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Abstract

This paper builds on the concept of sociomateriality to investigate different modalities by which information technology may scaffold work practices. Taking into account the constitutive entanglement of both the social and the material, the authors identify a model to map emergent work practices through which IT use unfolds. An investigation of mobile IT usage in 10 companies indicates a model of four modalities of behaviors: (1) When people perceive that the mobile technology supports their local needs, they will use it in the prescribed way; (2) when they perceive that the mobile technology can produce additional advantages, they augment its use beyond that prescribed; (3) when possible, people use unprescribed technologies to complement their prescribed mobile technology; and (4) people use unprescribed mobile technology to scaffold their work and limit their use of the prescribed IT as much as possible.

Keywords: sociomateriality, mobile technology, work practices, improvisation.

Introduction

People's use of technology in organizations may be explained according to two alternative views. The objective view claims that the features and material properties of technologies shape people's behavior (Kling 2000). Therefore, people are agents of the particular mix of technologies that gets implicated in their everyday work (Winiecki 2004). The subjective view instead claims that people can use technology to whatever ends they require (Noble and Lupton 1998), and therefore, technology is a resource that can be changed at users' will (e.g., Cecez-Kecmanovic et al. 1999; Zuboff 1988).

Various attempts work to integrate these disparate views into a combined method that recognizes the agency of people as well as the material properties of technologies that necessarily inform practices. This research acknowledges that users might overcome technological constraints but also notes that some technologies present users with more constraints than others. As technological artifacts become more tightly integrated into wider systems or networks, a narrower range of enactment may be expected from users. That is, organizational technologies are not "infinitely malleable," in the sense that their use is open to multiple possibilities. As Orlikowski (2000: 424) notes, "such integration is likely to reduce the degrees of freedom available to users to experiment with and modify their technological artifacts in use. As users become more dependent on using integrated technologies, the variety of technologies-in practice that they will enact may decrease."

This integrative perspective also has evolved to become a sociomaterial view of technology, which "posits the entangled relations between humans and technologies as performed, that is, not pre-given or fixed but enacted in practice" (Orlikowski and Scott, 2008: 454). This approach emphasizes that the emergent uses of technology are acts of bricolage, "a process of sensemaking that makes do with whatever materials are at hand [by] us[ing] whatever resources and repertoire one has to perform whatever task one faces" (Weick 1993: 351-352). The technologies implicated in improvised practices thus shape action; they do not constrain or enable it but instead ground it in a finite set of material resources. These material characteristics scaffold and support certain work practices while constraining others. Information technologies (IT) mandated by management tend to be improvised upon in ways that support both prescribed and unprescribed work practices. Concurrently, organizational members tend to use not only prescribed information technologies but also unprescribed ones to scaffold their local needs and pursue their goals (Orlikowski 1996).

Studies that adopt this sociomaterial approach to the relationship between IT and organizational members highlight the importance of artifacts in this relationship (DeSanctis and Poole, 1994), though they have yet to exhaust its potential. Specifically, such research lacks a practice-based model of what happens when prescribed IT gets used in prescribed and unprescribed practices and, on the contrary, when practices employ prescribed and unprescribed IT. These combinations of prescribed and unprescribed sociomaterialities have critical importance for organizational life, and their theorization represents a worthwhile theoretical and practical effort.

This article draws on a study of the implementation of mobile IT in 10 organizations to develop a model that reveals how the entangled relations among organizational members and IT may become manifest in four modalities: (1) sole use of prescribed IT; (2) use of ancillary unprescribed IT to augment prescribed IT; (3) use of unprescribed IT to complement deficiencies in the prescribed IT; and (4) sole use of unprescribed IT.

Toward a Sociomaterial Model of the IT Artifact

Research on and around IT and organizations recently has begun to emphasize the central role of the IT artifact—"those bundles of material and cultural properties packaged in some socially recognizable form such as hardware and/or software" (Orlikowski and Iacono, 2001: 121)—in organizational processes, including knowledge sharing, strategizing, and performing everyday work that allows organizations to fulfill their role in the market and earn profits. In a recent review of information systems literature, Orlikowski and Iacono (2001) argue these efforts are but first steps in a longer journey to prioritize the material artifacts that constitute each organization's IT in multiple models that link the use of information systems to strategic and organizational outcomes. That is,

> *The tendency to take IT artifacts for granted in IS studies has limited our ability as researchers to understand many of their critical implications—both intended and unintended—for individuals, groups, organizations, and society. We believe that to understand these implications, we must theorize about the meanings, capabilities,*

and uses of IT artifacts, their multiple, emergent, and dynamic properties, as well as the recursive transformations occurring in the various social worlds in which they are embedded (Orlikowski and Iacono, 2001: 133).

