned by the end-users themselves, through what Ghazawneh and Henfridsson (2013) call self-resourcing.

Our results show three major types of digital circumvention: 1) online communities, 2) layered-on software, and 3) external software. Online communities seem to be the most prevalent among the three types. Conventional social media such as Facebook are often used to bring together –often local –communities of platform workers. However, we also see examples of private chat rooms and even independent portals and social media specifically developed for the purpose. Layered software is specialized software developed to collect and disseminate data from the platform that otherwise are not easily available for the workers. Examples are browser plugins that distill and present data from Amazon Mechanical Turk. External software is decoupled software that is used individually or collectively by workers to do specific tasks, such as video conferencing tools to cooperate with other workers or with customers in freelance work.

Our data also show that these tools are used for different purposes such as moral and emotional support, task-specific collaboration, and support for collective action. We also see variations among the types of workers, e.g. those who primarily work with micro-tasks and those who work on larger and creative tasks. Our data also show different degrees of collaboration between platform workers and owners in developing digital circumvention tools.

Our paper is an important initial contribution to the fertile topic of digital circumvention in online labor and gig platforms. Often, the discussion about labor platforms and worker conditions happens in a top-down manner, involving legal and regulatory issues. Our study looks at existing empirical evidence of how the workers themselves find practical means of circumventing what they consider as unreasonable restrictions imposed on their work practices. This evidence can be an important input to various policy and regulatory discussion but can also be an important input to sustainable labor platform design.

In the rest of this paper, we first provide a brief background from extant literature. We then present our method and our findings, before we conclude with a discussion of the findings.

Background

In this background section we provide a short introduction to digital multi-sided platforms, online labor platforms, some emerging challenges for platform workers, and what digital circumvention tools can achieve.

Multi-sided platforms and platform labor

Digital platforms are defined in various ways. From a technological perspective, a digital platform can be regarded as a "software-based product or service that serves as a foundation on which outside parties can build complementary products or services" (Tiwana 2014 p. 5). This definition implies that a platform consists of a

foundation –often called the *core* of the platform –and a set of complementary building blocks –the *periphery* –developed by third-party complementors (Rodon Modol and Eaton 2021).

The platform boundary resource model developed by Ghazawneh and Henfridsson (2013) explains how the core and the boundary are connected and communicate through resources such as APIs and other non-technical tools such as end-user license agreements. Platform boundary resources are often used by platform owners to secure –i.e., gaining control of the platform by restricting the space in which complementors can operate –or to resource –i.e., increase the scope and diversity of a platform for the third-party complementors. Not all platform boundary resources are owned by the platform owners. For instance, the digital circumvention tools that we review in this paper are all developed by others that platform owners, i.e., workers and complementors. This is called self-resourcing, which is the act of third-party developers building their own boundary resources as an answer to the restrictiveness of digital platforms imposed by securing (Ghazawneh and Henfridsson 2013).

Besides this technical view of digital platforms, platforms are also often regarded as marketplaces. The core of a platform facilitates the connection between producers and consumers situated in the periphery. From this perspective, platforms are regarded as multi-sided markets that sit between platform owners, producers, and consumers (McIntyre et al. 2021). Sutherland and Jarrahi (2018) have identified several affordances for multi-sided sharing platforms, including match-making, trust-building, extended reach, and transaction management. Digital labor platforms can be regarded as multi-sided platforms that create a marketplace for trading labor.

This review will use the categorization suggested by the International Labour Organization (ILO) to distinguish the different types of digital labor platforms and the type of work they mediate (International Labour Organization 2021). ILO differentiates labor platforms by how the work is conducted, either online or physically.

Online web-based labor platforms facilitate work that is done entirely remotely, making it possible for workers and clients to connect globally with ease. Different types of online platforms are freelance- and contest-based ones for more demanding tasks like accounting, programming, and design (e.g., Upwork, Fiverr and 99designs) and microtask platforms for small, simple tasks given to a crowd, such as image categorization, survey completion, and text translation (e.g., Amazon Mechanical Turk and Clickworker). The latter type is often referred to as crowdwork platforms. ILO also mentions competitive programming platforms and medical consultation platforms as types of online web-based labor platforms.

