

Preprint of paper presented at HC05.

Paper appeared in Proceedings of BCS Healthcare Computer Conference'05. pp.34 - 40

Out with the old in with the new: What gets missed when deploying new technologies in A&E?

Catherine Broome & Dr. Anne Adams

UCL Interaction Centre,

Remax House,

London

C.Broome{a.adams}@cs.ucl.ac.uk

Abstract

This paper presents a longitudinal study (over 4 months) of an A&E department where the existing whiteboards were replaced with PC based computer systems. The study was conducted in two parts; an observation of the physical whiteboard usage and in-depth interviews with all users of both the traditional whiteboard usage and the replacement technology. The research was conducted with systems manager and all whiteboard users (i.e. nursing management, nurses, doctors, porters, and agency staff) across a spread of time-frames. Although the technology supported simple information requirements complex co-ordination, collaboration and awareness issues were left unsupported. The important role of a 'pen-holder' (information co-ordinator) was poorly supported by the replacement technology as was the task of annotating information with changing situations and needs. Specific deployment issues are derived from these findings that should guide designers when implementing technology replacements for current physical information formats (e.g. whiteboards, notice boards, shared paper notes).

Background:

One challenge for the deployment of new information systems is to support current information processes while making sure that critical practices are now more efficient and accountable. This often looks easier than it is, especially in the clinical domain where informal work practices and social norms prevail.

A crucial element of information usage within the clinical domain, which is often overlooked, is the importance of collaboration and communication. Although there is a substantial amount of research on individual information seeking within the clinical setting, there are relatively few studies on shared or collaborative information use. Reddy & Dourish [1] reviewed information seeking behaviours in a clinical setting and two important points were identified:

1. Colleagues are the first information reference point for clinicians.

2. Clinical and organisational issues were intertwined within a clinical setting.

The clinical domain poses particular challenges for introducing technology to support collaborative information usage as users have limited time to access information and often have negative technology perceptions. Cicourel [2] notes how team members on medical rounds provide contextualising information to each other. This was confirmed by Reddy & Dourish [1] who identified that clinical staff provided the contextual information that could not usually be provided in a hard copy format. This and other research highlights the need to understand users' work practices, both formal and informal, and the relevance of these to their communities of practice [3].

With the ever growing use of complex information there is a growing need to co-ordinate information searching, filtering and usage. An important element of collaborative information usage is the role of mediating and co-ordinating that information. Several studies have identified that within information settings some co-workers act as unofficial consultants and information co-ordinators for their colleagues [4, 5]. One act of information co-ordination is to annotate current information resources to reflect changing situations and needs [6]. It is important to understand that with annotations the information recorded reflects not only current actions but patterns of former activities and expectations about future behaviour. However, within this domain the timeliness of this information is paramount. Reddy & Dourish [1] highlight the importance of information being available at a glance to members of a clinical unit. The major problems encountered within this domain centre around users' negative technology perceptions, poor skills, time constraints, access to technology and expert intermediary support.

When implementing technology replacements for current physical information resources it is important to appreciate the visibility of technical artefacts within a clinical team. Bossen [7] identifies the importance of artefacts being available in the right place in a physical space to support collaborators. Visible information resources help to establish common interpretation of information and work practices within their environs. Conversely, information resources that are not easily visible allow for disparity in work practices and situational conceptions. The importance, for both individuals and the group, of information resources that are easy to access and interpret must not be underestimated within the clinical domain.

Method

The focus of this study was the whiteboard in the ‘majors’ A&E department and the deployment of technology as a replacement. After patients are registered the triage nurse allocates them to either ‘Majors’ or ‘minors’ within the A&E department. Each section has its own function, with communication and awareness mechanisms to support it, such as whiteboards.

Pilot observations and interviews (with systems & nursing manager) of the current whiteboards were conducted to identify the structure of the observational studies (i.e. pen-holder observations, other staff observations) and key time-frames (i.e. night and day shift changes, typically busy and quiet periods). A total of 10 hours were then conducted observing nurses, senior nurses, doctors and porters over a 10 day period across different time-frames.

