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Mobile Communication in Organizations

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Mobile information technologies within organizations shape the way work is conducted. Equally, working practices and organizational arrangements shape the specific technological configurations. Whereas much of the research into mobile communication emphasizes peer-to-peer voice and message communication, the organizational use of mobile communications has for much longer engaged in more complex configurations of mobile technologies. As such, the organizational experiences precede the widespread consumer use of a diversity of smartphone and tablet apps. This chapter explores, based on a review of the related literature, the broader role of mobile communications where peer-to-peer mobile voice and message connectivity is only one aspect among several. The chapter discusses in detail and exemplifies through cases the impact of mobile communication on interactional barriers, the degree of individual discretion and centralized control, and the possibilities to exercise algorithmic agency. Portfolios of data services shape the possibility for redesigned and complex collaborative patterns.

Keywords: enterprise mobility, mobile at work, mobile information technology, mobile affordance, technology performance

Introduction

Mobile communications began within an organizational context when car-based two-way radio systems were used for policing, but the first generation of mobile phones primarily served high-end business users due to very high cost (Agar, 2003). However, the consumer mobile phone very rapidly took a place on or near people's bodies along with other essentials, such as cash, credit cards, keys, and perhaps cigarettes for those still smoking (Chipchase, 2007; Stewart, 2004). As a result of this widespread consumer adoption since the mid-1980s, mobile telephony has enabled an increasing proportion of workers with instant connectivity at work. While a significant body of research is concerned with the broader social impact of mobile communication, in particular peer-to-peer voice and text messaging, much less closely coordinated activity has investigated this phenomenon in an organizational context. The interrelationships between mobile communications and the organization of work are specifically interesting—how organizational activities and arrangements shape the need for mobile technologies and equally how new technological developments can shape the organization of work (Sørensen, 2011; Sørensen & Landau, 2015). The organizational context offers a richness of mobile communication based on varied portfolios of services beyond peer-to-peer voice and text messaging. Such diversity of mobile communication points toward the

current situation of heterogeneous personalization of mobile services on smartphones, tablets, and wearable technologies. The chapter argues that studies of organizational mobile communication, therefore, can support research into contemporary challenges of app-based mobile communication.

This chapter adopts an organizational perspective on collaboration among distributed mobile workers and characterizes mobile communications as planned and improvised technology performances resulting from conflicting work requirements meeting mobile technology affordances. Empirical cases drawn from a number of projects conducted from 1993 to 2012 support the analysis of (1) the cultivation of both fluid interaction without boundaries and boundaries managing interaction explicitly, (2) the shifting degrees of individual discretion and centrally stipulated decisions, (3) the organizational balancing of centralized decisions informed by situational uncertainty and equivocality, and (4) how this complexity requires portfolios of supportive services enabling a diversity of decision support for mobile workers.

The chapter is organized as follows. The next section highlights important academic contributions to the understanding of mobile communication in organizations. The third section briefly presents the perspective of mobile technology performances enacting technology affordances under conflicting and even paradoxical work requirements. The fourth section considers the individual and organizational aims to both cultivate fluid mobile communication as well as ensure appropriate access management through interaction. The fifth section is concerned with the balancing of individuals making localized discretionary decisions against centralized organizational decisions. The sixth section focuses on the locus of decision-making contingent upon the situational characteristics and in terms of combinations of human and algorithmic agency. The seventh section reflects upon how mobile technology affordances can be orchestrated into portfolios of mobile communication services through the provision of consumer app store apps. The final section concludes the chapter.

Research into Organizational Mobile Communication

There is a substantial body of literature on the organizational use of information and communication technologies, for example, the early use to manage distributed activities (Yates, 1989), as means of obtaining organizational and societal control over production (Beniger, 1986), as an integrated part of management decision-making (Culnan, 1987), and as the dual effects of both automating tasks and empowering workers (Zuboff, 1988). As a maturing field, the organizational study of information and communication technology covers a large range of subject areas (Galliers & Currie, 2011). Beyond this field, much research has focused on mobile communications and mobilities in general, for example, on mobile lives (Elliott & Urry, 2010), the social use of mobile phones and the influence on language (Baron, 2008; Ling, 2004), changing social rituals (Ling, 2008), and the use of Short Message Service (SMS) messages (Harper, Palen, & Taylor, 2005). These studies on mobile communication focus mainly on mobile voice and messaging and less on a broader set of technological affordances and associated behavior.

However, despite the widespread adoption of mobile communication within organizations, the body of literature exploring this subject area is much more limited despite the argument that enterprise mobility—the organizational use of mobile communications—provides a novel perspective on the relationships between organizational processes and supportive information and communication technologies (Barnes, 2003; Basole, 2008; Sørensen, 2011). This can

probably in part be explained by the general lack of attention within both management and information systems studies to the material and physical aspects of organizations (Dale & Burrell, 2008; Orlikowski & Iacono, 2001; Orlikowski & Scott, 2008). The lack of attention to the organizational importance of mobile communications led Lyytinen and Yoo (2002) to formulate a research agenda, which largely did not have the desired effect as the study of mobile communication in organizations has not yet had its "mobility turn" (Sørensen & Landau, 2015; Urry, 2007, p. 6).

