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Editorial

Human–Computer Interaction for Medicine and Health Care (HCI4MED): Towards making Information usable

Making IT/Informatics useful, useable and enjoyable can be seen as a key success factor in our future digital world: technology must support and enhance people. Medicine and Health Care in particular are currently subject to exceedingly rapid technological change. They are also a vital area of our economy; consequently, in our modern society Medicine and Health Care issues involve everybody and are a great challenge for Human–Computer Interaction (HCI) research. However, it is of vital importance that the findings are integrated into engineering at a systemic level. Information Processing, in particular its potential effectiveness in modern Health Services and the optimization of processes and operational sequences, is of increasing importance. Therefore, we need to ensure that we engineer effective solutions, as well as understanding the stakeholders and the issues they can and do encounter. It is particularly important for Medical Information Systems (e.g. Hospital Information Systems and Decision Support Systems) to be designed from the perspective of the end users, especially given that this is a diverse set of people. This diversity implies that a solution for everybody is not achievable and compromise may be necessary. Various adaptive solutions for specific end user groups can ease this dilemma, whereby, knowing the end users, the context and the workflows is of vital importance. Meanwhile, Information Systems are extremely sophisticated and their technological performance increases exponentially, resulting in a mass of information (Beale, 2007; Edmondson and Beale, 2008); however, human cognitive evolution has not advanced at the same speed, consequently this gap results in a possible information overload (Holzinger et al., 2007).

The focus on HCI&UE research is on ordering the mass of information of increasing importance in Medicine & Health Care (Holzinger, 2007). HCI&UE must be focused on the daily activities of medical professionals, surrounding and supporting them with new and emerging technologies to enhance the safe and effective delivery of health care.

The traditional approaches of HCI are essential, but they are unable to cope with the complexity of typical modern interactive devices in the safety critical context of medical devices (Thimbleby, 2007; Thimbleby and Thimbleby, 2007); this has led to a broad range of UCD methods (see e.g. Holzinger and Errath, 2007; Holzinger, 2005, 2004); however, much further work is necessary, especially to bridge both user models and computational models, in order to ensure the most naïve end user can operate the devices.

Traditionally, Human–Computer Interaction (HCI) bridges Psychology and Informatics, while Usability Engineering (UE), as an engineering discipline, is anchored in software technology thus enabling appropriate technological implementation. Together, HCI&UE provide an emerging potential to assist the daily workflows in the realm of medicine and health care.

This special issue is only a small fraction of those ambiguous goals and can cover only some aspects in this vast area of research.

Fenne Verhoeven et al. noticed that infection control guidelines in hospitals and other health care institutions were more expert-driven than user-oriented. In order to enhance the usability of the expert-driven guideline format, the authors developed a website for the communication of existing guidelines that better fit the practical information needs of health care workers (HCWs). They employed a user-centered design process that involved two studies. In the initial study, 28 HCWs were asked to solve tasks using existing, paper-based infection control guidelines. In order to detect their strategies and problems, the participants were asked to think aloud. Usability problems occurred due to poorly structured information, insufficient quality of information, and a mismatch between experts' and HCWs' terminology. To overcome these shortcomings, three design principles were applied for communicating infection control guidelines: better navigation (the guidelines should be searchable in several ways); multimodality (the guidelines should not be presented as text only), and action-orientation (the guidelines should be presented as HCWs' behaviors).

Ten Kenneth et al. report on the well known fact that ventilation strategies for newborn infants may vary significantly between individual doctors. The aim of their

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study was to elicit knowledge of ventilation management to provide a baseline for evaluating the performance of an expert system for neonatal ventilation (FLORENCE). The modified Delphi method and focus group techniques were used to arrive at consensus management strategies on 40 hypothetical ventilation scenarios. The underlying cognitive processes of the experts were also explored further to assist in the development of the expert system. The strategies arrived at were used to provide a performance level which FLORENCE was tested against. The solutions were judged to be equivalent between FLORENCE and neonatologists in 29 of the 40 cases. In the remaining 11 scenarios; FLORENCE also provided adequate solutions. The outcome demonstrated that the focus group technique was more effective than modified Delphi method in achieving consensus on ventilation management. This consensus ventilation was used as the baseline to evaluate the performance of an expert system.

Elena Zudilova-Seinstra et al. describe a series of experiments that compared the 2D and 3D input methods for the selection and positioning tasks related to medical image analysis. For their study, they have selected a switchable P5 Glove Controller, which can be used to provide both 2DOF and 6DOF input control. Their results suggest that for both tasks the overall performance and accuracy can be improved when the input device is used for manipulation of the visualized medical data with more degrees of freedom. 3D input turned out to be more beneficial for the positioning tasks than for the selection tasks.

Theresia Gschwandtner et al. discuss the mapping of medical concepts from a terminology system to the concepts in the narrative text of a medical document, which is necessary to provide semantically accurate information for further processing steps. They developed a MetaMap Transfer (MMTx) program, which is a semantic annotation system that generates a rough mapping of concepts from the Unified Medical Language System (UMLS) Metathesaurus to free medical text, where this mapping still contains erroneous and ambiguous bits of information. Since manually correcting the mapping is an extremely cumbersome and time-consuming task, they have developed the MapFace editor, which enables users to correct this information on both a conceptual and a syntactical level.

Rosemarijn Looije et al. start from a major problem for a large group of older adults with obesity or diabetics: the daily health self-management, such as the synchronization of food, exercise and medication. The authors developed a personal assistant in order to help them to behave healthily by persuading and guiding older adults. The authors derived a set of social behaviors, and implemented a subset of tasks using a physical character, a virtual character and a text-interface. In an experiment, 24 older adults (45–65) interacted with the text-interface and one of the characters, consistent with a "one-week diabetics scenario". They experienced the virtual and physical character as more empathic and trustworthy than the text based assistant, and expressed more conversational behavior with the characters.

William Newman et al. observed that talk is often suspended during medical consultations while the clinician interacts with the patient's records and other information. They studied four general practitioners (GPs) and a detailed conversation analysis revealed how GPs took action to close conversations down prior to attending to the records, resulting in a 'free turn' that could be taken up by either GP or patient. The durations of the intervening pauses were also analysed. The authors argue for considering the two timeframes when designing systems for use in medical consultations and other conversational settings, and they discuss possible outcomes.

Yvonne Schikhof et al. explore the role of monitoring systems in small-scale housing for older people with dementia. By incorporating principles of Value-Sensitive Design in a Human Centered Design process, the authors developed a system for remote monitoring at night in dementia care. The performance of the working system was evaluated in the real-life context of a nursing home and is currently being implemented in small-scale housing.

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