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Cognitive ergonomics of digital desks for healthcare teams: A set of interaction techniques

Magnus Bång, magba@ida.liu.se, Department of Computer and Information Science, Linköping University, Sweden and Interactive Institute, Stockholm, Sweden

Mattias Arvola, matar@ida.liu.se, Department of Computer and Information Science, Linköping University, Sweden, and School of Communication, Technology and Design, Södertörn University College, Sweden

Background

The clinician workstation and electronic medial record software (EMR) have been criticised on several accounts. The terminal with its single keyboard, mouse and small display is developed solely for one-person work and this setup makes it impractical for multiple data input and for face-to-face collaboration which is so common in clinical environments (Heath & Luff 2000, c.f., Latour 1991). Researchers have also said that current EMRs provide little flexibility in terms of informal information sharing and annotation. For example, the user interface provide no means to highlight important items so that team members more easily can perceive irregularities in the record, which still is possible with ordinary paper forms and sticky notes (Berg & Toussaint 2003). The net result of present day computerization could be that the cognitive load on clinicians is increasing due to that the informal communication routines and flexible visualisations are hampered by rigid technology.

Digital desk technology is now emerging (Scott et al 2003,Tang et al 2006). These computerised desks allow users to visualise and manipulate computer-based information on an active surface. Several research prototypes have been developed to approach general questions regarding the functioning of the desk such as multi-user data input and how one can visualise and move objects among a set of collaborating individuals (Shen 2004). However, missing still is specialised designs that have emerged from actual work routines such as those in a hospital setting. In this paper, we discuss how digital desk technology could be applied as a complementary user interface to the EMR. We believe that such a desk approach could significantly support administrative routines and teamwork and offload cognitively demanding tasks from clinicians.

Methods

A one-month observation study of paper-based deskwork was conducted in an emergency room at a middle-sized Swedish hospital (Bång 2003). Analysis of the data was made from the perspective of distributed cognition (Hutchins 1995) to identify interaction requirements for a digital desk. The goal was to understand patient folder use, and how informal information sharing around the desk was done in the team. Subsequent analysis sessions at our research facilities resulted in a set of interaction requirements for digital desks for small healthcare teams.

Results

For smaller clinics, we suggest that the group of patients under treatment in the ward can be visualised directly as *virtual folders on the digital desk* (Fig. 1). These movable folders can be *stacked and arranged* according to the situation, for example, by the head nurse to convey triage order, prioritized patients and demonstrate turn-taking of group tasks facilitating workflow (Fig. 2). *Highlighting* can be done in several ways; (1) annotating directly on patient folders with a pen and means to place virtual sticky notes directly on the folders should be possible. (2) When one needs to assess one patent jointly in the group the desk could display this folder solely along with its main content. Such a mode is useful because it allows clinicians to create meaning and discuss patient-related issues standing face-to-face or side-by-side.

Discussion/Conclusion

This paper presented a set of interaction and visualisation techniques for manipulating and sharing information on digital desks. An integrated approach with handheld computers working in concert with the digital desk is a promising setup for collaborating clinical teams. Moving small information items flexibly among these devices will be important to support coordination and collaboration in the team.

Our concept implements also *hyper dragging*, which means that users can copy, paste, and move information items flexibly between the handhelds and the desk via a wireless link to facilitate this type of sharing. We believe that the main advantage of digital desks is that they provide a level of flexibility missing in today's EMR. This flexibility is highly needed in face-to-face collaborations in healthcare. Moreover, having appropriate visualisations of the patients under treatment is important because such representations offload cognitive tasks from clinicians.