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RESEARCH ARTICLE

THROUGH THE EYES OF OTHERS: HOW ONLOOKERS SHAPE THE USE OF TECHNOLOGY AT WORK[1]

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In this paper, we argue that the use of technology is structured not only by users, technology, and social context, but also by onlookers (i.e., actors for whom the use is visible, but who are not directly involved in the activities of use themselves). Building on the "technology-in-practice" lens and insights of an ethnographic study in operating rooms where nurses used mobile technology for various work-related and recreational purposes, we show how onlookers contribute to structuring collective patterns of technology use. We conceptualize their role as the onlooker effect, which means that onlookers' inferences, judgments, and reactions trigger users to reflect on consequences and adjust the use in front of others, a phenomenon which is activated by the cues unintentionally given off when using technology. By identifying the role of onlookers in technology use, this study goes beyond user-centric and feature-centric perspectives on information technology use, illustrating that it does not happen in a physical vacuum, but often draws in unintended audiences. The onlooker effect provides a more in-depth explanation for unexpected patterns of technology use emerging in the workplace.

Keywords: Technology use, technology-in-practice, structuration theory, the onlooker effect, visibility, human agency, physical materiality, dual structuration

Introduction

Explaining how collective patterns of information technology (hereafter, technology) use emerge and stabilize is one of the central topics of information systems (IS) research (Azad and King 2008; Burton-Jones and Gallivan 2007; Leonardi 2013; Oborn et al. 2011; Orlikowski 2000; Schultze and Orlikowski 2004; Stein et al. 2015; Vaast and Walsham 2005). Research explaining institutionalized patterns of technology use has long shown that people are not using technology in a vacuum, but are influenced in this use by various other actors. These studies go beyond a typical user-centric perspective on IS use (Lamb and King 2003) by showing that technology users are subject to social influences—that is, they draw on the views, opinions, and frames of other people when engaging with technology. A variety of "others" have been discussed in previous studies, for instance designers (Orlikowski 1992), opinion leaders (Godinho de Matos et al. 2014), coworkers (Fulk et al. 1987; Wang et al. 2013), managers (Liang et al. 2007; Vieira da Cunha 2013), clients and lead users (Sykes et al. 2009), technology mediators (Orlikowski et al. 1995), and a wide array of other institutional stakeholders (Berente and Yoo 2012; Lamb and Kling 2003).

Even though this research has led to important insights about the influence of various actors on technology use, it has rarely considered how a particular group of people, a group we refer to as *onlookers*, influences the patterns of use. Onlookers are

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The appendix for this paper is located in the "Online Supplements" section of the *MIS Quarterly*'s website (http://www.misq.org).

defined as people for whom technology use is *visible*, but who are not directly involved in the activities of the use themselves. When people interact with technology, some aspects of that use are often visible to others, either through digital or physical traces (for an overview, see Leonardi 2015). For instance, users can leave traces in the form of the actual *content* of their technology use (e.g., information they provide), or in the form of cues about the *process* of their interaction with technology (e.g., duration, manner of use, or physical behavior, such as body posture or facial expressions). Whatever the exact nature of these traces may be, it is likely that the visibility of technology use will in some way affect onlookers, and that these onlookers will in turn affect technology use in some way by responding to what they see. Therefore, the agency of onlookers needs to be included in studies analyzing the patterns of technology use in order to more fully understand how collective patterns of use emerge.

Within IS studies, a theoretical perspective that has a potential to theorize the agency of onlookers is the "practice lens" (Orlikowski 2000). It conceptualizes collective patterns of technology use as "specific structures routinely enacted as we use the specific machine, technique, appliance, device or gadget in recurrent ways in our everyday situated activities" (Orlikowski 2000, p. 408). Individual patterns of technology use at work are said to converge over time once a community of users develops routines of using technology in particular ways. Studies based on this tradition have provided multiple accounts of how IT use is enacted in various contexts, and how this often deviates from the intentions of designers and implementers. Thus, this perspective emphasizes the centrality of human agents who, drawing on features of their situated institutionalized contexts, enact various structures (Azad and King 2008; Boudreau and Robey 2005; Leonardi 2009; Leonardi et al. 2010; Mazmanian 2013; Orlikowski et al. 1995; Vaast and Walsham 2005; Vieira da Cunha 2013). However, when referring to "human agency," they commonly imply that it is the *user* whose agency has the transformative potential, and rarely pay attention to the agency exercised by *onlookers*, that is, actors who are not directly involved in the activities of use, but are exposed to traces of technology use. As we argue below, providing explanations of how onlookers contribute to structuring patterns of technology can help to more fully account for how human agents come to enact technology, without privileging the users as the central group of actors.

Our insight that onlookers are important in structuring technology use primarily emerged from an ethnographic study we conducted on the use of mobile devices by nurses in a hospital operating room. There we observed a striking pattern of use becoming stable and legitimized: during surgery, where matters of life and death depend on effective coordination between team members, non-sterile nurses were frequently using their mobile devices for both work-related and recreational purposes. We argue in this paper that it is only by accounting for the specific contribution of onlookers that we are able to understand how this particular pattern of use was legitimized. Consequently, by investigating the role of onlookers in structuring technology use, this study augments previous research on technology-in-practice, going beyond the user-centric perspective on technology use and explaining how technology use is not happening in a vacuum, but is being structured by other actors who are not necessarily interacting with technology features themselves.

Theoretical Background

Technology-in-Practice Perspective

The *technology-in-practice* perspective (Orlikowski 2000), also referred to as a *practice lens* for studying technology use in organizations, or an *enactment* perspective (Leonardi and Barley 2010), represents an extension to the structurational perspective on technology use. In suggesting the practice lens, Orlikowski goes further in building on Giddens' work (Giddens 1984) to argue that structures are not embedded in technological artifacts, as various authors have implied earlier (DeSanctis and Poole 1994; Orlikowski 1992; Orlikowski and Robey 1991), but are only *instantiated* "in and through the activities of human agents" (Giddens 1984, p. 256). Thus, the practice lens highlights the emergent character of patterns of technology use as they are shaped by ongoing action. Seeing structures as enacted and instantiated in everyday activities implies shifting the analytical attention from institutional properties influencing users and designers (Orlikowski 1992), to the regularized interactions of users with technology in the course of everyday activities. It is in these micro-interactions, Orlikowski argues, that users come to enact certain structures. In these enactments, certain properties of technology use become mobilized in use and come to matter for organizations. Until and outside the moment of use, these properties have no meaning on their own.

Moving away from concepts of "faithful" or "unfaithful" appropriation (DeSanctis and Poole 1994) or "embodied structures" (Orlikowski 1992; Orlikowski and Robey 1991) and recognizing instead that the same technology can be taken up in radically different ways in different contexts, a practice lens has been helpful for revealing the emergence of unexpected patterns of use. Thus, this perspective can help explain, for example, improvisation in technology use and unintended consequences for organizations (Azad and King 2008; Boudreau and Robey 2005). More broadly, it inspired researchers to stop assuming that technologies have some pre-existing meaning or "spirit" on their own, but rather start their

analyses from the meaning that features have for specific users in specific contexts and, through exploring the emergent character of patterns of use, illustrate why similar technologies are adopted in different and sometimes unexpected ways (Leonardi 2009; Vaast and Walsham 2005; Yates et al. 1999). While technology in practice studies have been helpful in illustrating unexpected ways of technology use and their consequences, they have been mostly focused on analyzing and outlining the activities of one group of actors: the users themselves.

Table 1 provides an overview of illustrative examples of studies that build on the technology-in-practice lens, specifying the groups of actors that are studied and the mechanisms that lead to structuring the pattern of technology use. Common to these studies is the focus on the behavior of *users* and the assumption that the human agency at stake here belongs to users.

Human Agency of Onlookers

Although the literature has not yet developed theoretical sensitivity to explain how exactly onlookers matter in shaping patterns of technology use, there are studies that do provide references to the role of onlookers in their empirical descriptions, yet only marginally and without theorizing their role in shaping patterns of technology use. For example, in a study by Chu and Robey (2008), users of online learning systems rejected using these tools when they learned that many of their coworkers considered this not to be "real work." Similar findings are presented by Mazmanian (2013), where coworkers joking about the ways users displayed their mobile devices made users choose to hide their BlackBerries by tucking them under their shirts. Oborn et al. (2011) mention how medical professionals decide not to use electronic patient records (EPR) in front of patients during consultations. Similarly, Shachak and Reis (2009) found how EPR use during patient–doctor consultation influenced patients' experience of rapport with the doctor, influencing the quality of the patient examination. In studies of mobile phone use it was found that bystanders were often offended by the "absent presence" behaviors of phone users, producing tensions in existing social relations (Gergen 2002; Katz and Aakhus 2002). On a similar note, Love and Perry (2004) demonstrated how bystanders were not only affected by others' use of mobile phones, but also actively reacted to this with physical body behaviors, ranging from nonattendance to the call, to actively reminding the caller of their presence and trying to influence their behavior.

In sum, these examples illustrate that technology use is *visible* to onlookers and that onlookers may take *actions* toward users to actively change the use. Theories of technologies in practice have not yet explicitly, let alone theoretically, accounted for this possibility. Providing conceptual explanations of the nature of onlookers' influence on users' behaviors can significantly contribute to our understanding of emerging patterns of technology use, allowing us to more fully grasp the role of human agency in enacting technology use, which is the central aim of the technology-in-practice perspective. Explaining how onlookers matter is also practically important and especially relevant today, when the number of onlookers to technology use seems to be rising as technology use becomes increasingly public, invading more and more different social settings and practices. Due to technological developments like the rapid miniaturization of hardware, growing processing power and storage capacity, as well as the increasingly distributed nature of ICT, technology use has become increasingly ubiquitous and therefore visible to more and diverse groups of people (Lyytinen and Yoo 2002; Yoo 2010). Accounting for what happens when more onlookers are exposed to various aspects of technology use can therefore be an important and more accurate way of explaining various unintended outcomes of various types of technology use in the workplace. For example, including the role of onlookers might reveal their influence on the non-adoption of a new technology (such as Google Glass; Cave 2015), or on users' decisions on when and how to use a technology in the presence of others, as is the case with medical professionals deciding not to use electronic patient records during patient consultations (Oborn et al. 2011). As a result, understanding the role of onlookers can ultimately provide important implications for the design and implementation of new technologies in the workplace.

Dual Structuration as a Framework to Include Onlookers

Some theoretical sensitivity to the role that onlookers may play in influencing technology use has been developed in the work of Young and Leonardi (2012) on social issue emergence on the web. Young and Leonardi's study focuses on how actors involved in social issues bring structure to the social issue space by creating hyperlinks on their websites, thus representing the actors involved in this space and the relations between them. In their analysis, they argue that previous structurational theories have studied technologies for which the use and consequences were "limited to the group who uses them" (p. 234), while the use of many modern technologies is more public, and visible to others who have not been considered in IS research thus far. In their dual structuration model, Young and Leonardi conceptualize the process of structuring as consisting of two instances. The first instance consists of hyperlink creators establishing links between websites and thus enacting an empirical hyperlink network. Next, decision makers, who navigate websites to

Table 1. Illustrative Examples of Technology-in-Practice Studies

Authors and Year	Technology	Groups of Actors Considered	Central Theoretical Concepts	Process of Structuring	Outcome of Structuring
Orlikowski et al. 1995	Computer conferencing system	Community of users and technology mediators	Meta-structuring	Deliberate and organizationally sanctioned interventions to establish and calibrate rules of technology use	Active adoption of news groups, increased cross-team communication
Yates et al. 1999	Computer conferencing system for electronic communication	Users and technology mediators	Genres, implicit and explicit structuring	Planned replication, planned modification, opportunistic modification, migration and variation of existing genres	Community wide genres (more informal, less controlled) and local genres (more informal)
Schultze and Orlikowski 2004	Internet-based self-serve technologies	Users (sales reps of insurance companies and agents)	Social capital, embedded relationships	Expenditure of social capital to promote the use of technology, enacting network relations	Shifts in online quoting and consulting practices, limited use, information overload
Vaast and Walsham 2005	Knowledge management system	Community of users, managers, webmaster	Social representations, consonance and dissonance	Establishing consonance between practice representation and perception of IT	Intensive knowledge sharing through intranet
Boudreau and Robey 2006	Enterprise resource planning (ERP) systems	Users, project leaders, power users, peers	Temporal view of human agency	Improvised learning motivated by social influences	Inertia, limited use, improvised learning, reinvention, "tweaks" and workarounds
Azad and King 2008	Pharmacy dispensing systems	Users and their colleagues (pharmacists, physicians, nurses)	Negotiated order	Inducing cooperation from others to enact a workaround	Non-use and workarounds
Chu and Robey 2008	Online learning systems	Community of users, managers	Temporal orientations of human agency	Reconciling temporal contradictions in agency dilemmas	Limited adoption of the system
Hsiao et al. 2008	Global positioning systems (GPS)	Users	Sense-making	Different senses about technology developed over time	Evolving uses over time: experimental, efficient, selective, aggressive, perfunctory
Leonardi et al. 2010	E-mail, instant messaging, voicemail, VPN	Users	Connectivity paradox	Disconnecting and dissimulating	Keeping up appearance of constant connectivity
Oborn et al. 2011	Electronic patient records (EPR) systems	Users from various professional communities (e.g., nurses, doctors of various specialties)	Shared and relational work practices	Interrelating to work practices of other users	Diverse patterns of use (idiosyncratic, extensive, limited, non-use) adapted to each other
Leonardi and Treem 2012	Knowledge management systems	Community of users	Social construction of expertise, self-presentation	Using technology strategically for impression management	Deceptive use
Mazmanian 2013	Mobile e-mail devices	Two user communities (professional communities of lawyers and sales representatives)	Technological frames	Converging on collective assumptions about what technology is good for	Divergent patterns of use: increased availability for one group and limited for another one
Mazmanian et al. 2013	Mobile e-mail devices	Community of users	Autonomy and control, professional norms	Shifting norms and collective expectations about professional behavior with technology	E-mail addiction (intensity and frequency of e-mail use)

learn about social issues, enact an epistemic issue network, based on their interpretations of the creator's actions, but without being privy to the real reasons behind the creation of the hyperlinks. Based on these interpretations, they make certain decisions, such as on distributing funding for certain social issues. Such decisions can, in turn, signal to hyperlink creators how their hyperlinking practices are perceived by others.