Important contributions to the understanding of organizational mobile communication have, however, been made across a number of loosely connected research strands since the advent of teleworking in the 1980s (Bailey & Kurland, 2002). Research has explored the labor market shift toward an increase in home working (Felstead & Jewson, 2000), flexible project organization of work (Kunda, 1992), and itinerant work facilitated by specialist brokers (Barley & Kunda, 2004). This challenges our existing understanding of organizations as core aspects of work are carried out and negotiated in increasingly fluid arrangements (Felstead, Jewson, & Walters, 2005).

Stephens' (2018) work explores in depth the role of mobile communications both in creating opportunities for managerial control and for workers to resist this control (see also Chapter 6.3). A small number of edited collections broadly explore mobile communication at work (Andriessen & Vartiainen, 2005; Hislop, 2008; Kourouthanassis & Giaglis, 2008; Sørensen, Yoo, Lyytinen, & DeGross, 2005). The social study of mobile communication has explored a diversity of issues often related to the negotiation of boundaries between work life and home life, such as work–life boundaries and maintaining ongoing social contact (Golden & Geisler, 2007; Wajcman, Bittman, & Brown, 2008), work intensification (Bittman, Brown, & Wajcman, 2009), the negotiation of interaction paradoxes (Arnold, 2003; Jarvenpaa & Lang, 2005), constant connectivity and stress with mobile email clients (Ayyagari, Grover, & Purvis, 2011; Mazmanian, Orlikowski, & Yates, 2013; Straus, Bikson, Balkovich, & Pane, 2010), and the reshaping of our understanding of technology use as experiential computing (Yoo, 2010).

Domain-specific research explores mobile communication within, for example, policing (Manning, 2008), healthcare (Scheepers, Scheepers, & Ngwenyama, 2006), construction (Chen & Kamara, 2011), mobile learning generally (Kukulska-Hulme & Traxler, 2005), and learning within organizational contexts specifically (Lundin, 2005). Studies have also sought to use mobile communication as a means of obtaining the detailed measurement of behavior to map interaction and most productive individual performances (Aral, Brynjolfsson, & Van Alstyne, 2008).

Mobile Communications Viewed as Technology Performances

The role of mobile communication within organizations is in this chapter characterized in terms of individuals engaging technology affordances in mobile communication performances within contexts of paradoxical requirements for decision and action emerging from the working arrangement. The technological capabilities, also within the literature described as affordances, signify essential characteristics of a priori embedded design assumptions regarding the technological functions, the future user, and the context of use (Gaver, 1991; Gibson, 1977; Sørensen, 2011; Zammuto, Griffith, Majchrzak, Dougherty, & Faraj, 2007). As an example, the design assumptions behind Nokia's smartphones were based on Finnish cold winter

conditions where resistive touchscreens perform much better than their capacity counterparts chosen by all modern smartphones (Litchfield, 2009). The choice of a resistive screen assumes that users will prefer the more assertive pressure needed in order to interact, whereas a capacity screen will be activated by the slightest touch of a (non-gloved) finger. However, the affordance of a multitouch screen is for now settled in terms of assumed relationships between the technical artifact (resistive screen), the (non-gloved) users who will end up using it, and the context in which this will take place (warmer than a cold Finnish winter).

A comprehensive characterization of mobile technology affordances is beyond the scope of this chapter. Briefly, however, mobile technology can be characterized as combinations spanning the following affordances (Sørensen, 2011, Chapter 2): (1) portability—they can be carried along by the user; (2) connectivity—they connect to other mobile devices and to remote services through a variety of network protocols, such as Bluetooth, Wi-Fi, and 4G LTE networks; (3) intimacy—the devices will contain data and customized processes reflecting the particular user; (4) pervasiveness—the mobile device's ability to use data about its environment, for example, GPS location, temperature, or other environmental characteristics; (5) memory—the mobile device may store ongoing interactions and present these when required, for example, threads of messages; and (6) priority—the device may be able to apply a variety of rules to filter and prioritize interaction.

The core mobile phone affordances of portability and connectivity have with smartphone apps, and a range of sensor technologies been expanded to complex combinations of these six affordances. Within organizations, such complex affordances have, however, for much longer been deployed to support mobile technology performances—the act of invoking affordances for the specific purpose of doing work, making decisions, coordinating with colleagues, etc. The need for such activities will arise from specific work situations possibly imposing conflicting requirements of the mobile worker, perhaps even paradoxical ones that in the situation seem incommensurable (Schad, Lewis, Raisch, & Smith, 2016).

