Context Sensitive Health Informatics: Human and Sociotechnical Approaches M.-C. Beuscart-Zéphir et al. (Eds.) © 2013 The authors. This article is published online with Open Access by IOS Press and distributed under the terms of the Creative Commons Attribution Non-Commercial License. doi:10.3233/978-1-61499-293-6-119

Extended Communication Possibilities for Nurses: Taking Context Into Consideration

Joakim KLEMETS^{a,b,1} and Lill KRISTIANSEN^{a,b}

^aNorwegian University of Science and Technology, Department of Telematics, Trondheim, Norway ^bNorwegian Research Centre for Electronic Patient Records, Trondheim, Norway

Abstract. Due to the versatile nature of nurses' work, whether contact requests can be initiated or received depends on the situation the nurses find themselves in. Through a qualitative study influenced by the participatory design methodology, we uncover issues with a communication system at a hospital when nurses are situated in different contexts. Based on the findings, we suggest a new system design where nurses can initiate and receive contact requests on a heterogeneous set of devices. Further, we argue that the new system should allow communication of context information to aid nurses to assert whether to engage in a communication request or not.

Keywords. Communication, Nursing informatics, Interruptions.

Introduction

An important aspect that often has been overlooked within the field of health informatics is clinical communication. A major portion of information retrievals in the health care environment is made through communication with colleagues, rather than through querying information systems or reading documents. Further, people within health care seem to favor discussion in order to receive information and support for decisions [1].

There is also evidence of morbidity and mortality being a result of clinical communication failures [1]. Further, it has been shown that current communication practices in hospitals are ineffective and cause an interrupt driven environment [2, 3].

As health care workers are highly mobile [4], hospitals have provided them wireless communication devices, such as pagers and mobile phones in an attempt to support that mobility. Although this enables high availability, it also leaves the users more exposed to harmful interruptions [2, 5].

Our study investigates a communication system deployed at a Norwegian university hospital. Previous research reports that this type of system causes harmful interruptions and does not conform well to working practices [5]. The aim of our research has therefore been to further identify challenges and to find new design solutions. Based on our findings presented in Section 3, we propose in Section 4, a system that incorporates a heterogeneous set of devices with the intention of tackling issues of initiating and receiving contact requests within troublesome contexts.

¹ Corresponding Author: Joakim KLEMETS. Email: joakim@item.ntnu.no

1. Previous Work

Grandhi and Jones discuss interruption management practices in [6]. Through a literature review, they divide interruption management research into two paradigms; the interruption impact reduction paradigm and the interruption evaluation paradigm. Recent interruption research has mostly focused on interruption impact reduction through the use of prevention, dissuasion, notification modification, or context-aware software agents [6]. However, Grandhi and Jones argue that focus should instead be directed towards the interruption value evaluation paradigm. This paradigm acknowledges that not all interruptions are unwanted, but that every interruption should be evaluated by the interruptions. While research in the interruption impact reduction paradigm considers the cognitive and social context of the interruptee, the interruption evaluation paradigm also includes the relational context [6].

The research presented in [7] argues that by showing context information, such as location, status, and activity, about colleagues in the wireless phone's address book, the caller would not choose to interrupt in an inappropriate situation. However, the research presented in [8], which also uses an interruption dissuasion approach, indicates that users do not use the provided context information to learn the availability of a person, but rather whether the person is present or not. Hence, the authors conclude that providing context information to the interrupter might not reduce inappropriate interruptions.

A study of communication behaviors in hospitals reported in [3], suggests that providing the possibility of screening calls would help the health care workers to make an informed decision about whether to answer the call or not. Brown and Randell provide an example where people use technology to communicate context in [9], where they show that calling twice can indicate that the matter is urgent.