The dual character of the structuration process is relevant to our goal of understanding the role of onlookers. As a phenomenon, onlookers become relevant in an age in which technology use is increasingly public—or visible to others. As Young and Leonardi suggest (p. 243), in order to analyze the use of such public technologies it is necessary to include the perspectives and actions of both users and actors who are somehow exposed to, and possibly affected, by this use. Nevertheless, Young and Leonardi's conceptual idea is grounded in a very specific example of hyperlink creation and use. Essentially, they consider situations where onlookers to technology use are the receivers of the information that is channeled to them via the technology that they both used. However, as we illustrated with our examples above, technology use not only provides digital traces to intended audiences, but even more so, and often unintentionally, it leaves visible and physical traces to unexpected onlookers. In our study, we broaden the idea of dual structuration beyond Young and Leonardi's specific example of hyperlink creation on the web to also include onlookers who are part of such unintended audiences. Therefore, this study aims to answer the following research question: How do onlookers influence the use and structuring of technology-in-practice?

Method

Research Setting

As an empirical setting for study, we examined surgical teams who recently introduced a new technology into their work practices. In line with work on similar processes (Barley 1986; Leonardi 2011), we conducted an ethnographic study, which allowed us to make an in-depth analysis of the situated work practices of the people involved. We studied the work of operating room (OR) staff in a large university hospital in the Netherlands. We gained access to the department of Anesthesiology and Operative Care, which consists of 200 staff members, including OR nurses, anesthetic nurses, and anesthesiologists. The department provides surgery time, room, and assistance services to surgeons from other specialty departments of the hospital. In total, 16 ORs are functioning 24/7, covering most surgical specialties.

We focused on surgical teams, usually consisting of two to three surgeons and two OR assistants. One of these OR assistants works with the operating surgeon(s) in a sterile part of the OR around the operating table with the patient. This part is referred to as the *sterile island*. Sterile OR assistants are called *scrub nurses* since they are "scrubbed" or thoroughly washed. The non-sterile area in the room is occupied by the three-person anesthesiology team, consisting of one anesthesiologist, one assistant, and the second OR assistant, called the *circulating nurse*. Non-sterile staff are allowed to carry some small personal objects on them such as glasses, phones, or books.

Typically, the collaboration between the members of the surgical team is characterized by *implicit coordination*, a form of coordination that requires little or no direct communication but relies on anticipation and dynamic adjustment (Rico et al. 2008). The patient is operated on by surgeons who depend on a scrub nurse to hand them the instruments. The scrub nurse needs to anticipate what is required, and preferably needs to act without the surgeon needing to explicitly address him/her. The scrub nurse in turn relies on the circulating nurse to proactively put the supplies (e.g., bandages) on the table and provide additional instruments or supplies from elsewhere if an unexpected need arises. A circulating nurse, for instance, helps to ensure sterility by holding and opening the packages so that the scrub nurse can take out the instrument without touching unsterile packaging. In this way, circulating nurses form a bridge between the sterile island and the rest of the hospital.

It is important to note that OR assistants can and do perform both scrub and circulating roles. In fact, they typically *switch roles* once or twice during a working day, to have variety in their tasks and allow each other a break. The work of circulating nurses is characterized by significant periods of "standby" when the rest of the surgical team is settled and does not require their direct assistance. Sometimes this can take hours, during which they usually perform other supporting tasks like answering phones, bringing food or drinks to the scrub team, preparing for the next operation, reading protocols, administering medical charts, taking care of lab samples and counting bandages, or enjoying a magazine. During these times circulating nurses still have to pay peripheral attention to the surgery in order to guarantee implicit coordination.

At the beginning of 2010, the department launched what came to be known as the *iPod project*, referring to the initiative of introducing a personal digital assistant for work-related purposes—the iPod Touch. The iPod project was initiated by a group of OR employees: two nurse anesthetists and one OR nurse. Annoyed by problems with accessing necessary documents such as operation procedures, information on medica-

tion, lists of equipment needed for surgeries, and lost in abundant paper documents, this group of employees, also referred to as "the Pod fathers," collected all the necessary information from the department's intranet and created a digital library on their own private iPod Touch devices. With the small format, the easy-to-use interface, and the touch screen, the device was expected to enable fast, flexible, and accurate access to all the necessary information. Management became committed to the initiative and was willing to invest in providing other OR employees with the same device to optimize overall work processes. The iPod project was enthusiastically received by OR employees and the majority of employees applied to receive an iPod Touch. Over time, the iPod Touch became an indispensable device for the OR staff. The iPods were introduced into the practices of nurse anesthetists and OR nurses, while doctors (i.e., surgeons and anesthesiologists) were not involved in the project. Since the head of the department was eager to learn how the iPods were used, he gave us permission to conduct an ethnographic field study in the department, which eventually stretched over a period from February 2012 (almost a year after the introduction of the iPods) until March 2013.

Data Collection

As is common to ethnographic and grounded theory approaches, we collected and analyzed qualitative data iteratively so these processes strongly built on each other (Strauss and Corbin 1990). Data collection primarily relied on nonparticipant observation and in-depth interviews, conducted in the spring of 2012, the summer of 2012, and the spring of 2013. Table 2 shows a summary of all data collected per period, as discussed below.

All of the observations were conducted by the first author of this paper, while all other authors visited the field at least once. Typically, the fieldworker would come to the hospital at around 7:00 in the morning before the start of the surgeries and begin the day with changing into the hospital scrub uniform that was mandatory for everyone entering the operating room department. The field visits usually started with observing how the instruments were laid out in the preparation rooms and then continued inside the OR, where the fieldworker stayed for the duration of the procedures, with some short breaks in the coffee room and storages shadowing nurses. During the operations, she mainly stood in the corner or sat on a chair next to the circulating nurses, where she could observe most of the activities of all the OR members. While sitting next to the nurses during surgeries or coffee breaks, the researcher often chatted with them about their technology use, their work, or just joined the larger conversations among the employees. She was particularly alert to all the instances in which the participants made use of the iPod. When possible, she asked informants for clarification of activities or to comment on their iPod use, either on the spot or afterward. Over time, she started to observe the same people and seeing the same patterns of action occurring.

Although initially surprised by the openness of the teams to her observations, the fieldworker later realized that such hospitality was typical for the academic environment of the hospital she was studying: visitors (e.g., medical and nursing students, researchers, or firm representatives) to these ORs were commonplace and frequently came in to observe the procedures for various purposes. Thus, the operating teams treated the fieldworker like any other visitor to the OR, feeling an obligation to teach her about their activities, something they routinely did as part of their jobs with students.

One of the things that was immediately striking was the possibility of using the mobile devices inside the operating room during the surgeries, even for nonwork-related activities, such as checking news, e-mail or playing games. Nurses would often sit with their iPods on the chairs, absorbed in their devices and seemingly "out of this world." Later into the study, when the fieldworker grew to understand the nature of operating nurses' work better, this observation started to feel understandable. What became apparent is how often the circulating nurses' work felt routine and monotonous. The area outside the sterile island was dark, quiet, and sometimes up to five hours would pass by without much action, just a monotonous beeping sound of the machines. Besides, for those not at the operating table, not many activities were permissible; they had to remain available but could not do much (even had to minimize the talking) as this would distract the operators. They would thus search for other activities to keep themselves busy, such as preparing for the next operations, checking the supplies in the OR, or now with the iPods, catching up on their e-mail, updates, or simply entertaining themselves with games.

To keep track of the observations and impressions in the field, the researcher took brief field-notes on a small paper notepad while in the OR and then expanded these notes into explicit, detailed narratives at the end of each day. No specific observation protocol was used, but the researcher was paying attention and noting down the following aspects: (1) details of (inter)actions of participants; (2) time-stamps to keep track of the length of work tasks and technology use; (3) summaries of informal discussions with participants. The narratives were supplemented by pictures taken in the field when the field notes required visual explanation; for example, of the layout of the rooms and the positioning of actors toward each other.

Table 2. Overview of Data Collection

Period	Data	Purpose
Spring 2012	Total of 98 hours of observation on 16 full working days, 28 surgeries Total of 29 semi-structured interviews (20-60 minutes): • Operating room nurses (N = 15) • Nurse anesthetists (N = 3) • Recovery unit nurses (N = 4) • Manager and IT staff (N = 4) • iPod project initiators (N = 3)	Reveal the role of the iPod in supporting (or hindering) the daily work practices of OR nurses and anesthetists (and assess its impact on efficiency by studying its functions)
Summer 2012	Total of 63 hours of observation on 10 full working days, 22 surgeries Total of 20 semi-structured interviews (30-90 minutes): • Operating room nurses (N = 7) • Nurse anesthetists (N = 5) • Surgeons (N = 8) • iPod project initiators (N = 2)*	Analyze the consequences of non-work related (recreational) use of the iPod on work practices of OR nurses and anesthetics
Spring 2013	Total of 37 hours of observations on 5 full working days, 7 surgeries Total of 13 semi-structured interviews (20-60 minutes): • Operating room nurses (N = 13)	Identify effects of onlookers (in interaction with users) on technology use
	TOTAL: • 197 hours of observation, including informal conversations • 57 surgeries • 62 interviews	

*The total number of respondents interviewed at this stage is 20, because two iPod project initiators are simultaneously one OR nurse and one nurse anesthetist. The iPod project initiators were the only people we interviewed in different periods: we first talked about their role in the iPod project and later about their work as nurses. We collected our data at three separate moments in time, after which we analyzed the data before collecting more, with a more specific, zoomed in focus.

In all, 57 surgeries were observed in the OR, with approximately 197 hours of observations conducted. In addition, 62 semi-structured interviews were conducted with OR nurses, nurse anesthetists, surgeons, IT staff, and managers. Different people were interviewed in each phase, while our interview protocol evolved throughout our study through adding questions (see Appendix A). The interviews were recorded and fully transcribed.

Analytical Process

The research team met frequently during data collection periods to share insights and to learn from the observations, in order to combine "insider" and "outsider" perspectives, which is appropriate for ethnographic studies (Bartunek and Louis 1996). We used Atlas.ti as a digital tool for supporting the organization and analysis of qualitative data. In the diagram of Table 3, we lay out the details of the process we followed during data analysis, which illustrates that the central research question and conceptualization of findings were iteratively developed over time.

Analyzing the Use of iPods in the OR Work Practices: Developing Provisional Codes

Our analysis was initially aimed at understanding how the use of iPods impacted the overall efficiency of work practices in the OR. We listed the various uses that nurses made of iPods and the consequences of those uses for work, which resulted in provisional codes such as those displayed in Table 3 and in Table A1 in the appendix. Because we found that nurses often used their devices for recreational purposes, while at the same time many respondents indicated this as inappropriate and annoying, we then aimed at comparing multiple perspectives on this (recreational) iPod use. We thus further collected data on perspectives of other actors, such as surgeons, in the summer of 2012. Through comparing perspectives of initiators, users, and team-members who observed the use, but did not use iPod themselves at that point in time (not involved in the activities of use), we arrived at the importance of the role of onlookers.