Location-based labor platforms mediate tasks that are to be carried out in the physical world. Examples are found in sectors such as accommodation (e.g., Airbnb), transport (e.g., Uber and Lyft), delivery (e.g., Foodora and Deliveroo) and household services (e.g., Taskrabbit and Helpling). Workers on these platforms

usually must provide their own equipment to be able to do the work, such as mobile phones, transportation methods, tools, etc.

Platform labor and its challenges

Platform labor is supported differently by different platforms. Some platforms may use a competition-based strategy to select workers, while others may choose the first person to sign up. There are also differences in worker-client communication; some platforms opens up for a more direct, closer relationship between the two, often seen on freelancer platforms, while others restrict the communication to predefined steps mediated by the platform (Gray et al. 2016). Platforms can be general purpose or specialize in services such as driving.

Platforms do more than enabling labor. In addition to their support for the task itself –e.g. ride hailing –platforms implement several mechanisms to enable the marketplace where the labor is traded. Choudary (2018) has identified several incentives, punishments, and subsidization mechanisms in labor platforms, including multihoming costs, reputation systems, network effects, reduction in transaction costs, and various risk reduction systems for the platform owner.

A crucial aspect of the operation of most digital labor platforms, which makes standardization and scalability possible, is their algorithmic management of workers (Jarrahi et al. 2020). This encompasses several ways in which algorithms are used for decision making in organizing and controlling workers and managing transactions on platforms through search, matching, prioritization, and scheduling (Raval and Dourish 2016).

The algorithmic nature of digital labor platforms creates a complex work environment for gig workers (Jarrahi and Sutherland 2019). As identified by Caza et al. (2022) in a thorough literature review, the way work is structured imposes several challenges on workers related to viability, organization, identity, emotional, relational and career-path uncertainty. For instance, viability refers to workers' concerns about whether work is going to provide them with the income they need and help them to reach their goals. Organizational challenges are related to the atomization of workers, who are left on their own to navigate the platforms, make themselves available on the market, and be attractive to clients (Yao et al. 2021). Atomization also creates power asymmetries, making it difficult for workers to collectively organize and collaborate (Kinder et al. 2019).

Digital circumvention among platform workers

Despite atomized work arrangements by digital labor platforms, and the absence of a traditional physical workplace, research has shown that these restrictions do not stop workers from collaborating and collectively coordinating (Gray et al. 2016; Yin et al. 2016). With little or no support from platform owners and policy makers, gig workers turn to their own solutions to solve their challenges, often through

digital means. These digital tools, what we call *digital circumvention tools*, have been sporadically documented in the literature in form of online groups, individual task support tools, tools specialized for specific platforms, platforms for collective action etc. Our objective in this paper is to provide a systematic overview of these tools, which is provided below in the Findings section.

Method

In this paper we report on the first iteration of a systematic literature review of digital circumvention tools. This is a first step because we aim to follow a hermeneutic approach in our work with literature (Boell and Cecez-Kecmanovic 2014). Digital circumvention is an emerging concept, and a common conceptual model or a vocabulary is still missing. It is therefore difficult to find all relevant literature by merely searching for keywords. By documenting and presenting preliminary results we hope to get focused feedback on our research questions and what to search for in a new round (Tynan and Bishop 2022), but also to develop our conceptual framework for the study (Leidner and Tona 2021).

We followed a standard staged model for our initial review, suggested by, among others, Oates et al. (2022). These stages are searching, obtaining, assessing, reading, evaluating, recording, and writing. The process resulted in a total of n = 41 relevant publications that are included in the review, illustrated in Figure 1.

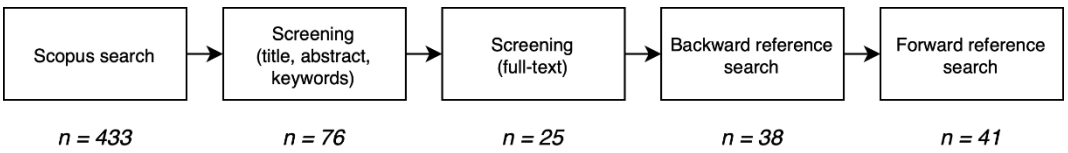

Figure 1: Literature review process followed in this study and the number of primary sources in each step.

