User Participation in Pilot Implementation: Porters and Nurses Coordinating Patient Transports

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ABSTRACT
Pilot implementations provide users with real-work experiences of how a system will affect their daily work before the design of the system is finalized. On the basis of a pilot implementation of a system for coordinating the transport of patients by hospital porters, we investigate pilot implementation as a method for participatory design. We find that to foster participation and learning about user needs a pilot implementation must create a space for reflecting on use, in addition to the space for using the pilot system. The space for reflection must also exist during the activities preparing the use of the pilot system because the porters and nurses learned about their needs throughout the pilot implementation, not just during use. Finally, we discuss how the scope and duration of a pilot implementation influence the conditions for participation.

Author Keywords
Pilot implementation, learning, real-use experience

ACM Classification Keywords
H.5.3 [Information interfaces and presentation] Group and Organization Interfaces – Evaluation/methodology.

INTRODUCTION

Users who participate in information technology (IT) projects are expected to specify what they need and wish from the new system before they have experienced how it will transform their work. Multiple participatory design (PD) methods support users in this process, yet it remains challenging because the transformed work situation may also transform user needs (Carroll et al., 1991), because PD methods tend to focus more on envisioning than on specification in detail (Sanders et al., 2010), and because IT projects do not become salient to users until project outputs affect their daily work (Wagner and Piccoli, 2007). Pilot implementations of new systems while their design is still malleable aim to circumvent these challenges and may thus improve the conditions for user participation.

Hertzum et al. (2012, p.314) define pilot implementation as "a field test of a properly engineered, yet unfinished system, in its intended environment, using real data, and aiming—through real-use experience—to explore the value of the system, improve or assess its design, and reduce implementation risk". This definition positions pilot implementations in between the use of low-fidelity prototypes and the release of system versions. In contrast to low-fidelity prototypes, pilot systems are functional, implemented in the field, and sufficiently robust to be used for real work. In contrast to system versions, pilot systems are not yet finalized, lack some functionality, and must be expected to malfunction occasionally. Beynon-Davies et al. (1999) propose a taxonomy of prototyping activities, where they characterize the activities in terms *what*, *when*, and *how* to prototype. Drawing on this taxonomy, pilot implementations are field tests of high-fidelity prototypes, performed during the middle or late stages of design, whereafter the incremental prototype will become or evolve into the delivered system.

This study is about a pilot implementation of a system for supporting the ordering and coordination of patient transports by hospital porters. Porters transport patients, and equipment, from one clinical department to another for, among other things, diagnostic tests, scheduled surgery, and treatment of diseases pertaining to another medical specialty. Patient transports are ordered by nurses, who along with the porters are the two user groups targeted by the system, which has progressed sufficiently to be pilot implemented but is not yet finalized. The pilot system is part of a larger information infrastructure for supporting communication and coordination in the clinical departments as well as across the departments. While the infrastructure is evolving and regularly gets additional features, it also constitutes an installed base (Hanseth and Lyytinen, 2004) that constrains the design of the system for the porters. The infrastructure has mainly been designed with the physicians and nurses in mind. In a hospital context, porters are a more peripheral and less powerful user group.

The pilot implementation of the system for the porters involved patient transports from the emergency department (ED) for a period of three weeks. For the porters the pilot system ran on a smartphone because they are constantly on the move. In contrast, the nurses' access to the system was integrated in the electronic whiteboards that constitute the main interface of the information infrastructure. On the basis of observation, interviews, and direct involvement in conducting the pilot implementation, we analyze:

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First, *the challenges and prospects of using pilot implementation as a means of learning about user needs*. We consider this analysis important because obtaining feedback from real-world use of (pilot versions of) systems is increasingly recognized as a central PD challenge, especially in large-scale projects (Balka, 2013, Hartswood et al., 2008, Simonsen and Hertzum, 2008). Pilot implementation appears a promising method for obtaining such feedback, yet little work has analyzed the challenges involved in conducting pilot implementations (Hertzum et al., 2012).

Second, *the conditions for obtaining user participation in a pilot implementation*. While pilot implementations engage users at the time their daily work becomes affected by a new system, it should be considered whether they merely become users of the pilot system or also participants in the process of its design. In the former case pilot implementations fail as a PD method. We aimed to involve the porters and nurses in an ongoing dialog about their reflections on their use of the pilot system, and report our experiences.

RELATED WORK

Many studies of user participation in design have focused on the early stages of information system projects before the system is ready for (pilot) implementation or have explored the use of the developed system in an experimental setting away from the users' real work (e.g., Blomberg et al., 1996, Bødker and Grønbæk, 1991, Müller, 1991, Pilemalm and Timpka, 2008). In the following, we focus on studies of how the use of a system for real work may influence its design.

