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GUEST EDITORIAL

Special Issue: Human–computer interaction in engineering contexts

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Although the human–computer interaction (HCI) community has been active for several years, very little attention has been devoted to supporting engineers. Engineers are unique computer users with particular needs. They are familiar with fields such as applied mathematics, applied sciences, simulation, project management, technical drawing, and design, as well as engineering law and economics. The nature of the engineering design process means that engineers usually operate within changing environments. Uncertainty relating to incomplete information adds to the complexity of the process especially since the engineer is legally responsible for decisions.

The intention of this Special Issue is to explore aspects of HCI within engineering contexts. Our objectives include improving the understanding of the requirements of engineers when they are engaged in a variety of day to day tasks. Such tasks may include design, integration and collaboration, fabrication, construction, evaluation, monitoring, repair, and control. Within this context, it has been assumed that the term HCI is not restricted to "front-end" issues. HCI also embraces complex concepts relating to information generation, representation, processing, and knowledge capture. Such activities, of course, rely upon appropriate data representation, visualization, and other state of the art interface aspects. The purpose of the Special Issue is to capture this larger picture in the form of a set of high-quality complementary papers and thus broaden the general perception of HCI.

Included are themes, methods, and techniques relating to knowledge capture, the representation of engineering knowledge, the support of engineering tasks, proactive and passive support, solution navigation, and interface evaluations. Of particular interest is the development of HCI techniques that support the capture of experiential engineering knowledge in iterative human- and machine-based processes, which lead to the identification of good solutions. Papers relating to this aspect highlight requirements for two-way information exchange in the form of succinct representations of generated data (computer to human) and appropriate problem reformulations using generated data and experiential knowledge (human to computer).

The issue commences with a paper from R. Fruchter and P. Demian, which introduces the concept of a corporate memory that supports the management and reuse of knowledge by ensuring context related storage. Designers can then interact with the rich content of this knowledge repository, find reusable items, and understand these items in context. In the second paper, Ellen Do moves toward a computational sketching interface for architectural design describing studies of design drawings and the building of computational sketching tools to support early architectural conceptual design. The identification of domain-specific graphical symbols supports a reasoning process framework of drawing marks, acts, and reacts. The development of design support systems based on these concepts and various applications are discussed. Next, Benny Raphael et al. propose flexible graphical user interfaces through the composition of model fragments stored in a fragment library. Fragments are linked to models of physical behavior to guide model composition. Applications are easier to extend and maintain than standard graphical user interfaces. Paper number four concentrates upon background HCI relating to the machine-based generation of high-quality design information from evolutionary search and exploration processes. Ian Parmee shows how such information can support better understanding of a problem domain and, when combined with the experiential knowledge of the designer, can result in a reformulation of the problem space.

R. Stalker and I. Smith introduce engineer–computer interaction (ECI) as a new subdomain of HCI that is specifically tailored to engineers needs. ECI uses an information

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classification schema, provides a modular approach to task decomposition, and integrates standard engineering characteristics and working procedures into software. Empirical evaluation of an ECI software tool kit shows potential for application to a range of engineering tasks. Pierre Leclerq and Roland Juchmes propose a tool that is capable of interpreting design sketches and feeding data to various project evaluators from the early phases in the design process. The concept of an "absent interface" is illustrated within EsQUIsE, a software prototype for capturing and interpreting architectural sketches. CineADD, a design explanation generation model based on cinema techniques such as animation, scripting, editing, and camera movements, is introduced in the seventh paper by Ana Garcia et al. CineADD provides designers with a tool for describing the media where projects should be visually explained, as in movies. Designers develop their projects within an active design document environment. The final paper from Chris McMahon et al. concerns HCI within a web-based design information search environment. The browsing of hierarchically organized information entities allows incremental narrowing and pruning of the organizational structure. The user is presented with only that part of the organizational structure that will lead to a nonnull selection. The computational basis of no zero match browsing is introduced and this is followed by a trial implementation and case studies.

The Special Issue therefore presents a diverse set of application domains, techniques, and strategies that serve to illustrate a number of approaches toward the satisfaction of both front-end and background HCI issues within engineering contexts. We hope that this material proves to be both interesting and stimulating, and we wish to thank all the authors for their papers and for their help reviewing.

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