chi+med
making medical devices safer

Update
July 2010

Welcome to our first CHI+MED project update! In this edition we outline some achievements of the project since its start in October 2009. Our publications can be found at www.chi-med.ac.uk/publications.

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New Team Members

Several people have joined the project team since the last whole-project meeting in January. In March we welcomed Chris Vincent to UCLIC. By October at least three new PhD students will have started: Sandy Gould and Atish Rajkomar (UCLIC), and Huayi Huang (Queen Mary) who is currently doing a linked summer internship. Karen Yunqiu Li will start in November as a researcher at Swansea, Paolo Masci in December as a researcher at Queen Mary, and by October we may have a further PhD student at Queen Mary and a further researcher and a PhD student at Swansea. Others, including Michael Harrison (Newcastle), Siti Salwa Binti Salim (University of Malaya), and various MSc students, have ongoing research projects linked to CHI+MED.

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http://www.chi-med.ac.uk

The CHI+MED team has a new easy-to-navigate website and a logo which will appear on all of our material. The website will be our first point of contact for most people, and its design means that visitors from the project's many different audiences will quickly find what they need. The site is divided into a series of dedicated access pages for each audience to find the information relevant to them. Casual visitors will be able to find general information about the project using the navigation links at the top of the page, enabling the site to act both as a hub of information for everyone and as a tool to engage with different groups.

Jo Brodie (jo.brodie@ucl.ac.uk)

Models of cognitively plausible behaviour

Formal models of cognitively plausible user behaviour allow one to perform an exhaustive analysis of interactive medical devices, under given assumptions. We have developed formal user models for a simple infusion pump based on an Alaris device. These models have been used to analyse both correctness (e.g., infusion is set up with the required values) and efficiency (e.g., a task is performed within the time limits) properties, and how these are affected by changes to the interface design. In parallel, a generic model of cognitively plausible behaviour has been extended to accommodate multiple user activities. This is an essential feature in medical settings, and scales up the approach, potentially allowing more complex interactive systems to be automatically analysed.

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Number Entry Errors

Wrong doses are a common type of medical error. While there are several factors that might contribute to this, in Swansea we have been looking at the interface provided for number entry in medical devices. Our preliminary analyses of two different number entry interfaces have shown some inconsistencies in the interaction design. For calculator-style numeric keypads, there is no standard for handling syntactically incorrect input and alerting the user to errors. Instead the device guesses what the user means and silently fails. We are currently exploring standards for evaluating different number entry interfaces both in terms of usability and dependability.

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Recovering from Interruptions

Hospital wards are busy places, and medical professionals conducting routine tasks, such as setting up an infusion pump, are likely to find themselves interrupted at some point in the sequence. We have been investigating ways to reduce cognitive slips caused by interruptions, such as exploring the value of encouraging users to stop and think before resuming a task following an interruption. Findings suggest that the process of retracing previously achieved sub-goals can help with resuming a task. Ways of encouraging people to take time before resuming their task rather than jumping straight back in have been tested. In addition to demonstrating that people make speed-accuracy tradeoffs when resuming after an interruption, we are also investigating whether we can predict from eye-movement data if someone will make an error. Ultimately, as this work matures it will allow us to make predictions about device designs that better support error avoidance.

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Working with the Medical Device Industry

CHI+MED researchers have been working with the medical device industry to understand the tools, techniques and processes involved in specifying the interactive properties of infusion pumps. The work will contribute towards the provision of safe and usable devices, which has become a priority following recent product recalls and safety alerts. For a given product, manufacturers can spend years considering the interaction between users, the tools they use, and the environments in which they live and work. We have learnt about the benefits of this approach such as a decrease in support costs, exposure to new markets, identification and mitigation of potential errors, and avoidance of fundamental design flaws. There is still work to be done to identify gaps in provision, in addition to contributing tools, models and knowledge. Ensuring good device interactivity helps manufacturers by preventing costly re-designs, recalls, or litigation.

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