2. Method

In the system under scrutiny, health care workers have been equipped with a wireless phone, on which ordinary phone calls as well as nurse calls are delivered. The system allows patients to call for the assistance of a nurse by pressing a button located close to the patient bed. The nurse call, which is a signal carrying the patient room number from where the nurse call was issued, is then delivered to the responsible nurse on her wireless phone. The signal is also displayed on a public display in the nurse station, as well as on displays inside patient rooms where a nurse has marked her presence. A more detailed description of a similar system can be found in [5].

Workshops that were based on knowledge gained from previous observations, in line with [10], were held at the hospital. Each workshop was divided into two parts. In the first part the current practice around the use of the nurse call system and the wireless phones were in focus. In the second part both paper and real prototypes were introduced² as triggers for discussions and analysis [10]. The idea was to enable nurses to reflect on alternative design solutions that could more efficiently assist their work [11]. We also introduced the concept of nurse messages, a type of asynchronous nurse

² In two of the workshops we introduced only paper prototypes, while the two others included both paper and real prototypes.

121

call, where patients are able to send a message with information about their needs to the nurse. The nurse message functionality was implemented on the real prototypes. A participatory design approach to the workshops was adopted to enable co-analysis and mutual learning with the users of the system [10, 12].

Both our observation findings and previous research [5] suggests that the current system does not sufficiently acknowledge that nurses move around a lot and are often situated in different contexts [4]. For nurses to initiate or receive contact requests using a wireless phone; this was shown to be troublesome in certain contexts. We therefore designed a number of scenarios [13] for the workshops where these problematic situations occur. For example, using role play [14], the participating nurses were instructed to change a wound dressing or discuss a serious matter with an insecure patient. While carrying out the task, a contact request in form of a nurse call, phone call or nurse message was issued to the performing nurse. Discussions then arose on the effects of the incoming request and how the situation could best be handled.

To ensure that important details were not missed and to enable later interaction analysis, the workshops were recorded using video [15]. We held four workshops that lasted three hours each, with a total twenty-one ordinary and student nurses from different hospital departments. The scenarios and guiding questions were more or less the same in all workshops with some variations as a part of a creative process.

3. Results

3.1. Initiating and Responding to Contact Requests

In an earlier system, nurses had the option to call for assistance of another nurse by pressing a dedicated button mounted inside the patient room. In the existing system nurses were restricted to use the wireless phones for assistance calls. However, in an isolation room, it is not appropriate to pick up the phone due to the infection risk. Neither is the practice of opening the door and asking someone in the hallway for help. This meant that if a nurse had gone through the procedure of putting on a sterile dress, which takes a considerable amount of time, asking for help would mean that this procedure had to be repeated. A nurse mentions during the workshop: *"The assistance call button was very handy (.), you could use the button even when dressed in a sterile gown (.), then one could receive assistance without having to change again"*. In the discussion a nurse stated that the threshold of leaving a patient is often high, so being able to call for help without having to do so would be beneficial.

The patient terminal, which had been covered with a blank paper sheet, was also used in the workshops. Nurses proposed that the terminal could be used for responding to or initiating contact requests (Figure 1a). Due to the small display, but also the issue of isolation rooms, nurses felt that it would be easier to respond to, for example, nurse messages, if they could use a bigger screen. They also expressed a wish to be able to contact a doctor or the laboratory through the terminal.

As the patients also use the terminal, nurses agreed that there needs to be some login mechanism to access the nurse functionalities. The nurses suggested that it should be possible to log on to the terminal using a personal device worn on the chest (Figure 1b).



Figure 1. To the left (a), a nurse describes how the terminal could be used. To the right (b), another nurse illustrates how the personal device could be used for authentication.

3.2. Receiving Contact Requests

Nurses report that they usually answer phone calls received while in a patient room. A nurse reveals: "If I was expecting a call I would have answered", indicating that who is calling influences whether the call is answered or not. A nurse also said that she would at least want to know who is calling, but that it might not always be necessary to take the call at that time. Another nurse describes a situation where the phone is taken out of the pocket in advance in order to see who is calling: "…when we insert CVC^3 then we dress in a sterile gown (.), then I put away the phone as I know that it can ring (.), so I never have it in my pocket (.), then I see who is calling and then I assess whether to take it or not". Similarly, a nurse responds when asked how a phone call would be handled: "…if it is a phone call then you have to see if it is something very important (.), if it is someone that you are expecting and you know that if you don't answer you have to sit two hours trying to get hold of the person afterwards".

