PARTICIPATORY DESIGN FIT FOR THE 21ST CENTURY
IMPROVING THE DESIGN OF AN EMERGENCY DEPARTMENT IN A UK HOSPITAL

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ABSTRACT

Design has enormous potential to affect people's health and wellbeing. One way to improve staff and patient experiences of healthcare services and environments is to use participatory, or co-design approaches. However, the issue is that participatory design projects are often described as taking place in "greenhouse settings", shielded from the time constraints of everyday work, where workers are given time off their everyday duties to participate in design improvement projects typically in intensive face to face sessions. The challenge therefore, is this: in today's economic climate with the time and financial pressures facing healthcare staff in a busy, stressful environment, how can staff and patients be engaged in extended participatory design improvement projects at the minimum cost but with the maximum benefit? This paper describes a yearlong participatory design research exercise which is underway to improve the physical environment of a busy UK hospital Emergency Department.

Keywords: Participatory Design; Healthcare Design; Co-Design

INTRODUCTION

Design has enormous potential to affect people's health and wellbeing. One area where this is increasingly important, and where there are proven links, is for the design of healthcare environments (e.g. Ulrich 1991). Many UK healthcare environments such as hospitals, fail to meet healthcare needs from both a patient and staff perspective. While they may often deliver on a functional level, they do not always enhance wellbeing or deliver a therapeutic environment, which can result in negative experiences for both patients and staff.

Improving staff and patient experiences of healthcare services and environments has become a central theme in research (e.g. Bate and Robert 2006; 2007) and policy discussions (DH, 2010; Couter et al. 2009). One approach for improving healthcare environments is to use participatory, or co-design approaches. These approaches provide a context in which participants can articulate their values in relation to designed artefacts or services, which can be used to generate further design ideas, especially in contexts where design problems are poorly understood (Halloran et al., 2009). Co-Design has already had some success in service improvement (NHS III), but has not been used to its full capacity as an approach to improve environments, and largely relies on intensive face to face sessions.

Participatory design projects are often described as taking place in "greenhouse settings", shielded from the time constraints of everyday work, where workers are given time off their everyday duties to participate in design improvement projects (Kensing and Bloomberg, 1998), typically in intensive face to face sessions. Kyng (2010) has argued that participatory design has failed to keep up with the changing context in which it must now be used, with important issues such as IPR, funding, and the need for sustainable design outcomes being overlooked.

The challenge therefore, is this: in today's current economic climate with the time and financial pressures facing healthcare staff, and coupled with busy, stressful healthcare environments, how can

staff and patients be engaged in extended participatory design improvement projects at the minimum cost but with the maximum benefit?

This paper describes a yearlong participatory design research project currently being conducted within a busy UK hospital Emergency Department. The objective is to improve experiences for the clinicians and other staff working there through co-designing improvements to the physical environment. Specifically, the aims are threefold: (i) to identify how the physical environment impacts staff members' stress levels; (ii) to adapt existing participatory design methods to engage staff in redesigning features of the physical environment to better meet their needs; and (iii) to evaluate the extent to which stress levels are reduced and opportunities for psychological restoration are improved following interventions to the environment.

The core research team for this project come from industrial design, HCI and environmental psychology. This combination of different disciplines brings an interesting, and complex mix of different approaches to tackling this problem. The creativity of design is complemented by people and technology approaches from HCI, and balanced with the rigorous methodological approach from environmental psychology.

This study is being conducted as part of a multi-disciplinary five-year EPSRC-funded programme called *Participation in healthcare Environment Engineering*, which aims to develop participatory design approaches for improving the design of healthcare environments, to ultimately enhance health and wellbeing.

BACKGROUND

STRESS AND RESTORATION IN HEALTHCARE ENVIRONMENTS

An Emergency Department is a highly demanding working environment, requiring high levels of concentration and long working hours. Medical staff commonly report symptoms of burnout and stress (Helps, 1997; Ulrich et al., 2008) and there is a significantly higher occurance of psychological distress, depressive and anxiety disorders in doctors, nurses and hospital managers than in their counterpart professions (professionals, associate professionals and managers) (e.g., Wall et al., 1997).

The physical environment of hospitals can be one such potential source of stress for healthcare professionals (Weinberg & Creed, 2000; Ullrich et al., 2008). While there is relatively little research focusing specifically on the role of the physical environment in generating stress in this context, (Ulrich et al. 2008), some has implicated environmental features in increasing staff stress levels. For example, issues with ambient temperature and lighting can, if they persist over a long time contribute to the development of stress symptoms (Helps, 1997). Noise levels in intensive care units have also been linked to staff stress (Corr, 2000). Exposure for short periods to bright light has been shown to positively impact the levels of distress felt by nurses working on a night shift (Leppamaki et al., 2003). Social stressors can also be related to the design of the physical environment – for example, the openness of a department can affect the ability of a patient to be violent towards a nurse.

