Agency, Sociomateriality and Configuration Work

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Agency, Sociomateriality and Configuration Work

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Abstract

Social informatics research offers insights into the relationship between information technologies and social contexts. However, the material roles of information technologies, and their interplay with the agentic work of social actors, have not been addressed. Drawing on a field study of 37 mobile knowledge workers, we examine the dual material roles (enabling and constraining) played by information technologies in their work practices. We also investigate how these workers exert agency by fashioning multiple information technologies into a functioning digital assemblage. Although information technologies provide consequential affordances that enable mobilization of work across spaces and times, they simultaneously present design-driven, local, organizational, and temporal technological constraints that require mobile knowledge workers to engage in "configuration work" to make information technologies function effectively. Building on a sociomaterial perspective, we further discuss the interplay of information technologies and work practices enacted by mobile knowledge workers, in which both human and technological agency are materialized.

Keywords: Social informatics, sociomateriality, materiality, human agency, technological agency, configuration work, mobility

Introduction

Situating information technologies (IT) at the core of social informatics research, the late Rob Kling defined social informatics as "the interdisciplinary study of the design, uses and consequences of information and communication technologies that takes into account their interaction with institutional and cultural contexts" (Kling, 2007, 217). Lamb and Sawyer (2005) go on to sum up social informatics in two words: "Context matters!" Broadly, social informatics emphasizes context-aware studies of IT uses in organizational and social settings (Fichman, Sanfilippo and Rosenbaum, 2015).

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Social informatics decries the pervasive tool view of IT and the attendant technologically-deterministic stances of IT "pundits," who are seen as both unempirical and uncritical (King, Iacono and Grudin, 2007; Kling, 2007). Instead of focusing exclusively on the technological artifact, social informatics examines the ways in which people and information technologies interact (Sawyer and Rosenbaum, 2000). By studying various dynamics in organizational and social contexts, researchers informed by social informatics are able to identify and understand the often paradoxical outcomes of IT adoption (Lamb and Sawyer, 2005; Oltmann, Rosenbaum and Hara, 2006).

Social informatics is mindful of the material properties of information technologies (Huvila et al., 2016; Kling, 2007). This recognition of the materiality of technology contrasts with social constructivist approaches, which effectively deny the agency of technology by viewing it as open to boundless interpretive flexibility (Sawyer and Jarrahi, 2014). Kling himself made a clear distinction between social informatics and the strong social constructivism that overlooks the effects of technology, arguing: "physical objects like guns and roses have some capabilities that are not only arbitrarily derived from the talk about them. It is much harder to kill a platoon of soldiers with a dozen roses than with well-placed high-speed bullets" (Kling, 1992, 362).

To understand the complex role of information technologies in institutional contexts, social informatics research has produced several foundational theoretical models, including the web of computing (Kling and Scacchi, 1982), sociotechnical systems (Kling, 2007; Kling and Lamb, 1999), and the sociotechnical interaction network (STIN) (Kling, McKim and King, 2003; Meyer, 2006). Metaphors of "networks" or "webs" capture multiple interactions among humans and technological artifacts, embedded in a panoply of norms, rules, and social practices (Sawyer and Rosenbaum, 2000). The configurations of such webs (or networks) of relationship are amorphous, and evolve over time in response to the dynamics of the social milieu (social context) within which they are embedded (Horton, Davenport and Wood-Harper, 2005; Sawyer, 2005).

Whereas social informatics research has made substantial contributions in multiple fields of study (e.g., information science, computer science, and information systems), it has two shortfalls: (1) the understanding of the materiality of information technologies is still rudimentary, and (2) social informatics researchers have predominantly focused on the "enabling" roles of information technologies and failed to provide similar attention to the constraints they impose, especially those arising from their configuration.

First, social informatics is primarily an analytical approach for understanding information technologies in the social contexts of design and use (Davenport, 2008; Fichman, Sanfilippo and Rosenbaum, 2015), but it struggles to define the nature and role of information technologies, especially how social actors interact with (or disengage from) their materiality (Lessard, 2014; McCoy, 2017; Sawyer and Tyworth, 2006). In most social informatics research, information technologies' materiality is glossed over, as a greater emphasis is on the embeddedness of technology in sociotechnical ensembles. Beyond recognizing the materiality of information technologies, social informatics offers few guidelines with respect to the "mangle of practice" and "configurational nature of ICTs" (Sawyer and Hartswood, 2009, 201). Sawyer and Tyworth (2006) propose practice-oriented approaches for studying the sociomaterial nature of information technologies.

Second, social informatics research tends to explicitly or implicitly see information technologies merely as enablers. For example, employing the affordance framework, studies explore how the use of certain information technologies invites certain types of actions (e.g., Faraj and Azad, 2012; Nelson, Jarrahi and Thomson, 2017; Treem and Leonardi, 2013). Here, the term "affordance" reveals a bias towards the positive roles played by information technologies. This view masks the configuration work needed to make the technology function as desired. Inspired by Fleck's (1994) notion of "configuration," we define configuration work as activities beyond core work tasks that must be performed to configure technologies and align them with contextual contingencies of implementation and use. In other words, it is a specific form of "articulation work" needed to make information technologies function as desired (Kling and Lamb, 1999). Social informatics scholarship to date (with a few exceptions such as the work of (Suri and Ekbia, 2016) on the constraining material features of GIS) has mostly focused on how technology works rather than how it may not work; and how technology enables work practices rather than how it may also constrain them.

As dynamic sociotechnical systems, all information technologies are in flux and brought into local stability only through active engagement and coordination by the users (Dourish and Bell, 2011; Star and Bowker, 2002). These systems impose their own limitations, fail to fully support work practices, and impose what Kling and Lamb (1999) call "the hidden costs of computing." As such, workers often have to conduct recurrent, extensive, and invisible configuration work to make information technologies function (Suchman, 2007). Our research explores the less visible configuration practices of mobile knowledge workers directed at configuring information technologies in accordance with their personal and organizational contexts. We define "knowledge work" as work that: (1) primarily builds on and produces knowledge, (2) involves intellectual skills such as manipulation of abstract knowledge, (3) requires creative problem solving, and (4) draws on theoretical and technical knowledge grounded in either formal education or on-the-job continuous learning (Davis, 2002; Pyöriä, 2005; Schultze, 2000).

In addition, directing attention to technological configuration, this work advances the concept of "social actors," and incorporates a more robust view of human agency in shaping technological outcomes. Social informatics breaks away from the notion of "users" of information technologies, and instead views people as complex "social actors" in the way they employ technology (Lamb and Kling, 2003). Leveraging institutional theories, Lamb and Kling (2003) conceive of a social actor as an "organizational entity," influenced by the technological and institutional environments. Much like other social informatics inspired frameworks, this social actor framework focuses on "how institutional structures and context shape IS related practices" (Rowlands, 2009, 53), and not the reciprocal interactions between social actors and information technology artifacts within the institutional context. Moreover, the agency of social actors in configuring this technology is minimized. According to Lamb and Kling (2003, 218), "social actors exercise limited discretion in ICT choice and use, since in their multiple and aggregate roles, organization members articulate the preferences of a collection of actors".

