The Role of Cognitive Ergonomics in Interaction Design, Addressing Advances in HCI

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ABSTRACT
Cognitive Ergonomics has always been concerned with the cognitive and user aspects of using the computer systems to operate and control production systems such as industrial installations, Air Traffic Control and office systems. The introduction of computer systems outside the traditional application areas poses challenges to Cognitive Ergonomics and we need to adapt our design approaches and practices to the newly emerging interaction techniques and the expanding application context of HCI systems.

User centred and interaction design methods focus on the isolated use of the design product, even though that product will only be a part of a complete working environment or context of use. In this workshop, we invite researchers, educators and practitioners to reconsider the role of Cognitive Ergonomics within the design of HCI systems.

Author Keywords
cognitive ergonomics, interaction design, design approaches, design perspectives.

ACM Classification Keywords
Interaction design: Interaction design process and methods - User interface design, User centered design.
Human computer interaction (HCI): HCI design and evaluation methods, HCI theory, concepts and models.

INTRODUCTION
Cognitive ergonomics has always been concerned with designing for human use in studying the interaction of complex tools, cognition, collaboration and the context of use. However, design methods in user centred design and interaction design are mainly focusing on the product as the result of the design process and how it is used in isolation instead of being used as part of the working environment or personal information ecology.

While the original focus was on work settings, for example, the cognitive and user aspects of using the computer systems to operate and control production systems such as industrial installations, Air Traffic Control and office systems it might be interesting to extend this focus to other aspects of life. In our current society, designing for use is needed not only for working environment, but people regularly use information technology in many aspects of life. We have experienced how HCI products are entering the personal sphere, ranging from smart phones and internet-accessible pace-makers to sports watches, etc.

In HCI, technological advances (e.g., ubiquitous computing, wireless connectivity, Internet of Things…) and their application in many areas of life, influences from other design practices such as product and service design and marketing, led to the emergence of interaction design and to the development of new concepts guiding design processes, such as the concept of user experience.

It is possible now to create more flexible and modular products (flexibility in terms of functionality and adapting user interfaces) and to better separate between concept design and implementation in software. Without the need to pay attention to the software implementation of computer systems supports a focus on user-centred design by, for instance, enabling user participation in conceptual design activities in the form of sketching, prototyping, personas and by applying specially developed methods such as Living Labs as well as exploratory approaches to product design [4].

Although it is accepted that interaction design is not only concerned with large monolithic systems but also with flexible and modular products which have to be integrated with existing artefacts in use (regardless whether in working environments or in “personal ecologies” of artefacts) [1] there are few methods that consider this in actual design practices. Design practices are mainly product-oriented and not oriented towards the working environment or information ecology.

SOME EXAMPLES
Computer systems are not used in isolation but they are part of an operating or working environment. Such an environment may exist around professional work but also around personal activities such as care, leisure or hobbies. For this reason, Bødker and Klokmose [1] refer to environments or contexts, which give meaning to individual systems, as artefact ecologies.

Personal Ecologies
Dittmar and Dardar [3] explore such an ecology in their study about personal calendars. In the study, they follow and 'reconstruct' how a number of different individuals use a variety of calendars in their personal and professions
lives. Personal calendars link for a given person, the different roles, organizations and realms in which they live. For instance, in order to make an appointment with a friend, the appointment has to fit your work calendar(s), the one of your household and the agenda with your leisure activities. As such, the many different types of calendars are not just mere productivity tools or artefacts but they constitute a personal ecology that enables one to navigate and to maintain the different realms of life.

One of the conclusions of the study is that, in combination with the wide variety of calendars found, calendar usage must be understood as something that evolves into ecology over time, even reflecting cultural values, rather then the mere application of some tool. With respect to designing new calendar tools, the implication is that in designing calendar tools, the focus should no be on the functionality, usability of user experience of the calendar used in isolation but rather on understanding how collections of tools form personal ecologies which emerge and evolve over time and use.

**Unintended and Implicit Interaction**

Another example derives from the concept of unintended interaction as interactivity not triggered by the explicit wish of a human being but as a side-effect of behaviour in general, such as the opening of an automatic sliding door whenever someone is nearby. Unintended interactivity may be pleasing and make being somewhere more pleasant. An example here is the Dune project of studio Rosegaard [8], an interactive flower-bed of gently moving and sounding plant-lights which induces a more pleasant atmosphere in an otherwise creepy pedestrian tunnel under the river Maas. On the other hand, streetlights that 'follow' you in the dark or automatically opening sliding doors may also be experienced as creepy because of their behaviour.