At this first step in our study, we searched only in Scopus. Our search phrase (shown in Table 1 below) emerged from our background study (see previous section), our formulation of the research question, but also from the interactive search functionality offered by Scopus. The two concepts seek to grasp how labor platform workers, reflected in concept 1, may use IT solutions to address their challenges, reflected in concept 2. The search query is generated using the Boolean operator OR between the keywords within each concept, and then using the Boolean operator AND between the two concepts. This ensures that the resulting documents include at least one keyword for each concept. The search is performed on the title, abstract and Scopus-provided keywords.

Table 1: Our search phrase.

Concept 1: Target group	Concept 2: Purpose	
"Digital labor platform"	Mobilization	"Peer support"
"Gig economy"	Resistance	Network
"Gig work"	Organization	Collective
"Gig worker"	Union	Collaborate
Crowdwork	Community	Share
Crowdworker	Group	Learn

We included only papers that were in English, peer reviewed, and that were focusing on digital circumvention among platform workers. We excluded papers that were about worker challenges in general without studying digital circumvention. Screening of the search results based on inclusion and exclusion criteria resulted in 25 papers. We then did one round of backward and forward snowball search that resulted in additional 13 papers, bringing the total number of included papers to 41. These papers were then imported to a qualitative analysis tool (MAXQDA) and coded. Through a thematic analysis (Braun and Clarke 2006) a range of themes emerged related to types of tools, types of supported activities, and challenges. These themes are presented in our Findings section.

Findings

Types of digital circumvention tools

Our data show three classes of digital circumvention tools in use. These are online groups and communities, layered-on tools, and independent tools (see Table 2 at the end of this section). In the following sections we shortly introduce these and summarize our findings related to each.

Online communities and groups

Online communities are used to create a sense of identity, provide emotional support among workers, and provide information that is otherwise not available through digital labor platforms (Cropanzano et al. 2023). These efforts can help workers increase their productivity and efficiency, but also satisfy their social interaction needs (Kost et al. 2020). The communities are built on social media platforms, in chat and messaging groups, and on independent forums and websites (Gray et al. 2016).

Most of the literature discusses how gig workers utilize the collaboration support features of popular platforms to complement their work life. Examples include

social media platforms such are Facebook (Raval and Dourish 2016; Yin et al. 2016; Holikatti et al. 2019; Williams et al. 2019; Maffie 2020; Soriano and Cabañes 2020; Shalini et al. 2021; Yao et al. 2021; Posada 2022), social news sites such as Reddit (Schmidt and Jettinghoff 2016; Yin et al. 2016; Williams et al. 2019; Kinder et al. 2019; Waldkirch et al. 2021; Yao et al. 2021), and online video platforms such as YouTube (Chan 2019; Kinder et al. 2019). Although the literature shows that most types of gig workers have used these means of community building, it is also shown that freelancers are more likely to organize in social media groups compared to crowdworkers (Wood et al. 2018). Crowdworkers usually make use of independent community websites, discussed below.

Chat and messaging groups share many of the same functionalities and benefits as social media groups but tend to be smaller and more specialized for a specific geographic location (Seetharaman et al. 2021; Shalini et al. 2021). Compared to other online communities, gig workers prefer messaging groups with people they know (Woodside et al. 2021; Posada 2022). Chat and messaging groups offer instant and synchronous communication among participants. Examples found in the literature are instant messaging and voice over IP (VoIP) services such as WhatsApp (Tassinari and Maccarrone 2020; Popan 2021; Seetharaman et al. 2021; Shalini et al. 2021; Posada 2022), Discord (Williams et al. 2019; Posada 2022), Messenger (Williams et al. 2019), Telegram (Williams et al. 2019; Posada 2022) and WeChat (Zhou and Pun 2022).

There is a subcategory of online communities that has emerged, especially within crowdwork. These communities are independent websites and forums without any connection to any third-party organization, such as social media platforms or messaging providers (Lehdonvirta 2018). From the perspective of the platforms, they are third-party websites (Schmidt and Van Dellen 2022). These communities often function similarly to social media groups but are specifically tailored for their users and may have different sections for different topics (Ihl et al. 2020). Crowdworkers turn to these communities, as they are independent of the platform and the requesters on the platform (Gray et al. 2016; Ihl et al. 2020).

Independent community websites have facilitated collaboration between workers in several ways. These efforts cover up information asymmetries, often targeting more inexperienced workers. For example, they help each other with account creation and how to find reliable and well-paying tasks and requesters (Gray et al. 2016; Ihl et al. 2020). They also collaborate to solve tasks through the websites (Gray et al. 2016).