Theorizing about the IT artifact is important for developing a more precise understanding of the dynamic processes through which IT gets woven into organizational processes as a resource for everyday practices, as well as to understand how its use may have consequences for organizational processes. Different material manifestations of information technology enter people's practices in very different ways and lead to very different outcomes.

Research into the role of boundary objects in knowledge sharing makes this point by showing that the choice of artifacts influences people's ability to address the challenge successfully (Carlile 2002; Levina and Vaast, 2005). The point is not to revive technological determinism and frame IT as a constraint on people's practices but rather to acknowledge that each form of IT points to a multiplicity of opportunities for action, and their material features inform improvisations by acting as a set of resources that suggest possibilities for adaptation, appropriation, and reinvention (Barley 1986; Black et al. 2004). In summary, to cite Latour (2004: 227):

> *There exists no relation whatsoever between the material and the social world, because it is the division that is first of all a complete artifact. To abandon this division is to rethink the whole assemblage from top to bottom and from beginning to end.*

The material characteristics of the surrounding world are integral to what we do and know. Therefore, material forms, artifacts, spaces, and infrastructures play critical roles for everyday practices and the knowledge embedded in those practices. However, as Latour (1992) points out, researching the integration of materiality and practices means going back to the basis of human sciences and considering the material grounding of everyday experience.

The Sociomateriality Approach

A few recent studies integrate materiality with an agency-based view of the relationship between IT and organizational outcomes by attending directly to the specific ways in which the features of particular artifacts become entangled in the social practices of people at work (Knorr-Cetina 1999, Berg and Bowker, 1997). In addition to explaining the role of social dynamics, such as perception and interpretation, these studies explore the opportunities afforded by technologies as a bundle of resources and procedures, as well as the way in which agents draw on them in the course of their everyday practice. Therefore, practice is not only emergent, embodied, and embedded (three concepts slowly being integrated into IS development efforts) but also material. Action is "deeply bound up in the material forms, artifacts, spaces, and infrastructures through which humans act" (Orlikowski, 2006: 460), and practices and artifacts are mutually constituted. Practices must always be material, in the sense that they are improvisations on tools and resources, or at least embodied, in the sense that action inevitably implicates the body. Artifacts then are living sediments of practices, changed or reproduced as they become implicated in everyday action and everyday work. In particular, IT artifacts, because of their openness to tailoring and adaptation, are deliberately or unwittingly modified in use.

This view pushes management research in general and studies on IT in organizations in particular to eschew the separation between practices and artifacts and look instead at sociomaterialities—that is, assemblages that get changed and reproduced in everyday work.

Prescribed and Unprescribed Sociomaterialities

We contribute to this research stream by distinguishing prescribed and unprescribed sociomaterialities. Prescribed sociomaterialities are those assemblages of practices and artifacts that are sanctioned by organizations or managers. They embody the organization's prescribed goals and the processes it defines for their accomplishment. Sociomaterialities of this type include electronic work management tools (Orlikowski 1992), surveillance technologies (Sewell 1998), and performance management systems (Ball and Wilson 2000). Prescribed sociomaterialities thus support convergence among routines, people's interests and identities, and the organization's strategy. They underpin exploitation processes in organizations that unfold as managers attempt to implement strategies to apply IT to the optimization of organizational processes. Research on the reinvention of prescribed information also shows this process of exploitation gets subjected to multiple situated tensions that push people to improvise sociomaterialities to address local contingencies. Such studies emphasize the resilience of local demands to small and large deviations from prescribed artifacts and practices. They also underscore the role of improvisations with and around IT for people's and the organization's ability to develop innovative sociomaterialities. These

innovations underlie the dynamics of exploration, or the processes through which IT gets implicated into emergent processes of organizational change and renewal. However, the sociomaterialities also can support processes of resistance that erode the organization's ability to profit from its prescribed information technology.