Participatory Design in the Wild

Ehn (2008, p.95) notes that "envisioned use is hardly the same as actual use, no matter how much participation there has been in the design process". This statement acknowledges a central limitation in how use is represented during design. It also emphasizes that the boundary between design and use is permeable in that use, in some form, informs design just as design, in some form, continues during use.

While considerable work on user participation investigates how design continues during use, it mostly maintains a distinction between design at project time and design at use time. For example, Henderson and Kyng (1991) analyzed the possibilities for end-users to shape their technological environments by tailoring their systems and evolving their ways of working. A conclusion from that study was that for tailoring to succeed the initial design of the system must include facilities that support tailoring. Trigg and Bødker (1994) investigated how templates for standard forms started to emerge at the studied labor inspection agency after the introduction of a text processing system with comprehensive template facilities. These templates evolved from tools for individual use to elaborate templates shared by all inspectors and important to how they conducted their work. The study did, however, not include feedback to the designers of the text processing system about desired revisions of the template facilities. Thus, design at project time remained separate from design at use time, temporally as well as in terms of who did the designing.

To make systems increasingly tailorable to local needs, the facilities for tailoring, or configuring, systems have become increasingly complex. This shift from systems that can only be changed through revisions of the code toward an "era of configurability" has introduced a need for intermediaries skilled in configuring systems to match local practices (Balka et al., 2005). The presence of such intermediaries may bring design decisions closer to users or it may create another layer of separation between users and design processes, thereby introducing additional challenges to user participation. To achieve the former, Dittrich et al. (2002) formulated the need for intermediaries as a need for shop floor IT management, that is organizational support for locally and continuously adapting information systems to user needs. Fleron et al. (2012) emphasized the importance of a similar resource in their study of the organizational implementation of a configurable electronic whiteboard. The scope and complexity of the facilities for configuring the whiteboard meant that it remained unclear to most of the users what they could change locally by means of configuration and what required revisions of the code. To these users the distinction between design at project time and at use time had blurred, yet the study did not explore this issue.

PD approaches that aim to integrate design at project time and at use time include co-realization, continuing design, and cooperative experimental system development (CESD). Co-realization (Hartswood et al., 2008) insists on maintaining a long-term engagement between users and IT professionals by stationing IT professionals at the users' workplace after a system has been introduced, thereby fostering spontaneous shifts of attention between design and use. Continuing design (Karasti et al., 2010) targets the collaborative development of infrastructures, which exist for decades rather than years and require a similarly long-term perspective on design to evolve with changes in needs and circumstances. CESD (Grønbæk et al., 1997) involves "an incremental organizational implementation of new systems which can give feedback to analysis and design". The aim of such incremental implementation resembles that of pilot implementation. In both cases, design resources are available when a new system has become salient to users and they are motivated, and able, to express their views (Wagner and Piccoli, 2007).

Pilot Implementation

Pilot implementations consist of five elements (Table 1) with the overarching aim to learn and feed this learning back into the project that works to finalize the system (Hertzum et al., 2012). It is the focus on learning that makes pilot implementation a potentially important PD method. It is however neither apparent how a sustained focus on learning is ensured, nor how to collect information about what is learned. Hertzum et al. (2012) point out that because the pilot system is used for real work, the learning objective may become secondary to concerns about getting the daily work done. A similar contestation of the learning objective has, to our

Element	Description
Planning and design	The pilot implementation is defined. This includes determining where and when it will take place, what facilities the pilot system will include, and how lessons learned during the pilot implementation will be collected.
Technical configuration	The pilot system is configured to fit the pilot site. This involves that data are migrated to the system and that interfaces to other systems at the pilot site are developed or simulations set up.
Organizational adaptation	The pilot site revises work procedures to align with the pilot system. This also involves training users in the system and the revised procedures and, possibly, assigning extra staff to maintain safeguards against errors and breakdowns.
Use	The system is applied at the pilot site and used for real work. This involves striking a balance between making the system a part of normal procedures and maintaining a focus on the system as an object under evaluation.
Learning	The four other elements spawn opportunities for learning about the system and its use when it is employed over a period of time in a real use environment. Learning is the overarching objective of pilot implementation.

Table 1. The five elements of pilot implementation according to Hertzum et al. (2012).

knowledge, not been raised in relation to other PD methods, such as future workshops (Kensing and Madsen, 1992) and cooperative prototyping (Bowers and Pycock, 1994).

With respect to collecting information about what is learned and feeding it back into the development process, Hertzum and Simonsen (2011) incorporate pilot implementations in a process of iteratively specifying, realizing, and assessing the usage effects desired from a system. During pilot implementations they collect learning data by measurements of the planned effects and by observation and interviews to discover emergent effects. Several studies show that learning need not be explicitly identified as learning by the users but may instead be implicit in their changes of their work practices (Orlikowski, 1996, Pipek and Wulf, 1999). In this relation, shop floor IT management (Dittrich et al., 2002) is an example of the organizational resources required to follow up on learning that occurs during the (pilot) use of systems.