Layered on software tools

The category of layered-on software includes digital tools that use data from labor platforms and in some way provide additional information to the user interfaces of the platforms. In this way, they mitigate some of the information asymmetries enforced by the platforms, which, as we will see, further affects precariousness and

power asymmetries. Examples found in the literature are browser extensions (Irani and Silberman 2013; Callison-Burch 2014; Hanrahan et al. 2015; Williams et al. 2019; Savage et al. 2020; Cini 2023), apps (Woodside et al. 2021) and messaging bots (Pentland et al. 2022; Calacci and Pentland 2022).

Many of the layered-on software solutions target crowdwork platforms like Amazon Mechanical Turk. These are often browser extensions, ranging from simple interface enhancements, such as blocking out content that is not in use, to more sophisticated enhancements to display earnings and statistics, and automatic alerting when new tasks are created (Lehdonvirta 2018).

Layered-on solutions are based on data collection and data presentation as a response to information asymmetries. The data collection is initiated by workers and is done manually or automatically. Manual data collection is found in Shipt, where workers take screenshots and send them, and in Turkopticon, where workers write reviews of tasks and fill in their pay. Other software solutions collect data from the platforms automatically as they are being used, as seen in the CrowdWorkers, TurkBench and TurkerView plugins, and in Driver's Seat and Mystro. The presentation of data is often inserted into the platform user interfaces, like in most of the browser extensions, or presented through an external interface, like its own application or website, such as in TurkBench, Driver's Seat and Mystro.

External software tools

External software can be categorized as tools that do not have a direct connection to digital labor platforms, but otherwise help workers in their work situation. Research shows that external software is used to bypass the limitations of the tools provided by the platforms (Williams et al. 2019; Kinder et al. 2019). Freelance workers have been found to use external communication tools such as Skype and Google Hangouts to stay in touch with their clients (Kinder et al. 2019). They also use external tools for file sharing, due to the reduction in image and video quality, and the limitations on file size enforced by the platform (Kinder et al. 2019). Tools such as Google Sheets, Google Docs, Word and Paint are also used by crowdworkers in an administrative way to log and document their tasks (Williams et al. 2019). Drivers on location-based platforms use Excel to calculate the true costs of driving, covering gas money, waiting times and car repairs (Cameron 2022).

Table 2: Types of digital circumvention tools reported in the included literature.

Article	IT solution				
	Online community			Layered-on software	External software
	Social media	Chat	Inde-pendent		
Callison-Burch (2014)				x	
Calacci and Pentland (2022)				x	
Cameron (2022)					x
Chan (2019)	x				
Chesta et al. (2019)	x	x			
Cini (2022)	x		x	x	
Cropanzano et al. (2022)	x	x	x		
Graham et al. (2020)					x
Gray et al. (2016)	x	x	x		
Hanrahan et al. (2015)				x	
Harmon and Silberman (2018)					x
Holikatti et al. (2019)	x				
Ihl et al. (2020)			x		
Irani and Silberman (2013)				x	
Kaine and Josserand (2019)	x				
Kinder et al. (2019)	x				x
Kost et al. (2020)	x	x	x		
Lehdonvirta (2018)	x	x	x	x	
Lettieri et al. (2019)					x
Li et al. (2022)				x	
Maffie (2020)	x				
Popan (2021)		x			
Posada (2022)	x	x			
Raval and Dourish (2016)	x				
Salehi et al. (2015)			x		
Savage et al. (2020)				x	
G. Schmidt and Jettinghoff (2016)	x		x		
G. Schmidt and Van Dellen (2022)			x		
Seetharaman et al. (2021)		x			
Shalini et al. (2021)	x	x			
Soriano and Cabañes (2020)	x				
Tassinari and Maccarrone (2020)		x			
Waldkirch et al. (2021)	x				
Walker (2021)			x		
Watkins (2022)			x		
Williams et al. (2019)	x	x	x	x	x
Wood et al. (2018)	x	x	x		
Woodside et al. (2021)	x	x	x	x	
Yao et al. (2021)	x				
Yin et al. (2016)	x		x		
Zhou and Pun (2022)		x			

Types of activity supported by the tools

In this section we provide a categorization of the types of activities that digital circumvention tools are used for.