10 In-depth interviews were conducted with A&E nurses from varying status levels including agency staff (temporary staff). Interviews contained scenarios to support procedural whiteboard experiences and semi-structured questions (see below) to allow the respondent the freedom to discuss issues concerning them:

- Perceptions of their role within the organisation, and their information requirements.
- Perceptions of current whiteboard information practices, social structures and organisational norms.
- The impact of the technology replacement on practices, structures and norms.

In the very first stages of technology deployment the staff training sessions were observed and notes made of specific issues raised and common areas of misunderstanding. This served to deepen the understanding of the work processes used and the nature by which the new system sought to facilitate these.

The data was collected and analysed using Grounded Theory [8], a social-science method that combines systematic levels of abstraction into a framework (i.e. open, axial and selective coding and identification of process effects) about a phenomenon which is verified and expanded throughout the study. Compared to other social science methodologies, Grounded Theory provides a more focused, structured

approach to qualitative research with its continual cross-referencing allowing for grounding of theory in the data, thus uncovering previously unknown issues.

Results & Discussion

The findings from the study were very complex and in-depth identifying issues relating to ‘seeking and recoding information’, the ‘organisation of workflow’ and ‘social issues’ (i.e. ‘identification’ with ‘colleagues, definition of roles’ and ‘distribution of information’). In this paper an overview is given of the importance of annotating data, the role of the ‘pen-holder’ (i.e. information co-ordinator) and the shortfalls of the technology replacing the physical white-boards.

Observational Studies

The important role of the ‘penholder’ was identified by initial research with the system manager and incorporated into the observations, to explore this further. The ‘penholder’ was observed to enter most of the patients’ information on the whiteboard with higher penholder whiteboard entering and annotating (36%) than that of other staff members (1%). The penholder was also observed to co-ordinate activities in the department.

	Penholder Whiteboard Interactions	Other Staff Whiteboard Interactions	Total of overall observations
Long looks	28%	48%	38%
Glances	26%	51%	31%
Entering and Annotating	36%	1 %	21%

Table 1: Type of interaction and user

With the physical attributes of the real world whiteboard it was possible to annotate an entry to show the previous and current status simultaneously. The annotation seen

in diagram 1 would indicate that the patient had been seen by the A&E team thus providing some temporal elements to the information.



Diagram 1: representation of a whiteboard annotation and later adaptation

The observations also identified that 26% whiteboard interactions also included verbal communication between the penholder and the nurses. This is believed to be the sharing of knowledge in task specific collaboration, which in turn builds the *shared knowledge* of the group.

In-depth interviews

The representation of the whiteboard in the new system closely mirrored the sections of the original (although lacking a treatment section). It was found that the system partially supported *organisation of the workload and task* in aspects such as *information sorting*. However, more complex issues related to *organisation of workflow* or *social issues* were poorly supported. In particular the role of the ‘penholder’ was found to be prominent in *distribution of information*. The technology replacement did not support this role and thus impacted adversely on the co-ordination, contextualisation and shared understanding of the information.

The notion of having a designated ‘penholder’ is closely linked with the concepts of *recognition of authority* or *categorisation of roles* for the purpose of the *organisation of the workload*. This also has strong implications for the concept of *shared knowledge*. It is interesting to highlight that 50% of nurses interviewed thought that they were entering information to the board themselves. However, the observations revealed that they were mostly annotating information that had already been entered by the ‘penholder’. 80% of the participants who explicitly acknowledged the role of a ‘penholder’ were of a status to have been the ‘penholder’ before. Only one participant who was unlikely to have been the penholder before acknowledged the role.