Ju and Leifer [7] discuss automatic behaviour as implicit interaction in order to make interactive and automatic systems less obnoxious. They propose a framework of foreground-background and reactive-proactive to extend interaction design with notions to understand address the behaviour of ubiquitous systems. Ju and Leifer restrict themselves to single systems, such as automatically sliding doors or alerts to remind one of an appointment. However, when automatic agents become a common element in the everyday environment, it will be very hard to avoid obnoxious effects from the interactions with multiple automatic agents.

Both these examples show how our present tools, techniques and practices for user centred design and user experience may not be sufficient when the interactive product being designed have agency incorporated or when there are used as a single element and environment from which it derives its meaning and usefulness. Naturally, other examples are possible; in web application it is not always clear when command are being processed, if at all, and hidden links and dependencies in ambient environments may make it hard to understand how systems are functioning.

**Interaction Design and HCI Advances**

What we can conclude is that there are circumstances in which present tools and techniques for user centred design and user experience design, or their implicit assumptions, are too restricted to explicitly create a usable environment and to support the user's experience. It may be possible to address these limitations with simple extensions to the design process, for example, by analysing the behavioural outcomes of different interaction scenarios or by extending the usability lab into the real world [6].

Another possibility to address the discrepancies may be to use different design methodologies, as proposed in [4], and adopt design methods with special provisions for exploring design opportunities [5] or in which the design is brought into the environment and the communities for which the design product is intended [2].

Given that current practices in user centred design and interaction design show some gaps and white spots, it may be worthwhile to investigate and make an inventory of the issues, problems and possible solutions in how to address and fit the mostly technical advances of HCI into useful and sound practices for interaction design.

**WORKSHOP GOALS**

In this workshop, we are interested in integrating perspectives of Cognitive Ergonomics into interaction design practices. For example, exploratory prototyping in Cognitive Ergonomics is understood as a means to investigate hypotheses about the relationship between technology and cognition/collaboration [9] while in interaction design, exploratory prototyping is mainly related to the product itself. We believe that a consideration of both perspectives can also support a better understanding of concepts such as user needs and user-centred design.

The workshop seeks to exchange ideas, thoughts and visions, and perhaps experiences on the changing role of Cognitive Ergonomics in Interaction Design. Eventually, the purpose of the workshop is to arrive at an overall understanding of the relevant factors and possible actions to ensure a future role for Cognitive Ergonomics in the context of Interaction Design and Human-Computer Interaction outside the (computer) box, such as, for example, the development of conceptual, social and exploratory design approaches, training and experimentation facilities such as Design Studios, Fablabs and Living Labs, and, perhaps, teaching approaches to get students acquainted with exploratory, creative and co-design approaches [4]. Other possible topics for positions papers that one might consider:

- creativity in Cognitive Ergonomics
- requirements for exploratory design
- methods to raise context-awareness in design
emergent and emerging design approaches
social computing practices
end user programming and development
crowd sourcing and sensing
co-design and co-creation
towards the Internet of People
Design Research

PARTICIPATION
Participation will be sought by distributing a call for workshop participation, asking interested parties to submit a position paper. Participation will be based on the quality and interest of the position statements, submitted. Participants will be accepted based on their experience, visions, or research, showing their contribution to the intended discussion.

Submissions
Position papers should be 2 to 4 pages long written in English. Submissions must follow the ACM conference proceedings formatting guidelines. A Microsoft Word template and LaTeX template are available. Please send the abstracts in PDF format to: geert.de.haan@upcmail.nl and/or anke.dittmar@uni-rostock.de.

INTENDED PUBLICATION
The statements from accepted participants will be available on the workshop website for prior orientation and discussion. We intend to disseminate the results of the workshop discussions in the form of a publication submitted for peer review, either in the way of a monograph, a journal paper, or a chapter in a handbook, aiming at an audience of interaction designers or teachers in interaction design.

Workshop Deadlines
- June 24, 2016: Submission of position paper
- July 1, 2016: Notification of acceptance - in time for early registration on July 6
- August 1, 2016: Submission of final position paper
- September 5, 2016, 12:00, Workshop at Nottingham University Park, Psychology building, Room A16

Workshop Contact
For additional information about the workshop, see: http://www.nottingham.ac.uk/conference/fac-eng/ecce16/workshops. For any other questions and problems with submitting, please contact: geert.de.haan@upcmail.nl and anke.dittmar@uni-rostock.de

REFERENCES