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Of organization, device and context: Interruptions from mobile communication in highly specialized care ☆

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ABSTRACT

This paper presents an ethnographic study of mobile communication at a surgical unit in Sweden involved with highly specialized care for the upper abdomen. The primary focus of the study is interruptions related to usage of mobile communication, with the goal of informing the design of systems that better balance interruptions and availability. The department uses a patchwork of hospital pagers, personal cell phones, and department provided cell phones. Issues related to social factors at the department, technical features of mobile communication devices, and specific contexts where interruptions were identified to be a problem are presented. Some of the salient findings of the study include a generally complex situation with respect to interruptions that is impacted by technical, social and individual factors related to mobile communication, challenges related to managing personal and private communication on the same device, issues related to supporting distributed work in highly specialized care and how this contributes to interruptions, and a more in depth overview of specific contexts where interruptions are problematic than previous studies. Some theoretical perspectives on these issues are presented as well as implications for design.

1. Introduction

Hospital work is inherently mobile (Bardram and Bossen, 2003). A variety of mobile communication tools are utilized in order to keep colleagues in contact with each other and support coordination and other relevant activities. The most pervasive of these technologies is hospital paging systems. Paging systems are notoriously difficult to replace despite the fairly basic functionality that they provide in comparison to newer solutions such as wireless phones.

One issue that has limited the use of wireless phones in hospitals is interference with medical equipment by standard cellular phones (Klein and Djaiani, 2003). Over time however these fears have been reduced. Positive effects attributed to cell phone usage in terms of improved communication and coordination do seem to outweigh any negative effects related to possible interference with medical equipment in some situations (Soto et al., 2006). Bans on cell phones have been lifted and use has slowly started to make its way into the hospital setting.

Today a mixture of phones and pagers is thus used in hospitals. One study in 2006 for example reported that 65% of anesthesiologists use pagers as their primary mobile communication tool while 17.5% use cell phones (Soto et al., 2006). There are socio-technical challenges however with respect to the introduction and usage of cell phones and other wireless phones among hospital workers in order to obtain maximum value and reduce any negative effects they might incur.

Interruptions in face-to-face settings (Coiera and Tombs, 1998) and from paging systems (Blum and Lieu, 1992) are known challenges with hospital work for example. Empirical studies provide some evidence that wireless phones may also lead to an increase in interruptions. Early experiments that provided voice services to nurses using wearable radio transceivers cautioned that such services may lead to nurses being "fatally available" and suggested for "...continued work in designing practice patterns that minimize nurse interruptions" (Minnick et al., 1994). A study of wireless communication by physicians at an oncology department in 2007 also noted interruptions to be a greater problem with phones than pagers (Scholl et al., 2007). Even though DECT phones were available to senior physicians, many of them were highly skeptical of using them, and some chose to limit their use or refrain from

Abbreviation: OR, Operating Room.

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using them entirely. A primary issue of concern was that interruptions from these devices were more frequent, and more difficult to deal with than interruptions from pagers. As cell phones and other wireless phone systems make their way into the hospital environment, greater understanding of interruptions that may result from their use, and any design strategies that can be used to deal with these interruptions, are thus interesting issues for study.

This paper focuses on this issue. A study of wireless communication at a highly specialized surgical care unit in Sweden that provides care for the upper abdomen (hereafter referred to as Gastro) is presented. The study focuses primarily on the issue of interruptions from these devices with the goal of informing the design of future communication systems in hospitals. Issues such as organizational factors, and technical features of the wireless communication system at Gastro are presented. An overview of specific contexts identified to be problematic with respect to being interrupted is also provided. One of the key findings was a generally complex environment with respect to interruptions that is impacted by social, technical and individual factors. This helps emphasize the socio-technical nature of interruptions, with social factors needing to be considered in studies and in design. Challenges were also noted at Gastro related to supporting distributed work in the context of delivering highly specialized care, and in managing a combination of private and personal communication. One of the more interesting issues related to the usage of mobile communication at Gastro for example, is that the use of cell phones evolved without any plan of action by the management, as the workforce independently adopted their personal cell phones at work. This resulted in an interesting Grudin paradox (Grudin, 1988) where usage of mobile communication by one type of worker (surgeons) has resulted in extra work for another type of worker (nurses and nurse assistants).