The new replacement system was also found to impair the visibility and accessibility of the information. The 'free text' nature of the whiteboard as opposed to the constrained nature of the new interface effected informal methods of communication between the staff, for example, the use of the white board as a notice board:

"just put unknown and what was ... sort of wrong with them.. in an abbreviated form, in the patient name section... just during handover, just as a reminder of what was going on." (Nurse)

The method of input also no longer supported the *adapting of information* as the system requires keyboard interaction into designated fields as opposed to marking, ticking or crossing. Furthermore the nature of *personal annotating* has changed as this was often conducted in the treatment information category:

"... like if I had triaged the patient and, you know , I thought that they needed a nuro-screen, or an ECG, or bloods or whatever... then I could write it up there so that the nurse concerned would know, without looking up the notes.... Urm , and I also wrote up when the next set of obs is due and none of that comes across, comes up on the new system and so you are not always sure what they are waiting for." (Nurse)

Conclusions

Ultimately the technology replacement for the A&E physical whiteboards was found to support some of the basic information and task practices. However, the more complex informal collaborative task actions and social issues (i.e. shared knowledge, social structures, distribution of information) were left unsupported. Some key guidelines for design and deployment that can be learnt from this study are:

1. Although the role of the penholder was not consciously acknowledge as vital by the staff, it was a key aspect of the observations and resulted in much of the dissatisfaction with the technology replacement. This highlights the difficulties in acquiring user requirements for new technology since the current systems and the users may not clearly represent their needs. Observational studies and interviews qualitatively analysed to identify the importance of issue can help to clarify these issues.

2. It is important to understand the temporal elements of clinicians' information requirements.
3. The visibility and accessibility the information artefacts is vital

Some of the participants took to using continuing the whiteboard usage to fulfil this function. More recently the A&E department has placed a computerised version of the whiteboard on openly viewed monitors for users to acquire of the functionality lost through the PC based system. It is interesting to highlight that after the deployment of the PC based technology was primarily motivated by a need to adhere to privacy concerns about the display of personalised information. However, while openly viewed monitors provide the functionality and usability they still do not respond to the original privacy concerns. This highlights the need for further research required within the health sector into the contradictory and complimentary aspects of usability and security [9]

References

1. Reddy, M. & Dourish, P.(2002) A finger on the Pulse: Temporal Rhythms and information seeking in medical work. In *Proceedings of ACM CSCW'02*. ACM Press. 344-353.
2. Cicourel, A.V.(1990)The Integration of Distributed Knowledge in Collaborative Medical diagnosis. In J. Galegher, R.E. Draut and C. Egido (Editors) *Intellectual Teamwork*. Hillsdale, NJ: Lawrence Erlbaum Associates. 221-242.
3. Adams, A., Blandford, A & Lunt, P. (in press) "Social empowerment and exclusion: a case study on digital libraries" *ACM Transactions on Computer-Human Interaction (ToCHI)* ACM Press. Draft available from <http://www.ucl.ac.uk/annb/DLUsability/ClinicalDL.html>
4. Brewer, A., Ding, W., Hahn, K. & Komlodi, A. (1996) The role of intermediary services in emerging digital libraries. In proceedings of DL'96, ACM Press, Bethesda. pp.29 – 35
5. Adams, A. & Blandford, A. (2002) "Acceptability of medical digital libraries" *Health informatics Journal*. Sheffield Academic Press. Vol 8 (2). pp. 58 – 66.
6. Preece, J., Rogers, Y., Sharp, H., Benyon, D. Holland, S. & Carey, T. (1994) "Human-Computer Interaction" Addison-Wesley : Wokingham.
7. Bossen, C. (2002) *The Paramaters of Common Information Spaces: The Hetrogeneity of Cooperative Work at a Hospital Ward*. University of Aahaus . Denmark.
8. Strauss, A. & Corbin, J. (1990) Basics of qualitative research: grounded theory procedures and techniques. Sage, Newbury Park.
9. Adams, A. & Sasse, M. A (1999c) "The user is not the enemy" in *Communications of ACM*. **ACM Press** Vol. 42 (12) pp. 40 – 46 (Dec. 1999)