Access to additional information

Evidence shows that the most prominent benefit of social media groups for gig workers is the information sharing capabilities they facilitate, helping to compensate for platform-imposed information asymmetries (Raval and Dourish 2016; Kaine and Josserand 2019; Kinder et al. 2019; Maffie 2020; Yao et al. 2021). Workers use these groups to share experiences to better understand digital labor platforms and their algorithms, and how to bypass them (Posada 2022), creating entrepreneurial solidarity (Soriano and Cabañes 2020). Facebook groups for location-based work are found to contain four types of information sharing behavior. Workers seek solutions to the problems they face, seek experiences from other workers, share experiences in their work, and share external resources such as official information (Yao et al. 2021).

While online communities can facilitate information sharing among workers, many layered-on software tools focus on providing individual workers with information that is difficult to share or see in the platforms interface. An example is Turkopticon, a browser extension that augments the Amazon Mechanical Turk website with the ability for workers to review employers (Irani and Silberman 2013). These reviews are aggregated so that other workers can easily see whether an employer is reliable and pays well. Turkopticon reverses the roles of evaluation and information asymmetry, allowing workers to avoid employers with a bad reputation (Cini 2023). Another example is the CrowdWorkers plugin that tracks when a worker accepts and delivers tasks and aggregates the pay of all users of the plugin, so they get a quantitative overview of well-paid tasks (Callison-Burch 2014). A similar software is TurkBench, a browser plugin and website that crawls the Amazon Mechanical Turk website for tasks, tracks worker usage, and enhances the interface so that workers can easily locate lucrative tasks and requesters based on their qualifications (Hanrahan et al. 2015). Another example is TurkerView, which functions similarly to the CrowdWorkers plugin, by crawling the website and showing the expected hourly wage for a given requester (Williams et al. 2019; Savage et al. 2020). The goal of these software tools is to "minimize unpaid work and increase earnings" (Hanrahan et al. 2015), which directly helps mitigate the challenges related to precarity.

Education and training

Workers who rely on digital labor platforms for their primary income and career development often participate in communities of practice and create resources for learning, increasing their competencies, and possibly creating "boundaryless careers" (Kost et al. 2020). For instance, on social media such as YouTube, there are numerous Uber drivers who create video content, acting as bloggers, to increase the knowledge and skills of other drivers (Chan 2019). These resources are often targeted towards the algorithmic aspect of the platform, to get an understanding of its functioning for drivers to maximize their profit.

As they learn more about their work, workers also tend to be more active in social media groups, moving from a peripheral role, often just observing the group, to being integrated into the community (Holikatti et al. 2019). These bottom-up learning and training strategies have shown to be important for workers in the gig economy (Waldkirch et al. 2021).

Emotional support

Gig work is often perceived as low status by friends, family and society, due to its precariousness (Seetharaman et al. 2021). Although informational support is dominant in social media groups, there are also cases of emotional support (Yao et al. 2021). Members are often in the same situation, which makes it easier to ask for and provide emotional support, as there is less fear of being stigmatized. Emotional support often takes the form of humor related to the work, rant or complaint about the work situation and experiences, and compassion for others (Yao et al. 2021).

The use of chat and messaging groups fosters the building of relationships with other workers to create an environment for emotional support. The groups are often smaller than in online communities and may have members with pre-existing relationships. They facilitate the acceptance and understanding of similar-minded workers, providing emotional support and solidarity, mitigating labor atomization (Seetharaman et al. 2021). For physical gig workers, they offer a digital free space from both platform control and the society (Shalini et al. 2021; Zhou and Pun 2022). Workers also often use them to plan real-world meetings (Tassinari and Maccarrone 2020; Shalini et al. 2021).

Like social media groups and messaging groups, independent communities also provide emotional support among workers (Ihl et al. 2020). On one hand, they share negative emotions and work incidents, and receive support from their peers. On the other hand, they share positive aspects, such as the achievement of goals to be recognized by their peers and to receive appreciation. Through these cases of support, workers feel that their work is more meaningful and that they develop a sense of shared identity with others (Ihl et al. 2020; Schmidt and Van Dellen 2022).