Table 3. Diagram of Analytical Process

Purpose	Key (Provisional) Codes	Emerging Themes	Questions for Further Study
Reveal the role of the iPod in supporting (or hindering) the daily *work practices* (and assess its impact on efficiency by studying its functions)	iPod use in practice (affordances): • accessing protocols (66%*) • e-mail (72%) • social networking sites and games (72%)	Nurses use iPods for multiple purposes, both intended and unintended ones (affordance of killing time and recreational use).	How is it possible to condone recreational use of iPod in the work practice of OR?
Analyze the consequences of non-work related *(recreational) use* of the iPod on work practices	Different views on iPod use • initiator perspective • user perspective • onlooker perspective	Initiators, users and team-members have different perceptions of iPod (use). Physical and digital elements of iPods matter for forming these perceptions.	How do onlookers influence the technology use?
	Effects and consequences (user reflections) • hypocrisy • feeling guilty • hiding • confessing • rationalizing	Onlookers have a different perspective on the use and, in spite of having no direct relation to technology, they influence the user behaviors.	
Identify the influence of onlookers (in interaction with users) on technology use	Distortion of shared practice • Annoyance with the use by others (83%) • Inferences about the function (77%) Onlookers signaling reactions to users (61% reported) • jokes • subtle reprimands • explicit disciplining (of students) • ignoring	The influence is there, because of the interdependence between the actors and role-switching. Ambiguity of technology also shapes the influence of onlookers.	How do onlookers contribute to structuring of technology-in-practice?
Develop a theoretical *framework* to explain the *role of onlookers in structuring technology use*	Technology • Giving off cues to onlookers Pattern of legitimized hypocrisy • tolerance of recreational use Adjusted use of technology (cues) • hiding • sitting closer Enabling factors • Materiality (digital and physical) • User–onlooker relations (shared role knowledge, normative expectations, authority relations)	The onlooker effect: Onlookers are activated by the technology use via given off cues. They pick up these cues to make inferences and judgments about the user. They then actively influence the user through signaling reactions that are picked up by users, who start reflecting on the consequences of their use for work. They start adjusting their cues. Such recurrent cycle forms an agreed upon pattern of use of technology. This process occurs in a specific way under influence of 1. Materiality (in particular the physical) and 2. User–onlooker relations.	Questions for future research: • How do onlookers' inferences and actions vary depending on what sort of unintended cues they are exposed to? • Types of onlooker effect (positive reinforcement, negative reinforcement)? • Differences between physical and computer-mediated onlooker effects?

*Percentages in this table refer to the subset of respondents who reported that particular activity or feeling.

Analyzing the Role of Onlookers in Structuring the Pattern of Use: Categorizing Codes

After "discovering" onlookers and realizing that literature had not yet taken that up, we focused the analysis on specifying what sort of influence both users and onlookers had on technology use, and collected more data on this in the spring of 2013. We initially found that users demonstrated particular behaviors in relation to their iPod use, such as hypocrisy, feeling guilty, hiding the device, and rationalizing their use. We also identified particular actions taken by onlookers to correct users, including subtle reprimanding, joking, and disciplining. By categorizing our provisional codes we began to theorize about a set of concrete activities of both users and onlookers as part of a larger process of collective structuring of technology use. We then went through all the statements of respondents and all instances in the observations notes to categorize what typical actions and reactions of onlookers could be distinguished. We constructed lists of various activities that respondents referred to as "typically" or "recurrently" taking place (and that we saw taking place in the field). Mapping them onto the dual structurational model of Young and Leonardi (2012) led us to arrive at the following set (as shown in Table 4), that makes up the onlooker effect: using technology; giving off cues; making inferences and forming judgments; signaling reactions; reflecting on consequences of use; adjusting cues and IT use; arriving at a collectively agreed pattern of technology use. To confirm our impression of the stabilized pattern of use that we saw occurring (observing in Spring 2013), we went through the statements of respondents interviewed in that period describing iPod use and compared their reflections on the changes that followed the introduction of the iPods. All 13 respondents interviewed in that last period indicated that the use of iPods is quite "normal now," "always occurs," while the vast majority of them also confirmed that the official norm is that such use is inappropriate, but that they are willing to tolerate it, because "everybody does it" and because users are doing their best to make it unobtrusive and that "absent presence" or "complete absorption" on the part of circulating nurses is quite rare.

Theorizing on the Explanations for the Onlooker Effect

As soon as we realized that different onlookers influenced the collective structuring of technology use in different ways, we systematically went through our data to identify respondents' explanations for why they acted in certain ways, compared different onlookers, different technologies, and compared our insights to other cases and literature. We also compared use of the iPod to the stand-alone computer (PC) in the OR, a technology used by circulating nurses before the iPod introduction. We show our key codes in this stage in Tables 3, 5, 6, 7, and 9. One specific empirical detail was very salient in our case: the fact that nurses regularly switched between performing scrub and circulating duties and thus could be both a user or an onlooker at different points in time. This seemed to be an important reason for why scrub nurses did not explicitly reprimand users or did not ban iPod use from the OR. In order to analyze how this role switching influenced the process of dual structuration, we systematically compared all interpretations and behaviors of scrub nurses to other important actors in the OR who did not switch roles with users: the surgeons. This resulted in the insight that what matters for dual structuration is what sort of *user–onlooker relations* exist in different pairs. In theorizing these user–onlooker relations, we arrived at three aspects that enable onlookers in influencing the use: *shared role knowledge, normative expectations,* and *authority relations*. Table 4 gives an overview of our data structure, based on interviews and observations. In the next sections, we present our findings along the themes, indicated in the last column of Table 4.

Results

The main finding of this study is the discovery of the onlooker effect that explained the emergence of a case-specific collective pattern of iPod use during surgery that we characterize as legitimized hypocrisy: all actors in the OR agreed that iPod use was at the same time inappropriate as well as condoned. The onlooker effect means that onlookers' inferences, judgments, and reactions trigger users to reflect on consequences and adjust the use in front of others, a phenomenon which is activated by the cues unintentionally given off by users during the use of technology. The illustrative evidence for the activities constituting the onlooker effect is presented in Tables 5, 6, and 7. The sequence of these activities is also graphically represented in Figure 2. In the following sections, we explain how the onlooker effect came about and how it ultimately led to the collective pattern of use.

The Use of the iPod in the Operating Room

The purposes for which circulating nurses used their iPods were very diverse. Some were directly related to surgery, such as reading the protocols to better prepare for the next operation. Others were only indirectly related to surgery, such as e-mailing for work (e.g., to coordinate shifts) or learning more about new surgical techniques. The mobile device was mainly used during the stable moments of the opera-

Table 4. Overview of Data Structure

First Order Codes	Second Order Categories	Themes
• Type of use: work-related use; recreational use • Why to use: use during quiet moments (e.g., fight boredom, catch up on work) • How to use: intense use (absent presence), absorbed, distracted	Using technology	IT use in practice
• User behaviors: nonverbal cues (e.g., body posture; scrolling; laughing; swiping; typing fast, reading intently) • Use aspects: frequency of use; duration of use; timing of use; manner of use	Giving off cues	
• Making inferences through reading facial expression and bodily behavior • Inferences about user activities (e.g., browsing internet; using work resources (books; protocols); playing games; chatting (Facebook/ Whatsapp); ordering stock) • Inferences about the purpose of use: work-related or recreational	Making inferences	Onlooker interpretations and actions
• Assuming users are not working • Comparing to the norms: inappropriate use (e.g., not a good nurse/ teacher) • Comparing to what is expected at a certain moment during surgery • Assessing if the user is involved in following the surgery • Annoyance with disturbance of implicit coordination • Giving users "benefit of the doubt"	Forming judgments	
• Explicitly drawing attention of users • Directly reprimanding users (during or after surgery) • Indirectly reattracting attention through reference to surgery (raising voice or mentioning interesting part) • Disapproving looks • Making jokes • Explicating rules of non-use or multitasking to students • "Whatever you do, you have to listen"	Signaling reactions	
• Realization of what others perceive (low reaction time; lower alertness; less anticipation; showing uninterested/detached image) • Realization that it is inappropriate behavior (violating norms) • Realization that it hurts coordination • Realization of the need to be role-model to students	Reflecting on use consequences	User reactions
• Selective to moments of use; shorter periods of use; using it less frequently • Increased eye contact with and better/open body posture towards scrub nurse, sitting closer • Hiding iPod • Rationalizing use • Looking guilty when using it (recreationally) • Verbalizing use, especially when work-related	Adjusting cues	
• "Normal here," "typical" to use iPod in the OR during surgery ("everybody does it") • Tolerance of recreational use (actions) • Recreational use is considered inappropriate (norms) • Inconsistency between actions and norms	Legitimized hypocrisy	Collective pattern of use
• Small size of the device • Touchscreen • Sound notifications	Physical materiality	Materiality of technology
• Multiple apps • User reconfigurable • Work protocols installed	Digital materiality	
• Knowing about introduction of iPods • Knowing about boredom during surgeries • Knowing what is expected (and possible or not) to do in what situation • Regular role-switching	Shared role knowledge	User–onlooker relations
• Implicit coordination • A good circulating nurse is proactive and acts on subtle cues • A good nurse is interested in the surgery • Surgeons only directly expect actions from scrub nurses during operation; but expect relative silence in the OR (e.g., "this nurse does not exist for me")	Normative expectations	
• Telling students what they should (or cannot) do as part of training • "It's easier to say to students than to colleagues" • If they have a diploma, it's their call • We say something to each other's, especially if it's a student • Status and formal dominance of the surgeon	Authority relations	

Figure 1. The Use of the iPod by a Circulating Nurse During Surgery

tion, when nurses were done with preparing, supplying, and administering, when the surgery went smoothly, and when they could sit down and relax for some period of time. During these moments, a circulating nurse usually took a chair close enough to the operating table to hear and to guarantee awareness of how the process there was developing, took out the device from her/his pocket, and started peeking on the screen and/or scrolling down. We could observe that nurses developed an almost automatic habit to reach for their device and experienced a strong urge to check it during the quiet moments of a surgery. The moment they took out their device, they became fully immersed into it. The physical shape and size of an iPod required the user to slightly bend over the screen. While doing so, nurses formed a body posture that looked like the one represented in Figure 1.

In fact, a situation of nurses being *absent present* (Gergen 2002) during a surgery, was observed at almost every surgery we attended. When showing this picture during interviews, the respondents confirmed that this was quite a typical representation of a circulating nurse during a surgical procedure.

The work-related use of the iPods was in line with the intended purpose of the iPod introduction, such as reading protocols to prepare for the next operation, and caused nurses to consider its use inside the operating room as permissible and justifiable during quiet periods. The recreational use of the devices, such as playing games or chatting with friends, however, was considered highly inappropriate by most of the nurses. The perception of iPod use as an inappropriate activity in the OR was shared by many respondents during interviews, as more than 80% of respondents echoed this sentiment, oftentimes expressing extreme annoyance with nurses' iPod use during surgery:

> Now that we have the iPods, almost everybody has an iPod, so they are going to watch and play games, and check e-mail or workbooks, but sometimes they don't listen anymore, and I think that's a bad thing. You always have to listen! Because that's your job! If you want to play games—you do it at home, or if you are at lunch! So, I think that's a bad thing! (Interviewee 24, scrub nurse perspective)

It is the contradiction between the general opinion that iPod use was inappropriate (mostly expressed from the scrub nurses' perspective) on the one hand, and the persistence of this use on the other, that ultimately required focusing on the role of the partner nurses, the so-called scrub nurses. Because of their joint collaborative work, scrub nurses stayed peripherally aware of the circulating nurses' activities and expected this to happen vice versa. Thus, scrub nurses were acting as *onlookers* to the iPod use: they were not using the technology themselves at this point in time, but this use was happening right in front of their eyes.

The Use of the iPods Seen Through the Eyes of the Onlooker

Because the iPod device was small, it was essentially only the user who could directly see what was happening on the screen. Thus, the nature of circulating nurses' activities on the device was kept "private" only to the users, making it difficult for the onlookers to observe exactly what their partners were doing on their devices.

> You don't know; maybe someone is checking the mail from the hospital, and I think that's okay, or someone might be reading the points of the meeting from yesterday, and I am like "okay, when it's quiet in the OR and you are in the rest, peace phase, then it's fine to read something for the next operation, but not fine to play WordFeuds.… [but] that you can't see! I can't see if someone is playing a game or reading about the meeting of yesterday." (Interviewee 22, scrub nurse perspective)

However, as in many other situations when mobile devices are used in the presence of others, some aspects of the iPod use were visible. For instance, onlookers could see how often circulating nurses took their iPod out of their pockets (frequency of use), how long they used it (duration of use), at which phase of the operation they did so (timing of use), as well as the facial expressions and movements, such as typing (manner of use). In other words, cues like the way of holding the device, typing or scrolling on the screen, the posture of the circulating nurses and their facial expressions provided the scrub nurses with information to construct inferences about which features were used on the iPods, and for what sort of purposes. For example, scrub nurses inferred that when the users were smiling while typing or swiping, this would probably mean that the nurses were browsing Facebook or chatting with friends on Whatsapp. At other times, when the nurses were reading intensely, onlookers inferred that the users were engaged in work-related activities, such as preparing for the next operations by reading the protocols. Thus, users unintentionally leaked information about their actual use, thereby giving off cues, making some of their activities known to the public observers. Consider, for example, how this nurse interprets the users' behaviors:

> Facebook is this [shows: scrolling very fast through the newsfeed]. And protocol is this [shows: looking intensely into the screen] you read … I don't use Facebook but if I want to look at Facebook feed I always look like that. (Interviewee 4, scrub nurse perspective)

The scrub nurses used these cues not only to make inferences about the purpose of circulating nurses' iPod use, but also for judging the implications of this use for their joint work and general professional norms, such as those of paying continuous attention to the procedure. For example, scrub nurses estimated if the circulating nurses were indeed following the flow of surgery and if not, if they needed to explicitly ask the circulating nurse for their assistance or to get them involved again.