The relationship between technology and social context evokes complex and contrary cause–effect relationships, in particular mobile technology, which both renders the user at the same time both highly mobile while it also fixes the user's availability (Arnold, 2003). Contemporary work can present workers with a range of conflicting requirements and situations, for example, balancing short- and long-term concerns (Holmberg & Mathiassen, 2001), increasing intensification of work (Bittman et al., 2009), managing the additional complexities of remote and mobile working (Dubé & Robey, 2009; Pearlson & Saunders, 2001), and managing the tensions between personal autonomy and work commitments (Mazmanian et al., 2013). Such conflicting and paradoxical contingencies can be more fluidly coordinated through mobile communication, but the technology itself can equally create disturbances and interruptions (Jarvenpaa & Lang, 2005; Ljungberg & Sørensen, 2000), rendering the technology itself ubiquitous rather than disruptive (Sørensen & Gibson, 2008).

Contemporary mobile technologies imply the provision of a diversity of affordances, which are applied in heterogeneous ways by workers (Mathiassen & Sørensen, 2008). This emphasizes the role of portfolios of services to be configured according to individual user needs, rather than a parsimonious set of functions to be adopted homogeneously by all users. Figure 6.1.1 outlines the elements and context of mobile technology performances. In these, the meeting of the planned and the improvised performances are continuously seeking to cultivate fluid interaction, allowing for immediate interaction and coordination according to the various needs, while at the same time allowing for the cultivation of barriers to interaction.

Individuals engage in this process of managing interaction, as do teams seeking internal support for creative interaction, while carefully managing boundaries for external interaction. Equally, entire organizations seek to manage interaction in order to concurrently support members in effective decision-making, while engaging with the outside world in a productive manner. Mobile information technology here supports rapid and flexibly shifting microcoordination processes (Ling, 2004), while at the same time placing central organizational decision infrastructures containing rules, procedures, forms, etc. directly in the hand of mobile and remote members of the organization. This provides a much more granular, interactive, and possibly multicentric form of coordination and collaboration.