Practical support

While online media is mostly used for informal sharing and emotional support, practical support related to specific types of task is done through chat groups and specialized layered-on or independent tools. Groups that target location-based work are used as a safety net in the absence of instrumental support from platforms and society (Tassinari and Maccarrone 2020; Popan 2021; Seetharaman et al. 2021). When entering the gig economy, many are unaware of the risks they might face. As a consequence, workers turn to their peer networks in messaging groups to minimize some of the risks (Seetharaman et al. 2021). The groups are used to contact other workers for support in emergencies, for example, in cases of theft, violence, vehicle problems, and accidents. They are also used to mitigate risks in advance. For

example, they provide information about dangerous locations and whether workers should accept tasks they are offered.

Several tools are used to share salary-related data among workers. The layered-on Shipt calculator is a tool that grocery delivery workers on the Shipt platform use to increase wage transparency (Calacci and Pentland 2022). The tool works by having workers take screenshots of their pay history from the labor platform app and send them using SMS, and then having them send different commands so that they can learn more about their pay in aggregation and in relation to other workers. Otherwise, this type of information is not accessible through the platform. For transport platforms such as Uber and Lyft, Driver's Seat and Mystro are used (Woodside et al. 2021). Driver's Seat uses your data from multiple platforms to let you understand your performance compared to others, including pay, productiveness, driving strategy, etc. Mystro lets you filter incoming requests on several platforms by setting your own criteria on for example distance, bonuses and rating.

Collective action

The literature is split on how social media groups may facilitate collective action among gig workers, as an answer to the power asymmetries and precarity they face. On one hand, evidence shows that social media groups have been used successfully to organize workers to collectively resist platform organizations and facilitate strikes (Chesta et al. 2019; Kaine and Josserand 2019). As workers join social media groups, they discover the possibilities of collective action and turn them into "a kind of political site for collectively voicing their collective outrage" (Cini 2023).

On the other hand, research has found that the outcomes of social media organization and resistance are weak and that there are not many real-world cases of success (Soriano and Cabañes 2020). Successful cases are often related to specific geographical locations and groups of workers (Woodside et al. 2021). More experienced workers, with more social and cultural capital compared to others, are more likely to participate in collective action through social media (Chesta et al. 2019). However, these workers have the highest risk of doing so, as their primary income depends on the work offered by the platform.

Although social media groups have managed to facilitate collective action, it is argued that these actions are only small-scale and have short-term effects. This is because workers have different goals, they do it solely for money, they are afraid to risk their reputation, and because there are several crowdwork platforms to choose from (Salehi et al. 2015). The same has been found for independent community websites; peer-to-peer discussions can unintentionally encourage small-scale collective action (Walker 2021). A counterexample is drawn by Salehi et al. (2015), who showed how a forum specifically designed for Amazon Mechanical Turk workers, called Dynamo, could foster collective action to a greater degree and relieve some of the more severe power asymmetries. Through this forum, workers

could submit issues and suggest steps to collectively solve them. Examples of successful outcomes are the development of ethical guidelines for academic research requests regarding crowdwork, including the scope of tasks and their fairness of payment, and the creation of an open letter campaign aimed at platform owners with the goal of humanizing workers (Salehi et al. 2015; Cini 2023).

Chat and messaging groups facilitate collective action to a greater extent compared to social media and independent community websites, as they foster stronger bonds between participants and communication is carried out in a closed space without platform representatives (Tassinari and Maccarrone 2020; Zhou and Pun 2022). Through affordances for association, discourse and mobilization, chat and messaging groups are argued to promote solidarity (Zhou and Pun 2022). Association refers to how chats help overcome the atomization of workers by facilitating connection. Discourse is how chats function as a channel to share grievances and form a collective consensus on worker experiences. The affordance of mobilization is generated as messages are used to coordinate and plan collective action, both online and offline. Consequently, discourse and mobilization are preventive mechanisms of power asymmetries imposed by platforms.

Challenges

The literature outlined several challenges related to digital circumvention tools and their use, which will be covered in this section.

Finding each other

Most gig workers are unaware of the communities in which they can participate and assume that their work is forced to be atomized (Yao et al. 2021). A catalyst for joining communities is often the conflicts they encounter that make them unsure of their responsibilities and how they should act (Maffie 2020). When the digital platforms themselves do not have a clear answer or provide sufficient support, workers seek to online communities, providing "concrete, personalized and experiential information" (Yao et al. 2021).