> I don't think you have to know [what the circulating nurse is doing on the iPod], but you can see if he is alert. Because then you talk with the surgeon and he is asking for something and then you see already if they [circulating nurses] are getting up or acting. Then you don't have to ask for things, so then he is alert and is he also engaged with what's happening in the operating theater. (Interviewee 8, scrub nurse perspective).

In sum, the scrub nurses were triggered by the various cues of users' behaviors to construct perceptions of the use and judge the various aspects of users' professional performance.

Onlookers' Reactions to the iPod Use

Scrub nurses often turned their inferences and judgments about the iPod use into particular actions, although this was usually done in quite a subtle manner. Even though scrub nurses perceived the use of the iPod in the OR as inappropriate, their actions toward the users rarely resulted in an observable confrontation between the scrub nurse and circulating nurse. Our observational data shows that during the 57 surgeries we observed, only 3 cases of (direct) corrective actions by the scrub nurses were witnessed (those included disapproving looks and asking for more attention), which confirmed that if corrective actions were there, they were not explicitly observable, at least during the procedure. Also, the interview data confirmed that scrub nurses rarely reprimanded users in a direct manner. Instead, scrub nurses tried to regain the attention of users indirectly by referring to a particularly interesting aspect of the procedure and inviting them to jointly watch it. By means of disapproving looks, making jokes about the need for more attention, calling out loud to the user to ask for more attention, or inviting them to join watching the operation, scrub nurses signaled their awareness of the iPod use to the circulating nurses.

> And when it's happening, then I say to my colleague, "Can you please, stay with me?" Or make fun of it. Not like be angry or something. (Interviewee 22, scrub nurse perspective)

Sometimes scrub nurses also reprimanded circulating nurses in a more direct manner, for example, by starting discussions around the appropriate way to use the iPod. This feedback was mostly given *after* the surgery, when nurses reflected on the surgery, telling the circulating nurses in broad terms to pay more attention, be able to multitask and stay involved in the surgery. Direct feedback *during* the course of the operation was only given to nurses-in-training, again in broad terms by emphasizing the importance of learning and observing.

> Q: Have you ever had a situation when it [lack of attention due to iPod use] was really a problem?
> A: Yes I had. It was bleeding a lot and it was a really simple and small operation on a small child and the small child can only lose like 200 cc of blood, they have a problem already. And she didn't see it, she really didn't see it. I really had to call her, "pay attention."
> Q: Did you talk afterwards about that?
> A: Yeah I did because also it was a student. I told her, okay "whatever you do, listen to what they are saying." (Interviewee 3, scrub nurse perspective)

Thus, onlookers' reactions toward users took various forms, ranging from open and direct, mostly after surgery, and mostly given to nurses-in-training, to rather subtle signals, by merely alerting users to the importance of being aware and present. These actions, however, were rarely directed specifically at the recreational use of the iPod, but addressed iPod use in general, and were mainly aimed at restoring attention to and involvement in the surgery. Table 5 shows more examples of inferences and reactions of onlookers.

Users' Responses to Onlookers' Signals

Scrub nurses' reactions to users' interactions with their iPods in turn triggered the users to see their use through the eyes of others and to reflect on the judgments made by the scrubs about their iPod use. They realized that their absent presence during the surgery was inappropriate and detrimental to coordination. For example, if scrub nurses explicitly asked for more supplies on their instrument table, raising their voice and repeating requests, this was already enough for the circulating nurses to realize that they were too absorbed in their iPod. They realized that this slowed down their reaction time and could reduce their ability to be alert, anticipate, and contribute to smooth teamwork needed in the OR:

> Sometimes [I feel guilty]. Like when I find myself not paying enough attention when she has to ask for something. Like, I should have noticed that before she has asked me or I should have noticed that she needs some gauzes before she asked. Then I think, oh, that's not so good. But normally no, I don't feel guilty, no. I think I am experienced enough to know when I can do it, and when I cannot do it. If it's a stressful situation or whatever, I am not constantly in [showing that she is peeking in the device]. (Interviewee 23, circulating nurse perspective)

Table 6 provides additional examples of the reflections and (re)actions of users.

Consequently, the circulating nurses not only became more aware of their iPod use in the presence of others, it also made them adjust how they were using their devices. For example, they adjusted their decision *when* to take out the device, choosing the moment when it was less visible and less disturbing. They also adjusted the manners in which they used it: as continuous peeking at the screen hampered their eye contact with scrub nurses, they needed to accommodate both their use of the device and the ease of eye contact with the team at the table, demonstrating approachability and alertness with their body posture. As one interviewee stated, when asked about others' objections to personal iPod use:

> I think you have to be very careful, when to use it for personal communication. Well, at a coffee table it's all right, of course—we are on the break. But inside the OR, you have to really know *when* you can pay a little less attention to what's happening. And you always have to be aware that you have at least your ears open and keep looking. So don't get too much involved in your iPod. ... And if it's a difficult surgery, then you don't use it; then it stays in the pocket. (Interviewee 15, circulating nurse perspective)

Also, users understood that scrub nurses often inferred that the iPod was mainly used for recreational purposes and not so much for work-related reasons. This urged them to emphasize the work-related nature of their use, justifying their use as not being largely recreational:

> It's easy to think that someone is on the internet or something like that, but most of the time we are also reading the procedures. And doing games. Different things. And it's not right that you always conclude: "Oh, he is on the internet!" [Imitates complaining.] You can also read on the internet what you see about the illness, or something like that. (Interviewee 17, circulating nurse perspective)

Table 5. Illustrative Evidence for the Onlookers' Reactions

Activity	Illustrative Quotes	Description
Making inferences and forming judgments	Yeah, they do take it out, and they watch it sometimes, I know, because they are doing this [shows that they do it secretly and raising eyes to check if she is following their actions]. With a guilty face. And I know that they are on Facebook. (Interviewee 24, scrub nurse perspective) You see typing, if you look for information for the operation, you don't need to type. You see it nonverbally, laughing or something. You see that at this moment you don't read about the operation. (Interviewee 9, scrub nurse perspective) There's always a moment, when you can look [at the iPod] and I won't be angry, but continuous looking is not good. So you have to look at me, look on what I have, and look at the operation, and you learn something about the operation, because you have to assist in the operation, if you are ready for it. (Interviewee 4, scrub nurse perspective) Because I think that people use it too much for individual purposes, or private purposes, and the goal for which it was introduced here in the OR. Well, it's not used for only that goal. People in the OR, they have to watch, they have to pay attention to what is happening there. And I have noticed that people that are sitting on the chairs, they are only busy with their own things, and not with the surgery. (Interviewee 6, scrub nurse perspective)	Onlookers register and interpret the hints in a broader context, to link them to what they know about the users, technologies, and usage, and thus form an opinion about the users' behavior in relation to the work practice
Signaling reactions	(To students) I always say: "You have to be present during the operation, with your mind with the operation, you have to know what to do, when you are going to do what and you are learning a lot when you watch the *scrub*, when you watch the operation, and you learn nothing, if you check your Facebook!" So they know that they are wrong if they use the iPod. [And when I introduce nursing students to our specialty]I have a conversation, then I know where they stand and what they want to learn, and I also tell them "I don't want you to use your iPod in the OR," "You can read protocols, but not playing games, no Facebook, no WhatsApp." Yeah, I say that and they understand. (Interviewee 24, scrub nurse perspective) Some colleagues, when they start in the OR, they go sitting and peeking into their iPods. There are not a lot, but I know the stories. And sometimes when something happens—they don't react too quickly, because they play games. And I think that's not good, but I think when people see it [playing on iPod] in the operation room—we say it to each other. I say it to someone, when I am the scrub and I think—you need to pay attention now, I say "Pay attention now," because that's more important. (Interviewee 21, scrub nurse perspective)	Onlookers take action according to their judgments with the goal to influence users' behavior

As a result, circulating nurses started to hide their iPods, holding their device at the level of their hips, or using it while sitting behind the instrument table, shielding their use. They also sat closer to the operating team in order to be more approachable and maintain eye-contact while at the same time holding their iPods on their laps, stealing glances at the device when they felt they were not watched. The purposes for using the iPods did not change, as the content of activities on the iPod were never a point of direct complaints of scrub nurses. Thus, nurses continued surfing the web, catching up on their e-mails about coordinating shifts, reading protocols, chatting with friends, and playing games. What they did change were the visible traces of their iPod use. Consequently, the duration of use became shorter, the frequency was reduced, and using the iPod was mostly restricted to the moments when they knew scrub nurses either would not directly see the use, or would not require their attention.

Collectively Shaped Pattern of Mobile Device Use

As a result of this collective and recurrent process of users and onlookers adapting to each other, an agreed upon pattern emerged over time that we call *legitimized hypocritical use*, as also illustrated in Table 7. This pattern entailed that it was

Table 6. Illustrative Evidence for the Users' Responses

Activity	Illustrative quotes	Description
Reflecting on consequences of use	I don't use e-mail that much, I always call or text, or use WhatsApp, it's a program that's free, can send texts. But I only check them in my break .... Because I have an example role, or role model, you know? I also have to judge the students, I have to have talks with them about how they function and stuff like that. So I cannot do all those things and give a bad example. (Interviewee 10, circulating nurse perspective) Mostly e-mail. Sometimes Whatsapp (laughs)—I have to admit—but it's anonymous, right? (laughs). No, sometimes, when you sit all the time, and you check your iPod and, "Oh, I have friends" [online] and you reply. Something like that. But I think when you have a job in the office, you also do that. So why shouldn't we be able to do that? That's a little thing I think (Interviewee 21, circulating nurse perspective)	Users become aware of what their use is doing to others (onlookers)
Adjusting cues of use	A: When you are the surgeon, let's say, and I sit here [shows that she sits in front] and I read my e-mail, it's not a very big problem I think, because when you say something, I still hear it, because my ears are still open. And I think you are not allowed to play games or anything like that, because you are at work. But when you do things that are related to work, or things that are very quick, when you hear what's going on and when you know the right moment, it's not a very big problem I think Q: And, when you do that, you feel it's okay? I mean you don't have this guilty feeling that "I should not do that?" A: No, because mostly it's related to work. E-mail from work, or sending an e-mail to someone from work. Mostly it's like that. And sometimes, of course, I check nu.nl, or news, but then it's always on a point, when I know that nothing is going to happen, and they don't need anything from me. (Interviewee 21, circulating nurse perspective) I also don't use it as a circulating nurse. Yeah, sometimes, I watch. But then it's only watching—and not like 50 minutes using the iPod. (Interviewee 22, circulating nurse perspective)	Users take action to change their behavior of usage to give off different cues that before

Table 7. Illustrative Evidence for the Adjusted Use of Technology

Activity	Illustrative Quotes	Description
Institutionalized IT use: Legitimized hypocrisy	I use it for my e-mail, sometimes I read it in the coffee room, when I am on a break, but sometimes I also read it when I am in the operation room, and it's not very good (laughs). But yeah, when they don't need me at once. (Interviewee 18, circulating nurse perspective) A: I am fine with that [circulating nurse using iPods]! Only if I have to constantly ask something, because she is like this (peeking into the screen), then it's [not nice] But no, normally it does not really happen. Q: And can you remember a specific example when you had a circulating nurse being too absorbed into the thing? A: Yeah, I had once a student. I think there is a difference if you are experienced, you have an extra ear or an extra eye, and the student does not have that yet. And when they are on their iPod or their Facebook and they are really not paying attention to anything at all, that's disturbing when you have to ask for everything you need. Because they are students and they are here to learn, and they have to learn. So they are in a different situation, they are in learning situation. But I think that we have to give the right example for them, when you are not a student anymore, and that's difficult, because you know you can do it yourself—paying attention and looking on Facebook, but it's difficult for you to explain to them, why they should not be playing word feuds (laughs). That's difficult. (Interviewee 23, scrub nurse perspective)	The collective pattern of technology use that got stabilized after (recurrent) dynamics between users and onlookers

allowed to use the iPod in the OR, but only if this was hidden from other team members and caused only minimal disturbance to the surgical procedure. This was further evidenced by users who confessed that they used the iPod during surgery while at the same time adhering to the norm that its use during surgery was inappropriate.