In summary, prescribed and unprescribed sociomaterialities constitute two very different and complementary (if not opposite) dynamics in organizations: One supports processes of convergence that appropriate information technologies to support the organization's goals, whereas the other supports processes of divergence that appropriate information technologies to achieve the individual goals of managers and employees and that may or may not benefit the organization. We distinguish these two types of sociomaterialities by extending the prescribed/unprescribed dimension to the practices and artifacts that constitute them (see Figure 1).
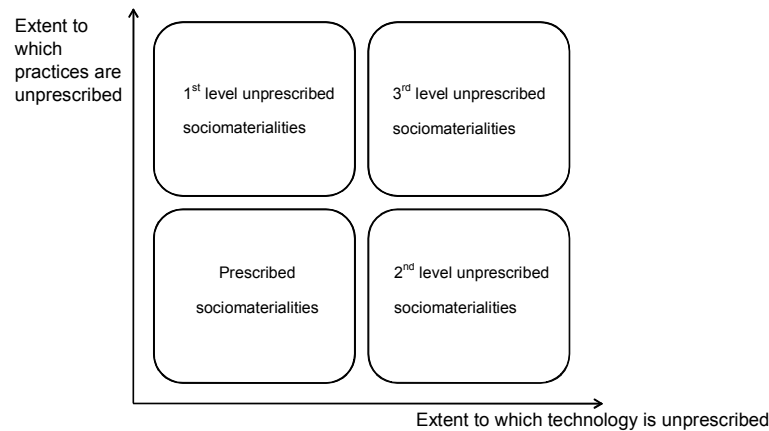

Figure 1. Combination of prescribed and unprescribed sociomaterialities (assemblages)

In prescribed sociomaterialities, prescribed artifacts are implicated in the organization's prescribed routines, such as when salespeople use sales automation software to keep track of sales opportunities or consultants employ knowledge management systems to develop solutions to a client's problem. Local improvisations and adaptations push sociomaterialities beyond the boundaries of prescribed processes and goals though. When salespeople use sales automation software to coordinate service work for customers or consultants use knowledge management systems to impress their colleagues and managers, they are enacting unprescribed work practices, though with prescribed IT. Therefore, their work remains visible to managers and is open to attempts to discipline unprescribed practices to encourage compliance or explore their potential for learning and change.

Empirical studies of information technology in organizations tend to focus on each of these elements individually, but very little material explores the relationships among the various combination of prescribed and unprescribed technologies and practices. Illustrating the forces that affect the sociomaterial assemblages represents the theoretical challenge for this study, which we seek to address by using data pertaining to the implementation of mobile technologies in 10 European multinational firms.

Research Methodology

Research Setting

Because our goal is to determine how technology might scaffold work practices from a sociomaterial standpoint, we focus on a modern, widespread technology that seems likely to have substantive organizational consequences: mobile technology (Lyytinen et al. 2002).

Mobile technologies include technological, social, and organizational interconnected elements that enable the physical and social mobility of actors, as well as an anywhere/anytime connectivity (Lyytinen et al. 2002). Mobile technology appears appropriate for understanding the constitutive entanglement of both social and material aspects (Orlikowski 2007). In particular, they can be used for private or business purposes and reflect "multi-contextuality" (Henfridsson and Lindgren 2005), which implies different kinds of impacts and uses in various contexts. Furthermore, Lyytinen et al. (2002) note that several levels of analysis may be affected by what they term "nomadic computing," including not just the individual level but also group and organizational levels. Studying mobile technology deployment in organizations should reveal different social and material forces at play at different levels that enable certain improvisational behaviors but restrain others.

We conducted a qualitative research study in 10 French multinational companies that recently implemented various types of mobile technologies, such as mobile phones, laptops, personal digital assistants (PDAs), and tablet PCs. The technologies represent various economic sectors, including manufacturing, services, and industry (both business-to-consumer and business-to-business). The companies employed their different technologies (prescribed and unprescribed IT) in different use contexts (voluntary and mandatory). In Table 1, we provide an overview of the companies that took part of the study, the different mobile technologies they used, and the users of these devices. Some companies equipped fieldworkers with tablet PCs, PDAs, and laptops; some managers also made use of mobile devices such as smart phones and laptops.

Table 1. Mobile IT Used and Users

Company	Type of Company	Mobile IT Deployed	Users Equipped with Mobile IT
A	IT and service provider company	Mobile phone, PDA	Management, Field force (Technicians), Teleworkers
B	Insurance company	Mobile phone, Tablet PC	Management, Sales reps
C	Distribution company 1	Mobile phone, Laptop	Sales representatives
D	Construction company	Tablet PC	Site foremen
E	Energy company 1	PDA	Executives, management
F	Cosmetics company	Mobile phone, Laptop, PDA	Sales representatives
G	Utilities company 1	Mobile phone, Laptop	Executives, Management
H	Distribution company 2	Smartphones	Sales force
I	Energy company 2	Smartphones, PDA, GPS	Execs, Management, Sales reps
J	Utilities company 2	PDA, Tablet PC, GPS	Field workers

Data Collection

The case study is part of a larger research project and relies on a combination of data collection techniques. First, observation studies took place over a period of 30 days at the respondents' workplace to enrich the analysis. These observations also provided a better understanding of the various company settings, background information related to the interview situation and validation of comments during the interviews. Second, we conducted 109 semi-structured onsite interviews with employees from all ten companies (see Table 2), including top managers (e.g., CEO, CIO, HR managers), to perceive their visions of mobile IT deployment and the goals pursued with the prescribed technologies. We also interviewed operational and middle-level managers to gain alternative views about the reasons for mobile IT deployment and to determine the impacts of these technologies on structures, processes, jobs, and employees. Third, to address the real impacts on jobs and the relationship between prescribed and unprescribed technologies, we focused on the actual mobile IT use by field workers.