An additional complication of conducting pilot implementations relates to their scope. Hertzum et al. (2012) describe a pilot implementation in which one hospital department piloted a system intended for, among other things, communication between departments. Limiting the scope to one department reduced costs and minimized the disturbance to hospital work, but it also necessitated considerable behind-the-scenes work to simulate that the system supported communication with other departments. It appears that any system with infrastructural properties will make it difficult to define an appropriate scope for a pilot implementation. At the same time, it may well be the infrastructural properties that warrant pilot implementation because they require the realism of experimenting in the field rather than the laboratory and because they are difficult to get right (Hanseth and Lundberg, 2001).

Studies of Hospital Porters

Patient transports are recognized as an inevitable part of hospital procedures and one that involves high risks of morbidity and mortality to the critically ill patient (Dunn et al., 2007). Somewhat detached from these risks, studies of the work of hospital porters tend to view it as a service aimed at transporting patients with minimal delay. Odegaard et al. (2007a, 2007b) summarize the fundamental difficulty in achieving this aim: Whenever the demand for patient transports exceeds the capacity of the porters, delays will occur. A delay has carry-over effects because the delayed transport consumes capacity that would otherwise have been available for later transports. In contrast, excess capacity does not carry over; any excess capacity is lost.

Delays can to some extent be avoided through advance planning of the porter capacity needed to match hourly demands. However, communication and coordination among ordering departments, porter dispatchers, and porters is essential to minimizing delays. Odegaard et al. (2007a) found that communication was problematic between departments and dispatchers as well as between dispatchers and porters. Departments often provided insufficient information when they ordered a transport, resulting in porters being dispatched with the wrong equipment. The communication between dispatchers and porters was by one-way pagers and therefore limited. Porters sometimes needed to call back to clarify the details of a transport. Xiao et al. (2010) studied how a physical patient transport card supported the coordination of patient transports. They particularly noted how the porters had extended the formal coordination function of the transport cards with additional informal coordination functions that expedited transports and made it possible for the porters to handle deviations from their schedule more competently.

SETTING THE SCENE

In this paper, we report from a study conducted at a medium-sized hospital in Region Zealand, one of five healthcare regions in Denmark. In December 2012, electronic whiteboards were mounted on central locations in all wards of the hospital to provide at-a-glance access to an emerging information infrastructure. Prior to that,

the ED had been using the electronic whiteboards for four years, and the emergency clinicians' enthusiasm about the whiteboards was essential to the decision to extend the use of the whiteboards to the entire hospital. The aim of the infrastructure was to support communication and coordination, especially in order to ease and safeguard the transfer of patients from one department to another. The whiteboards displayed selected information about the patients admitted to the departments, including room, patient name, age, symptoms, responsible nurse, responsible physician, notifications of test results, and, if decided, the next department on the patient's trajectory. Initially, the porters were not users of the infrastructure. Patient transports were instead ordered over the phone.

During dayshifts the majority of porters worked in teams, where each team was responsible for patient transports pertaining to a specific department or part of the hospital. The porters also carried a dedicated phone, pertaining to that specific team, and at the end of the shift, this phone was handed over to the new porter responsible for the same department. To order a patient transport, nurses made a phone call to one of the porters in their porter team. The porters would then orally affirm that they were going to come right away or – if they were busy – in, say, ten minutes. Upon arrival at the nurses' station, the porters would receive further information about the transport. This meant that the porters in some cases had to leave the ward again to fetch necessary equipment (e.g., wheelchair or oxygen). During evenings, nights, and weekends, there were fewer patient transports and the porters' work was therefore coordinated by a central dispatcher. In these shifts nurses from all departments would call the dispatcher, who then assigned porters to transports. The organization of the porters into teams responsible for specific departments was only necessary during the dayshift, which was the busier shift.

In the beginning of 2013, the hospital decided to extend the information infrastructure with support for the coordination of patient transports. This extension was part of an effort to develop a version of the electronic whiteboard for mobile use. The porters were chosen because they were on the move for the majority of their shifts and thus benefitted little from the wall-mounted whiteboards. It was also decided that the process with the porters should include a pilot implementation, during which some of the porters would contribute to the design of a pilot version of the system and use it for real patient transports. The authors were invited to participate in this process and, specifically, to take part in preparing and conducting the pilot implementation.