A related issue to stress, is that of restoration. In this context, the impact of the physical environment on stress is also the extent to which it offers opportunities for staff to 'restore', for example, to escape the stress of clinical areas in staff areas or quiet rooms. Kaplan's (1995) attention restoration theory posits that stress can result from fatigue of directed attention; this is focusing attentional resources onto a specific target, while inhibiting attention to other features of the environment. The ability to inhibit these unwanted demands on attention diminishes over time, which in turn can lead to a decreased ability to carry out tasks, greater likelihood of making rash decisions and an increase in irritability, all of which can lead to stress.

Attention is primarily restored by switching from directed attention to involuntary attention on something that is inherently fascinating, requiring little cognitive effort. There is strong evidence that real or simulated views of nature or vegetation can

provide restoration from attentional fatigue (e.g., Kaplan & Kaplan, 1989; Kaplan, 1995; Ulrich et al., 2008). However, these are not available in many healthcare settings.

While research on the effects of the physical environment in healthcare settings on stress and restoration is suggestive, the literature leaves many questions unanswered: what other environmental features may cause or ameliorate stress, or offer opportunities for restoration? How specific can potential solutions be to particular settings? To what extent do interventions to the physical environment to reduce staff stress levels have follow-on effects on patients or other staff groups?

Given the gap in detailed knowledge of how best to adapt specific healthcare environments and the diversity of job roles in a hospital emergency department, a design approach that encourages worker participation is particularly suitable. The reason for adopting a participatory approach is to improve the knowledge base upon which design decisions are made, to reduce resistance to workplace modifications and manage staff members' expectations of any changes to the workplace (cf. Bjerknes & Brattetieg, 1995). The next section provides an overview of user engagement methods that have been applied in healthcare design, followed by a detailed description of the participatory design approach that is being used in this project.

USER ENGAGEMENT APPROACHES IN HEALTHCARE

The practice of improving staff and patient experiences of healthcare services and environments has become a debated topic (e.g. Bate and Robert 2006; 2007) and a focus of policy discussions (DH, 2010; Couter et al. 2009). Participatory or co-design techniques are one such approach to improving healthcare environments, where various tools and methods are employed to gain insights into work processes and experiences. These methods include questionnaires, interviews, group discussion of experiences with existing technologies, work site visits to explore different implementation possibilities and detailed ethnographic observations of work practices, as well as design approaches such as card games, co-operative prototyping, generation of storyboards and role-play to represent work (or leisure) practices (e.g., Kensing & Blomberg, 1998; Sanders et al., 2010).

The key to all of these methods is enabling potential users to envisage what it would be like to carry out a task or activity with a future technology, product or process or in a new environment, and/or helping the design team to think, empathise and experience what it would be like to be a user of their designs. They also provide a context in which participants can articulate their values in relationship to designed artefacts and environments, which can be used to generate further design ideas, particularly in contexts where design possibilities or problems are poorly understood (Halloran et al., 2009).

Co-Design and related approaches have historically been applied in healthcare environments to the design of IT systems (e.g., Sjöberg & Timpka, 1998; Pilemalm & Timpka, 2008; Weng et al., 2007) and also to service improvements (e.g., Bate & Robert, 2006; 2007, NHS III). However, to date their use as approaches to improving the physical environment has been more limited.

There are a number of potential issues associated with applying a participatory design (PD) approach in a healthcare environment, particularly one as busy and stressful as an Emergency Department. Conventional participatory design projects have been described as often taking place in "greenhouse settings", shielded from the time constraints of everyday work, where workers are given time off their everyday duties to participate in design improvement projects (Kensing and Bloomberg, 1998), typically in intensive face to face sessions. This may work well in some hospital contexts, but is not necessarily suitable for an emergency department where the staff are under significant time pressure, where funding cuts are beginning to be felt and where patients may be stressed and distressed and with little incentive to engage in a service improvement activity once they have completed their visit. Bowen et al. (2010) document difficulties in engaging staff members from an

Outpatient department in an Experience Based Design project (cf. Bate & Robert, 2006; 2007). It was reported that staff members worried about the effect of their absence on colleagues, despite the research team paying for temporary staff to cover their work, and some dropped out of the project. Kyng (2010) has argued that participatory design has failed to keep up with the changing context in which it must now be used, with important issues such as IPR, funding, and the need for sustainable design outcomes being overlooked.