Table 2. Surveyed Population

Company	Type of Company	Top Managers	Middle Managers	Operational Managers	Field Workers	Total
A	IT service provider co.	3	2	1	3	9
B	Insurance company	2	2	1	3	8
C	Distribution company 1	3	4	2	2	11
D	Construction company	3	3	4	4	14
E	Energy company 1	4	2	2	2	10
F	Cosmetics company	4	0	2	3	9
G	Utilities company 1	2	3	4	1	10
H	Distribution company 2	5	3	2	8	18
I	Energy company 2	6	2	0	4	12
J	Utilities company 2	3	3	0	2	8
Total		35	24	18	32	109

Each interview lasted approximately 60–90 minutes. We developed an interview guide that highlighted the social and material aspects of the mobile technologies and their impact on work practices and procedures. Therefore, each interview started with general questions about the respondent (function, role, responsibilities), followed by more IT-oriented questions, such as technology's role and consequences for work conditions, procedures, or the organization, reasons for mobile implementation, origins of the mobile IT adoption decision, and impacts on professional and private lives. Questions also pertained to adoption and use, the potential gap between intended use and actual use, the appropriation of prescribed and unprescribed technologies, and the reactions of employees faced with mobile IT offers.

The interview guide also provided some flexibility to enable respondents to express themselves on topics not addressed by the interviewer. Moreover, we collected secondary data, such as internal documentation, meeting notes, and press reviews.

Data Analysis

The 109 interviews were tape recorded and transcribed verbatim. The field notes from the observation studies and transcribed interviews were then subjected to a qualitative content analysis using a thematic coding procedure with Nvivo software. The thematic analysis began with data reduction to categorize, classify, and make sense of the data. In Nvivo, we created "tree nodes" (i.e., codes based on the literature review and its main constructs) and "free nodes" (i.e., emergent codes from the textual corpus) and thereby identified different themes from the transcripts of the interviews. We applied a rich coding procedure that could attribute the same extract to different nodes.

The qualitative coding (Richards 2005) followed a set of principles and three steps: (1) *descriptive coding*, or storing information that describes the case; (2) *topic coding*, which allocates passages to topics; and (3) *analytical coding*, which defines and interprets the meaning of the extracts in their context. We applied a mixed and rich thematic coding system and performed textual and Boolean searches. Through the textual searches, we identified certain words or expressions and thus highlighted dominant themes (linked to socio-materiality and technology as scaffolds for change). With Boolean searches, we constructed intersections of nodes. The qualitative analysis of our data in turn enabled us to identify the material part of the technology that affects work practices and procedures and the relationships between prescribed and unprescribed technologies. We also employed double-coding to check the reliability of the analysis.

Analysis

The content analysis of the interviews indicates four different modalities of mobile IT scaffolding work practices: (1) using prescribed IT as intended; (2) augmenting the performance of the prescribed IT by adding extra features; (3) perceiving the prescribed mobile IT as subject to improvisation and using unprescribed IT to complement prescribed mobile devices; and (4) using unprescribed mobile IT to scaffold work while avoiding the use of prescribed IT as much as possible. In the following sections, we detail these four modalities through an empirical analysis.

Prescribed Use of Prescribed IT

Our content analysis reveals that employees sometimes use prescribed IT as intended by their managers, especially when they lack alternatives. The working conditions observed in our study generally incorporate explicit pressures on field workers to assimilate and use the mobile IT. Many study participants reported using IT as intended by their managers, which sometimes seemed like an imposition. For example, a fieldworker in Company D explained: "Actually, we don't really have the choice. We were clearly told by our hierarchy that we are equipped with these tools and we have to use them. That's it."

Others, such as a sales representative for Company I, believed that "if we didn't use them, I'm sure we would be sanctioned." The managers we interviewed confirmed such beliefs were their intention. The CEO of Company C even emphasized that her employees "are obliged to use the devices we give them. Now, when we recruit new salespeople, we even write it into their contracts."

The framing is a rational one. An IS manager for Company A explained: "Once we make such investments, which have a certain cost for our company, we can't accept that some field workers use them and others not. They have to use these technologies, it's a rule they all have to respect."