> A: And I don't think it's good that people bring their mobile devices to the OR. It's not always a good thing in my opinion. Because people get distracted, I think.
> Q: What about when you do it yourself?
> A: Yeah, I do it fast and try not to do it too often. Yeah. … Everybody does it, so … (laughs). (Interviewee 14, circulating nurse perspective)

In the next section, we explain the aspects of materiality of technology and the nature of user–onlooker relations, which represent conditions influencing how the structuring process took place. We thus go one step further in theorizing how onlookers contribute to structuring technology use.

The Role of Materiality of Technology in the Onlooker Effect

The visible cues that were given off to onlookers and were adjusted later were in the first place shaped by the characteristics of the technology; specifically, its materiality. In order to understand better how both digital and physical materiality played a role in the process of structuring technology use, Table 8 offers a comparison of the consequences of the iPod use with the technology that was used prior to the iPod implementation: the personal computer (PC). Table 9 provides illustrative evidence for the role of materiality.

The physical form of the iPod was important in terms of not only defining where and how often the users could use their devices, but also in determining the extent to which users' activities on their iPods were visible to the onlookers. The small size of the iPod made it possible for nurses to carry it everywhere in their pocket, and take it out relatively unobtrusively for others (e.g., under the table). In terms of digital affordances, nurses could download their own apps on the iPod, which contributed to the intensity and enjoyment of use, and also made the iPod useful for their work and learning. For the circulating nurse, this wide range of functions provided a legitimate reason for using the iPod in the workplace, because it also contained work-related apps. For onlookers, the same physical and digital elements of the iPods had an almost opposite effect. The physical form of the device, in particular its small size, made the *content* of use (i.e., the actual activities of users on their devices) invisible to the onlooker. The cues that were visible to the onlookers were related to the *process* of using the device (i.e., the physical interaction between the user and the iPod, their body posture, timing, movements, and facial expressions). Also, the diversity of software applications contributed to onlookers' uncertainty about what users were doing.

Before the introduction of the iPod, circulating nurses used a stationary desktop PC for various purposes, such as to register the stages of the procedure in the electronic patient record system "ChipSoft," check e-mail, browse the internet, or order products. The most important difference in terms of visibility of use and the role of the onlooker was that the PC had a central large screen attached to the wall and thus provided clear cues on the *content* of users' activities on the PC. Consequently, compared to the iPod, inferring the nature of PC use was a far less ambiguous process. For users, the physical shape of the iPod afforded them to hide their use as soon as they noticed that their recreational use was not appreciated, something that was not possible with the PC.

> Well, I remember some people, that was not very often, but even if when they did not have the iPod yet, but we have a computer in the room and they were always on the computer. Because they wanted to look up flight tickets, or Facebook or e-mail, I don't know. But I think PC was worse than the iPod—because they had to sit on that special place behind the computer, and with their backs toward the surgery. So it was even less approachable than if he or she would sit on the stool very near to me. Even if they are looking on their iPods—they can be close. So I think—that's much better! Because with this computer, it does not work during surgery. (Interviewee 15, scrub nurse perspective)

User–Onlooker Relations Shaping the Onlooker Effect

So far nothing has been said about another prominent actor in the operating team: the surgeon. While surgeons are obviously dominant actors in the operating room, their role in iPod use by circulating nurses is less obvious. From the observations and interviews conducted with the surgeons, it did not seem that surgeons were even aware of iPod use: when asked about their opinions, many surgeons reported that they did not particularly care, as the circulating nurses "do not exist for them." Nevertheless, their silence played a role: not being receptive to the cues given off by the users, and consequently not actively responding to these cues, surgeons were essentially signaling that it was permissible to use the device in the OR. In the long run, the surgeons' silence had a certain legitimizing effect on the behaviors of users.

Table 8. Key Differences in the Materiality of Different Technologies Used by Circulating Nurses

	Physical Materiality	Consequences for Users	Consequences for Onlookers	Digital Materiality	Consequences for Users	Consequences for Onlookers	Consequences for Structuring Technology Use
iPod	Small screen Portable	Can sit with the iPod everywhere, including OR and close to operating team Can hide iPod Can see onlookers' reactions	Cannot see the content Can observe user behavior Cues are limited and process related	Multiple apps Reconfigurable by the user	Can use both work-related and recreational features Can justify any use as work-related	*(Indirect: triggered by physical cues given off)*	Onlookers are hesitant to reprimand because of ambiguity of technology Onlookers can accept the continued use if it is compensated by users sitting closer to demonstrate engagement Users can justify the use and hide it
PC	Bigger screen Fixed position, on the wall in the corner of the OR, away from OR team	Need to sit/stand behind the PC, often in the corner of OR Have to turn backs to the team members, distant from them Cannot keep an eye on the team Cannot see onlookers' reactions	Onlookers can see both the content of use and the process (manner, duration, etc.) Cues are more extensive and are both content and process related	Centrally configured software	Cannot download their own programs Can use both work-related and recreational features	*(Indirect: triggered by physical cues given off)*	Onlookers are confident in inferences and do not accept the distance and turned backs Users know what onlookers can see

Table 9. Illustrative Evidence for the Materiality of Technology

Conditions	Illustrative Quotes	Definition	The Role in the Onlooker Effect
Physical materiality of technology	I think before the iPod, people were more on the computer! In the OR we have a computer, and you were watching news, or checking their e-mail or something like that. And that was on the other side of the OR . … That was more annoying, that was further away. When you are on the iPod you sit close and you have contact and when you are on the other side of the OR—you don't have the contact. So I think the iPod is perfect. (Interviewee 21, scrub nurse perspective)	Those aspects of the technology that refer to its tangible physical properties (e.g., size of device)	Provides onlookers with the opportunity to observe the use through cues that were given off and enables users to alter the cues
Digital materiality of technology	iPod at my work—it's my second brain. It's everything in it! If I don't know some kind of operations—I check it, and during the week we have to, today is Thursday, on Friday there are big operations, we have to make stuff ready on big carts, and sometimes there are specialties I don't know, for example, urology, and I need to check, what do they need tomorrow, and I check it to prepare. … At my work it's for protocols, and in the break—it's Facebook and these kind of things, and sometimes games. I always make pictures on my iPod at my work, so these pictures are for my work, and on my phone—they are private. Yeah, sometimes I would take a private picture with this, but most of the times it's for my work. Now it's most of the times, it's work device, I only use it at work. At home, it's my alarm clock. (Interviewee 24, circulating nurse perspective)	Those aspects of the technology that refer to the software–based digital artifacts (e.g., applications on a device)	Provides users with the possibilities for work and recreational use

The fact that surgeons were also onlookers to the use, but acted differently, provides an opportunity to explain under what conditions the onlookers are likely to be activated. Whether the use mattered to onlookers depended on particular relations existing between users and onlookers. Generally, because the surgeons focused on their immediate area of activity on the operating field, they treated circulating nurses as indirect background support and thus were more distant to them. In contrast, scrub and circulating nurses worked directly together, regularly switched roles, and thus cared more deeply about the activities of one another. Based on a systematic comparison of the differences in relations in different pairs (see Table A2), we specify below how the relations between users and onlookers are characterized for the onlookers to be actively involved in structuring the use. The following characteristics of user–onlooker relations influenced how onlookers contributed to structuring technology-in-practice: the nature of *shared role knowledge*, the content of *normative expectations*, and the type of *authority relations*. Table 10 provides illustrative evidence for each of the identified characteristics of these relationships.

Shared role knowledge. Because nurses frequently changed roles of scrub and circulating, they had a deep understanding of each other's work practices and could identify with each other's experiences. Related to the iPod use, this meant that as onlookers, scrub nurses could draw upon their experience as circulating nurses—and thus, as users. This had several consequences for how onlookers *interpreted the use* and how they *reacted* to it when observing it. First of all, all nurses knew that the iPod was primarily intended to support their work (and was in fact also used for that purpose), as they all knew about the intentions behind the iPod project. As a consequence they were willing to give users the benefit of the doubt and justify the use as being work related. Second, scrub nurses had intimate knowledge of what it meant to be an iPod user in the OR. Thus, when observing the use, scrub nurses were able to construct inferences based on such a limited cue as the duration of use and were fairly confident in their inferences about users' activities:

> Q: What do you think they are doing on their iPods?
> A: They are checking their Facebook.
> Q: Do you think that they are checking their Facebook?
> A: Oh, I know it. I don't think—I know! [laughs].
> Q: How do you know it?
> A: Well, because everybody here on the floor has their Facebook and you can't be constantly checking protocols or things for work—that's done in 5 minutes. You can't do that the whole, the entire day. So they have to be doing personal things. Facebook or e-mailing, or texting, Whatsapping, you know. (Interviewee 14, scrub nurse perspective)

Moreover, switching roles gave scrubs a basis for "perspective taking": based on their own experience they knew an iPod could be useful for work as well as killing time during long operations. This created empathy with users' behaviors, making them more willing to accept the inappropriate use. Finally, it would not have been to the scrubs' own advantage to ban iPod use from the OR. They knew they could also use the iPod for their benefit when it was their turn to fulfill the circulating role. This also contributed to the fact that instead of explicitly confronting or sanctioning iPod use, scrubs reacted in surreptitious, non-confrontational ways, essentially colluding with users to cover up this deviation from the espoused norm.

Normative expectations. The work division in the OR also implied a difference in the normative expectations that scrub nurses had of circulating nurses. Scrub nurses expected their partners to facilitate implicit coordination by being attentive, actively involved, proactive, and anticipating their needs, and to be generally interested in the procedure, even when their efforts were not directly required. Using the iPod for other than work-related reasons was thus considered negative and unprofessional.

> The perfect circulating nurse is the person who will know what I need before I have thought about it. … [And] the worst circulating nurse is also getting me the instruments and the things, but everything that I wanted to have—I have to ask for, and they are not thinking themselves that they have to give me something, and then, when everything is done and operation is going smoothly, they are sitting down and looking in the iPod, all the time! And playing games! And then I have to ask two or three times before they give me new swabs or anything. I don't like it! (Interviewee 12, scrub nurse perspective)

Users were aware of these expectations, which formed an important source for their reflections on their iPod use. Understanding the normative expectations enabled them to interpret the onlookers' signals, and made them aware that their behavior was not in line with these expectations. Consequently, they realized that their iPod use was inappropriate, felt guilty for not abiding by the norm, and felt that they needed to justify their behavior:

> I watch what they do, sometimes I check my iPod, my e-mail. … [whispering, to the side] doing a little game [laughs] if it takes a long time. Yeah, I know,

Table 10. Illustrative Evidence for User–Onlooker Relations

Characteristic	Illustrative Quotes	Definition	The Role in the Onlooker Effect
Shared role knowledge	I don't think it's good to [use iPods in the OR], we are working here, not playing games. But in the night, it's really, then you also need sometimes to play a game or do something. [It sometimes takes] hours and hours doing nothing! And then it helps me stay awake. When you are experienced, you know when it's quiet and you know when you have to work. (Interviewee 3, circulating nurse perspective) iPod project? I don't know. Never heard of it. Yeah, and I have never seen it [being used]. Sometimes we ask about protocols, but I have never noticed them using an iPod. And looking something up. Again, may be it's my mistake, you know. … I am really a great supporter of nursing staff here at the hospital, and to me they were an excellent working group already. So I have definitely not noticed a difference. I think they are very good. They are very conscientious, and if things need to be changed in the protocol, they take it up and they change it and the next time I notice that it has improved. But I have never noticed an iPod in that process. So they have been hiding it from me? (Interviewee 31, surgeon)	The user–onlooker relations are characterized by a shared knowledge base of each other's work practices	Provides onlookers with the basis for receiving cues and making inferences about the use and provides users with the basis for understanding onlookers' signals when they react
Normative expectations	Some colleagues are all the time sitting and checking things on the internet. And when you are a scrub nurse, you think [rolling eyes, annoyed] "yeah, okay, are you paying attention to me?" .... Yeah, for me it's disturbing, because I am working—and they are doing their private stuff on the OR! (Interviewee 16, scrub nurse perspective) I don't like if people come in and they just talk with each other. For instance, there is one supervisor and he or she is checking if all the ORs are running smoothly. And then they start talking and chatting and this is something I find very disturbing because this patient can hear everything and if the patient hears the people aren't talking about him, the regular things, then they get worse and they think "is she paying attention, my surgeon" or "is she not paying attention" because patients tend to—they don't get it if you talk about other things in the surgery because they think if you talk about your weekends or the weather, that you make complications, that you do not pay attention. (Interviewee 30, surgeon)	The user–onlooker relations are characterized by a set of norms that inform each other's behavior	Provides onlookers with the basis for evaluative judgments and provides users with the basis for reflecting on the consequences of their use
Authority relations	Q: Do you say anything to the circulating nurses when you are annoyed? A: Sometimes. But it's easier to say to students than to colleagues. But most of my colleagues know how to handle it. But sometimes the younger people are too…[absorbed]. And then I say something like: "a little less on your iPod." (Interviewee 17, scrub nurse perspective) But if they don't listen—then I say like, "Hey, you have to listen!" Especially the students. My colleagues—I can say it to them: "I don't like if you are playing a lot on your phone," but they do their own thing. But the students, they have to learn and I can say: "Now you have to watch, now you have to listen." (Interviewee 24, scrub nurse perspective)	The user–onlooker relations are characterized by how they relate to each other in term of status (differences)	Provides onlookers with the basis to signal reactions and provides users with the basis for adjusting cues

I know [says in a confessional tone]. But when I do that, I always listen what they are saying, so if they need something, I hear it, and then I can take it, and then they don't have to ask me like, "oh, hey, hello, we need you!" but I always listen! (Interviewee 24, circulating nurse perspective)

Authority relations. Work division in the OR also enabled scrub nurses to influence the behavior of circulating nurses. Both nurses related to each other as peers. Even if they were annoyed or dissatisfied with the other party's inappropriate iPod use during surgery, nurses did not feel they were in a position to formally or directly reprimand each other. Instead,

they chose to use subtle ways of influencing behavior, in which they also emphasized that they were dependent on the circulating nurse, relying on their input for their shared task. Thus, scrubs primarily exercised peer pressure in signaling their feedback to circulating nurses, lacking any formal authority over their colleagues. This was different when the iPod was used by nurses in training though. Scrub nurses acted as supervisors over these trainees, and thus had the resources to dictate appropriate behavior.