The challenge therefore, is this: in today's current economic climate with the time and financial pressures facing healthcare staff, and coupled with busy, stressful healthcare environments, how can staff and patients be engaged in extended participatory design improvement projects at the minimum cost but with the maximum benefit?

CREATING AN APPROPRIATE PARTICIPATORY DESIGN APPROACH

We have identified that using a PD approach to improve the physical environment of a hospital emergency department would seem to have significant potential: it fits well with UK policy guidance on including patients and staff in service improvement activities, as well as potentially improving the knowledge base upon which design decisions are made and increasing staff buy-in to any changes by enabling them to share ownership of the decision-making process. It also has the potential to add to the existing body of knowledge on participatory design methods.

However, as discussed above, we identified that there may be a number of problems in integrating a traditional intensive PD workshop approach into this kind of environment, where staff may be unlikely to be able to commit to an extended design process and patients will be difficult to engage and to keep engaged.

Therefore, we proposed to adapt and combine some existing participatory and co-design methods to be more appropriate for use in this context. As our starting point, we take as our inspiration, four approaches:

1. Firstly, the emerging field of distributed participatory design, which aims to use software tools to support participation in the creation of computer systems by designers and end users who are separated by long distances (e.g., Naghsh et al., 2006; Näkki et al., 2008) The online tool Owela for example, enables potential users to participate in discussions, freely add their own ideas, and comment on and rate others' suggestions (Nakki et al., 2008).

2. Secondly, Crabtree et al.'s (2006) use of "informational probes": which are kits of materials that can be used to gather snippets of information about individuals and their situated everyday concerns. The informational probe kit by Crabtree et al (2006) has previously been designed for use by residents in a mental health unit and aimed to be less disruptive than conventional social science research methods such as ethnography, while still providing (a limited amount of) information that could be used to inspire design. From this informational probe approach we draw the perspective that small insights into the everyday concerns of the participants are able to be used in design, and while they may lack an in-depth understanding, they do nevertheless still have some valuable utility. This pragmatic approach has much in common with discount usability approaches in HCI (e.g., Nielsen, 1994) and the 'quick and dirty' approach to ethnography for system design (Hughes et al., 1994).

3. Thirdly, the idea of crowdsourcing: which is outsourcing a function normally carried out by particular employees to an undefined group of people via an open call (Howe, 2006). Crowdsourcing has been proposed as an approach to facilitate public participation in planning projects (Brabham, 2006) and used in high-profile media campaigns, such as the chef Jamie Oliver's challenge to encourage children to make better food choices, organised by the design firm IDEO (OpenIDEO, 2010). In our study, we put out an open call for ideas, but the group from which we draw suggestions is limited to the staff of the emergency department.

4. Finally, the VoiceYourView system (Whittle et al., 2010) is a situated intelligent kiosk that uses speech recognition and natural language processing to gather and classify opinions about the design of public spaces from members of the public. We take a similar, but more expansive approach to gathering feedback from users of the Emergency Department. Furthermore, instead of using AI techniques to summarise feedback and suggestions, we will aim to support participants in making sense of the data themselves, by encouraging asynchronous dialogue, mediated by the system.

So, using these four sources of inspiration, our approach draws together a number of non-technology and technology-based techniques, which are grounded in getting emergency department staff to specifically tell us how their work environment makes them feel, and how they would like to improve it. Staff in the department have previously reported that they can suffer from "survey fatigue" so our methods aim to be quick to administer, and where possible, fun to complete.

From a technology perspective, a participatory design kiosk on interactive surfaces is positioned in the staff room in the Emergency Department. The aim of this is to engage staff members in using the system when they have a spare moment while on a break. Thus, the level of their engagement may be far short of that typical for an intensive PD project, but it is hoped that by frequently collecting small amounts of relevant data from a larger number of staff members over time, the results will be as valuable.

Staff are repeatedly invited to contribute to different aspects of the participatory design process over a number of weeks, with tasks ranging from activities to help understand staff members' current restorative experiences both in and out of the workplace, such as simple questionnaires and postcards, to invitations to suggest changes to the current situation to aid restoration, to developing scenarios, selecting, voting on and critiquing design ideas for further development, or annotating graphical representations of potential changes to department. Thus, the goal is to create an ongoing dialogue relating to the physical design of the emergency department, which is open to all members of staff.