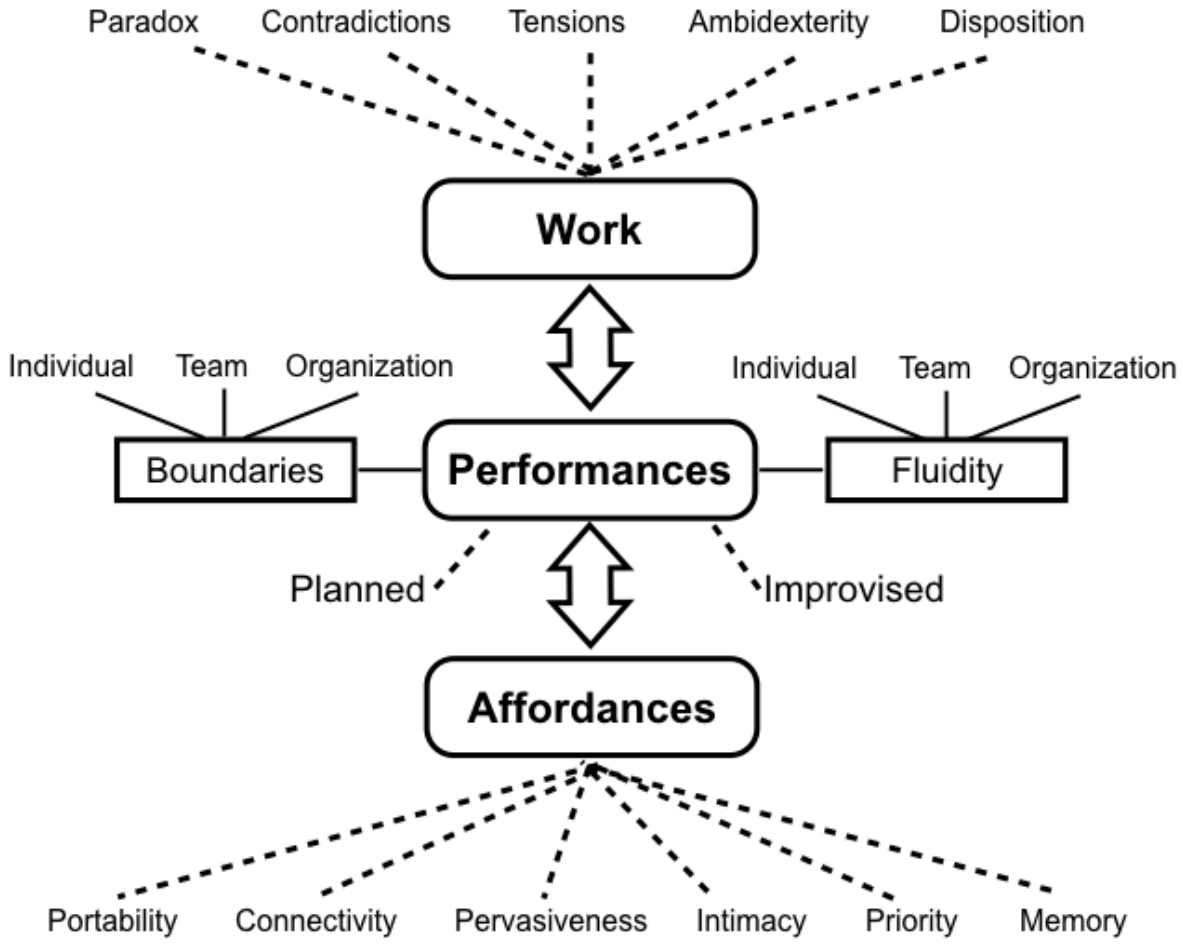

Figure 1: Mobile working as the meeting of complex working demands, and technology capabilities in technology performances seeking to balance bounded and fluid interaction for individuals, teams and the organization as a whole. Redesigned version of (Sørensen, 2011, Figure 3.2).

Cultivating Fluid Interaction & Interaction Boundaries

A large Middle Eastern bank struggles to best balance its requirements for 24-hour foreign exchange trading, following the exchanges' opening hours in London, New York, and Tokyo, with its foreign exchange traders' need for reasonable family life (Sørensen & Al-Taitoon, 2008). The case illustrates the challenges of finding appropriate ways of designing mobile technology performances that balance conflicting organizational concerns for efficiency and compliance with individual concerns for boundaries and fluid working.

Four different solutions were attempted, each with its own specific characteristics (see Figure 6.1.2): (1) a three-shift 24-hour trading floor on bank premises was too expensive as it needed many more traders and meant unpleasant shift-working; (2) home-based trading desks would allow more flexible use of a small group of especially trusted traders, but these were then tied to the home office for after-hours trading; (3) global transfer of trades between trading floors in established additional trading floors, in Singapore, New York, and London, turned out to be highly unfeasible as client relationships were not only of a codified functional character but to a significant degree governed by social relationships requiring shared practices and relinquishing of client ownership; and (4) mobile trading, equipping a select group of traders with mobile devices to support after-hours mobile foreign exchange trading, established some balance between the bank's and the traders' needs by allowing after-hours trading to flexibly mesh with the traders' private lives.

Mobile trading was made possible by a wireless trading device, which could be programmed with alerts to indicate when a certain market condition was met and a mobile phone to call in and record trades on an answering machine for subsequent back-office processing. These provided a complex mix of affordances supporting connected portability, as well as the intimacy and memory of bespoke profiles and data, priorities implemented in market alerts, based on pervasive market data streams. The solution still represented a significant after-hours commitment but was associated with high status for the traders and the best compromise between the bank and them. It relied on organizational arrangements to create boundaries within which the individual traders are left to obtain some form of fluid balancing of work-life and home-life requirements.

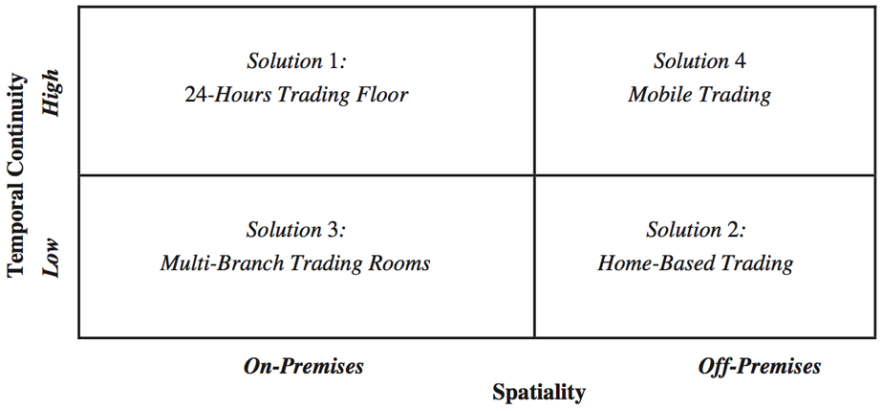

Figure 2: The four different solutions resolving the organizational need for 24-hour trading and the individual trader need for cultivated boundaries. Based on (Sørensen and Al-Taitoon, 2008).

The case of a Tokyo-based software industry executive (Kakihara & Sørensen, 2004) also illustrates a diversity of mobile technology affordances applied to carefully manage interactional boundaries and then to engage in fluid interaction within these boundaries. He actively sought to use the mobile phone as a central unique contact point for interaction. In order to manage constant interaction requests, he had established a variety of advanced filters, which would match incoming requests and evoke a variety of sounds and blinking multicolored lights depending on the identity and assigned priority of the incoming voice calls and messages (Kakihara & Sørensen, 2004; Sørensen, 2011). Here, the mobile device acted as a focal point for the interaction, with visuals and sounds providing subtle cues to the caller's identity, and thereby implicitly importance. Messages and calls from the executive's personal assistant were deemed particularly important and prioritized most highly. In this case, mobile technology

affordances allowed an opening for interaction and means to provide some on-the-fly filtering and assessment, with a team member acting as a human anchor point for external interaction. The executive was then able to move freely around Tokyo interacting and gathering inspiration for new projects as a complex portfolio of highly bespoke and continuously tuned affordances provided a semipermeable interaction boundary. The bleeps and dings emitted from the phone would only rarely result in a direct reaction. The majority of alerts became a part of the Tokyo soundscape for the executive, rather than a constant burden to react (Licoppe, 2010), and as such a delicate barrier shielding him.