METHOD

Our role in the pilot implementation was twofold. First, we facilitated the activities through which the porters and nurses were involved in the technical configuration, performed to prepare the pilot system for use, and in the organizational adaptation, performed to prepare the involved departments and people for taking part in the pilot implementation. The means for fulfilling this part of our role was workshops for determining the functionality of the system and for training porters and nurses in using the system and the associated work practices. On the basis of input from the workshops, the pilot system was configured by the vendor and by a local configurator. Second, we were responsible for eliciting, collecting, and documenting the learning that resulted from the pilot implementation and for communicating this learning to other actors, during as well as after the pilot implementation. All our activities in the pilot implementation had this part of our role as their primary or supplementary goal. Specifically, the observations conducted during the three-week period of pilot use included many informal conversations with porters and nurses about their experiences from using the system. We had more in-depth discussions with porters and nurses in interviews near the end of the three-week period and in a group interview after the end of the pilot implementation. These interviews were informed by the interviewees' experiences with the system and by our observations of their use of it. Table 2 lists our empirical activities, including initial observations to learn about the work of the porters and nurses. All empirical activities were conducted by the first author.

The study was approved by the healthcare region. The porters and nurses participating in the study were informed about its purpose and gave oral consent to observations and interviews. It may be noted that the final activity, the meeting reporting back to the project team, resulted in a decision to develop the system further and start planning a second pilot implementation.

Mar-Aug 2013	*Planning and design* • Shadowing of porters (18h) • Observation of nurses (5h) & 2 interviews
Sept-Oct 2013	*Technical configuration and org. adaptation* • Configuration workshop with 3 porters • Org-adaptation workshop with 2 porters • Workshop with 5 nurses
Nov 2013	*Three-week period of use* • Observation of first week of use (40h) • 5 interviews at the end of the third week
Dec-Jan 2013	*Follow-up activities* • Group interview with 5 porters • Meeting with project team about results

Table 2. Timeline of empirical activities.

Observations were documented in real time in detailed notes. The workshops and group interview were audio recorded, and detailed minutes were produced on the basis of these recordings. The two interviews with nurses were audio recorded and transcribed, and the remaining interviews were documented in detailed notes.

All notes, transcripts, and minutes were initially analyzed using an open coding approach, where the coding categories were taken directly from the data (Hsieh and Shannon, 2005). Incidents and quotes were grouped together and written into elaborate memos. These memos were subjected to a more focused analysis, directed by the two research foci presented in the introduction. The analysis resulted in four main topics, around which the next section is structured.

RESULTS

In the following we present the main topics resulting from our analysis: finding an appropriate scope, maintaining a sustained focus on learning, facilitating learning and support, and conditions for user participation.

Finding an appropriate scope

One of the main tasks in planning and designing a pilot implementation is to determine an appropriate scope. In the following, we will describe the decisions about what to include in the pilot system, where the pilot implementation should take place, and who should participate.

One of the challenges in deciding a scope was related to what to include in the pilot system. The porters wanted the system to support them in receiving information about the patient transports before showing up at the ward. This would enable them to plan the various transports better. Thus, the local configurator (a nurse trained to configure the whiteboard system based on requests from the various wards in the hospital) suggested that when the nurses ordered a transport in the system, a notification along with relevant information about the transport should be sent via text messages (SMS) to the relevant porters' smartphone. The porters agreed to this suggestion. However, whereas this solution honored the porters' requests about receiving information about transports before showing up in the ward, it presupposed that the coordination of patient transports was only a matter of the nurses sending information to the porters. Even though the porters had stated the importance of being able to give a reply back to the nurses, it was decided that the pilot system should not include this functionality, but that it could be added later.

In order to make the process of ordering the transport easy for the nurses, it was decided that they should use a template, which they could fill out using predefined dropdown menus (see figure 1). The template consisted of two dropdown menus and one text field. The first menu listed the various services performed by the porters and the second the equipment required to perform the transport. When a nurse chose an item in the dropdown menu, a corresponding text appeared in the text field. This text could be edited manually and, then, sent to the porters. During the configuration workshop, the porters defined the contents of the dropdown menus and the wording of the text in the text field.

Deciding where the pilot implementation should take place and who should participate was complicated by the mobility of the porters' work. Because the porters during dayshifts worked in teams responsible for a specific department, they proposed to include only one of these teams in the pilot implementation. When the pilot system was introduced, it however became apparent that the scope was too narrow. Therefore, the number of participating porters was increased, with the consequence that these additional porters were not as well prepared to use the pilot system. The porters also suggested the ED as the site for the pilot implementation. An important reason for choosing the ED was the constant flow of patients from the ED to other departments. In order to limit the amount of nurses that needed to be trained in the system, the scope was further limited to include only one of the wards in the ED, even though this meant that the porters had to respond to two workflows because the nurses in the two other wards of the ED still called the porters over the phone to order a transport.