Yet employees use the prescribed information systems to conduct their prescribed work procedures not only because they had been told to do so but also because they believed they were contributing to their own interests by doing so. These tools provide almost permanent access to a company's information systems and the continual availability of information across time and space. Their inherent characteristics make mobile IT into more effective work practices. They also become communication support systems for processing, storing, and analyzing data, and they can link all players in a business organization, regardless of time and place.

Some employees recognize that mobile communication tools provide an opportunity to improve their performance. A field worker in Company C claimed, "These tools were given to make us more efficient. It's invaluable progress." Others note that using mobile communication tools "enhances the image of their job," and an IS manager in Company I explained, "These tools are really motivating; they give us a sense of responsibility." Such feelings lead employees to appropriate prescribed IT in the prescribed way.

Prescribed information technologies also help employees comply with the unspoken norms of each organization. A field worker in Company J accounts for his constant monitoring of his mobile device by stating that he was "fully aware of the need to be available and reactive, even in the evening, or during the week-ends and holidays," because in his company, "working outside traditional hours is a moral obligation." Prescribed sociomaterialities that appear to include not only rules and procedures explicitly stated in job requirements but also those implicitly sanctioned by the company's culture.

Unprescribed Use of Prescribed IT

Prescribed work procedures are seldom enough to account for all of the practices that constitute people's everyday work. Rather, the participants in our study improvise their own practices using the mobiles communication tools provided by their companies. Some use the mobile communication technology features to optimize and organize their workday. For example, salespeople at Company A use the GPS functionality of their prescribed IT to optimize their interventions and the time they took to get to their customers' company. One of them reported: "mobile tools enable me to better organize my work. There are several functionalities that allow me to be more efficient, such as the GPS, the e-mails, and direct access to information related to clients. So for me, it's really important."

Other participants even went a step further and use their mobile tools to create information systems of their own to track sales and other customer data. One sales representative in Company H explained: "I really enjoy using my

Blackberry: for example I use it to keep track of how much was sold to each customer." He interprets mobile IT as an opportunity "to improve the organization of daily activity." A sales representative in Company F also improvised his own CRM system:

> *I think these tools were given to every salesperson to receive directly urgent e-mails in order to be more responsive… But I find many other ways to use them and to take advantage of them: for example, I enter all data about my customers and I use this information every day to follow my customers up and to know exactly when I should contact them.*

The practices that participants improvise with the prescribed technology draw not only on its unprescribed features but also on the meanings that the employees and their customers attribute to it. That is, according to a salesperson in Company C, using mobile communication technologies in the presence of customers presents "a modern and professional image." A sales representative for Company H agrees, because in his view, while using mobile tools, "the image given to clients is better; the perception that the client has of these tools is a perception of professionalism."

These field workers thus improvise on their prescribed IT by extending its features and uses in ways not prescribed by their companies. Situated challenges and opportunities and the material features of the technology are tightly connected: The technology provides the base for improvisation, which in turn highlights the need to improve the use of the prescribed technology with unprescribed practices. These challenges and opportunities emerge beyond the boundaries of the organization, such that participants try to use the prescribed technologies for their personal and private use. Some employees took advantage of the mobility offered by the mobile communication technologies from work to strike a better balance between work and family time. According to a marketing research manager in Company A:

> *Every week, we have a team meeting at the same time. Then I work really well. Also, because I work at home, I do this properly. I don't work from 8 in the morning to 5 at night. I don't do that. I take my kids to school; I work in the morning and the early afternoon. My kids come home from school and I'm home. We do their homework in the afternoon. But I always eat with the family. And I often work from 9 p.m. to midnight. But I have very flexible schedules.*

An international sales and marketing manager in Company B can account for practices such as these: They "combin[e] the notion of work time and availability. An individual who has access to such devices can go home, have his dinner, watch a movie and then go on working."

When using their prescribed IT to balance their work and family life, people extends their use of prescribed IT beyond the company's prescribed work practices. Thus, unprescribed use of prescribed IT constitutes a type of unprescribed sociomateriality that assembles improvised solutions to create situated conditions for action with the technologies that people use because they must.

Prescribed Use of Unprescribed IT

In some of the companies we studied, mobile communication tools were assigned according to status and hierarchical position rather than real need. The highest ranking employees received the most sophisticated and modern devices, though other employees (especially mobile field and operational workers) might have more use for them. The human resource manager in Company B thus explained:

> *With these technologies, people position themselves with regard to others: "I've got one, you, you're not in the same class as me." It's a shame—I really don't think that I'm the one who can benefit the most from mobile technology. It'd probably be more useful to someone who has a [mobile] job. He'll be equipped later whereas I'm equipped immediately. It's the problem of this categorization by level, by downward layers; it's the simplest but probably not the most effective.*

Similarly, the IS director in Company J recognized that "a distinction is made according to the colour of the workers' collars."