As illustrated in this section, organizational mobile communication can imply the negotiation of organizational and individual concerns for flexibility, and mobile technology affordances can provide the means of managing fluid interaction within negotiated boundaries. Achieving a state of fluid activities is, of course, highly desirable for the individual but far from easy (Csikszentmihalyi, 2002; Sørensen & Gibson, 2008). This can be the case when participants are geographically distributed and need to work together (Dubé & Robey, 2009; Olson & Olson, 2000).

Individual Discretion & Centralized Control

A key aspect of any type of work is the degree of discretion in decision-making bestowed on the individual worker or opportunistically grasped. As elegantly argued by Zuboff (1988), organizational use of information and communication technologies can, in general, lead to two diverse outcomes. The technology can support empowering workers to gain access to aspects of their work previously either hidden or distributed geographically, for example, across factory plants. Equally, however, the technology can automate key aspects of work and through this extract essential aspects of work and render activities mundane. The variety of individual discretion provided by the organizational context, therefore, also plays a critical role in our understanding of mobile communication at work. Whether part of an organizational routine, a team-based task, or an individual action, mobile communication at its core either links person and device in physical proximity (Barnes, 2003; Dourish, 2001; Felstead et al., 2005) or confines both parts to a bounded space, such as work conducted from a vehicle or a cockpit (Hutchins, 1995; Manning, 2008).

Discretion Variability – From Complete to None

Organizational mobile communication covers a wide range of tasks and roles and, therefore, significant variation in levels of individual discretion. Discretion can facilitate individual- or team-based on-the-spot improvisation to locally meet an emerging demand for action (Dusya & Crossan, 2005; Weick, 1998). Improvised acts can over time turn into sustained practices (Feldman & Pentland, 2003). Mobile technology is a valuable resource for individuals and teams when engaging in improvised performances as it can offer open-ended access to people and resources. Equally, technology can simultaneously provide extension of the organizational infrastructure of rules, policies, and systems directly to the hand of mobile workers.

The case of security guards supplied with radio frequency identification–enabled mobile phones provides a good example of one extreme end of a discretion spectrum (Kietzmann, 2007, 2008). Traditional security guards may be granted some discretion to patrol a building or an outside area according to their own route or according to a route specified in a document. They will typically document the timing and route chosen by recording it digitally on a device,

which is not connected to a network and therefore only a portable means of producing an audit trail. However, the security guards in the case study were completely controlled from a central system throughout their shift. When the guard waved his mobile phone over the start sensor, a central service would send an SMS message to the phone indicating what specific sensor to be scanned somewhere else within the perimeter. The route was completely determined centrally, with no room for individual guard discretion. Here, the use of mobile communication allowed for an extreme form of automation of work where the little remaining discretion was entirely removed. This is in stark contrast to some examples on the other end of the scale where mobile communication provided rich opportunities for individuals to further expand their level of discretion when interacting with others. The case of the Tokyo software executive, discussed previously, marks an example of the extreme opposite end of an imaginary discretion spectrum as the executive's own desires and preferences entirely governed the interaction.

The case of London black cab drivers also illustrated mobile technology performances governed by a high degree of individual discretion (Elaluf-Calderwood, 2010; Elaluf-Calderwood & Sørensen, 2008). The drivers were able to engage in solitary and self-directed working as they had invested several years learning the most common taxi routes by heart, also called "the knowledge," as a repertoire for establishing a complex combination of routines and improvised action (Elaluf-Calderwood & Sørensen, 2008; Rosen, 2014). While work was mainly accomplished alone, small groups of taxi drivers would communicate using mobile phones, to socialize, to discuss their trade, and to alert others to emerging needs for cabs, a use of mobile telephony adopted by taxi drivers in other cities (Skok & Kobayashi, 2007; Townsend, 2000).

In contrast, the use of smartphone-based taxi app services directly connecting drivers and passengers, for example, in Uber's platform, marks the engagement of algorithmic management of work (Möhlmann & Zalmanson, 2017) displaying similarities of both the security guards and the taxicab drivers. Uber drivers will have similar levels of discretion as the London taxicab drivers on the issue of when they work and when they do not. However, once they turn on the Uber driver app, the central algorithm will connect them with customers needing transport, as well as provide unequivocal guidance to the destination. Here, the specific mobile technology affordances support the unbundling of the main part of the knowledge element of taxi work and allocate it to automated self-services between driver and passenger, thus paving the way for self-driving taxis. It marks a combination of portability, connectivity, and intimacy relating to drivers' working hours preferences and the rating of everyone involved, as well as critically the pervasiveness of the phone guiding the car through data on its position and the best route to the destination.