> Well, if they have the diploma [meaning if they are not students], I don't say anything about it, *then it's their call*. (Interviewee 10, scrub nurse perspective, emphasis added)

In sum, the shared role knowledge, normative expectations, and authority relations between the onlookers and users informed them in their inferences and actions toward one another.

Dual Structuring of Legitimized Hypocritical Use of iPods in the Operating Room

Based on the findings of our case study, we put forward that the dynamics between users and onlookers in this dual structuration process (Young and Leonardi 2012) can be specified as a double interact (Weick 1969): an act triggers a response, and that response in turn results in adjusted acts. Over time, this double interact loop results in structured patterns of use. While using technology (act), users *gave off information* that provided *cues* to onlookers. Onlookers picked up those cues to *make inferences about* users' activities and *form judgments*. They further acted upon these judgments by *signaling their reactions* to the users (response). Users, in turn, reacted to this feedback by *reflecting* on the consequences of their use for them and for their work and ultimately *adjusted* the cues to adapt to onlookers (adjusted act), which in turn, after recurrent, repetitive cycles, stabilized as a collectively shaped technology-in-practice. The basic dynamics of this dual structuring process are schematically visualized in Figure 2.

As discussed above, both the materiality of the technology and the user–onlooker relations influenced how this process of structuring technology use took shape in our case. The physical and digital materiality of the technology afforded a particular way of using the technology, shaped the cues that were given off to onlookers, and influenced the certainty with which onlookers could make inferences about the use. The user–onlooker relations, in terms of shared role knowledge, normative expectations, and authority relations, influenced to what extent the cues were picked up, the type of inferences onlookers made, and the ways in which they responded to users' behavior. The nature of user–onlooker relations also influenced how users reflected on the consequences of use and adapted their use.

Discussion

Our findings add to a more refined understanding of the use of technologies in practice, which we outline below.

Beyond the User-Centric Focus

IS studies on technology-in-practice usually focus on how users use, appropriate, reuse, ignore, negotiate, improvise, and work around various functionalities of the newly implemented technologies (see illustrative examples of such studies in Table 1). As a result, their guiding questions are implicitly about whether and to what extent the intentions of technology implementations are fulfilled, whether improvisation takes place or features are used "faithfully," and what outcomes this use has for the organization and work practices. Although this literature does account for unexpected and improvised patterns of use (see Azad and King 2008; Boudreau and Robey 2005; Mazmanian 2013), it does so with a primary focus on users' activities and agency. In outlining the onlooker effect, this study challenges such *user-centric focus* that dominates the literature. In our study, we were confronted with the "mystery" of a legitimized hypocritical use of technology, where nurses agreed to tolerate mobile device use while saying that they disapproved. Explaining this required us to recognize the agency of onlookers, and unpack in detail why the two groups of onlookers present in the OR (scrub nurses and surgeons) reacted differently to this inappropriate use and how they influenced it. Including the onlooker to the structuring process implies that patterns of technology use developed and institutionalized over time are not only a product of how users interpret and interact with material features of the technology, but also that onlookers play an active part in this structuring process, taking actions toward users and triggering users to reflect on consequences and adjust their behaviors.

Although in our case the onlooker effect resulted in legitimized hypocrisy, there are other possible scenarios in which the reactions of onlookers have a more radical effect, for instance, through shaping and enforcing new rules of technology use that lead users to adjust not only the display, but also the content of their activities. Google Glass provides an illustrative example here: based on many onlookers' negative reactions, explicit guidelines were developed banning the use of Google Glass from public places (see Costill 2013). This outcome can be explained by the role of the onlooker and his/

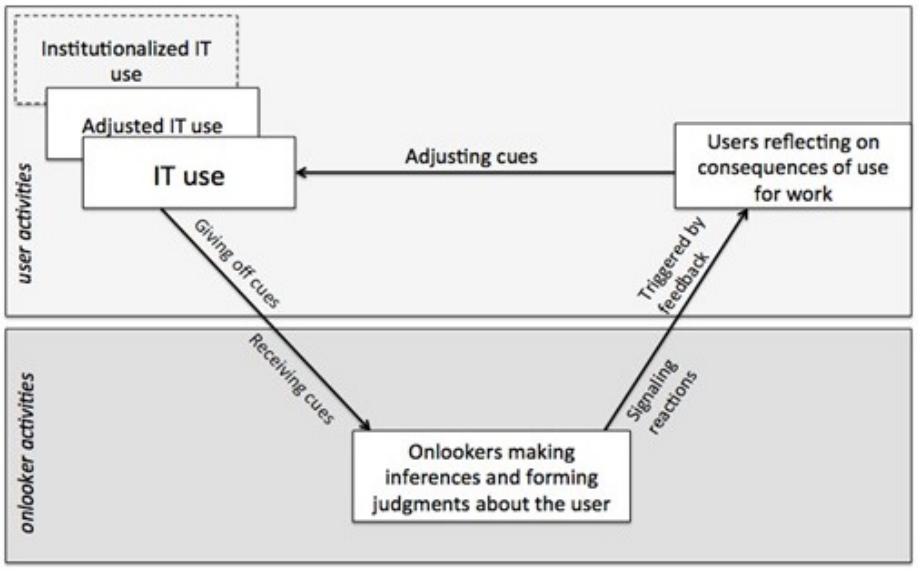

Figure 2. Dual Structuring of Technology-in-Practice by Users and Onlookers

her response to the ambiguous *cues* given off by Google Glass users (e.g., eye movements or touching the touch pad). In contrast to our case, onlookers of Google Glass use had a very different relationship with users: they did not possess shared role knowledge, and thus could not make accurate inferences about what these Google Glass users were actually looking at. Based on normative expectations of how to behave in a public setting, onlookers generally reacted negatively to users. Onlookers with a position of authority over users (e.g., restaurant owners) could dictate rules that banned the use of the technology altogether. This example illustrates that the agency of onlookers can take the form of the explicit exercise of disciplinary power, and not only subtle actions (like the scrub nurses), or legitimizing silence (like the surgeons).

Including onlookers' agency in analyses of the structuring of technology is an important addition to the extant literature. This literature typically sees other actors than users as being part of an impersonal, amorphous social context that is traditionally considered as a background for the focal actor. Typically, this social context is seen as informing users' opinions and behaviors through their professional identities and vulnerabilities to social pressures (Mazmanian 2013), their motivations and backgrounds (Young and Leonardi 2012), the negotiated orders of the organization (Azad and King 2008), and other features of situated work contexts. Actors in this social context have previously not been considered to be *active* participants in the structuring process. Outlining onlooker activities, however, helps to explain at a fine-grained level why users choose to make adjustments to their technology use and agree with onlookers on particular acceptable patterns of use, as was the case with hiding the iPod by nurses. Recognizing that these adjustments are triggered by onlookers' reactions is important, because even when these adjustments are seemingly small from the user's perspective, from the technology-in-practice point of view they may evolve into unexpected patterns that can significantly undermine the purpose of technology implementation. To illustrate, let us consider a case of mobile electronic patient records (EPR). Mobile EPRs are often introduced to maximize the quality and accuracy of patient documentation by affording data entry at the point of care (Prgomet et al. 2009). However, research shows that this particular purpose is often undermined, because doctors choose to delay the data entry, doing it in the hallways or in other locations away from the patient (Shannon et al. 2006). Similar findings of delayed and therefore "nonmobile use" of mobile EPR are presented in the ethnographic study by Oborn et al. (2011), where they explain that surgeons and oncologists are not using tablet EPRs during patient consultations, because of the nature and professional values of the "specialist practices" of their clinical discipline. The onlooker effect provides an alternative and more fine-grained explanation to such a pattern, highlighting the possibility that doctors adjust their uses (e.g., timing or manner of data entry), adapting to the reactions of patients toward their use. In other cases, adjusting cues may result in a complete non-adoption and therefore implementation failure.

Moreover, our study also shows the importance of acknowledging that onlookers are not a separate group of actors, but often are users themselves, albeit at other times. Such situations are increasingly common, as many technologies become ubiquitous and are used by almost everyone. For example, we are probably all familiar with how annoying it can be when others are distracted by their smartphone use at meetings, dinner tables, or lecture rooms. At other times, however, we also do it ourselves and thus create the exact same situation for the onlookers of our own use. Over time, we collectively develop norms of how to use the devices in front of others, and while doing that we draw on our shared experiences as both users and onlookers. Our study accounts for this fact by showing that neither users nor onlookers are making their inferences in a vacuum, but rather collectively draw on their shared role knowledge to construct perceptions of the use, signal reactions, and mutually agree on the norms of use.

Beyond the Feature-Centric View on Technology Use

Studies of technology use have called for and recently started to pay more explicit attention to the role of the materiality of technology in shaping users' behaviors (Faraj and Azad 2012; Jones 2014; Leonardi and Barley 2008; Orlikowski and Iacono 2001). The notion that materiality of technology is important for the behaviors of users is not unique to this paper: previous technology-in-practice studies have discussed, for example, how users' recurrent interactions with material features lead them to form perceptions of what the technology is good for (Leonardi 2009) or how users develop workarounds and "tweaks" to compensate for their limited knowledge of the systems' functionality (Boudreau and Robey 2005). However, as evidenced in recent calls and contributions, these views have been mostly "feature-centric" (Faraj and Azad 2012), which resulted in the neglect of the *physical* materiality of technology (Faulkner and Runde 2013; Osterlile et al. 2012). Most technology-in-practice studies have paid only scant attention to the physical or embodied character of technology use (Jones 2014), whereas our findings show that it is relevant to include this in the analysis of structuring of technology use.

Our specific contribution here is in demonstrating that both physical (e.g., size) and digital materiality (e.g., wide range of user-reconfigurable apps) play a role not only in how users interact with the technology, but also in shaping onlookers' responses. In particular, we demonstrate that physical materiality matters not only in terms of affording certain usages for individual users (e.g., e-mailing inside the OR), but also in terms of shaping the *form of cues* given off to onlookers, which activate onlookers' inferences, judgments, and reactions. In our case, the small size of the iPod shaped the cues for onlookers by making them ambiguous (onlookers could not directly see the users' activities) and process-related (onlookers could see the manners and ways in which users interacted with their iPods, such as frequency, duration, location, and facial expressions). In order to further interpret what users were doing on their devices in terms of content and to decide if they needed to take actions and how, onlookers relied on their shared role knowledge, normative expectations, and authority relations with users. The physical materiality of the iPod also influenced how users could further adjust their use to adapt to onlookers, affording them to hide or sit closer to the team, or to very quickly use it and put it away again: something that has no meaning without recognizing the onlooker effect. The digital materiality of the iPod also afforded users with the possibility of justifying their use by saying that they used it for work-related purposes. In sum, materiality of technology is not only instrumental in terms of affording and constraining some users' behaviors, but also in terms of shaping the form of cues for onlookers, activating their involvement in the structuring of technology use.

It is important to recognize this onlooker-activating role of materiality because it has distinct implications for how collective patterns of use will ultimately get stabilized in the workplace. Specifically, while previous technology-in-practice research mostly focused on the digital properties of technology, the onlooker effect highlights the role of physical properties in terms of making the cues given off either ambiguous (as in the case of mobile device use for nurses) or transparently visible, or content- or process-related. To give an opposite example of what can happen when cues are transparent instead of ambiguous and content- instead of process-related (as they were in our case of the OR nurses), take the use of large overhead screens in open transparent offices. A recent study (Ruitenbeek 2015) at a consulting company showed that the large overhead screens for use during meetings were quite quickly abandoned and substituted by the use of a "shared screens" function. Onlookers to the overhead screen usage in this case were the coworkers or clients passing by in the hallway, who could easily observe the meeting's topics of discussion and make inferences and judgments about the content of the presentations and their colleagues' projects. As a result of these transparent content-related cues and onlookers' reactions, users were triggered to reflect on the potential consequences of being watched and decided to switch to the individual shared screen mode on their laptops. Over time, the onlooker effect resulted in a collective pattern of using laptops with the shared screen function during meetings, instead of watching slideshow presentations projected on a full screen, which meant the investments in the screens were a waste of money.