In consulting firms, mobile devices such as mobile and smart phones often go to managers who tend to stay in the office, rather than to junior or senior consultants who often visit clients' sites. Instead of providing these workers with a full suite of mobile tools, the companies often give them only laptops. Because their jobs involve travelling, most of these professionals need a means to stay in touch with their trading partners (customers or senior managers).

Responsiveness and customer satisfaction are critical to their jobs, so they usually consider mobile IT use a necessity, and they would buy their own personal mobile technologies for professional purposes. They therefore use unprescribed IT to complement their prescribed mobile devices when enacting prescribed work practices. A junior consultant in Company G complained: "The mobile phone is not supplied by the firm, in any case for junior consultants […,] I am forced to use a personal mobile phone to place professional phone calls." In Company J, a field worker voiced a similar concern: "in my company they are a little bit stingy about technology … or at least they expect from me to be very generous with my personal mobile phone." A project leader in company C faced a similar plight: "It's not a work phone I use, it's my own. I have to use it when I'm travelling, when suppliers want to contact me, in showrooms…. Everyone has my personal number, my colleagues and my superiors."

Beyond social realities (e.g., status, hierarchical attribution processes), the material features of mobile IT such as its portability, its organizing functionalities, its multi-contextuality, and its discreetness scaffold prescribed work practices with unprescribed tools. Mobile IT constitutes work and communication tools that enable almost permanent access to a company's information system and continual availability of information across time and space. Some field workers thus consider mobile technologies indispensable tools, especially considering the mobile nature of their work. Work practices involving flexibility in time and place therefore become the norm, to the point that personal investments in improvised IT seem almost necessary to conduct prescribed work.

Participants also reported they voiced their complaints to their own managers. For example, a human resources manager from Company J admitted he occasionally had "to yield to employees' requests," because they told him that "if you don't give us this kind of technology, we'll go to your competitors." He acquiesced to these demands because of what he interpreted as a job market pervaded by "a real culture of zapping."

Such unprescribed sociomateriality thus applies personal IT to companies' prescribed procedures and goals. It gets assembled as people attempt to create, on their own, the same set of resources that others already possessed through the organization.

Unprescribed Use of Unprescribed IT

Finally, participants report using unprescribed IT to carry out unprescribed work practices. In some cases, these sociomaterialities complement prescribed information systems and prescribed work practices; in others, they do not.

One of the study companies, in the construction industry, gave foremen the responsibility for managing building site expenses, which meant they regularly needed to fill out reports to transmit to accounting services for control and validation. The foremen never welcomed this prescribed procedure, because it demanded time to go back to headquarters and complete the forms. As consequence, they implemented a mobile, computer-based system that enabled remote reporting from the building site. A site foreman from Company D noted, "we developed a little computer-based system with Excel sheets…. We gathered three or four computers and then we started processing our reports. It was more convenient for us." The site foremen seemed proud of this local data processing initiative, which also could be used by managers to review the whole process pertaining to building site expenses.

In other cases, individual workers used unprescribed technology to scaffold their work while *avoiding* prescribed information systems as much as they could. For example, in 2004, suffering from fierce competition in its sector, one of the companies decided to improve its customer responsiveness by equipping its technical sales staff with mobile technologies. Every sales representative received a Blackberry directly connected to the company's commercial information system. Management presented the technology as a means to increase employees' responsiveness and productivity by reinforcing their autonomy and responsibility. All necessary information would be at their disposal, even if they were far from the office. Representatives therefore were asked to fill in sales reports in real time, just after customer visits. Participants reported that this technology rarely was used as prescribed; several technical salespeople deliberately neglected to report their sales in their Blackberry devices. One of the most experienced sales representatives in Company H justified this choice by arguing, "I refuse to do my report on my Blackberry [because] I don't want to change my habits." The top performers felt entitled not to use a prescribed IT, complaining, "I do my job quite well, my performance is good, and so I don't see why would change my way of dealing with customers."

The reasons behind these responses are both organizational and technical. Organizationally, the behaviors reflect hostility to organizational goals or recourse to existing habits. Technically, technologies like the Blackberry seem complex to use. Furthermore, management often accepted such practices, because these representatives generally performed well. As a consequence, the unused features of IT or the use of unprescribed IT progressively was more

tolerated throughout the companies. Employees thus managed to avoid their prescribed IT if they could better support their work better using unprescribed technologies.

