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Editorial

As computers have moved out of the office and into everyday objects they have become part of everyone's lives. As a result, computers now need to be considered as interactive systems: where the system as a whole includes a user as well as hardware and software. The way we, the operators, interact with them is increasingly an issue. No longer are they used only by trained experts but by complete novices too. Furthermore we use them in situations where their incorrect operation can have safety, security or financial costs. The system as a whole, allowing for human behaviour, must be correct.

Traditional applications of formal verification techniques have focussed primarily on the correctness of the technical side of the system: the software and hardware. If user behaviour is considered at all, it is either to assume that the user will do precisely what the software requires, or for safety cases it is checked that no user action could possibly cause a problem. These approaches have their place. However, less course-grained analysis can be useful too. In particular, by paying attention to human factors we can draw finer distinctions and bring into consideration a wider range of issues of interest.

User interfaces and interaction design can be made the subject of verification, and verification techniques can be informed by results from cognitive psychology. Furthermore the same verification techniques can help improve our understanding of the way people behave. In this way we can ensure that human limitations are explicitly taken into account in design and that interactive systems play to our strengths.

This special issue originates from the *2nd International Workshop on Formal Methods for Interactive Systems (FMIS 2007)*, which was held on 4 September 2007 in Lancaster, UK. The aim of the workshop was to act as a forum for researchers in formal methods and cognitive psychology to discuss tools and techniques for the evaluation of interactive systems. The proceedings of the workshop have been published in volume 208 of Electronic Notes in Theoretical Computer Science. After the workshop, all presenters were invited to submit significantly extended papers for inclusion in this special issue. From the 18 submissions to FMIS 2007, 11 papers were presented at the workshop and we include here extended, revised and re-refereed versions of 5 of those papers.

The range of possible ways that human factors issues can be combined with formal methods is wide and the five papers here cover very different approaches. There are two main trends:

- the rigorous use of formal methods within psychology work; and
- attempts to apply formal and semi-formal methods to the design of interactive systems within real practice software development;

Two papers are clearly associated with the first trend.

Process Algebraic Modelling of Attentional Capture and Human Electrophysiology in Interactive Systems by *Li Su, Howard Bowman, Philip Barnard and Brad Wyble.*
This paper develops a model that gives a detailed psychological description of the allocation of human attention over time. It provides a way to evaluate performance trade-offs when humans operate in stimulus rich environments, and enables the rapid testing of interface designs via process algebra model simulations.

Correspondence and offprint requests to: A. Cerone, E-mail: antonio@iist.unu.edu, P. Curzon, E-mail: pc@dcs.qmul.ac.uk

Verification-Guided Modelling of Salience and Cognitive Load by *Rimvydas Rukšenas, Jonathan Back, Paul Curzon and Ann Blandford.*
This paper uses model checking to explore the links between the salience of interface cues, cognitive load and human error. State space exploration of a system specification that includes a model of human behaviour derived from cognitive psychology experiments delivers deeper insight of the causes of human error.

The other three papers are associated with the second trend.

Model-Checking User Behaviour Using Interacting Components by *Thomas Anung Basuki, Antonio Cerone, Andreas Griesmayer and Rudolf Schlatte.*
This paper describes a framework, based on interacting components defined using a rewrite systems, to formally model distinct attitudes coexisting within the same user behaviour and applies it to a simple case study to detect the emergence of human errors.

Refinement for User Interface Designs by *Judy Bowen and Steve Reeves.*
This paper proposes a semi-formal approach to defining a refinement process for user interfaces. The approach aims to achieve a degree of rigor comparable with the one used in developing the rest of the system. It takes a step towards the aim of incorporating real-world User Interface design techniques in a formal software development process.

Physigrams: Modelling Devices for Natural Interaction by *Alan Dix, Masitah Ghazali, Steve Gill, Joanna Hare and Devina Ramduny-Ellis.*
This paper defines a semi-formal notation, consisting of modified state transition networks, for describing the physical behaviour of devices when they are "unplugged" from their digital effects. Called Physigrams, they are intended to be used as part of the design process of devices including novel tangible ones where physical objects are embued with digital properties.

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Antonio Cerone
Paul Curzon
David Duce

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