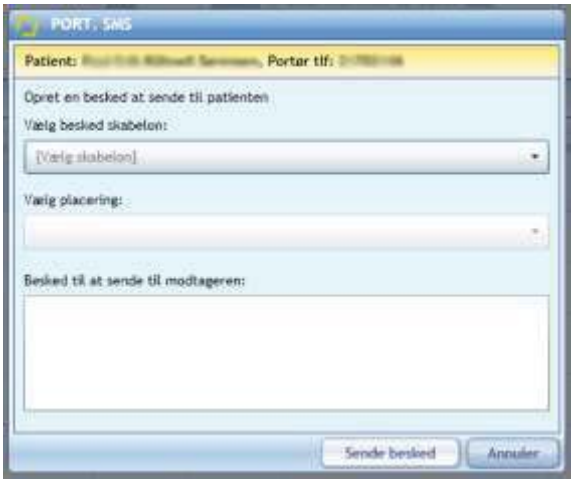

Figure 1. The template with dropdown menus and text field.

The number of participating nurses was difficult to limit because patient transports were ordered by the nurse responsible for the patient, not by a few selected nurses. Therefore, all nurses working dayshifts during the three weeks of pilot use were included. The head nurse stated that a user manual would suffice as preparation/training for the nurses. This decision avoided the difficulties of organizing training sessions for the nurses, most of whom alternated between day, evening, and night shifts. All nurses received an email with a user manual for the pilot system and a description of the pilot implementation.

Sustained focus on learning

The activities leading up to the period of pilot use facilitated learning about the users' work practices in that the porters and the nurses would talk about their existing work practices and how they imagined the system could help them perform their tasks. During these activities the users were also able to analyze their work, for example when the porters categorized their information needs to make them usable in the template. These activities were important for the facilitator (i.e., the first author), the local configurator, and the vendor in order for them to learn about user needs and prepare the pilot system for implementation. However, these activities were also important for the users in learning about their own work and the work of other users. For instance, during the interviews with the nurses, the facilitator made them aware of the porters' frustration about not receiving information about required equipment before showing up at the nurses' station or in the patient's room. The nurses expressed that they had not been aware of this frustration and one of them stated that she appreciated receiving the information because "…there are things we forget" and that the system could ease the nurses' work by helping them remember to forward this information.

The learning that was gathered from the use of the pilot system in some cases affirmed what had been pointed out during previous activities. This was for example the case for the abovementioned need for receiving information about the patient and required equipment before showing up at the ward. This had been pointed out by the porters during workshops and acknowledged by the nurses during interviews and workshops. During the period of pilot use the porters highly valued receiving the information and the nurses felt that the design of the template (the dropdown menus) aided them in giving relevant information to the porters in advance.

However, once the porters and nurses started using the system, their work practices changed. Thus, they learned something about their needs that the previous activities had not shown. During use the porters stated that whereas it previously could be a challenge for them to keep track of the incoming calls for several transports at a time, they could now receive several text messages in a row without worrying about the information getting lost (see figure 2). The porters had not mentioned the challenge of keeping track of incoming calls during previous activities, but when they experienced the continued access to the information on the smartphone, their previous efforts to keep track became clear to them. A similar learning was gathered from the nurses' use of the system. Whereas the nurses during previous activities had not requested the possibility to preorder porters, this was done during pilot use. One nurse for example ordered a porter in the system soon after the shift had started at 7:00 a m., but manually wrote in the text field: "transfer at 9:30 a.m.". She then stated that she was pleased with this opportunity because she did not have to "call the porter all the time". Whereas the nurses previously had to remember to call for a porter shortly before they needed the patient transport, they could now order the porter as soon as they received a specific time for the transfer and, then, had one less thing to remember.

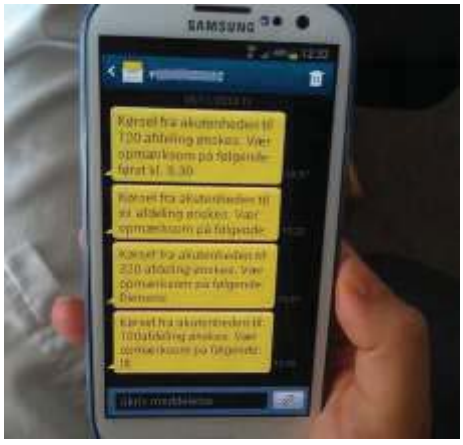

Figure 2. Porter phone with four messages about transports.