Beyond Intended Audiences

Our findings both advance knowledge about the unintended consequences of structuration and distinguish the onlooker effect from other processes described in IS research on technology-in-practice. Although research on structuration processes often takes unintended consequences into account, it mostly focuses on how these unintended consequences concern actors functionally related to the technology. For instance, Young and Leonardi (2012) discuss the case where hyperlink creators establish hyperlinks *for* website visitors to navigate, making these hyperlink navigators a direct and intended audience to which the cues are provided. The process of dual structuring consists of two sets of activities revolving around whether the onlookers constructed a correct interpretation of the social issue network and if not, how their perceptions and actions further modified the practices of hyperlink creators. Similarly, in their examination of self-service web-based technologies by sales representatives and insurance agents, Schultze and Orlikowski (2004) discuss how the new patterns of online quoting and consulting practices resulted in unintended consequences for the network relations between the users and the group functionally related to them. In both of these instances, even though technology use was recognized to produce unintended effects for other people, the users and the affected group were functionally related to the purposes of technology use. Our study demonstrated, however, that unintended consequences can involve broader groups than only those targeted, when onlookers are "drawn into" technology use through the cues given off. These cues are neither intentionally given off by users, nor specifically aimed at onlookers, and at this stage onlookers do not have a preconceived intention to become involved in the use.[2] Together these characteristics mark important differences from previously considered structuration effects involving audiences who are related to the use as a result of the functionality of the technology, such as readers navigating websites (Young and Leonardi 2012) or third-party observers of posts on enterprise social media (ESM) (Gibbs et al. 2013). For example, in the studies of the impact of ESM use on third-party observers (e.g., Leonardi 2015), these third-party observers are intentionally going to the ESM platform to browse through the users' posts and therefore are purposefully allocating their attention to the traces users leave through their ESM use. It is important to recognize that there are also unintended audiences that become accidentally involved in structuring the use after being triggered by the cues given off, because of the distinctive relationship these audiences have with the materiality of technology. Specifically, for intended third party observers like Young and Leonardi's (2012) hyperlink navigators, materiality acts as an *affordance*. This means that it fulfills their information needs and provides opportunities for intentional actions. For the unintended audiences in turn, materiality of technology acts as an *activator*, triggering and catalyzing their involvement in the users' interaction with the technology through cues given off, without any specific *a priori* intentions on their part. This distinct role of materiality that draws in unintended audiences might imply that in this relationship with onlookers, materiality needs to be given more agency than is usually assumed under the concepts of affordances, recognizing that it produces effects without users' and onlookers' intentions.

Future Research Directions and Implications

In sum, the contributions outlined above provide a broader lens to analyze technology in practice and raise new research questions. Further IS studies on the onlooker effect will benefit from developing a more fine-grained understanding of what types of onlookers there are and what their differences are in contributing to structuring. Specifically, as one of the distinctive features of the OR setting was the clear physical separation between the users of the iPod (non-sterile nurses) and onlookers (sterile nurses directly assisting the surgery), it would be useful to examine how the onlooker effect plays out when, for example, the distinction between the two is not that clear-cut, or when the onlookers are exposed to cues given off online (e.g., through the posts on ESM). In addition, future research can examine how onlookers' inferences and actions may vary depending on what sort of unintended cues they are exposed to. For example, how do the differences in the cues given off (e.g., process-related or content-related cues) influence the type of onlookers' inferences and reactions? Other research questions can relate to the various dynamics of onlooker effects that can be distinguished, such as negative reinforcement or positive reinforcement.

Moreover, our study is not without limitations, which also opens up opportunities for further research. One of the limitations of our case is the specific nature of IT in terms of its non-mandated character and the functionality taken up by users in their situated practices, which eventually resulted in a peculiar pattern of legitimized hypocrisy. Future research is needed to examine what type of onlooker influences emerge in the cases of mandated IT use. In addition, our research did not go in-depth into the possible influences of managerial or

[2]By referring to the lack of preconceived intention on the part of onlookers, we do not imply the lack of intention in their actions in general, but rather emphasize the fact that onlookers are not an intended audience for the technology use in the first place. There are two arrows in our model (Figure 2): one referring to how the "cues given off" trigger onlookers to become involved and the other one referring to onlookers' reactions. While the second arrow indicates onlookers might sometimes have intentionality, the first arrow is more produced by materiality of technology.

organizational factors on shaping the use of technology and legitimizing the appropriate way of using it. Identifying what happens when the onlookers are managers (thus having a different type of authority relation with users) represents another possible direction for future research. Finally, even though we spent a prolonged amount of time in the field and collected retrospective data referring to different periods, our study started almost a year after the introduction of the iPods and, thus, we were not able to provide concrete comparisons of the patterns of use in the very beginning with those observed at the very end. Future research may address this limitation by designing field experiments to more formally compare the extent of changes in the patterns of use under the influence of onlookers.

Being conscious of the onlooker effect also provides practical implications for designers of information systems and technology in general. Understanding that technology use is not happening in a vacuum, but that it often draws in unintended and accidental observers means that designers need to consider such possible audiences and the cues that they can be exposed to when imagining future situated practices of use. For example, coming back to the case of non-adoption of large screens in transparent offices because of the onlooker effect: if the office designers had taken the onlooker influence into account, probably no large screens in rooms with transparent walls would have been installed.

In conclusion, our study provides an important foundation for understanding many current phenomena associated with the use of technology in contemporary social practices that become increasingly infused with more and more technologies with diverse functionalities. Given that almost all of our technology use is also visible to others, the onlooker effect can help to more fully account for structuring patterns of technology use, without privileging the users as the central group of actors.

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References

Azad, B., and King, N. 2008. "Enacting Computer Workaround Practices Within a Medication Dispensing System," *European Journal of Information Systems* (17:3), pp. 264-278.

Barley, S. R. 1986. "Technology as an Occasion for Structuring: Evidence from Observations of CT Scanners and the Social Order of Radiology Departments," *Administrative Science Quarterly* (31:1), pp. 78-108.

Bartunek, J. M., and Louis, M. R. 1996. *Insider/Outsider Team Research*, Thousand Oaks, CA: Sage Publications, Inc.

Berente, N., and Yoo, Y. 2012. "Institutional Contradictions and Loose Coupling: Postimplementation of NASA's Enterprise Information System," *Information Systems Research* (23:2), pp. 376-396.

Boudreau, M. C., and Robey, D. 2005. "Enacting Integrated Information Technology: A Human Agency Perspective," *Organization Science* (16:1), pp. 3-18.

Burton-Jones, A., and Gallivan, M. J. 2007. "Toward a Deeper Understanding of System Usage in Organizations: A Multilevel Perspective," *MIS Quarterly* (31:4), pp. 657-679.

Cave, A. 2015. "A Failure of Leadership or Design? Why Google Glass Flopped," *Forbes* (online at http://www.forbes.com/sites/andrewcave/2015/01/11/give-up-your-big-data-the-dash-diet-for-business-leaders/).

Chu, T. H., and Robey, D. 2008. "Explaining Changes in Learning and Work Practice Following the Adoption of Online Learning: A Human Agency Perspective," *European Journal of Information Systems* (17:1), pp. 79-98.

Costill, A. 2013. "Top 10 Places that Have Banned Google Glass," *Search Engine Journal* (online at http://www.searchenginejournal.com/top-10-places-that-have-banned-google-glass/66585/).

DeSanctis, G., and Poole, M. S. 1994. "Capturing the Complexity in Advanced Technology Use: Adaptive Structuration Theory," *Organization Science* (5:2), pp. 121-147.

Faraj, S., and Azad, B. 2012. "The Materiality of Technology: An Affordance Perspective," in *Materiality and Organizing: Social Interaction in a Technological World*, P. M. Leonardi, B. A. Nardi, and J. Kallinikos (eds.), Oxford, UK: Oxford University Press, pp. 237-258.

Faulkner, P., and Runde, J. 2013. "Technological Objects, Social Positions, and the Transformational Model of Social Activity," *MIS Quarterly* (37:3), pp. 803-818.

Fulk, J., Steinfield, C. W., Schmitz, J., and Power, J. G. 1987. "A Social Information Processing Model of Media Use in Organizations," *Communication Research* (14:5), pp. 529-552.

Gergen, K. J. 2002. "The Challenge of Absent Presence," in *Perpetual Contact: Mobile Communication, Private Talk, Public Performance*, J. E. Katz and M. Aakhus (eds.), Cambridge, UK: Cambridge University Press, pp. 227-241.

Gibbs, J. L., Rozaidi, N. A., and Eisenberg, J. 2013. "Overcoming the 'Ideology of Openness': Probing the Affordances of Social Media for Organizational Knowledge Sharing," *Journal of Computer-Mediated Communication* (19:1), pp. 102-120.

Giddens, A. 1984. *The Constitution of Society: Outline of the Theory of Structuration*, Berkeley, CA: University of California Press.

Godinho de Matos, M., Ferreira, P., and Krackhardt, D. 2014. "Peer Influence in the Diffusion of iPhone 3G over a Large Social Network," *MIS Quarterly* (38:4), pp. 1103-1133.

Hsiao, R. L., Wu, S. H., and Hou, S. T. 2008. "Sensitive Cabbies: Ongoing Sense-Making Within Technology Structuring," *Information and Organizations* (18:4), pp. 251-279.

Jones, M. 2014. "A Matter of Life and Death: Exploring Conceptualizations of Sociomateriality in the Context of Critical Care," *MIS Quarterly* (38:3), pp. 895-925.

Katz, J. E., and Aakhus, M. (eds.). 2002. *Perpetual Contact: Mobile Communication, Private Talk, Public Performance*, Cambridge, UK: Cambridge University Press.

Lamb, R., and Kling, R. 2003. "Reconceptualizing Users as Social Actors in Information Systems Research," *MIS Quarterly* (27:2), pp. 197-236.

Leonardi, P. M. 2009. "Why Do People Reject New Technologies and Stymie Organizational Changes of Which They Are in Favor? Exploring Misalignments Between Social Interactions and Materiality," *Human Communication Research* (35:3), pp. 407-441.

Leonardi, P. M. 2011. "When Flexible Routines Meet Flexible Technologies: Affordance, Constraint, and the Imbrication of Human and Material Agencies," *MIS Quarterly* (35:1), pp. 147-167.

Leonardi, P. M. 2013. "When Does Technology Use Enable Network Change in Organizations? A Comparative Study of Feature Use and Shared Affordances," *MIS Quarterly* (37:3), pp. 749-775.

Leonardi, P. M. 2015. "Ambient Awareness and Knowledge Acquisition: Using Social Media to Learn 'Who Knows What' and 'Who Knows Whom,'" *MIS Quarterly* (39:4), pp. 747-762.

Leonardi, P. M., and Barley, S. R. 2008. "Materiality and Change: Challenges to Building Better Theory About Technology and Organizing," *Information and Organization* (18:3), pp. 159-176.

Leonardi, P. M., and Barley, S. R. 2010. "What's Under Construction Here? Social Action, Materiality, and Power in Constructivist Studies of Technology and Organizing," *The Academy of Management Annals* (4:1), pp. 1-51.

Leonardi, P. M., and Treem, J. W. 2012. "Knowledge Management Technology as a Stage for Strategic Self-Presentation: Implications for Knowledge Sharing in Organizations," *Information and Organization* (22:1), pp. 37-59.

Leonardi, P. M., Treem, J. W., and Jackson, M. H. 2010. "The Connectivity Paradox: Using Technology to Both Increase and Decrease Perceptions of Distance in Distributed Work Arrangements," *Journal of Applied Communication Research* (38:1), pp. 85-105.

Liang, H., Saraf, N., Hu, Q., and Xue, Y. 2007. "Assimilation of Enterprise Systems: The Effect of Institutional Pressures and the Mediating Role of Top Management," *MIS Quarterly* (31:1), pp. 59-87.

Love, S., and Perry, M. 2004. "Dealing with Mobile Conversations in Public Places: Some Implications for the Design of Socially Intrusive Technologies," in *Proceedings of SIGCHI Conference on Human Factors in Computing*, E. Dykstra-Erickson and M. Tscheliqu (eds.), April 24-29, Vienna, Austria, New York: ACM Press, pp. 1195-1198.

Lyytinen, K., and Yoo, Y. 2002. "Research Commentary: The Next Wave of Nomadic Computing," *Information Systems Research* (13:4), pp. 377-388.

Mazmanian, M. 2013. "Avoiding the Trap of Constant Connectivity: When Congruent Frames Allow for Heterogeneous Practices," *Academy of Management Journal* (56:5), pp. 1225-1250.