Social media groups are often used to target specific groups of workers. In location-based work, geographical location is used to restrict the scope, as both city-based, state-based, nation-wide and international groups have been found (Yao et al. 2021). The more local groups have been shown to foster a higher degree of engagement between members, as they provide more relevant information, while national and international groups tend to have more general content (Holikatti et al. 2019). In online-based work, groups are of varying sizes (Lehdonvirta 2018). Larger groups are often more open with few restrictions, overlooked by a group of moderators (Posada 2022).

Lack of the personal touch

Several factors have been identified that contribute to less emotional support compared to informational support in online communities (Yao et al. 2021). These include the competitive environment in which gig work is performed, the use of offline relationships for emotional support, and the structure of social media groups. Some groups have several thousand members, and communication is happening in an asynchronous manner, making it difficult to establish close relationships.

Competition

A drawback noticed by several workers is how the competitive nature of the gig economy prevents them from sharing specific strategic information (Kost et al. 2020; Yao et al. 2021). This information is usually regarded as valuable because few people are aware of it, giving the information holder a competitive advantage. On digital labor platforms where workers bid for gigs or where some actions lead to higher profit, the sharing of strategic information with other workers may not be very tempting, as the competition will increase. In location-based work, this phenomenon may be even stronger, as there can be a skewed worker-client balance in the geographical area, which in turn leads to a limited set of gigs to choose from or get assigned to. There are also many "lurkers" in online groups, staying in a peripheral role, only reading content, and rarely participating. Due to them, more part-taking workers are unwilling to share competitive information (Yao et al. 2021).

Due to the sharing of well-paying tasks and requesters, Yin et al. (2016) argue that workers who do not use circumvention tools may have a disadvantage, as lucrative tasks may have been completed long before they ever get to see them. Through this division, it is argued that e.g., online communities themselves contribute to a higher degree of precarity for isolated workers who are not aware of such communities. The same is seen in the prevention of payment scams or requesters that do not approve solved tasks. If a worker warns about a scam on a forum and this scam has already been identified in another post, the worker is perceived as a non-legitimate member of the community (Watkins 2022). Therefore, workers should be aware of the communities and what they may offer to have an advantage in the market.

Decentralization

The reasons for the weakness of social media resistance are argued to be related to the numerous challenges that gig workers face. A key concept here is decentralization. Workers feel that collective action would be ineffective due to their employment status (Soriano and Cabañes 2020; Yao et al. 2021). Gig workers are regarded as independent contractors with no formal organizational foundation that supports them. This notion of employment stops many from organizing collectively, as they can choose not to take a gig and can easily leave the platform

and find other work. Furthermore, it is difficult for workers to assess the sentiments and activities of other workers, as they are atomized and have a high variance of participation in labor platforms (Yao et al. 2021). The use of a digital intermediary for communication, such as social media, makes this even harder. Social media groups and online communities, in general, are aligned with labor platforms in terms of their decentralized infrastructure (Yao et al. 2021).

Williams et al. (2019) suggest that there are not only positive effects of using external and layered-on software. They argue that the tooling used in crowdwork contributes to fragmentation of the work through the ease of switching between tasks and doing multiple tasks at once. Furthermore, they argue that tool usage creates an environment in which work can be done anywhere and anytime, promoting unstable working hours. They also suggest that social bonds between workers in communities are becoming more fragmented, as workers use different tools, and not all tools are available or known to everyone.

Cooperating with the platforms

As noted by several researchers, mobile operating systems for app-based platforms and the platforms themselves make it difficult to read data directly from platform applications, due to security and the protection of their business models (Woodside et al. 2021; Li et al. 2022; Calacci and Pentland 2022). Layered-on software must bypass these restrictions if automatic data collection is to be possible. The literature refers to backdoor approaches, such as crawling websites through installed browser extensions and software (Callison-Burch 2014; Hanrahan et al. 2015; Williams et al. 2019) or exploiting screen reading accessibility features on phones (Woodside et al. 2021; Li et al. 2022). Because layered-on software that uses automatic data collection is not directly attached to the software of the platforms, but depends on data from them, it becomes unreliable if the platform software changes (Woodside et al. 2021).

There is also external software specifically made to rate labor platforms, targeting workers across platforms and individuals entering the gig economy (Lettieri et al. 2019; Harmon and Silberman 2019; Graham et al. 2020). Graham et al. (2020) present the Fairwork foundation, an initiative created to make the society aware of the working conditions on digital labor platforms. The foundation displays ratings for both online-based and location-based platforms on the Fairwork website. The ratings are based on five principles co-developed with platform economy stakeholders, including workers, unions, platform owners, lawyers, academics and government. The principles cover payment, working conditions, contracts, management and worker representation, and are evaluated per platform on a yearly basis. The initiative has proven to impact the gig economy, as platforms have agreed to change their way of operating to get higher ratings (Graham et al. 2020).