In some cases the period of use provided an understanding of issues that were mentioned but not fully understood during the previous activities. Whereas the nurses during interviews had described the coordination of patient transports as an activity where the nurses submitted information to the porters, the porters had stated the importance of being able to reply to the nurses. However, the pilot system (by definition, a not yet finalized system) did not include functionality for the porters to send messages back to the nurses. Thus, during use the porters received information from the nurses without having the possibility to provide feedback. The nurses however reported that they did not receive sufficient feedback from the system about whether the porter had received the message about the transport. One of the nurses stated that she had a desire to call the porters to know whether they had seen her message. The porters also mentioned that the nurses sometimes called them to make sure that they were aware of a pending transport. The porters therefore wanted to be able to acknowledge ordered transports, especially when they were occupied and could not come immediately. This issue was critical to the porters, because they had wanted the system to enable them to plan their transports. While the system enabled them to prepare for the individual transports, it reduced their opportunities to communicate with the nurses about scheduling issues compared to what they were used to from the oral ordering of transports over the phone. The porters stated that they wanted functionality for responding to orders before they were prepared to participate in further pilot implementations. Thus, the period of use highlighted the importance of the two-way communication between nurses and porters.

Facilitating learning and support

During the planning and design of the pilot implementation, it was determined that the facilitator was responsible for facilitating learning throughout the pilot implementation. It was also decided that during the first week of pilot use, the facilitator should be present during dayshifts to document work processes and lessons learned and to forward the users' wishes and difficulties to the local configurator. As it turned out, the facilitator also spent considerable time supporting the users when they needed assistance.

To ensure that the *learning* objective was maintained, the facilitator met with the porters on a regular basis during the first week to talk with them about their experiences and to observe their work. The facilitator documented her observations and the porters' feedback: how the system worked/failed, how it affected their work, which opportunities they saw, and so forth. Before the porters ended their shift, the facilitator had a debriefing meeting with them in front of the whiteboard at the nurses' station, where the porters logged out of the system and talked about their day with the system. Learning about the nurses' use of the pilot system was gathered and documented in much the same way. The facilitator frequently visited the nurses' station to observe them or to ask them about their experiences.

The importance of providing *support* became apparent already the first day of use. The majority of the nurses had not read the manual and therefore did not feel prepared to use the system to order porters. To enable the nurses to use the system, the facilitator improvised a collective demonstration the first morning, where she introduced herself to the nurses that had not yet met her and demonstrated how to use the system to order patient

transports. After the demonstration, the facilitator also encouraged the nurses to call on her assistance, if they needed support and stated that she would be present to follow the process and was interested in their feedback. The demonstration was repeated the following mornings. On the fourth morning however, when the facilitator entered the nurses' station, the nurses were already talking about the pilot implementation and one of the nurses demonstrated the new work procedure for the nurses that had not been working dayshifts the previous days. These improvised activities ensured that most of the nurses could use the system during the three weeks of pilot use and were able to provide feedback about how they wanted the system to support them.

The porters knew the facilitator from the activities leading up to the use of the pilot system. Therefore, the porters frequently sought out the facilitator, when they wanted to voice their opinions and wishes regarding the system. They also frequently called upon the facilitator when they needed support. This is also apparent in observation notes from the first week, where there can be gaps of half or whole hours, because the facilitator was busy providing support. Like for instance a note saying: "Written afterwards – happened between 8:40 and 10:20: Porters 1 and 2 came in almost two hours ago. Porter 2 needed help to get his phone up and running." Support was necessary to ensure that the porters and nurses got experience with the system and to motivate the reporting of wishes and lessons learned. Hence, the provision of support and the facilitation of learning were highly interdependent.

Conditions for user participation

In the activities leading up to the period of pilot use, the porters reflected upon their own work, the work of others, and how they wanted the system to support them in coordinating patient transports. The porters who used the pilot system had been highly involved in discussions about its design. They had participated in deciding the scope of the pilot implementation and were aware of its learning objective. They were also familiar with the facilitator and expressed satisfaction with how they participated in the design: "It is exciting that we are participating in the development. It is the right way to do it."

Once the ED was chosen as the site for the pilot implementation, we performed activities in the ED to find out, how the nurses wanted the system to support the coordination of patient transports. Because only a small number of nurses participated in these activities, most of the nurses who subsequently used the pilot system did not feel that the pilot implementation was 'theirs'. One of the nurses told the facilitator that she had viewed the email informing the nurses about the pilot implementation as information about a pilot implementation that involved the porters.

During the period of pilot use, we noticed a difference in the level of participation between the users who had participated in previous activities and those who had not. The nurses who had not participated in previous activities tended to see themselves as passive 'extras' in a pilot implementation owned by the porters. Conversely, the nurses who had participated in some of the previous activities were more prone to see the pilot implementation as a learning experience. They, for example, called on the facilitator to volunteer feedback about the system or to propose improvements. The porters were equally swift to call on the facilitator and seemed motivated to give feedback about the pilot system and to bring forth new requests. Thus, participation in the previous activities fostered a sense of taking part in the design of the pilot system, as opposed to perceiving one's role as one of merely using the pilot system.