Continuous Balancing of Routines and Improvisation

The previous section discussed the great variability of discretion, and this section explores the more complex relationship between individual discretion and organizational rules and procedures. For mobile workers, their mobile communications are made up of planned performances informed by technologically embedded rules, procedures, and requests for compliant action, combined with the ability to engage in improvised, unplanned technology performances in order to optimize decisions according to a local overall concern. Discretion implies the freedom to engage in such local decisions—a freedom the security guards did not have and the Tokyo software executive had in abundance.

Policing is an interesting domain of work as it exemplifies a complex combination of planned and improvised technology performances seeking to balance the need for centralized control and coordination, with the local need for police officers to deal with difficult situations in a planned yet improvised manner (Manning, 2003). The requirement of accountability and due process places strict emphasis on stipulated rules being followed, and the precarious nature of policing containing significant situational uncertainties and possible danger places equal importance on the ability to adapt behavior to situations. The need for discretion can then create issues of public accountability (Bass, 2001).

A patrol car–based study of policing documented complex use of a variety of mobile affordances and how the officers' discretionary choice of technology performances was informed by the specific situations they found themselves in (Sørensen & Pica, 2005). Incidents reported to the control room were listed on a small in-car monitor as a queue of "jobs," and officers would choose which "job" to respond to. While en route to the incident, officers would use a broad range of information sources to gain a better understanding of the situation awaiting them. Arriving at the scene of the incident, the officers would rely heavily on experience-based improvisation when dealing with other people; and as situations tensed, the use of mobile communication would be severely reduced to sparse and codified radio conversation with the control room (Sørensen & Pica, 2005). The officers engaged in improvised media choice informed by experience as it sought to allow for their full attention in critical situations while allowing for extensive access to past data (Sawyer, Tapia, Pesheck, & Davenport, 2004; Straub & Karahanna, 1998).

In some contexts, the localized individual concern for getting work done may conflict with the central organizational concerns, as illustrated in the case of delivery drivers for a wholesale supplier to fast food restaurants illustrates (Boateng, 2010). Here, the drivers and clients were required to only coordinate through the central dispatch office, which then would have an updated view. However, drivers would often find it more flexible to leave their mobile phone numbers with the restaurant in order to flexibly coordinate the delivery directly rather than through the central dispatch office. Frequent turnover of drivers made the direct coordination an unsustainable solution for the organization, illustrating a direct clash between organizational procedures and individually improvised solutions. The case illustrates how mobile technology performances can satisfy local conditions well but not organizational requirements. In other cases of mobile workers spending much time on their own, various forms of peer-based discussions and knowledge exchange can support common ground, as illustrated in the studies of repair engineers exchanging war stories and coordinating efforts (Orr, 1990; Wiberg, 2001). Common goals in virtual and remote working can indeed be greatly strengthened by socialization and cultivation of common ground (Dubé & Robey, 2009; Olson & Olson, 2000).

At times the discrepancy between local and remote improvisation may have very reasonable grounds and indeed be invisible to centralized management oversight. This can be illustrated by the case of a group of industrial waste management lorry drivers collecting full industrial waste containers and driving the empty ones back (Kietzmann, 2008). This work was largely organized by the team of lorry drivers, with key information passed upward to management, who in turn provided the schedule of work. However, unbeknown to management, the lorry drivers worked within an overconstrained environment where there simply were not enough containers in circulation to make the system work according to rules. As the drivers were able to self-organize, a number of improvised practices had emerged as a means of optimizing performance and minimizing effort, such as temporarily storing empty containers halfway between customers or temporarily borrowing containers from competing waste management

companies. When the company started electronically tagging each container and recording their movements, these practices were suddenly visible to management. The specific detailed movement of the objects of work became visible to those other than the lorry drivers at a much more detailed level, resulting in a higher degree of management insight, illustrating the general role of information systems as means of achieving organizational control (Beniger, 1986) as well as increased granularity of data systematically collected on work that began when organizations became large and geographically distributed (Yates, 1989; Zammuto et al., 2007). The technological possibilities now increasingly allow organizations in detail to deal with individual worker data irrespectively of the geographical distribution at the individual level. This is already a reality in many domains, most dominantly for delivery drivers who rely on a strictly central route-planning system with continuous updates, unlike this example (Aral et al., 2008; Mazmanian et al., 2013; Yoo & Lyytinen, 2005). In addition, such data will in aggregate form enable higher-level understanding of productivity and effect, as in these cases of policing (Blanes i Vidal and Kirchmaier, 2018; Garicano & Heaton, 2010).