OVERALL PROJECT STRUCTURE

The project happens in three phases. In the first phase of the project, all staff members are given the opportunity to identify aspects of the environment that cause them stress, and to explain how and why it makes them feel and respond in a certain way. They are able to identify occasions where psychological restoration is hindered or enabled. They provide this feedback anonymously via colour-coded 'postcards' and 'post boxes' positioned around the department (Figure 1). These allow staff to quickly report a specific incident with the environment that either caused them to feel stressed, or restored. Red postcards are for recording stressful experiences with the ED environment, orange postcards are for recording experiences of the ED staff room, and green postcards are for recording experiences of restoration in the ED.

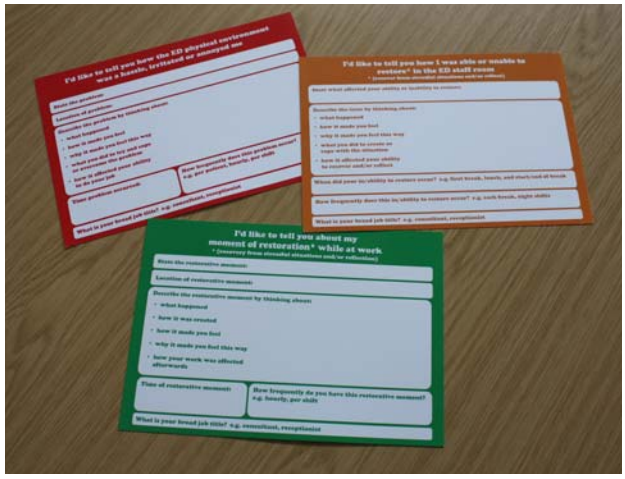

Figure 1: Colour-coded postcards. Red: Stressors, Orange: Staff-room stressors, Green: Restoration.

These postcards are then posted in the post-boxes around the department. Figure 2 shows a selection of the completed postcards. Interestingly, most of the comments are to do with stressors in the environment, with few comments about restoration.

To gain further deeper insights, a subset of the staff are invited to participate in a 'stress walk', which is qualitative semi-structured interview where a staff

member walks the researcher through the department and points out various stressors that affect them and their ability to do their job with ease.

Figure 2: Completed postcards

For the second phase of the project, a participatory design kiosk is positioned in the department staff room. The development of the interactive kiosk is a parallel development activity in this project, and aims to digitise selected participatory design techniques in order to make them quick and engaging to take part in. The participatory design kiosk is developed through paper prototyping techniques (e.g. Figure 3).

Figure 3: Paper prototyping for interactive kiosk

We do not go into the details of the development of the kiosk here, other than to briefly say that in order to develop the kiosk, existing participatory design techniques were evaluated for their potential to be adapted to be used on a digital kiosk over a short time scale by multiple participants. The techniques then identified as having the greatest potential for use during different stages of the participatory design process were further developed through a user-centred design methodology (e.g., Sharp et al., 2007; Buxton, 2007). This involved the mocking-up of paper prototypes and testing these using the 'Wizard-of-Oz' method (Kelley, 1984), which involved the computer system functions being carried out by an experimenter to enable potential users to experience aspects of what it would be like to use particular interface features. The most promising techniques were then developed into two applications, and deployed in the department staff room. These are being used in two design activities: ideation and iteration (cf. Zimmerman et al., 2007). Ideation involves gathering many potential design ideas from staff members, while during iteration the research team supports on-going discussions through which potential designs are elaborated, critiqued, and developed into one or two final design modifications.

The final phase of the project uses a repeated measures within-factors experimental design to assess if the environmental modifications made as a result of the participatory design process (independent variables) have affected stress and fatigue levels as well as enabling restoration (dependent variables). The stress and general fatigue measures are taken three times with roughly two months in between each measure point. Restoration measures, comprising a questionnaire and a clinical measure of attentional capacity are also compared in a repeated measures study with a much shorter time frame difference of under 30 minutes, in order to allow the two measuring points to fit within staff break times.

CONCLUSIONS

This paper has focussed on describing the need for and the background to the research project, and in particular why this research aims to do something

novel, and addresses a gap in the current literature. The issues with conducting design improvement projects within the UK National Health Service (when time and resources are in short supply and research budgets have been cut) make for a timely and interesting investigation. The paper has discussed specifically:

- The methodological design of the study, which includes a phase of design ethnography to observe and uncover the problems that staff experienced with the design of the Emergency Department;
- The design of an extended participatory design process, employing digital technology, informational probes and crowdsourcing to allow emergency department staff to contribute in engaging and novel ways to improving their work environment;

The data collection stage of this project is currently underway and we expect to be able to conclude with recommendations for:
(i) ways in which participatory design can practically be employed within a busy healthcare service, which contributes to our evidence base for practical PD methods; and
(ii) specific environmental design interventions which can be deployed in hospital Emergency Departments to positively improve staff experiences.

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