Seeking to redress the two shortfalls of social informatics research noted above, this article examines how mobile knowledge workers (MKWs) use information technologies. In doing so, it makes two contributions to social informatics: (1) a better articulation of sociomaterial practices through which information technologies' materiality comes into play and enables workers to exercise their agency in

configuring technology, and (2) a nuanced understanding of the dual enabling and constraining roles played by information technologies in shaping work practices.

MKWs are a particularly good group for this study on several counts. In recent decades, knowledge work has become increasingly untethered from a geographic location (D'Mello and Sahay, 2007; Dal Fiore et al., 2014; Davis, 2002). Correspondingly, many knowledge workers have adopted a nomadic work style, performing work across various locations (e.g., coffee shops, co-working spaces) or in transit (Czarniawska, 2014; Kietzmann et al., 2013). In this process, MKWs have to deal with unpredictable work environments and negotiate technological and spatial resources (Sawyer, Erickson and Jarrahi, 2018). They constantly have to manage technological and contextual breakdowns as they navigate multiple organizational boundaries, spatial terrains, and networked infrastructures (Bardram and Bossen, 2005; Cousins and Robey, 2005). Much of this extra work involves coming to grips with various personal, local, and organizational IT infrastructures, and constructing an IT assemblage that undergirds their mobile work practices (Erickson and Jarrahi, 2016; Su and Mark, 2008). All this renders their relationships with information technologies quite visible, making mobile knowledge work a fertile area in which to observe the agency of workers and their dynamic engagement with information technologies (Perry, 2007).

Against this backdrop, the questions motivating this research are as follows:

1. How do information technologies manifest their agency?
2. What are the key material enablements and constraints presented by various information technologies in the context of mobile knowledge work?
3. How do mobile knowledge workers interact with these material features in an attempt to mobilize their work practices?
4. How do mobile knowledge workers demonstrate their agency by performing configuration work to address technological constraints, and by constructing a functioning IT assemblage?

Theoretical framework: Sociomateriality

Research on sociomateriality foregrounds the role of technologies by explicating how technologies contribute to the production of social practices and contexts (Orlikowski and Scott, 2008). It stands apart from both technological and social determinism by assigning agency to both humans and technologies.

Materiality has long been an object of enquiry in science and technology studies (STS) and in philosophy of technology fields (Callon, 1999; e.g., Latour, 2005; Law, 1992). In recent years, we have witnessed a "materiality turn" pervading the humanities and social sciences (Packer, 2013; Van Dyke, 2015), ranging from communication studies to human-centered computing. The concepts of materiality and sociomateriality have become umbrella terms, with different research traditions developing varied definitions (Jones, 2014; Kallinikos, Leonardi and Nardi, 2012).

The materiality turn is grounded in the work of STS scholars who have been critical of the implicit social determinism embodied in many studies of technology. Barad (2003, 801), for example, pointedly highlights a lack of attention to materiality: "Language matters. Discourse matters. Culture matters. But there is an important sense in which the only thing that does not seem to matter anymore is matter."

She calls for “agential realism" that emphasizes "the ontological inseparability of intra-acting agencies" (Barad, 2007, 206), and to dispense with the distinction between subject and object. In her formulation, agency of objects is based on particular relationships, and emerges through intra-actions of objects and subjects. Like Barad, other feminist theorists such as Butler and Haraway have contributed to the materiality discourse by advancing the notion of “mattering” (the conditions under which objects appear and play out) beyond its attachment to physical forms and bodily characteristics (Butler, 2011; Hafermalz and Riemer, 2015; Haraway, 1991). In her book entitled *Bodies that Matter*, Butler (2011, 7) notes: “that which matters about an object is its matter.”

Technological materiality has gained currency in computing and informatics in recent years. Information scientists have criticized “the trope of immateriality” (Blanchette, 2011), directing attention to digital information as a material object (Dourish and Mazmanian, 2012; Jarrahi, 2015). Likewise, Wiberg et al. (2013) suggest that human-computer interaction research has demonstrated two important shifts: (1) a move away from treating people and information systems as two separate entities toward bringing them together as one whole, and (2) a move away from how computing is used and interpreted toward a focus on the material character of technology.

Despite variance in methods and foci, different formulations of sociomateriality and materiality have two common denominators. First, by adopting a post-humanist approach, they appreciate technological agency and its transformative capacity in the social life of humans, without an analytical interest in ascertaining causal relationships. Second, by building on a relational ontology, sociomaterial research questions any separation between technology and people, and instead brings into focus the mutual constitution of social and technological worlds. In this perspective, social meaning and technological functions are ontologically inseparable (Suchman, 2007), meaning “people and things only exist in relation to each other” and therefore “entities have no inherent properties, but acquire form, attributes, and capabilities through their interpenetration” (Slife, 2004, 455).

In this article, we primarily draw on recent developments regarding sociomateriality in organization science and information systems fields (e.g., Cecez-Kecmanovic et al., 2014; Jones, 2014; Leonardi, 2012; Niemimaa, 2016; Orlikowski and Scott, 2008). This theorization of sociomateriality offers a rich conceptual vocabulary for explaining how the social and technical components are brought to bear in work practices, and presents social practices as intrinsically conjoined with material things (Leonardi, 2012; Orlikowski, 2007). Here, the roles played by information technologies in work practices are not given *a priori*, but are seen as temporally and situationally emergent and enacted, reflecting the peculiarities of the work context within which the social actor (here a MKW) is embedded. At the same time, information technologies facilitate new ways of performing work practices and result in the restructuring of these practices through their material effects (Orlikowski and Scott, 2008). In effect, materiality of technologies influences and is influenced by how it is interpreted by social actors in their daily work practices (Orlikowski, 2007; Rivera and Cox, 2014).

A sociomaterial perspective enables researchers to see how social practice and the material functioning of information technologies are intertwined. This framing is particularly useful for examining the dual roles played by information technologies in work practices because it offers insight into “what technology lets developers, implementers, and users do, what it does not let them do, and how people

work around these constraints" (Rice and Leonardi, 2013, 432). It is through work practices that workers' norms, preferences, and goals are achieved or hindered by the material properties of information technologies. Material properties are defined as those features that are intrinsic to technological artifacts with which social actors engage in their situated, recurrent, everyday work practices (Orlikowski, 2000). Taking into account these material properties, social actors enact technology-in-practice, as a set of rules and resources. Technology-in-practice is influenced by technological hindrance or affordance, and is, in effect, an outcome of both technological and human agency. The concept of affordance, as put forward by Gibson (1977), is closely tied to the material features of an object, but also stems from the unique ways different users make sense of the same object. Gibson argues that the same object can be used very differently by different people (or animals) because each individual may consider it useful for a different set of activities.

Methodology

We collected data through interviews and digital diaries from 37 mobile knowledge workers. To be considered MKWs, participants had to be engaged in knowledge work (e.g., software engineering, law, business consulting), and be more than occasionally mobile (i.e., physical mobility was a core component of their working practice, not something that occurred occasionally). Interview participants were identified through purposive (snowball) sampling, utilizing contacts from the professional networks of the researchers in North Carolina, online searches for nomadic workers, and suggestions from interviewees.