The nurses indicate that it also depends on the situation whether a phone call is answered or not. A nurse tells: "A phone call is not prioritized over a serious ill patient (.), but that's rarely the situation (.), often you are able to take the call if you excuse yourself to the patient". Similarly, while in an isolation room, a nurse tells the following: "If I'm in the middle of changing a wound dressing I won't answer the phone (.), but if I'm just talking to the patient then I would go out".

When asked what the nurse would do when the phone was ringing while in an isolation room the answer was: "I would have responded to the call (...), I would have told the patient that I need to answer the phone, but that I'll be right back (.), and I would then have gone to the gowning room, taken of my gloves, washed my hands, and picked up the phone". The nurse continues: "... the procedure of answering the call would have taken some time, but that is how you have to do it in isolation rooms".

For the workshop we created a paper prototype of a simple personal communication device that could be attached onto the chest (Figure 2b). While playing the scenarios, the participants used the paper prototype to illustrate how this device could be useful in their daily work when receiving contact requests. The nurses explained that this device would enable them to view messages or information about a contact request without having to pick up the phone out of the pocket. A nurse describes: *"You would be able to see the message without having to take off the sterile*

³ Central Venous Catheter (CVC).

gown". Another nurse explains that a short beep would be enough to become aware of a contact request and less disruptive than the current phone's ringtone. The nurses also said that being able to just throw a glance at the device (Figure 2a) would be less disturbing for the patient. Further, nurses suggested that beyond just a phone or room number, a name and some information about the matter could be displayed on the device.



Figure 2. Nurse throwing a glance at the device on the chest (a). Paper prototype (b).

4. Discussion

Our findings reveal that it can be troublesome in some contexts for nurses to initiate, respond to, or receive contact requests using the wireless phones. Isolation rooms are one example of such a problematic context, where due to the infection risk, it is not appropriate to pick up a phone. The results show that the situation the nurses find themselves in plays a role when nurses decide whether to respond to a contact request. Also who is calling and what the call is about (relational context) [6] has a significant influence on the decision. It could therefore be favorable to provide call screen information to nurses in an easily accessible manner [3, 6]. In addition, as the results hint at, callers could have the possibility of providing further context information about the call in accordance with [9].

The findings support the proposal in [16]. A system that allows health care workers to utilize a set of different, both fixed and mobile, dynamically interconnected devices to initiate, respond to, or becoming aware of contact requests. Hence, the introduced prototypes became artifacts-that-matter [10]. Further, such a system would allow communication of context cues and notification modification based on status information [6]. Next follows a brief discussion on a system proposal.

A simple personal communication device: While some nurses suggested that contact requests could be displayed both on the patient terminal and on the wallmounted display in the patient room, others pointed out the integrity issues that follow. Therefore nurses suggested that using a personal device would allow the message to be shown only to the relevant nurse. Realizing the paper prototype from the workshop would allow health care workers to receive call screening information in a discrete manner, without having to compromise integrity. The device could also be used for seamless authentication by minimizing the interventions needed by the user to authenticate themselves [17].

Initiate contact requests through the patient terminal: As the results indicate, it is not always possible to pick up the phone and issue a contact request. We therefore

suggest, in line with the nurses' idea, to use the patient terminal for initiating or responding to requests. This would allow nurses to call for assistance, a doctor, or the laboratory also from an isolation room. Another option to initiate contact requests within isolation rooms could be to utilize voice recognition technology. However, this approach was not discussed during the workshops, but mentioned by a colleague afterwards.