Agency

Designing mobile working requires an understanding of the specific trade-offs between centralized control over distributed collaborative activities, the need to engage in unplanned and improvised activities, and the increasing algorithmic automation of complex decisions**.**

The Limits to Centralized Control

The increasing granularity and timeliness of data recording the process and outcome of mobile working are both premised on the proliferation of smartphones with GPS and Internet connectivity. These developments have further enabled the creation of entirely new algorithmic patterns of collaboration where customers and drivers are tied together by computational agency (Schneiderman & Maes, 1997; Wegner, 1997). Where the traditional taxicab was managed exclusively by the driver, an Uber cab relies on complex algorithms to match customers and drivers and to mediate their mutual assessments of each trip. Uber is carefully balancing central and decentral decisions, for example, ensuring central matching of customers and drivers and central rules on behavior and equipment but also drivers themselves deciding when to work and if they also work for other companies.

The closeness of mobile technologies to the user's body further enforces the complex paradoxical relationships between central control and decentral improvisation (Jarvenpaa & Lang, 2005; Mick & Fournier, 1998). These paradoxical relationships are consequential of the characteristics of the intimate human–technology relationship cultivated for individual needs but then immersed within a social context. The individual paradoxical relationships of consumption will, for example, render the user dependent on the mobile phone even as it offers individual independence. The skills associated with the manual adjustments of a complex camera may be replaced by clever smartphone camera software, and as a result technology commodifying skills will render the user with fewer skills (Mick & Fournier, 1998). Paradoxical relationships form as mobile communication, for example, both empowers and enslaves. Cultivated practices through ongoing technology performances will enable drivers to navigate using a GPS system and thereby will not need to engage in extensive training on maps and routes. However, this also forges a deep interdependent relationship over time, rendering it difficult, if not impossible, for the driver to navigate without GPS. The independence gained from mobile communication will be matched by an equal dependence. In social contexts, the

mobile phone will provide the freedom of being physically mobile while interacting with others. This was a key part of the successful resolution of the foreign exchange trader's problem discussed earlier in this chapter. However, precisely as the mobile phone makes the user individually free to move, the technology renders the user fixed and always reachable to others (Arnold, 2003). The specific social conditions of mobile communication with conflicting local and remote demands for decisions call for constant application of a variety of coping strategies (Jarvenpaa & Lang, 2005; Sørensen, 2011).

Decision Uncertainty and Equivocality

Traditionally, the variation in discretion offered by the organization to individuals and teams allocates the highest level of discretion to executives and knowledge workers, while routine information processing and manual work can be assumed to have least discretion. This relates to the challenge of decision uncertainty (is the necessary information for deciding readily available?) and decision equivocality (is the decision obvious to all given the necessary information is available?) (Mintzberg, 1983).

In unequivocal decisions with a low degree of uncertainty, such as the security guards' routine patrolling of a facility, a centralized and programmed process can execute the decisions. Unless a fire broke out or a burglary occurred, a preplanned route could easily be scheduled and stipulated centrally.

When decisions are unequivocal but where there is uncertainty (too little information), the decisions should be organic and centralized but emerge through communication. A taxi driver with an interactive location system will exactly provide the mobile communication feedback to a central dispatch system, which allows for the continued central coordination of vehicles. As discussed, if locational data on both taxicabs and customers are updated in real time through access to smartphone GPS data, then the function of matching the two can be entirely automated.

For equivocal decisions with a low degree of uncertainty, the process must be decentralized and programmed by skills rather than by a process. This will ensure that decisions match the specific local circumstances. The classic example is the typical bureaucratic process of matching a specific set of rules to local circumstances, for example, in casework (du Gay, 2005). The coordination within the bank with mobile foreign exchange traders represented an example of such a process. The traders would at the end of the normal working day know what their individual trading limits were, and they would continue trading on their own, applying their expertise while obeying the established compliance rules for traders. Only in very rare cases would they need to coordinate the bank's total exposure with each other.

When there is both a high degree of uncertainty and equivocality, organic and decentralized decision processes are needed as decisions emerge through mutual adjustment. The London black cab drivers spend years of establishing complex routines, which forms the foundation for highly improvised adjustments to allow for the mutual adjustment between the ebbs and flows of demand (Feldman & Pentland, 2003). In the case of Uber, readily available data demonstrate that identifying supply and demand is combined with various incentive mechanisms to enable an adaptive central process (Rosenblat & Stark, 2016). The police officers engaged in a simple decentralized decision process of matching incidents to patrol cars by selecting what incident to attend on the in-vehicle computer system, based on the list of reported incidents and their indicated urgency. This decentralized mutual adjustment was even more prevalent when the

officers arrived at the scene and the decisions would be made under a complex mutual adjustment involving the police, people at the scene, and the set of laws and practices governing the setting (Sørensen & Pica, 2005).

Mobile Communications Unbundling and Automating Decisions

The increased use of mobile and itinerant workers (Barley & Kunda, 2004) and speculations on how future work may be assemblages of highly modularized and hyperspecialized tasks (Malone, Laubacher, & Johns, 2011) raise the issue of the role of technologies in the support for lean supply chains of distributed, yet interdependent, collaborative activities. The changed working practices, new commercial and contractual arrangements, as well as supportive mobile information technology provide new and emerging ways of working.