Of the 37 participants, 15 are female and 22 are male. They range in age from mid-twenties to mid-sixties, and all have attained a certain level of technological competence by experimenting with different technologies. Six participants work at large organizations, 12 at medium/small organizations, and 19 are freelancers. They hold various knowledge work positions, such as IT consultant, business strategist, web developer, realtor, attorney, writer, digital marketer, and health-care researcher.

Three core subject areas were addressed in the interviews: (1) interviewees' professional background, working situation, work tasks, and work arrangements; (2) the nature and structure of their mobility (e.g. spatial and temporal mobility) and workspaces and (3) the way that different technologies and infrastructures played a role in their work. The interviews were semi-structured conversations lasting around 60 minutes. All interviews were audio recorded and transcribed verbatim.

The diary study was conducted with 14 of the original 37 participants who were willing to share situated notes about their daily work practices. The diaries were used to collect data *in situ* about mobile knowledge work, and to provide further insight into participants' practices in naturalistic settings over a longer period of time (Grinter and Eldridge, 2001). The workday of a MKW involves frequently shifting social and spatial environments, making direct researcher observation difficult (Ciolfi and de Carvalho, 2014). On the other hand, participants could complete the diary entries from any location and on any device. They responded to a brief questionnaire about work activities and information technologies and took pictures when possible. Questions were based on findings from the initial participant interviews. The questionnaire was a mix of multiple-choice and open-ended questions about what work had been occupying the participants' time and what technologies they had been using in the previous few hours.

As part of the questionnaire, participants were asked to upload pictures of their work environment, power sources, and computational devices. The questionnaire was emailed to participants twice a day for 7-10 days. Participants were asked to complete both diary entries per day during the duration of the study, and to submit them through online survey software from a computer or mobile device. Qualtrics software was used to collect diary entries from participants who used either their smartphones or laptops to submit responses. Participants were compensated $3 per entry, given by gift card after the completion of the diary collection (e.g., 2 entries per day for 7 days = $42 gift card).

All participants (except one individual) who participated in the diary study were interviewed a second time. The second interview was more focused and individualized. The diary responses were analyzed and compared with notes from the first interviews, and new questions were developed to clarify the situated activities of each participant.

Data collection and analysis were conducted simultaneously. Data analysis was aided by NVivo software and focused on (1) the key work practices that were common among all the participants, (2) the ways various forms of IT artifacts and infrastructures were used by the participants, and (3) how various information technologies enabled and constrained their work practices. The researchers engaged in successive rounds of transcript reading, memo writing, and extended conversation to become familiar with the collected data.

Findings

Information technologies facilitate mobile work practices while simultaneously imposing certain impediments, requiring crucial configuration work. These enablements and constraints are manifestations of material agency (technological doings), and create a sociotechnical space for humans to bring about technological consequences.

Technological enablements

Technologies as "material scaffolds" complement and extend human agency by making possible work practices that are difficult or impossible to achieve without the technology (Woerner, Orlikowski and Yates, 2005). In the case of mobile knowledge work, the three technological enablements discussed below – information management, communication and collaboration, and time and task management – capacitate MKWs to achieve their work across different times and spaces (See Table 1). MKWs are thus able to engage in location-independent work practices, and to forge or maintain social/professional ties remotely.

Mobile work practice	Major activities	Primary enabling IT tools
Information management	Creating, accessing, and manipulating information across time and space	● Mobile devices ● Note-taking and scanner apps ● Digital signature capabilities ● Cloud services ● Physical backup systems
Communication and collaboration	Collaborating and communicating with teammates, work partners, and clients, as well as maintaining a social infrastructure	● Various communication technologies (e.g. emails, instant messaging systems) ● Cloud services ● Social media
Time and task management	Managing timelines and task completion (e.g., planning for "dead time")	● Project and time management tools (e.g. Asana and Basecamp) ● Task management applications (e.g. WorkFlowy and Todoist) ● Online calendar systems ● Voice recognition systems

Table 1: Technological enablements that support mobile knowledge work.

Information management

Mobile smart devices are usually part of a mobile knowledge worker's IT assemblage because of their size and transportability. P7 shared in a diary entry: *"*Early 6:40 am flight out of Raleigh-Durham Airport heading to San Diego for 2 week business trip. Relying on my mobile devices to keep me connected and moving forward with work related tasks such as processing email, creating/editing client meetings. Using Excel mobile to update a shared database." P14, a real estate agent, uses his cell phone to take notes while visiting sites. He notes, "It's easier to find my phone than it is a pen and piece of paper" (P14).

MKWs rely on various information technologies to go paperless. This, in turn, allows them to be even more location-independent, as all the information they need is typically accessible through their mobile devices. For that reason, digitizing non-digital information resources is a common practice among many participants. For example, P10 writes in Moleskin notebooks and then takes a photo "from the app, in

Evernote. Then it will make your handwriting readable or searchable in Evernote." P13 and P31 take pictures of notes or other non-digital content with the CamScanner mobile application and then store them in applications like Evernote. Not only are these digitized notes accessible from mobile devices while they are traveling, but the notes also become accessible across other devices (e.g. computer desktops).

Other applications facilitate the flow of digital documents once they are created. P9 and P29 use different mobile applications (SignEasy and DigiSign) to sign digital documents. P5 leverages Mac OS's preview for the same purpose. "I don't have to print things out the way I used to. Prior to that, I would need to print out the last page, sign it, and then scan it" (P5). Not only are MKWs no longer tied to paper for signed documents, they do not even have to be tied to a computer. P32, a mobile business consultant, has given up all other computational devices and now relies exclusively on his smartphone for his work. He appreciates that his smartphone "freed him from the computer."

Multiple inexpensive or free cloud services enable the accessibility of digital information and provide MKWs access to necessary work resources while away from the central office (be it the home or work office). P7 keeps her training manuals on Microsoft OneDrive while moving between California and North Carolina. P1 uses Dropbox to work from different locations. She might start the day on a desktop computer in the library, "then just have my changes sync up and then go home and open it up on the laptop and have it there." For P9, this access across devices makes Dropbox a convenient backup during business trips, because "in case my computer disappeared or broke, I could log onto someone else's computer and get the documents." In sum, cloud systems help MKWs work across locations and devices, and offer peace of mind as well. Remote access or virtual private networks are similar strategies MKWs may utilize to access work-related information remotely. P15 notes "remoting into my office machine kind of opens the door to essentially me sitting in my office and doing my work."

Cloud storage is a popular backup option. However, many MKWs also backup on non-cloud locations. P2 keeps "backups of client stuff" on a "big 2 terabyte hard drive." P5 uses an application, Crashplan, to backup on a computer at a relative's house. Just as hardware can fail, the Internet can fail as well. P7 carries a USB drive with a backup of presentations that are also saved to the cloud, as access to the Internet cannot be taken for granted. She says, "I don't wanna show up unprepared. If Wi-Fi didn't work, and I couldn't access all those drives that are in the cloud, I don't want to be sitting there going, 'well, sorry, the Internet's not working.'"