Dynamic Device Interconnectivity: Received contact requests on a personal communication device could be responded to using the patient terminal. Similarly, by setting their status using the personal communication device, other devices would modify any notification accordingly.

Our findings illustrate nurses' difficulties of initiating or receiving contact requests when situated in different contexts. These issues should be considered when building communication systems for nurses that involve mobile devices. Design suggestions have also been discussed, but these still need to be properly evaluated.

Acknowledgements

The authors would like to thank Tor Erik Evjemo for valuable discussions and comments.

References

- [1] E. Coiera, When conversation is better than computation, *Journal of the American Medical Informatics* Association 7 (2000), 277-286.
- [2] J. Scholl, P. Hasvold, E. Henriksen, and G. Ellingsen, Managing communication availability and interruptions: a study of mobile communication in an oncology department, in: *Proceedings of the 5th international conference on Pervasive computing*, 2007.
- [3] E. Coiera and V. Tombs, Communication behaviours in a hospital setting: an observational study, *BMJ* 316 (1998), 673-676.
- [4] J.E. Bardram and C. Bossen, Mobility Work: The Spatial Dimension of Collaboration at a Hospital, Computer Supported Cooperative Work (CSCW) 14 (2005), 131-160.
- [5] L. Kristiansen, Nurse calls via personal wireless devices; some challenges and possible design solutions, in: CBMS '11 Proceedings of the 2011 24th International Symposium on Computer-Based Medical Systems, IEEE Computer society Washington, DC, USA, 2011.
- [6] S. Grandhi and Q. Jones, Technology-mediated interruption management, International Journal of Human-Computer Studies 68 (2010), 288-306.
- [7] J.E. Bardram and T.R. Hansen, The AWARE architecture: supporting context-mediated social awareness in mobile cooperation, in: *Proceedings of the 2004 ACM conference on Computer supported cooperative work*, 2004.
- [8] J. Fogarty, J. Lai, and J. Christensen, Presence versus availability: the design and evaluation of a contextaware communication client, *International Journal of Human-Computer Studies* 61 (2004), 299-317.
- [9] B. Brown and R. Randell, Building a Context Sensitive Telephone: Some Hopes and Pitfalls for Context Sensitive Computing, *Computer Supported Cooperative Work (CSCW)* 13 (2004), 329-345.
- [10] P. Mogensen and R.H. Trigg, Using Artifacts as Triggers for Participatory Analysis, in: Proceedings of the Participatory Design Conference, 1992.
- [11] K. Bødker, F. Kensing, and J. Simonsen, Participatory IT Design: Designing for Business and Workplace Realities, Mit Press, 2004.
- [12] T. Bratteteig, K. Bødker, Y. Dittrich, P.H. Mogensen, and J. Simonsen, Methods: Organizing Principles and General Guidelines for Participatory Design Projects, in: *Routledge Handbook of Participatory Design*, J. Simonsen and T. Robertson, eds., Taylor & Francis, 2012, pp. 117-144.
- [13] J. Bardram, Scenario-based design of cooperative systems, Group Decision and Negotiation 9 (2000), 237-250.

- [14] D. Svanaes and G. Seland, Putting the users center stage: role playing and low-fi prototyping enable end users to design mobile systems, in: CHI '04 Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, ACM New York, USA, 2004, pp479-486.
- [15] A.M. Hostgaard and P. Bertelsen, Using video observation to gain insight into complex clinical work practices, *Studies in Health Technology and Informatics* 180 (2012), 378-382.
- [16] J. Klemets and L. Kristiansen, A Pervasive System for Communicating Urgency Cues to Health Care Workers, in J Mantas et al. (Eds.) 24th International Conference of the European Federation for Medical Informatics, Quality of Life through Quality of Information, MIE 2012 /CD / Short communications, http://goo.gl/r0l6z, 2012.
- [17] J. Bardram, The trouble with login: on usability and computer security in ubiquitous computing, Personal and Ubiquitous Computing 9 (2005), 357-367.