For the design of the appropriate organizational mobile communication arrangement, this distinction can be helpful as an initial characterization. However, as also illustrated by the examples discussed, the technological development can significantly shift decision processes both from decentralized to centralized and the other way. The reliance on advanced local data processes makes it easier to set out the boundaries for improvisation, supporting some decisions to better match local requirements. Equally, the more local data that are recorded and transmitted, the easier it is to centralize decisions through an interactive process of simply asking for more data to be input if necessary to make a decision contingent upon local changes.

Furthermore, the skills necessary to match local situations to existing rules, as well as the malleability of these rules, are also subject to degrees of automation, changing over time as digital data become increasingly available and sufficiently frequently updated. Digital technologies play an increasing role in the making of complex decisions previously done by humans alone. Using a smartphone app to navigate a vehicle is just one simple example but an example where the upgrading of the technology can result in significant impact for low-skilled work, for example, self-driving vehicles that would reduce the need for delivery drivers or complex and adaptive robotics technology that would reduce the need for manual factory work (Dellot & Wallace-Stephens, 2017). In complex automation of business processes, the decisions can be conducted in complex collaborative arrangements of humans and software agency (Willcocks & Lacity, 2016). Many professions are experiencing technology applied for professional services automation where parts of the skilled professional decision process are unbundled and automated (Susskind & Susskind, 2015; Wang & Swanson, 2007). Organizations are, among others, formed of a myriad of forms, formal rules, statutes, schedules, traditions, and standard operating procedures. These constitute, according to Max Weber, an “iron cage” (Maley, 2004). Allocating a large proportion of organizational decisions to such structural and predetermined procedural arrangements forms everyday practices. However, the expected use of various forms of artificial intelligence and process automation, for example, deploying deep learning, will signify a much more dynamic, interactive, and granular version of the iron cage. The algorithmic codification of mobile communication can support interactively algorithmic management of human agency (Aral et al., 2008; Möhlmann & Zalmanson, 2017; Rosenblat & Stark, 2016).

Orchestrating Mobile Affordances in Portfolios of Services

While many of the developments of mobile communication at work have been underway since

the days of fixed home offices (Felstead & Jewson, 2000), they were fueled by the rise of the laptop computer and the standard mobile phone, supporting fluid patterns of interaction. However, the increasing sophistication of consumer smartphones and tablet computers with associated app stores populated by millions of affordable apps has significantly shifted the possibilities for advanced mobile support. For small companies, independent contractors, and itinerant workers in general, the explosion of cheap and capable software has also allowed advanced yet highly affordable access to a great variety of applications and services supporting their work. This democratization of access to complex software services is largely facilitated by the app platforms for smartphones and tablets providing software developers direct access to large markets.

This provision of software relies critically on generative platforms combining computing in the small—highly user-friendly devices interconnected and linked to a variety of networks—with computing in the large. Interconnectivity, in particular, supports the direct connectivity to computing at scale where large data centers host powerful computing capabilities enabling multisided platforms feeding millions of different apps and thereby radically lowering the cost of code (de Reuver, Sørensen, & Basole, 2018; Eaton, Elaluf-Calderwood, Sørensen, & Yoo, 2015; Sørensen, 2016). These arrangements reflexively support the creation of the apps, their global distribution, and their use. Generative infrastructure for the production of apps connects to existing new business systems as well as produces a large diversity of productivity and communication apps. This has greatly increased the scope to deploy "bring your own device" policies (French, Guo, & Shim, 2014) (see also Chapter 6.3). The diverse user needs for varying portfolios of apps can be served either through the consumer app stores or through firm-specific app stores.

Conclusion

This chapter discussed the organizational use of mobile information technology through a number of cases. It considered the meeting of mobile technology affordances and the conflicting demands for decisions and actions by specific work contexts. The chapter discussed the variety of affordances and performances supporting mobile working in terms of the need for both fluid interaction and interaction boundaries as a means of creating spaces for fluid work and interaction. The chapter, furthermore, discussed the challenges of balancing centralized organizational control over localized contextual decisions and the improvisation of such decisions to match the local context. This was further explored in terms of decision uncertainty and equivocality. Finally, the chapter explored how computational agency can record increasingly granular performance data and thereby unbundle and automate activities previously under the control of mobile workers.

Mobile communication within organizations has a significant head start on advanced use of a variety of mobile affordances. However, smartphones and tablets provide consumerization of mobile information technology capabilities, which in the first decade of this century was only possible through extensive enterprise investments. Furthermore, the advent of further diverse technologies in the form of the Internet of things will likely expand these opportunities (Shim et al., 2019). The technology performances previously mainly witnessed in organizational contexts are increasingly available in any context—for better or for worse.

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