Communication and collaboration

Many MKWs travel to meet teammates, work partners, and clients face-to-face (Su and Mark, 2008), but in most cases these interactions take place from a distance and/or while MKWs travel across locations. Although they primarily rely on their cell phones for such interactions, they make great use of communication apps such as Skype, Google Hangout, and Slack Talk to voice chat or videoconference. For example, P2 noted she seldom meets her colleagues in person, and spends a lot of time on Lync or Google Chat. Some of P11's collaborators use the GotoMeeting app to "drive into the side of the road and join a meeting on the phone." Cloud services also allow MKWs to collaborate on projects. P4 says, "We don't have to meet and we don't have to be on call, even, and we can just all be working on a

document." Text-based communication technologies (e.g., instant messengers) are equally instrumental. P25 mentioned using Slack in diary entries to "chat with coworkers" or "catch up on project progress." P26 (diary) planned a yoga retreat with a collaborator "using email/text messaging." P33 (diary) used both text and voice to collaborate in one day, including a "Skype call with a colleague, [and] instant messaging with another colleague." A suite of communication tools therefore allows MKWs to work remotely and attend meetings on-the-go.

Many MKWs work independently and remotely, and must make an effort to remain connected to colleagues and clients (Brown and O'Hara, 2003); they commonly pair a variety of channels and tools to connect with different collaborators, or even to share different information with the same collaborator. P12 described the various technologies he uses to collaborate on a single project: "I might email it to him, I know that's so 20th Century. I might put it in Dropbox and say here's the link to a file. [...] if we want to see what we're working on, if it's a particular file, we do a GotoMeeting and share the screen, be like does this look good to you, is there a problem?" P22 (dairy) also talked about using multiple tools for a single collaborative project: "I started my morning with a conference call between my partners in a project. [...] We are now collaborating on a sponsorship package using a shared document in Google Drive." If P13 needs to get in touch with collaborators he "could e-mail one of my teammates, I could e-mail my boss to get some feedback, or we use its called HipChat." P6 shares work with his editors through Tumblr and then responds to questions by email. A combination of multiple collaboration, communication, and knowledge sharing tools enables MKWs to meet the various demands of their collaborative work practices.

The communication and collaboration practices noted above build upon a foundation of social ties (Jarrahi and Sawyer, 2013). Because of the constant mobility of MKWs and their mediated interactions, they may lack mechanisms for nurturing social or professional ties that are important in knowledge-intensive work. P11 highlighted how easy it was to get "left out of the loop."

Social media can partly address this challenge by facilitating interaction with others, allowing MKWs to maintain a network of social ties. An active social media presence is an effective way for MKWs to stay connected with their social and professional ties. P8 uses social media to attract clients, and noted "LinkedIn has been a very big channel for vendors to me. Vendors use LinkedIn all the time. For clients they've used Facebook to message us. They've even used Twitter" (P8). P20 has also obtained projects from social media: "it's helped us get jobs, find new clients, do things like house sitting where we stay in people's houses and watch their animals and different things like that." She also asserted that part of the reason she and her husband got new contracts was their social media presence, and the fact that people "feel like they know us immediately even if we've never met" (P20). Likewise, P17 highlighted his "network of people who kind of know my skill set, my sweet spot."

Finally, MKWs use social media as a substitute for the social aspects of working in an office, even though they are physically separated from their colleagues. They collaborate on projects with social media tools like LinkedIn and Twitter. P2 described her interactions on the sites as "an amoeba network," through which she is connected to "a bunch of like-minded people with expertise in different areas." Social media also staved off MKWs' loneliness. P27 explained, "I'm a super social person, […and these tools]

really help me feel like we're all working together in a big office. I don't see everybody, but I can hear them if I choose to."

Another way in which social media take the place of the physical office is by allowing MKWs to be visibly "present" as professionals. The same social media sites that facilitate the scoping and gathering of information about others are also "important resources for sustaining work by letting others know where one [is], even without planning to meet them there" (Liegl, 2014, 14). Our MKWs promoted their expertise and work ethic with carefully crafted status updates, building "personal equity" (P17) over the social web.

Having a social media presence is important to MKWs, and this daily maintenance work was evident in the diary entries:

- "updating social media feeds" (P20)
- "participating in Facebook groups" (P30)
- "promoting friend's new book via social media" (P26)
- "writing a personal blog post" (P26)
- "social media advertising for future retreat event" (P26)
- "setting up Facebook ads" (P30)
- "creating page on my website for a new offering, sharing it on Facebook" (P33)

Time and task management

Spatial mobility and location independence often translate to temporal mobility in that MKWs enjoy a higher level of temporal flexibility (Kakihara and Sørensen, 2001). On the flip side, they must serve as their own project managers, planning tasks and projects, and making sure that time management mechanisms are utilized to meet individual and collaborative project goals. Nine participants mentioned things like "time management and prioritizing projects" (P26) in their diary entries as the biggest challenge of their day.

Some MKWs devote time regularly to task and project management, and may use multiple softwares such as Basecamp, Toggl, Asana, and Trello for managing tasks and projects. P27 stated: "Trello has specific boards for my specific projects and then I use Any.do as more a running task to do list that's all encompassing — anything that comes to mind whether it's 'do my laundry' or it's 'send this e-mail back." P1 keeps WorkFlowy open constantly so that she can edit or consult to do lists. Furthermore, some of the participants need to track their work time for billing purposes. This can be tedious, but information technologies have made it much easier. P5 uses a website called Toggl for tracking time for this purpose.

It is especially important that MKWs' task management software be mobile. P28 keeps up with tasks with To Do, a free smartphone app. P13 chose Trello "because it's a very nice interface on both the iPhone and the iPad for how you can kind of visually see what your progress is on the tasks." Since all of these programs work through apps, they are accessible on devices MKWs use throughout the day.

Mobile devices are helpful, once again, in making information accessible to MKWs on-the-go. Calendars can be viewed and updated from smartphones and tablets. P26 sees his cellphone as a "personal assistant," helping him to take notes, schedule meetings, and read emails. Shared calendars can also help MKWs schedule down time with friends and family. P8 shares a calendar with his girlfriend, a nurse, because it was hard for them to find time when they were both off of work: "So finally we were like 'Alright, why don't we just get each other's calendar on there?' And then we know what each person's doing, and then we can kinda figure out how to plan time to hang out from there."

Collaborating and managing work with others across time zones can be challenging, and MKWs may use a variety of tools to schedule this work. P33 listed "wrangling time zones" in her diary as the biggest challenge of the day, but stated that she "used worldtimebuddy.com" to confront this challenge. She also employs a feature of Google Calendar that allows "you [to] put things in different time zones, and so for example, I can put in a meeting at like 3:00 p.m. Eastern and then my computer will figure out oh wait you're not in Eastern time right now so that's actually going to be at 1:00 for you" (P33).