Similar to Fairwork is the Fair Crowd Work website, discussed by Harmon and Silberman (2019). They show how the Fair Crowd Work website also reviews labor

platforms, and more specifically crowdwork platforms. A platform review covers platform details, worker reviews and a terms of service check. The schema for worker reviews is based on a 95-question survey answered by workers on the specific platform, covering topics such as experiences, tasks, pay, communication, ratings and evaluations on the platform and platform technology. The reviews are shown as star ratings, but with qualitative information from the survey responses to back up the ratings. The terms of service check assesses the fairness of platforms and the working conditions based on official information from the platform. The website is found to attract not only workers but also unions, policy makers, journalists and researchers.

Discussion

Our research has mapped an array of different digital circumvention tools that are developed in the periphery of digital labor platforms to help workers in one or the other way. We grouped these tools into three classes: online communities and groups, layered on software tools, and external software tools. We also reviewed what the tools are used for, ranging from sharing information among workers, to emotional and practical support, and collective action.

These tools show that labor platforms lack some aspects that the workers find useful. In some cases, platform owners do not want to make this information available because of strategic decisions e.g., creating algorithmic control (Jarrahi et al. 2020). In other cases, platform owners might deliberately –as a means to reduce own costs and risk –leave it to the workers to develop and maintain with their own tools, in the same way that Uber drivers have to use their own cars to drive customers around.

The existence of these digital circumvention tools is most plausibly a testament to the strong securing mechanisms used by platform owners. All the reviewed tools, except for some of the layered-on software, have weak attachment to the core of the digital labor platforms. They are often made by workers with no support from the platform owners. Our study is one of the few that shows how self-resourcing (Ghazawneh and Henfridsson 2013) can function in practice. Our work shows that even if we deal with a purely transactional platform, innovation in the edges happens to a large extent but is often precarious because platforms can choose to change without notice –which will invalidate these tools.

The layered-on software found demonstrates a form for bypassing the securing of platforms, by reading data and interacting with the platform applications and websites with backdoor approaches. These approaches can be seen as self-resourcing (Ghazawneh and Henfridsson 2013), as the solutions make use of their own boundary resources used by their applications. Other solutions that rely on manual data collection are still applications in the ecosystem, but not attached to the core, just like online communities. The data they use do not come directly from the

platforms, but usually through the workers. Layered-on software, as seen in the results, is primarily used to mitigate the information asymmetries workers face, through the aggregation of data from the platforms or worker-generated data.

Worker voice and collective action through external software, such as the Fair Work website and the Fair Crowd Work website, together with online community building and self-resourcing through layered-on software, show that the tuning of boundary resources, discussed by Eaton et al. (2015), also occurs on digital labor platforms. Through these IT solutions, workers can influence the evolution of labor platforms, even though they have reduced power and resources compared to platform owners. For example, the Fair Work website has made platform owners change their way of operation, resourcing their platform and increasing openness, further making stakeholders, including workers, more satisfied with the platform (Graham et al. 2020). Online communities have been shown to occasionally be able to foster collective action against their platforms (Salehi et al. 2015; Walker 2021; Cini 2023) and layered-on software illustrates a worker-led initiative to make platforms more transparent.

While much of the research on labor platform focuses on the precarity of platform labor, our study has summarized research that shows how platform workers circumvent precarious working conditions by devising practical means. The research reported here can be used to empirically investigate the needs of the workers and can be a source of knowledge not only for policymakers but also for the designers of more sustainable labor platforms.

Conclusions

Our study of the concept of digital circumvention, including the search for literature and our analysis and theoretical framing, is in a preliminary phase. Our future work includes a more extensive search, a more in-depth analysis, and investigation of alternative theoretical framework. We also have started interview studies with platform workers and labor union representatives. We hope to present our results in future ECSCW conferences.

This work is part of the project SustainDiT (Sustainable Digital Transformations). SustainDiT investigates the affordances of digital platforms form a social and economic sustainability perspective.

The authors declare no conflicts of interests.

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