Another condition for obtaining user participation was that the porters and nurses were motivated to use the system and felt that their requests were heard and acted upon. During the period of use, the facilitator instantly forwarded many requests to the local configurator. In most of these cases, the assistance came promptly and the issues were often resolved either the same day or the following day. One of the porters stated that she appreciated the opportunity to participate in a process where "it all happens so fast, the configuration – that you do not have to go back and do the whole thing over again." It was important to the porters and nurses that many of their requests were acted on while they could still remember the rationale for expressing the request.

DISCUSSION

A space for reflection to enhance learning

The activities (workshops and interviews) leading up to the period of pilot use played an important role in the pilot implementation, because they created a space in which the porters and nurses could reflect upon their own work and the work of others and thus learn more about the coordination of patient transports. The nurses in our study were largely unaware of what the porters were actually doing. The porters' work can in this context be seen as an infrastructure that first becomes visible upon breakdown (Star and Ruhleder, 1996). Even though the work with patient transports can involve risks, previous studies tend to view it as a logistic service aimed at transporting patients from A to B. The porters in our study wanted the system to support them in coordinating the patient transports and in receiving relevant information about the patient's need at the time of ordering the transport. This coordination was also emphasized in the study by Xiao et al. (2010). The nurses in our study did however not always recognize the porters' need for up-front information and, instead, waited for the porters to show up in the ward before providing them with information about the patient and necessary equipment. During interviews, the facilitator explained to the nurses what extra steps the porters had to perform, when they showed up in the ward or in the patient room without necessary equipment. When the nurses were made aware of the porters' frustrations they stated that the information provided "good reflections", because they had not recognized this issue before.

In addition to giving nurses and porters an opportunity to learn about the work of each other, we believe that the space for reflection was important, because it prepared

them for interacting with the pilot system in a reflective manner during the period of use. In the workshops and interviews, the porters and nurses took a pause from their work and reflected on their work practices. They were performing reflection-on-action (Schön, 1983), which enabled them to explore, what they had done, why they had done it and not least: what they would like to do. What happened during these activities can be explained by what Schön refers to as becoming aware of one's frame: "When a practitioner becomes aware of these frames, he also becomes aware of the possibility of alternative ways of framing the reality of his practice" (Schön, 1983, p.310). Schön goes on to say that as the practitioners become aware of the variety of frames available, they are more prone to perform reflection-in-action, which is reflection performed while working. In other words, by participating in activities where the users performed reflection-on-action, they became sensitized to perform reflection-in-action during the period of pilot use. This can be one explanation for the difference in the level of participation between the users who had participated in previous activities and those who had not. The porters and nurses who had participated in workshops and interviews seemed to view the pilot system as an object under evaluation, which helped to trigger reflections that they could learn from. The nurses who had not participated in these activities did not seem to interact with the pilot system in the same reflective manner. When observing one of these nurses using the pilot system to order a patient transport, the facilitator wrote in her notes that the nurse appeared confused and nervous. She acted as though *she* was being evaluated – not the pilot system.

Whereas the space for reflection was important because it sensitized the users to perform reflection-in-action, it was also important to maintain because it provided an opportunity for the users and the facilitator to engage in mutual learning. During the period of pilot use, the porters met with the facilitator to talk about their experiences with the system. At these pauses, the porters would again engage in reflection-on-action, where they reflected upon how and to what extent the pilot system was supporting them and what possibilities they saw. These meetings were important in providing the porters and the facilitator with a deeper understanding of the porters' interaction with the pilot system, how they reflected upon and made sense of their experiences and how these could be used to drive further design.

We contend that to ensure that users are not only users of a pilot system but participants in the process of its design, it is important to establish a space for reflection and maintain it throughout the pilot implementation. Such a space provides for reflection-on-action and sensitizes the users to reflect also when they are in action, thereby contributing twice to the objective of learning from the pilot implementation. When the users engaged with the pilot system and it became salient to them, they also gained a deeper understanding of *how* to participate in its design. They became more aware of the potentials and limitations of the system and learned "what is 'easy' to incorporate, and what takes time" (Tyre and Orlikowski, 1994, p.85). This is particularly important, when the users take part in pilot implementations of systems that extend or form part of a larger infrastructure, used by a heterogeneous group of users.

Advantages of pilot-implementation limitations?

In this section we discuss how limitations of pilot implementation (e.g., scope and duration) influence the conditions for user participation. Pilot implementation and approaches like continuing design (Karasti et al., 2010) share the aim of integrating design at project time and at use time, yet they differ in how this aim is pursued. Pilot implementations are limited in scope and duration and conducted before the system is ready for full implementation. Conversely, approaches like co-realization and continuing design are extensions of full implementation that aim for a long-term commitment to design. We acknowledge that continuing design was specifically devised for the development of infrastructures, but our empirical case also has infrastructural elements. Table 3 provides a summary of the comparison.