Another challenge for MKWs is handling "dead times," times during the day when, at first glance, work cannot be done. For example, most participants get a big share of work-related conversation done while driving. If multiple workers travel together, it is also possible for passengers to work while one person drives: "We have a van that somebody else is driving. What will happen is you'll see four people all on their laptops. We have portable Wi-Fi and we all just work from the van as somebody is driving us" (P27). More often, participants drive alone between work locations, and want to be able to use that time. Voice command is a popular way for MKWs to interact with their smartphones while driving. "I'll say, 'Siri, set a reminder for such and such.' 'Put a reminder in here.' 'Siri, make a calendar appointment for such and such for this day'" (P8). P7 praised Google Voice for working for her while she was driving; after capturing her notes, Google Voice emails her a transcript. P3 agreed that "if I didn't have a voice recorder, life would be very difficult. Because I'm so mobile, voice is critical." Having a tool that enables work to be done in transit is necessary for MKWs to be productive.

Mobile technologies are also helpful for taking advantage of short windows of time between other work commitments. P7 (dairy) shared that her biggest challenge was "juggling the number of clients I need to work with in only two weeks while in San Diego while also working on other client projects and volunteer Board activities from North Carolina." She kept up with her work back home by "utilizing mobile technology to respond to emails while between client appointments" (P7). She was able to use that time between appointments because she did not have to set up at a desk to get her work done. P7 concluded her entry that day by noting: "I would be lost without mobile technology."

Technological constraints

Social informatics scholars point out that IT practices and emerging technological artifacts evolve in response to local, technological, and institutional conditions (Davenport, 2008). Although information technologies enable MKWs to carry out the work practices described above, MKWs concomitantly need to respond to technological constraints. As opposed to the "standard model of IT," social informatics research never takes for granted the IT infrastructure that is supposed to support work practices (Kling and Lamb, 1999). IT infrastructures always pose challenges to their users. These challenges could stem

from the technology itself (design-centric technological constraints). They could also be dependent of how information technologies' materiality interacts with local, organizational, temporal, and financial factors. To overcome these technology-related challenges, MKWs have to engage in technological workarounds and creative solutions to make their information technologies work. Thus through an "ongoing social process" (Kling and Lamb, 1999), MKWs (human agency) repeatedly come to terms with and negotiate the constraining and enabling features of information technologies (technological agency).

Constraints	Description	Corresponding configuration activities
Design-centric technological constraints	Limits in material features of IT or gaps between different technological systems	• Extending technological functionality by assembling multiple devices and tools • Bridging across and harmonizing different technological systems using system connectors
Local technological constraints	Constraints rooted in limits of local IT infrastructures	• Planning mobile resources ahead of time and working offline • Raising awareness about local IT infrastructures
Organizational technological constraints	Constraints rooted in organizational rules and policies regulating or restricting the use of IT	• Leveraging personal technologies or personal strategies to work around organizational constraints
Temporal technological constraints	IT interference in the boundary between personal time and work, and in effective time management	• Setting norms with collaborators and customers • Planning breaks from technology • Unplugging from email and social media
Financial technological constraints	Cost of premium IT devices and applications, preventing access to state-of-the-art technological capabilities	• Relying on free or lite applications • Using open source technologies • Leveraging free local infrastructures and resources

Table 2: Technological constraints impeding mobile work practices.

Design-driven technological constraints

Participants are constantly challenged by the material limits of personal and organizational information technologies, commonly understood as "*material constraints*" of technology (Orlikowski, 2000). The technologies present barriers to the performance of tasks in certain situations. These barriers are often rooted in the design of the information technologies, and manifest themselves primarily in how hardware and applications layer functions, requiring MKWs to undertake configuration work.

Major hardware challenges for MKWs can range from a lack of 4G-LTE wireless cards on certain laptops to the inadequate battery life of mobile devices. Most participants carry extra chargers and batteries for both their smartphones and laptops. For example, P22 always takes advantage of a suite of power-related technologies, including: (1) a 100,000 milliamp external battery for his smart phone (it can charge his phone five times from completely empty all the way to fully charged), (2) a 6-port charging station that charges multiple devices at the same time, and (3) a special Motorola charger that fully charges his smartphone very quickly (see Figure 1 for photos of the devices shared through digital diaries). A few other participants carry multiple devices (e.g. two laptops on long trips).

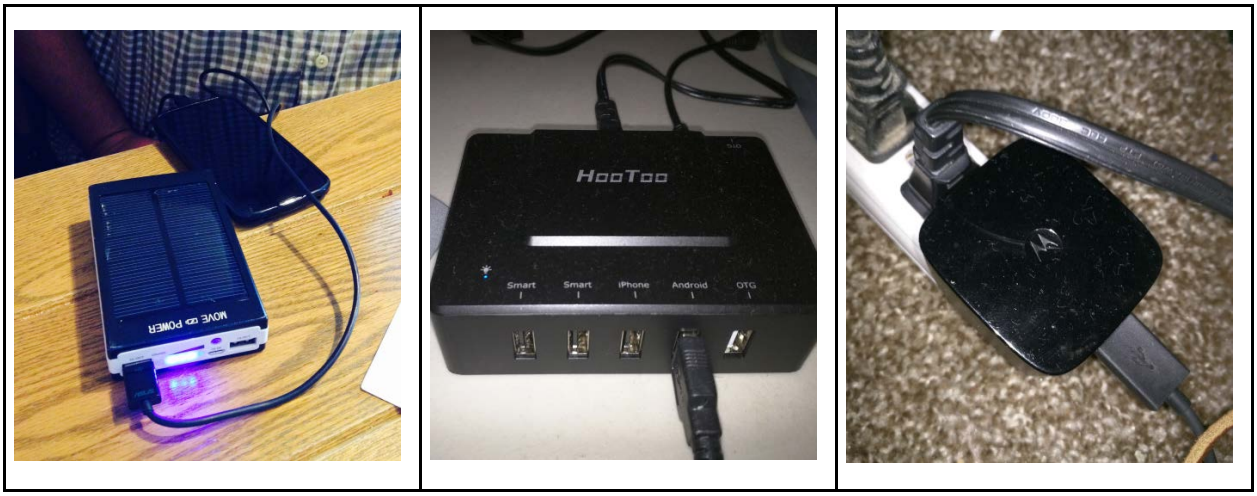

Figure1: Assemblage of external battery, charging station, and special charger used by P22

Another challenge is the difficulty of using on-screen multi-touch keyboards. P6 expressed this sentiment: "I can't write on the phone. I don't use the iPad for that much work either, for the same kinda reason; I don't like typing on glass." Several participants use voice recognition technologies to mitigate this problem, and to interact with smartphones when driving.

Many applications and systems still do not offer offline functionality, although MKWs often have to work from airplanes or other offline locations. Participants therefore may use software, such as Evernote, which functions offline, and then transfer content to other applications once they have access to a reliable Internet connection. As a public relations specialist, P3 regularly writes blog posts in a word processor while traveling by car or airplane, and then posts them to other platforms once she gets online. VPNs also may impose restrictions; for example, P11 has kicked his coworkers off of a client's VPN, or has gotten kicked off by them, when they logged in at the same time. To address this problem,

he and his colleagues developed an informal norm of putting up a status on their internal instant messaging service when logged in.