In a construction company, for example, top management decided to formalize the bottom-up local data processing initiative of worksite reporting. A mobile IT project was developed specifically to improve data management and optimize the processes, such that site foremen received tablet PCs, connected to the company server, to enter data about the building site directly into the system. This project aimed to enable more reliable and rapid data tracking and was supposed to avoid double entries; prior to the implementation of this system, reports went first to the manager and then to the accountancy department.

Yet some site foremen resisted this change, which they considered a top-down management initiative that ran counter to their own interests. Strong reticence linked to their concerns about surveillance and the perception of compulsory use of technologies. One foreman voiced a common complaint: He had "chosen this job to work on building site, not to do computing."

Other foremen underused or misused the newly prescribed IT, making voluntary mistakes in their report that no longer were double checked. An experienced site foreman confessed that he and his colleagues sometimes "chang[ed] the amount of expenses to annoy management" and to show that the electronic tools were not well adapted to the skills of these blue-collar workers. An accountant working in this company in turn noted that he still had "to check the report forms filled in by the site foremen before entering the data in the system." The foremen thus continued to use an unprescribed, bottom-up system of imputing the data in a spreadsheet and handing it to the manager for a first check, then submitting it to the accountancy department for data entry into the prescribed system.

Such sociomaterialities emerge as a reaction to prescribed procedures that employees interpret as at odds with their own interests or to technologies that they have trouble using.

Discussion

These results point to a set of processes that generate and reproduce prescribed sociomaterialities in organizations. Figure 2 illustrates both dynamics.
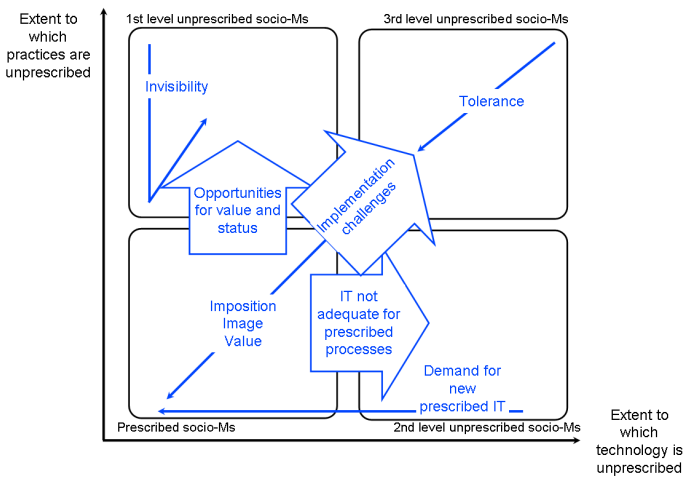

Figure 2. Combination of prescribed and unprescribed sociomaterialities (assembleges)

Prescribed sociomaterialities are determined and implemented by management. According to the participants' interpretations, prescribed technologies and prescribed work practices represent outcomes of a deliberate adoption of tools that can make organizational processes more efficient. Broader research on the adoption of information technology also suggests that these expressions can arise from processes other than rational choice. For example,

managers might adopt technologies to increase their legitimacy, and then do their best to incorporate these tools into their existing work practices.

Prescribed sociomaterialities become reproduced through employees' everyday work practices. Our data suggest that the early use of prescribed sociomaterialities is grounded in relationships of authority, which then get woven into narratives of efficiency and identification. Employees come to see prescribed sociomaterialities as justified changes to their toolset and work procedures. As they become implicated into everyday work, the prescribed sociomaterialities also are appropriated for self-presentation and become part of people's identity.

Our study further highlights three types of local tensions that push employees to improvise unprescribed practices within prescribed IT. The first are opportunities that employees discover in practice and apply to work processes other than those prescribed by their managers. The second involve opportunities to apply the prescribed technologies to their own goals, such as efforts to establish a balance between work and family life. Finally, the third type of tensions pertains to opportunities for impression management, such that employees exhibit prescribed information technologies as a symbol of their status.

Such unprescribed sociomateriality is not visible to managers unless they draw on the informational abilities of technology to keep track of employees' practices. None of the companies we studied supervised employees' use of mobile communication tools in such a way; managers generally were not exposed to employees' improvisations and thus could neither learn from them nor offer discipline. Unprescribed uses of prescribed IT thus were reproduced at the individual practice level but rarely diffused or formalized at the company level.

Employees also may enact unprescribed sociomaterialities by introducing their own IT to accomplish prescribed work practices. The motivation behind this sociomateriality is closer to the use of mobile communication technology as a means to claim status than to employees' concerns about efficient work practices. Nevertheless, participants report increased efficiency and improved work practices as a result of their efforts.