Pilot implementation	**Continuing design**
Conducted in the wild when system is salient to users	Conducted in the wild when system is salient to users
Scope is limited and difficult to set	Scope is full and thus presents no extra issues
A space for reflection is made available at a time that fits users' motivation	Users may quickly start to prioritize their primary work over design reflections
Conducted before the system has been finalized	Not until system is ready for normal implementation
Extra support and special precautions are affordable because it is temporary	Extra support and special precautions cannot be afforded over long periods
The temporariness provides more of an opportunity to stop or postpone systems	More about influencing how than whether a system will change work
May prepare users to engage in continuing design	

Table 3. Pilot implementation vis-â-vis continuing design.

As discussed above it is difficult to set the scope of a pilot implementation, especially when the system has infrastructural elements. Continuing design avoids these difficulties by maintaining the scope of the full implementation and thus not setting its own scope. The limited duration of a pilot implementation may not allow sufficient time for users to get acquainted with the system and for new work practices to stabilize. However, the limited duration may also have three advantages to user participation:

First, Tyre and Orlikowski (1994) argue that the window of opportunity for experimenting with a new system is brief and that after this window the use of systems tends to congeal. Rather than continued experimentation, users stop adapting the new system and return their attention to their primary work. The brief window of opportunity fits

well with the limited duration of pilot implementation but presents a challenge to continuing design, which aims to maintain a focus on experimentation over an extended period of time. Hartswood et al. (2008) propose to make an IT facilitator responsible for engaging users in continued design activities. However, Hertzum et al. (2012) illustrate that even within the limited duration of a pilot implementation it may be difficult to maintain a focus on experimentation and learning.

Second, pilot implementations are conducted before the system has been finalized, whereas continuing design must await that the system is ready for full implementation. Consequently, pilot implementation provides for earlier participation by users who have real-work experience with the system. This is possible because the limited duration of pilot implementations make extra support and safeguards against error affordable. In our case, the facilitator provided such extra support and the local configurator offered responsiveness to user requests at a level that could only be maintained for a limited period of time. In previous pilot implementations, the brief duration has also made it possible to simulate not yet implemented system functionality by means of behind-the-scenes manual work (Hertzum et al., 2012).

Third, the limited duration of pilot implementations means that it has been decided up front that the use of the pilot system is temporary. We argue that this temporariness supports users in stopping or postponing a system that does not, yet, fit their preferred ways of working. In our case the temporariness supported the porters in maintaining that they were not prepared to go forward with the system until it had been extended with functionality for them to respond when they received an order for a transport. This issue was central to the porters because response functionality was necessary for them to do their work competently and because it, in combination with the new possibilities for keeping track of multiple transports, pointed toward more self-organization in the scheduling of their work. When a system has already been put into ordinary use, like in continuing design, it is a more difficult decision to discontinue its use, even temporarily. We see a risk that in such situations users will more likely be deciding how to use the system than whether to stop using it until it has been improved.

While we see promise in pilot implementation as a PD method, we do not mean to dismiss continuing design. Pilot implementations derive part of their strength from interrupting users' normal practices. According to Tyre and Orlikowski (1994, p. 115) "interruptions can serve an important role by triggering actors to review and revise their procedures or processes". Conversely, continuing design aims at gradually growing systems. This approach suits its extended time perspective but may lack triggering events. This way a pilot implementation may be a valuable precursor to a process of continuing design by sensitizing users to design reflection and stimulating them to engage in continuing design activities after the system has subsequently been put into ordinary use. Also, a series of several pilot implementations, as planned in our case, may come close to a process of continuing design.

CONCLUSIONS

We have investigated the use of pilot implementation as a method to support user participation in design. On the basis of a pilot implementation of a system for coordinating patient transports, we contend with Hertzum et al. (2012) that it is difficult to set an appropriate scope for pilot implementations, especially for systems with infrastructural elements. These difficulties may persist into the period of pilot use, thereby complicating it and influencing the learning outcomes. We however also find that there are benefits to the limited duration because it fits the brief window during which users are likely to experiment with new ways of working, makes extra support and precautions affordable, and thereby provides opportunities for users to take part in the finalization of the system on the basis of real-work experience with it. Our main finding regarding pilot implementations as a method to support user participation is that to foster participation and learning about user needs a pilot implementation must create a space for reflecting on use, in addition to the space for using the pilot system. The space for reflection must exist throughout the pilot implementation because the porters and nurses using the pilot system learned about their needs during the activities preparing the use of the pilot system as well as during the period of use.

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