MKWs use assemblages composed of many different pieces of technology. The fact that important information is located across multiple systems can create a barrier to access, as it is simply difficult to keep up with it all. This reflects a lack of integration among diverse software platforms and device ecologies that many participants use. Organizers of each platform ecosystem (e.g. Google, Apple) implicitly impose their dominance, making cross-platform information sharing a thorny task. For example, several of the participants who use Gmail do not want to use Google Drive for cloud storage. Nevertheless, as P6 put it, "I use Google Drive, mostly because Google kinda forces you to use Google Drive." P3 faces similar challenges, since her preferred calendar system is Outlook: "I'm having trouble with making all the technologies work. Google wants to take over. It wants Google Calendar to be your calendar." P18 emphasized the lock-in effect that is inherent to these ecosystems: "Everyone tries to lock you in, and at a certain point, you have to decide which lock in you find useful." Therefore, the way in which Google or other ecosystems work together can be a convenience, but it also excludes the use of other applications MKWs may prefer or need to leverage.

Some participants have developed strategies for making these divergent ecosystems interoperable. P26, for example, uses Zapier (a service that integrates multiple applications and platforms) to share notifications and reminders between his Mac computer and Android phone. He also leverages Evernote to create and transfer notes between a PC laptop and an iPhone, creating a bridging practice between the two competing ecosystems. Participants leverage applications that coordinate information scattered across different systems. P10, a lawyer and owner of a small firm, takes advantage of Clio, which coordinates information across multiple ecosystems and personal devices: "If we have a deadline in the case [it] gets entered into Clio, which then gets pushed to the Google Calendar that we have, then, that gets pushed to mobile devices, or computers" (P10). The information is entered in one place, but ends up where it needs to be — in calendars on personal devices. Another lawyer, P24, appreciates Slack's ability to send alerts from various programs to one location. "We can connect various other systems to it like Dropbox or a payment process and so we get notifications through it" (P24). In this way, not only does P24 use Slack to chat with his coworkers, he also relies on it as a centralized source of news about his business.

Local technological constraints

Mobile knowledge work is usually hampered by the lack of an adequate and/or secure Internet connection in the locales MKWs visit*:* "The biggest kind of uncertainty is that I can't guarantee there will be a strong connection when I do go to coffee shops" (P36). P20 echoed this concern, noting that in Mexico "there was no Wi-Fi at our house. It was super slow at all the cafés. Everywhere around town it was basically like a black hole, it felt like, and so we ended up going to the phone company and buying one of those USB's for our computer that had 3G on it so that we could just connect anywhere using that." Others draw upon cellular data for other reasons. P33 occasionally uses her cell phone's hotspot for both speed and security: "I needed to do some sensitive stuff online, so I decided to use the hotspot from my cell phone's data plan instead, which I understand is more secure than public Wi-Fi. Then, to

avoid using too much data, I switched back to using the Starbucks public Wi-Fi once I was done with the more sensitive stuff." When participants use their cellular data, they are often mindful of data usage. P24 noted that when he connects to the Internet through his phone, he "need[s] to pause Dropbox syncing." The kind of Internet available in various locations determines what kinds of devices MKWs need to have on hand to supplement Internet connection.

For the reasons noted above, MKWs need to be continually cognizant of local infrastructure capabilities at different spaces that they occupy. The quality of wireless Internet at a location often determines whether an MKW will work there and what kind of work will get done. As an attorney working with confidential information, P10 worries about the security of public Wi-Fi and will not use it even if the bandwidth is superior. P22 noted that he "keep[s] track of the different places that I go to and what kind of speed I can expect." Some of the participants check Web reviews about venues (e.g., Yelp) to learn about the Internet connectivity, and P23 specifically contacts hotels about Wi-Fi before making a booking: "I tell them I'm going to be working. I need to have a strong Wi-Fi." Local awareness facilitates using local infrastructures such as airport or café Wi-Fi networks, VPN hotspots using cellular networks, or a client's infrastructures. MKWs may also use devices and technologies that extend these local infrastructures. For example, P9 carries "an electrical splitter that splits the plug into 3 plugs, and I carry it in my bag in case I'm in an airport or in a Starbucks and all the plugs are filled. I can split the plug and make 3 outlets."

Organizational technological constraints

As opposed to design-centric technological constraints, organizational technological constraints arise not only from the material design of information technologies but also the organizational rules and processes. For example, organizational policies can reduce technological flexibility, disrupting mobile practices. P4 describes his work issued laptop as "locked down." On this computer, he "can't use any type of Google platform, can't use Skype, and can't use any Open Source, because it's security issues" (P4). The measures taken by P4's organization create technological boundaries that require him to juggle between his personal laptop (to access personal applications that facilitate some work practices) and his work laptop (to access enterprise information resources and repositories): "I work with my personal computer because I can't do half the things I need to do on my work computer." Similarly, to access "behind the firewall" resources, P6 uses a company-provided MacBook laptop with relevant VPN settings in addition to his personal laptop. P37 described similar organizational constraints. Even though the organization (as a large pharmaceutical firm) provides important resources for mobility including a mobile hotspot device (MyFi), he is not able to install any applications on the work laptop or smartphone without going through a tedious bureaucratic process, forcing him to carry his personal smartphone in addition to the smartphone provided by his firm.

Even as independent workers, MKWs' find their work to be fraught with different restrictive requirements set by the client organizations they serve. They have to use various cloud services affiliated with different clients, and may need to keep abreast of different email accounts provided by these clients. P3, who works with multiple clients and through multiple systems, bundles those emails into one dashboard: "I have a lot of emails. I have email for each of my clients, I have my own corporate

email; I've got Gmail. They all go to my Outlook. And then Outlook is all structured so that they've got their own folders… Outlook has such great rules you know, I just say every time something comes in from [name] put it in this folder, and it does. I'll look at it here."

Clients' policies can specifically restrict the mobility of MKWs. P11 noted that as a security measure, clients may restrict access to their networked information by authorizing only specific IP addresses, limiting MKWs to either clients' offices or pre-determined locations. Workers affected by such rules may resort to workarounds, such as emailing the documents to themselves so that they can work with them outside of the designated IP addresses. As another example, P25 described how a client's mobility policies plague her work: "I had to install this really, really invasive security framework before they would let me install any of the apps and access any of the service for my phone. I'm sure they know every text I send and, I mean, I don't imagine anyone cares but I felt totally naked and unconnected, not being able to check my e-mail [email account provided by the client] from that client on my phone." As such, MKWs enact tactics to accommodate demands imposed by both their own organizations and their clients.

Temporal technological constraints

Wireless and mobile technologies render the boundaries between work time and personal time less distinct by making workers more accessible outside of normal work hours, and by blurring the cues and social meanings that distinguish spaces for work and personal time (Mazmanian, Orlikowski and Yates, 2013). P7 observes, "When you're in your office, people assume you're in the office, you're available. You're out of the office, maybe not as available. And now technology's made it we're available 24/7. People think, 'Wait a minute, I sent you an email. Why didn't you respond?'"

In response to these challenges, our participants leverage non-technological ways to impose boundaries for when work contacts could reach them or expect a response. P8 found that he had "become 24 hours". That is, clients assumed he was available 24 hours a day. So he "got the call center [as an outsourced service], to let them take the heavy lifting for getting all those inbound calls." Use of the call center allows him to block out times when he does not have to be personally available for accepting calls. Other MKWs set expectations for their work contacts regarding when they are available. P1 devised a rule, which is clearly communicated to work-related contacts: "I never check my email after 6 pm" (P1). Clients know that if they email at night, they will not have a response by the next morning. P7 tells most clients when she is traveling, "I'm not available. I won't be responding."