2. Background

The term "interruption" can be conceptualized in different ways. When considering the design oriented goals of the study, we conceptualized an "interruption" to be contact that is perceived as annoying, bothersome, unnecessary or unwanted by the workers at the department. In this respect, we were not concerned so much with reducing the overall level of contact or use of mobile communication, for example, by simply reducing the number of times someone would receive a call or page during their shift. Rather we sought to identify information that could be used to design future systems that could be perceived as more advantageous by the users than current systems.

2.1. The social nature of interruptions

Because work takes place in a social context we also considered an "interruption" to be contact that creates problems for people other than the person being contacted. Most studies of interruptions within HCI have not paid much attention to social issues however (Harr and Kaptelinin, 2007). Further analysis of issues such as "ripple effects", that can result when an interruption spreads to affect people other than the person being initially interrupted, have thus been suggested (Harr and Kaptelinin, 2007).

The issue of how interruptions may impact people other than the person being contacted has been included in a few studies of interruptions however, although the issue has not been extensively explored. A study of interruptions at a trauma centre has included this perspective for example, by including "indirect recipient" as an interruption classification (Brixey et al., 2008). Other conceptual models related to classifying and modeling interruptions have also highlighted social issues (Grandhi and Jones, 2010), as have some empirical studies in healthcare (Solvoll and Scholl, 2008; Kristiansen, 2011). A preliminary study investigating solutions for interruptions from mobile devices in surgical departments for example, noted meetings with patients to be a particularly sensitive context for being interrupted (Solvoll and Scholl, 2008). Concerns have also been raised about interruptions from wireless nurse calling systems impacting the nurse–patient relationship (Kristiansen, 2011).

2.2. Interruptions from mobile communication in hospitals

Interruptions in the context of healthcare work have been the focus of various studies over the past few years (Grundgeiger and Sanderson, 2009) with the healthcare environment being described as interrupt driven (Coiera and Tombs, 1998). Unlike the focus of this study, to a large extent the existing studies have not focused specifically on interruptions from mobile communication.

There are a few notable studies that have addressed interruptions from mobile communication in hospitals however. Interruptions from paging systems and wireless phones and calling systems have been noted to be a problem in some studies (Brixey et al., 2008; Scholl et al., 2007; Solvoll and Scholl, 2008; Kristiansen, 2011). The available studies have also identified a number of salient issues related to the nature of interruptions. Technical features of systems for example play a role in the nature and severity of interruptions. As noted in the Section 1 the increased ease of contact with phones in comparison to pagers may cause interruptions to be more problematic. Features of pagers such as the ease of interaction from a coat pocket also can affect how easy it is to deal with interruptions (Scholl et al., 2007). Lack of voice mail services on phones have also been noted to make interruptions more difficult to handle since people may feel more pressure to answer each call (Brixey et al., 2008). Features of artifacts in the surrounding environment can also have an effect. Support for mediated social-awareness through a Media Space connecting the Operating Rooms (ORs) at a surgical department with strategic locations in the ward has been noted to reduce interruptions (Bardram and Hansen, 2010). In this case the social presence provided by the system was useful for identifying if it was an appropriate time or not to contact someone.

2.3. Interruptions in mobile and pervasive computing

Outside of the healthcare setting there also are some relevant perspectives from mobile and pervasive computing worth noting. Cell phones have become a pervasive device that is utilized in almost every area of peoples' lives, including at work. They are also projected to become the primary personal computing devices (John, 2006), and their usage both in and out of the workplace is expected to increase in the future. This trend is reflected in hospitals as the health staff have adopted the usage of personal cell phones in many situations (Ramesh et al., 2008; Soto et al., 2006). In addition to workplace related mobile technology, another issue that should thus be considered related to interruptions is what impact personal cell phone usage have on the issue.

There are many unanswered questions related to the usage of cell phones during hospital work however and studies that report on any social effects of their use are needed. The current literature in pervasive and ubiquitous computing also highlights a need for studies more generally on this issue.

It has been noted that most research in pervasive and ubiquitous computing for example has been "concerned with establishing new infrastructures and with building new technical gadgets utilizing these infrastructures. Few empirical studies [however] explore state-of-the art technology experiences." (Sørensen and Gibson, 2008, p. 15). This presents a challenge with understanding