Employees then used the potential increase in efficiency and compliance with corporate goals to demand that their managers prescribe IT that they had acquired on their own. The managers we interviewed admitted to caving in to employee pressures, though their justifications for doing so do not suggest their ability or willingness to learn from their employees' improvisations. Instead, they suggested that unfavorable labor markets gave employees some bargaining power and influence over their company's IT policy.

Our study documents a final type of sociomateriality that combines unprescribed practices with unprescribed IT. Participants attribute their unprescribed uses of unprescribed IT to two sets of factors. One involves their habitual use of information technology. Sociomaterialities are tightly woven into people's everyday work and identities. Whenever new technologies and new practices emerge, some people attempt to resist them and rely on accustomed practices and technologies. Other unprescribed sociomaterialities patch up the mistakes and omissions left by the IT prescribed by the organization. They add practices and processes they need to comply successfully with their company's goals.

Managers in our study note a good awareness of these sociomaterialities, though they do not attempt to discipline or formalize them. Instead, managers tolerated these unprescribed uses of unprescribed information technology because of their contribution to the company's goals.

Concluding Remarks

The purpose of this research has been to further understanding of the complex and persistent problem associated with the appropriation of IT in work settings. We therefore take into consideration the relationship between mobile IT and work practices, moving beyond the limitations of technical and organizational imperatives, which focus on either the constraining effects of technologies on human action or human agency and usage.

We propose a conceptual model based on sociomateriality as an alternative and more complete lens for assessing IT scaffolding process in organizations. In so doing, we attempt to contribute to the "sociomaterial" project by distinguishing prescribed from unprescribed sociomaterialities. This important distinction creates the possibility of different processes in the course of the emergence, reproduction, and diffusion of sociomaterialities.

Our results show in particular that sociomateriality is a powerful approach to address some of the issues that have plagued attempts to integrate the IT artifacts into research on management and information systems. Prescribed sociomaterialities and different types of unprescribed sociomaterialities emerge from very different sets of local conditions for action. We further show that each sociomateriality has a different likelihood of diffusion and formalization. The results therefore imply that companies may become more sensitized to the multiple dimensions of sociomaterialities and their importance for work practices. Companies should attempt to learn and capitalize on emerging, unprescribed, but useful sociomaterialities to include some of them in their normal operating procedures more quickly.

Four modalities of the interaction between prescribed and unprescribed work practices and prescribed and unprescribed technologies emerge from this study:

1. When people perceive that the prescribed mobile technology supports their local needs and prescribed goals, they tend to use the prescribed IT according to the expectations of the organization.

2. When people perceive that the prescribed mobile technology can be modified to produce additional advantages, they tend to augment its use and achieve results beyond the expectations of the organization.

3. If people perceive prescribed mobile IT as insufficient to support their local needs or accomplish their goals, and at the same time the technology is amenable to improvisation, they use unprescribed IT to complement their prescribed mobile devices.

4. If people perceive prescribed mobile IT as insufficient to support their local needs and accomplish their goals but the technology is not amenable to improvisation, they will use their unprescribed mobile IT to scaffold their work and limit their use of the prescribed mobile IT as much as they can.

These results therefore enhance and complete our conceptual model, specifying the relationship between prescribed and unprescribed mobile IT as the outcome of a process of improvisation that uses information artifacts to improvise scaffolds of work practices that are both enabled and constrained by agents' interpretations.

Finally, our study contributes to the sociomaterial approach by underscoring the role of identity and face in the processes through which sociomaterialities emerge and endure. The identity claimed by adopting new IT to carry out more up-to-date work practices rests at the core of people's attempts to improvise their own practices and their own information systems. Efficiency criteria appear only in second place.

However, this research suffers from several limitations that could provide some avenues for further research. Our study contains an intrinsic complexity because we attempt to apply sociomateriality concepts, which tend to remain highly abstract and difficult to render operational, in the field. Our effort to discriminate between prescribed and unprescribed sociomaterialities indicates only that further distinctions are necessary. Research should attempt to develop greater insights into sociomateriality concepts and improve the operational qualities. This research indeed suggests several different propositions that deserve verification through further research. For example, we show that the scaffolding process is constrained by agents' interpretation of the level of improvisation of prescribed technology, especially in the case of mobile IT. Can we generalize this result to other kinds of technologies? It seems useful to understand the relationship of other prescribed and unprescribed information technologies. In summary, the sociomateriality model must be validated by empirical research and field testing, and it should be verified in other contexts and through longitudinal studies.

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