Participants also employ technological and manual strategies to avoid distractions. While creating a task list for the week, P27 notes that he will "plan breaks in there with that little alarm on my phone because what I find I could end up doing is just working nonstop on something and never even thinking about taking a break or eating lunch or anything like that." An alarm actually went off on P2's computer during the interview. She explained "that's my reminder to breathe every once in a while." Email applications on mobile devices often send push notifications when new messages arrive, which can be a constant distraction. P7 uses a strategy for preventing email from monopolizing her work time; she schedules times for "processing email" (P7 diary). She notes that it is "an almost daily task but one I do in set periods throughout the day rather than each time an email arrives" (P7 diary). Likewise, P27 uses a

timer to focus on a certain work task, knowing that she can take care of other tasks after the timer goes off: "I play little games with myself where I'll say okay I'm not going to check my e-mail for the next hour and I will set an alarm on my phone that says I'm not checking my e-mail for the next hour" (P27). Others use different approaches to prevent social websites from distracting them during the workday. P25 uses an "app called SpacetoFocus, it's a Chrome extension. From 8:00 to 5:00 Monday through Friday it's enabled, but I have 15 minutes that are allowed to me on my list." She has 15 minutes a day to look at social media sites, and then SpacetoFocus will block them. This prevents too much work time from becoming non-work time. P35 allots and tracks work time for each task she needs to complete in a day using an application called FocusList (See Figure 2) which helps her separate this time from non-work time.

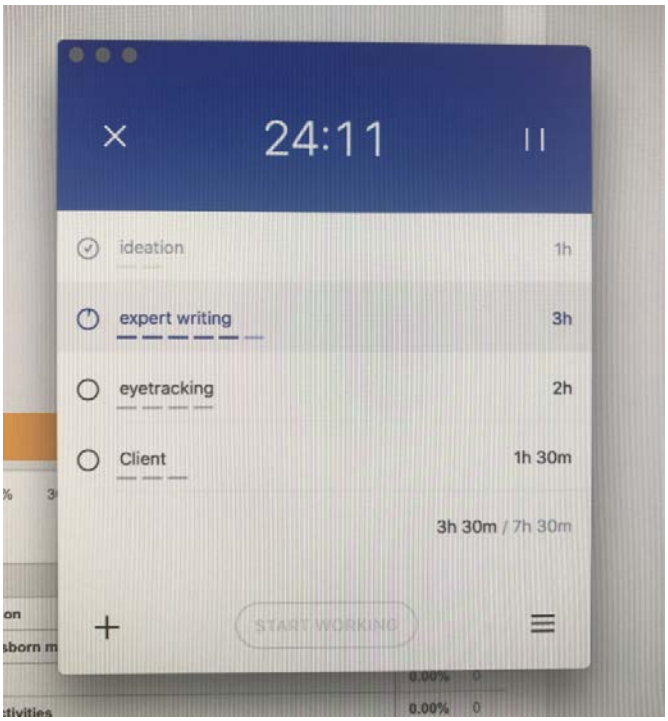

Figure 2: Use of FocusList to stay with tasks (P35, diary)

Financial constraints

As independent workers, many MKWs constantly face the challenge of creating their own technological infrastructures. They need to be creative in locating and using technologies that do not impose excessive costs. Not only are MKWs purchasing their own hardware, but their hardware devices also experience more wear and tear due to travel. P28 has observed that "when you set the backpack down over and over and over the hinge on the laptop gets damaged over time." MKWs must take this into consideration when purchasing laptop bags and handling their equipment.

The devices used by MKWs are also more susceptible to theft than those used by office workers. When P1 works at the library, "if I have to go to the bathroom or go get a snack or something I feel like I need to pack up my laptop and everything." Because of this, she prefers to work at a co-working space where

she can “just leave it and walk away.” Due to the cost of hardware and the possibility of theft, MKWs may opt for less expensive hardware and cloud services. For example, P30 recognizes that Apple MacBooks are probably better laptops, but she finds them too pricy, and because she uses many online platforms she does not feel the computing device is as significant.

Important work-related software can also be expensive. P26 noted he would prefer to use Dapulse for project management because of its visual interface that tracks entries from smartphones and desktop computers. However, he cannot afford to pay a few extra hundred dollars for a service that he would use infrequently. Instead, he takes advantage of free platforms: “I just have a Google Doc and use that for task management and maybe just for self-organization” (P26).

Finding ways to lower the cost of software applications is a common strategy among most participants. Several MKWs in the sample utilize open source software as a free option. P2 noted she uses OpenOffice when she has to. She also employs Photoshop Elements “which is like a cheap version of Photoshop where you mostly edit images” instead of Photoshop because “I’m not going to spend that kind of money.” P6 has managed to use Dropbox for free: “through absolute pure stinginess to avoid paying for Dropbox, I do everything they offer to keep bumping up my limit, and the latest thing was if you store your photos on Dropbox we’ll give you an extra 3 gigs. So I said sure.”

P22 chooses workspaces based on the strength of open Wi-Fi networks: “I’ve got on my phone an app that lists the Wi-Fi networks in the area and it shows a graph showing the strength of the signal, and so I can just walk around the neighborhood and keep track of which network ID’s I see. Whether they’re open, whether they have a password on them, how strong the network is.” P22, P23, P30, and P35 occasionally work from academic and public libraries as free workspaces with reliable Internet connections and other resources. P22 employs some creative strategies to further use computational resources in academic libraries: “You are not allowed to install software on [the computers]. But I can still plug in this flash drive and launch the application which is set up to actually be run from a flash drive.”

MKWs can potentially get work done while flying, but connecting to Wi-Fi on the airplane often costs money. Many avoid the cost by planning ahead and using the airplane as a quiet, offline workspace. However, P13 has figured out how to use in-flight Wi-Fi without paying for it: “When I’m developing [web applications], it’s happening locally on my computer. Well, we still have to make calls, like API calls out to other services. All those in flight Wi-Fi services redirect continually to this page, which is where you get to pay; that’s all it does over and over again. You still have an internet connection so the calls from my local website that I’m hosting still get on perfectly fine so I can run our website on my laptop 100% just like I would if I was at home or at a co-work space. So I can develop with absolutely no hindrance on the flight without paying any money.”

In short, most participants who operate as independent workers seek ways to assemble various resources that reduce the cost of technology, thereby reducing the overall overhead cost of their business.

Discussion

In a sociomaterial arrangement (see Figure 3), information technologies play dual roles; they enable work mobilizations, but at the same time are not "whole, uniform, and unified" (Orlikowski and Iacono, 2001, 131), and impose various challenges. As agentic actors, MKWs creatively configure information technologies in order to facilitate their work.

Figure 3: Mutual shaping of IT assemblages and work practices in a sociomaterial arrangement.