Mazmanian, M., Orlikowski, W., and Yates, J. 2013. "The Autonomy Paradox: The Implications of Mobile Email Devices for Knowledge Professionals," *Organization Science* (24:5), pp. 1337-1357.

Oborn, E., Barrett, M., and Davidson, E. 2011. "Unity in Diversity: Electronic Patient Record Use in Multidisciplinary Practice," *Information Systems Research* (22:3), pp. 547-564.

Orlikowski, W. J. 1992. "The Duality of Technology: Rethinking the Concept of Technology in Organizations," *Organization Science* (3:3), pp. 398-427.

Orlikowski, W. J. 2000. "Using Technology and Constituting Structures: A Practice Lens for Studying Technology in Organizations," *Organization Science* (11:4), pp. 404-428.

Orlikowski, W. J., and Iacono, C. S. 2001. "Research Commentary: Desperately Seeking the 'IT' in IT Research—A Call to Theorizing the IT Artifact," *Information Systems Research* (12:2), pp. 121-134.

Orlikowski, W. J., and Robey, D. 1991. "Information Technology and the Structuring of Organizations," *Information Systems Research* (2:2), pp. 143-169.

Orlikowski, W. J., Yates, J., Okamura, K., and Fujimoto, M. 1995. "Shaping Electronic Communication: The Metastructuring of Technology in the Context of Use," *Organization Science* (6:4), pp. 423-444.

Østerlie, T., Almklov, P.G., and Hepsø, V. 2012. "Dual Materiality and Knowing in Petroleum Production," *Information and Organization* (22:2), pp. 85-105.

Prgomet, M., Georgiou, A., and Westbrook, J. I. 2009. "The Impact of Mobile Handheld Technology on Hospital Physicians' Work Practices and Patient Care: A Systematic Review," *Journal of the American Medical Informatics Association* (16:6), pp. 792-801.

Rico, R., Sánchez-Manzanares, M., Gil, F., and Gibson, C. 2008. "Team Implicit Coordination Processes: A Team Knowledge-Based Approach," *The Academy of Management Review* (33:1), pp. 163-184.

Ruitenbeek, M. 2015. "The Ambiguity of Transparent Office Environments" unpublished Master's thesis, Vrije Universiteit (http://www.ubvu.vu.nl/pub/fulltext/scripties/27_2069806_1.pdf).

Schultze, U., and Orlikowski, W. J. 2004. "A Practice Perspective on Technology-Mediated Network Relations: The Use of Internet-Based Self-Serve Technologies," *Information Systems Research* (15:1), pp. 87-106.

Shachak, A., and Reis, S. 2009. "The Impact of Electronic Medical Records on Patient-doctor Communication During Consultation: A Narrative Literature Review," *Journal of Evaluation in Clinical Practice* (15:4), pp. 641-649.

Shannon, T., Feied, C., Smith, M., Handler, J., and Gillam, M. 2006. "Wireless Handheld Computers and Voluntary Utilization of Computerized Prescribing Systems in the Emergency Department," *The Journal of Emergency Medicine* (31:3), pp. 309-315.

Stein, M. K., Newell, S., Wagner, E., and Galliers, R. D. 2015. "Coping with Information Technology: Mixed Emotions, Vacillation and Nonconforming Use Patterns," *MIS Quarterly* (39:2), pp. 367-392.

Strauss, A., and Corbin, J. 1998. *Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory*, (2nd ed.), Thousand Oaks, CA: Sage Publications.

Sykes, T. A., Venkatesh, V., and Gosain, S. 2009. "Model of Acceptance with Peer Support: A Social Network Perspective to Understand Employees' System Use," *MIS Quarterly* (33:2), pp. 371-393.

Vaast, E., and Walsham, G. 2005. "Representations and Actions: The Transformation of Work Practices with IT Use," *Information and Organization* (15:1), pp. 65-89.

Vieira da Cunha, J. 2013. "A Dramaturgical Model of the Production of Performance Data," *MIS Quarterly* (37:3), pp. 723-748.

Wang, Y., Meister, D. B., and Gray, P. H. 2013. "Social Influence and Knowledge Management Systems Use: Evidence from Panel Data," *MIS Quarterly* (37:1), pp. 299-313.

Weick, K. E. 1969. *The Social Psychology of Organizing*, Reading, MA: Addison-Wesley.

Yates, J., Orlikowski, W. J., and Okamura, K. 1999. "Explicit and Implicit Structuring of Genres in Electronic Communication: Reinforcement and Change of Social Interaction," *Organization Science* (10:1), pp. 83-103.

Yoo, Y. 2010. "Computing in Everyday Life: A Call for Research on Experiential Computing," *MIS Quarterly* (34:2), pp. 213-231.

Young, L. E., and Leonardi, P. M. 2012. "Social Issue Emergence on the Web: A Dual Structurational Model," *Journal of Computer-Mediated Communication* (17:2), pp. 231-246.

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RESEARCH ARTICLE

THROUGH THE EYES OF OTHERS: HOW ONLOOKERS SHAPE THE USE OF TECHNOLOGY AT WORK

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Appendix

Interview Protocol

Interview Introduction

The purpose of our research is that we would like to know more about the recent iPod project in which iPods were introduced into your daily work practices, mainly to learn about how the iPod is used in practice. We will talk with different people that are involved in the project, and would like to know your personal take on the project and the consequences of the iPods for you as [*position*]. We also need to know what your work is like (as daily practice) in order to see the influence. The interview will be like a conversation instead of an interrogation. It will last for approximately [*40–60–90*] minutes and will be recorded in order for us to be able to analyze it correctly: we will guarantee anonymity, and we will use all of the information solely for research purposes; we have no agenda to inform the management in their decisions.

Interview Questions and Topics

This lists an overview of all questions and topics to be addressed in the interviews. Each may get follow-up questions (which are not mentioned here). *Note: it is an accumulated list of questions, as developed over time.*

Introduction:

- Could you please introduce yourself and tell us what you do?
- What does a typical day look like for you? (For example, can you describe what you did today, in great detail? How typical is that?)

Use of iPod in General:

- How was the iPod introduced into your work? For example, when did you get it? How did you learn about it? What did people say it was (good) for? What did they tell you about their assumptions?
- What were your assumptions and expectations about iPods prior to the introduction? What did you only realize later what you can do on it?
- What do you use it for exactly? For example, how often, and when, do you use it for that? Why? What did you use before? How do you see your iPod (*frame*)?
  - probe into: How do you use it for protocols, e-mail, Facebook, internet, games, photos, ordering instruments, etc.?

- Can you describe an example of what was the last time you used it and what for? For example, where did it occur (describe the situation)? Also for private purposes? (Probe into the theme of the boundaries between private and public life.) Do you use it at home?
- Do you use your iPod during surgery? Describe when you last did so.
  - Probe into: What mood were you in (boredom)? What things did you do on your iPod?
  - Probe into: In what phase(s) of an operation did you take it out? Why?
  - Probe into: What's your way to keep attention on the operation? What are the special conditions in which you know you can relax? How does iPod influence that?
- What would you do if you did not have your iPod anymore? Do you like it? Why?
- How do you know when you can use it? For example, how would you know that it is quiet enough to look into it?

Use of Other Tools:

- Did you already have a (similar) mobile device? For how long? What did/do you use that for?
- Do you use PCs or the internet café at the hospital? What do you use it for? Can you compare the different tools in terms of use and how they support your (work)life?
  - For instance: When confirming the appointment for interview, what did you use? (Did you use an outlook on your iPod?)

Work Practices: Scrub and Circulating [some were added in summer 2012]

- Describe what a circulating nurse does. What is a good circulating nurse? What are essential skills? What is important? How are the skills trained?
  - Probe into: What do you see as a role of a circulating nurse?
  - Probe into: What do you see as a role of a scrub nurse?
- How can you describe the work division between two types of nurses? What do they do? How do they relate to each other? Who decides who does what? What do you need to know in each role? Do you like each role equally? Why?
- Can you describe the switching roles between scrub and circulating nurses? Can you give examples of what you do and how you do it?
- As circulating nurse, do you feel to be on the periphery (of the action, surgery)? Do you feel as participating in the surgery in that role as in the scrub nurse's role? Is there a distance between the surgeon or not and is that larger than if you are a scrub nurse? Imagine if you are a scrub nurse, what do you expect from a circulating nurse? What if it does not work ? Give examples. Why?
- If you are circulating, how do you spend your time?
  - Probe into: Boredom, quiet phases. When is it okay to do so? How can you do it? What did you do before you had iPods?

Distraction: [added in summer 2012]

- Do you have any stories of your colleagues being absorbed in their iPod? What does that do to you? Do you get annoyed? Why do you think people are "into their devices" (during lunch or during surgery)? What do you think they are doing? How did you react?
- Being a scrub nurse, have you ever had a problem with a person being (too) absorbed? What did you do in the situation? Did that change over time? If (not) a problem, why? What did they do before the iPod? Were they absorbed then?
- Do you feel any boundaries between private and work related spheres, moments, activities, etc?

Contradictions and Challenges: [added in summer 2012]

- Tool and toy paradox: how do you deal with the fact that it can be used for multiple purposes (both work and play)?
- Present and distracted: being a scrub nurse, what happens when you see a person being absorbed into the iPod? When do you get annoyed? When is it problematic (can you provide examples of specific incidents)? What did you do? Did you have a discussion about it? Why (not)? How does that relate to teaching? How was it before there were iPods? Is there any pattern how it went from introduction until now? How did you spend your "downtime" before?
- Socialized and detached: have you noticed any changes in relation to the use of iPods during lunch? If so, can you elaborate on it? Do you use it for lunch yourself? What functions? For work or private purposes? When do you decide to use iPod and when not? Based on what?
- Portable but not visual: examples of when the screen is too small. What do you do then?
  - Probe into: go to PC, paper folders, use both?

User Versus Onlooker Perspective: [added in spring 2013]

- Onlooker perspective: When you are a scrub nurse in an operation, how do you interact with your circulating nurse? Does it matter what they are doing?
  - Probe into: the use of iPod by your partner (work-related or non-work related surgery): Can you see what they do? Why (not)? How does that influence or impact you, if at all? Specific incidents and what did you do in response?
- User perspective (see questions on the use of iPod in general)

Surgeon's Perspective: [added in summer 2012]

- Do you know anything about the project? Can you describe how you learnt about it (e.g., from nurses, management, etc.)? If not, have you seen nurses using mobile devices? When?
- What do you think they are doing on it? Did you see that?
- Do you have any opinion on whether their work has improved (in relation to you) since the use of iPods?
- Can you describe how the surgical protocols for nurses are crafted, updated and distributed?
- Do you remember any examples (or problems) with regard to the protocols and updates from the perspective of nurses?
- Can you describe in detail how you work with OR nurses? Do you know them by name? Do you tell them what you expect of them? How? Can you describe the different roles of nurses?
- What is the "ideal nurse" (probe into scrub and circulating)?
- Show the picture of the circulating nurse absorbed: Have you ever seen this? Is this common or not? What is your opinion on what you see? Why? What did they do before the mobile devices?

Table A1. Uses of iPod

iPod uses	Examples of Activities on the iPod Constituting the Use
Information support	• accessing and checking protocols • reading newsletters from management • retrieving phone numbers and e-mail addresses • reading about the procedures on the internet (e.g., checking online the unknown abbreviations of surgeries on the schedule), • making notes and pictures (e.g., of new or specific procedures) • fine-tuning of the protocol for personal professional use, etc.
Coordination support	• taking and e-mailing pictures of equipment to arrange repair or order new ones • taking pictures of instruments to teach students • taking pictures for surgeons upon their request • placing orders of equipment • e-mailing to coordinate shifts
Recreation	• social media networking • chatting • playing games • catching up on long e-mail newsletters (e.g., minutes from missed meetings) • checking news online

Table A2. Key Differences in User–Onlooker Relations in Two Different Pairs

Pair of User and Onlooker	Shared Role Knowledge	Normative Expectations	Authority Relations	Consequences for How Onlookers Reacted to Visible Cues Given off	Consequences for How Users Reacted to Signals	Consequence for Structuring Technology Use
Scrub and circulating nurses	detailed, deep, intimate, including knowledge of iPod project and use	anticipation and proactive involvement (implicit coordination) interest in and attention to the procedure	peers/equals (influence through normative and peer pressures)	actively picks up visible cues make detailed inferences (including benefit of the doubt) empathizes reactions are subtle	triggered to reflect on inappropriateness hide use stop using justify work-related cues	Colluding maintaining the norm of inappro-priateness of use, but covering up and thus accepting its use
Surgeons and circulating nurses	generalized, superficial, and uninformed about iPod project	silence from the OR team members (not chat too loud) indirect support (through the scrub nurse)	hierarchical, professional and status dominance	marginally picks up the cues (peripheral awareness) makes generalized inferences (when asked for) no action taken (unless really too loud); it actually helped them to stay quiet(er)	realizing it was not disturbing for surgeons, so no adjustment made	ignoring the use and thus indirectly contributing to allowing its use