Technological agency: Work mobilization

In contrast to social determinist accounts of technology (Bijker et al., 2012; e.g., Woolgar, 1991), which strip agency from technological artifacts, sociomateriality recognizes the role of the materiality of information technologies, and "the various supports [material artifacts] provide to human pursuits" (Kallinikos, Leonardi and Nardi, 2012, 7). Material effects of information technologies manifest themselves as "tangible resources that provide people with the ability to do old things in new ways and to do things they could not do before" (Leonardi and Barley, 2008, 161). Leveraging information technologies and the knowledge bases around them, MKWs are able to be productive, successful colleagues and collaborators.

Social actors "enact" IT-in-practice in ways that meet their situated needs and particular interests, which may not necessarily align with the uses intended by the organization or the developers of the technology (Orlikowski, 2000). In our case, MKWs bring together various personal computing tools and devices (in addition to enterprise information systems and local infrastructures), and construct their own bottom-up, emergent infrastructures. This stands in contrast to the top-down organizing paradigm, which has long informed research on the professional practices of workers (Huotari and Wilson, 2001). In top-down organizations, decision-making is hierarchal, centralized, and based on rigorously planned processes (Hagel and Brown, 2008). MKWs' technological practices are differently oriented. They need to work adroitly on the ground, and pull together multiple technological resources to construct their own personal IT assemblages (as IT-in-practice).

Human agency: Technology mobilization

Findings show (as outlined in Table 2) that in addition to providing useful affordances for mobile work, information technologies also pose several constraints (material, spatial, organizational, temporal and financial). As Orlikowski and Iacono (2001, 134) observe, when information technologies are put into practice, "interconnections are often partial and provisional and […] require bridging, integration, and articulation in order to make them work together". Consequently, much of MKWs' agency is directed at

less visible configuration work that weaves together information technologies and makes them work as a functional assemblage that caters to the unique mobile work context. This specific form of configuration work can be understood as "technology mobilization": the process of making technology functional across different times and locations.

Technology mobilization is emblematic of social actors' agency in that they configure information technologies by working around a diverse set of technological constraints that constantly plague their work. Social actors often "enact their human agency in response to technology's material agency" (Kallinikos, Leonardi and Nardi, 2012, 35). Previous research informed by a human agency perspective suggests that workers apply their discretion to appropriate information technologies by working around or re-shaping intended uses of a system (Boudreau and Robey, 2005). For example, as capable creators and improvisers, MKWs seek ways to extend the functionality of information technologies and bridge across competing platforms in the face of challenges imposed by a volatile, unpredictable mobile work context. In such a context, workers exhibit more agency in assembling all technological resources to their ends since they lose some of the richness of a traditional office context. Their work environment cannot be presumed stable; there is a higher risk that connections can fail, collaborations can break down – and the same organizational fallback solutions may not be available. Therefore, they typically bring larger and more creative assemblages of information technologies into the picture; these are situation-dependent, and have to be continually reinterpreted and reformed in relation to new and unseen contingencies.

A mainstay of human agency rests upon the knowledgeability of social actors (Giddens, 1984). In their interactions with various information technologies, MKWs demonstrate a "technological acuity," which reflects a tacit understanding of information technologies' functionality and how this comes into play in the mobile work context. Therefore, not only does technological acuity involve learning about the material features of a technology; but it also involves knowing how these features may enable or constrain local, temporal, organizational, and financial aspects of mobile work. For instance, knowing about the reliability and security of Wi-Fi connections in multiple locales is crucial for mobile work. Such a tacit understanding often hails from situated experimentation with various IT tools and infrastructures as MKWs come to grips with the peculiarities of their work contexts. Fleck (1994) sees this process of "learning by trying" as a critical element of technology configuration. For example, P10 learned he could conserve 10-15% of his laptop battery life by turning off Wi-Fi and Bluetooth adapters. Primarily through trial and error, P33 has learned how much of her cellular data is consumed by conducting online audio conversations: "I have an idea I think a one hour audio call only takes about 25 megabytes of data." MKWs are hence cognizant of how to leverage information technologies when affected by technological and contextual limitations.

Conclusion

This article provides insight into the intertwining of work practices and IT uses in the context of mobile knowledge work. Information technologies enable and constrain mobile work practices while MKWs actively (re)configure technologies to make them work for them. It makes visible the previously invisible but salient configuration work of MKWs.

Several recent publications observe that the technical and material components of work are not adequately addressed in social informatics (Lessard, 2014; Sawyer and Tyworth, 2006). This is consistent with Cox's (2014) call for the integration of practice theory into social informatics research as a way of "keeping with the increasing integration of computers into everyday life" (175). In response to this critique, this article also contributes to social informatics research by providing a more comprehensive perspective on the materiality of information technologies.

This article makes visible the agentic capabilities of MKWs as social actors. MKWs are required to organize these information technologies in a way that aligns both technically (i.e., links necessary tools together in a functional way) and contextually (i.e., aligns to contingencies of mobile work). They therefore adopt strategies to fashion various digital infrastructures and IT tools into functional assemblages to make them workable in their particular work conditions.

Like most social informatics frameworks, the social actor model of Lamb and Kling (2003) focuses on institutional settings, and more specifically social actors' interactions with organizational affiliates and the institutional environment. Certainly some of the most animated pictures of human agency come from instances in which participants devised various strategies to address the boundaries imposed by technological design or the intersection of technology with different contextual factors. Put simply, social informatics research makes it clear that information technology and its materiality matter; however, it is less conceptually clear about how humans and technology play out their roles together in practice, and consequently shape one another. The post-humanist stance of sociomateriality addresses this gap, and allows for equal treatment of both, shedding light on how social actors and technology co-create outcomes. Furthermore, the practice-oriented approach, espoused by sociomateriality, helps reveal the improvisational micro-dynamics of everyday practices, and the ways in which social actors bring about or change organizational outcomes. This grounded account of situated sociomaterial activities has practical implications in that it informs the formulation of organizational interventions and the context-aware designs of information systems.

In this article, we primarily made explicit how a sociomaterial perspective can enrich social informatics research by offering insight into both the agency of the human actors and that of technology. It bears stating that sociomaterial research can also benefit from the social informatics framework in at least two ways. First, whereas sociomateriality provides a more nuanced perspective on the entanglement of technological and human agencies, and how they unravel in practice, it may lack sensitivity toward broader contextual peculiarities. Social informatics, in fact, prompts a more holistic view of the social context – sociotechnical systems as an interdependent mix of people, contextual influences, information technologies, and information processing capabilities, beyond just the micro-context of sociomaterial practices.

Second, sociomateriality has made major strides toward a more cogent understanding of the enmeshment of technology in social practices, but it may not distinguish among various forms of technology. In contrast, social informatics is particularly concerned with the computerization movement and specific affordances of information technologies (and not more generically 'technology') (Sawyer and Jarrahi, 2014). Kling (2007) invites researchers to pay particular attention to "information structures" of information technologies as "content and content providers, rules/norms/regulations,

such as those that authorize people to use systems and information in specific ways, [and] access controls." As such, social informatics research problematizes the information in 'information' technologies thanks partially to its close ties with information science (Sawyer and Rosenbaum, 2000), which actively explores the specific role of information as the content of a system in social contexts (Saracevic, 1999; Sawyer and Huang, 2007).

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