Introduction to "Rethinking Cognitive Ergonomics"

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Abstract. An Introduction to the set of papers presented at a Workshop at the European Conference on Cognitive Ergonomics annual conference in 2019 (ECCE'19). The scope and procedures of the workshop are highlighted and its aims described. The position papers presented and the invited speakers talk are summarised in relation to Cognitive Ergonomics. Outcomes of the workshop, together with some next steps to achieve, extend and develop the workshop aims are considered.

Keywords: Cognitive Ergonomics · Human-Computer Interaction · Design Methods · Design Tools · Collaboration.

1 The Genesis of this Collection on "Rethinking Cognitive Ergonomics"

The Workshop which forms the content of this set of papers stems from an open workshop at the 2019 annual European Conference on Cognitive Ergonomics (ECCE'19), and from targeted discussions and activities at previous ECCE conferences. The ECCE Conference series started in 1982. ECCE'82, in fact, initiated the foundation of the European Association of Cognitive Ergonomics, and coined the label which originally defined the field of Cognitive Ergonomics.

The all-day workshop took place before the conference and attracted a number of papers addressing the general question of "What is Cognitive Ergonomics" and how the discipline can evolve to deal with a rapidly changing research and practice environment. The organisers believe that the future of the discipline of Cognitive Ergonomic (CE) depends both on visibility and greater involvement by new and younger researchers. The goal of the workshop itself was to bring together researchers and practitioners with an interest in redeveloping CE as a meaningful modern discipline.

A number of attendees and a keynote speaker were present, together with the authors of the six submissions chosen, and one invited paper. Their papers were extended and revised to form this curated collection.

The justification for the workshop was based on an increasing awareness that the CE discipline is becoming conflated with that of Human Computer Interaction (HCI) despite its genesis in Human Factors and Ergonomics (HFE) some 40 years ago. CE is broadly about designing technological artefacts and complex computer systems which express and enhance human abilities within a specific focus on cognitive aspects of human well-being, the performance of work systems, and the study of collaborative elements in a social context.

2   Workshop Activities

The first activity of the workshop was the presentation of position papers, together with a small number of condensed slides which authors were asked to provide. This was followed by discussion of these papers (which were made available to all authors in advance), together with consideration of potential strategies to achieve the aims of the workshop. The final session was an overview of the status of CE by an invited speaker, Professor Liam Bannon of the University of Limerick in Ireland.

The afternoon session comprised working groups in two breakout sessions. Topics to be discussed by each group were developed from the final discussions of the morning. There were many specific subfields and questions to the basic topics covered; areas addressed in each group covered 'subfields', 'questions' and 'processes', and 'techniques'. The four topics covered were, broadly:

– Conceptual issues in CE
– Business aspects
– Developmental and Educational issues
– Context and Domains

A wrap-up session was convened and a list of activities and actions to further the impact of CE was drawn up. In addition, feedback to the conference as a whole was planned, with a set of summary slides and display of posters prepared by the authors. The outcomes of the workshop were again discussed by everyone.

3   Definitions of Cognitive Ergonomics

The CE field, as is shown by many of the papers in this collection, is an evolving discipline, stemming from that of Human Factors/ Ergonomics (HFE) and co-existing with those of HCI and User Experience (UX). One of the workshop aims was to consider the issue of whether CE is actually a separate discipline in its own right and how it relates to the other areas of investigation identified as dealing with humans and their interactions with systems, machines and applications.

Three of the papers in this collection deal with the varied definitions of CE and with its relationship with HCI.

Dittmar's paper (pp. 5-11) addresses the question of what it means to say that a discipline exists together with the near future of CE, asking how this area of research and practice will develop, what its future role will be and how it can now relate to other HCI communities. Any one of these could potentially be the future of CE.

de Haan's paper (pp. 17-25) posits that CE is really "exploratory data-enabled design" which identifies the role of CE, working within the domain of 'context of use', as a new approach to design rather than that of 'user-centred design'. Theoretical considerations are identified in the paper with an argument in favour of a a combination of a user-focused co-design approach, based on a community of practice, collecting usage data and a design-research approach, based on explorating and reflecting on the artefact.

The paper by Kalakoski (pp. 46-51) addresses and describes the cognitive factors which underlie CE, stressing that the discipline should focus on the aspects of both the human user and socio-technical partners. Applied Cognitive Psychology is also part of the discipline and CE can play a theory-building role in providing applied cognitive psychology models that can handle complex everyday cognitive task.

All of the above papers collectively, and from different perspectives, identify CE as design paradigms and design practices, which, in some cases such as standards and usability/UX differ from HCI. A task for CE in working with new technology is intervention and the full utilisation of cognitive factors and human abilities.

4   New Application Areas and Cognitive Ergonomics Approaches

The scope of CE is expanding into many areas which have been traditionally covered in the HF and HCI disciplines. This collection includes two papers which address some new areas of application in all disciplines and one which presents a novel design approach for CE.

The invited paper by Malizia et al. (pp. 1-4) addresses the problems and issues which arise when designing interactions and interfaces for a near-future zone (such as smart cities, humanoid robots and autonomous vehicles). A solution which uses scenarios and prototypes as potential design solutions is proposed and described in detail. This can be seen as an enhancement of CE approaches towards the future of human-cyber interactions.

The paper by Li and van der Veer (pp. 12-16) looks at the development of a new creative collaboration between art and modern technology where the obvious need for CE approaches is made clear. CE can be applied to art and to interaction with artefacts; CE should thus evolve new values and recalibrations of the research field leading to a new application domain of 'Art Ecology'.

Chu and Mao's submission (pp. 36-45) considers design issues in context and presents an approach with empathetic, contextual and imaginistic design thinking. This is particularly oriented towards views of "my future self" by young entrepreneurs and designers. It was increasingly evident that the design focus by these participants' design focus and the solutions generated were based on the adoption of this perspective. The factor which impinges most on CE approaches is the introduction of a potential new too.

These three papers show the diversity of CE interests in new application areas and argue that the field is open to the development and use of new techniques in an iterative collaborative situation. They essentially return to the basic concept of "who are the users" in new organisational structures, in new areas of application, and in the use of new technologies.

5   Development of Cognitive Ergonomics

] The position paper by Witchel and Westling (pp. 26-35) deals most specifically with questions identified in the workshop call. The authors put forward an ambitious vision of a framework and manifesto for the future of CE based on three inclusive and co-existent concepts, those of: "visibility", "linking", and "nurturing". A manifesto which looks to the future of CE is an inspiring one and has led to the identification of specific actions which can be taken to enhance the reputation and visibility of CE.

6   Invited Talk

Professor Bannon talked about some features of CE, both historical and current. Discussed was CE's relationship to Cognitive Science and the modelling of users and tasks. A development in the initial stages of HCI research was to endorse the idea of 'practice' and 'artefacts'. Then came 'distributed cognition' and the understanding of phenomena through a shift from User Centred System Design (UCSD) to working with users in a participative design environment. A major issue in current CE is the movement away from manual tasks to people working in co-operation within collaborative groups. Consideration of the role of new technology can form the basis of a science of 'social ergonomics'.

7   Solutions and Outcomes

Returning to the progress of the workshop itself, the break-out groups addressed the four linked topics listed above. To recap, these were: Each group came up with a set of questions and a range of potential processes in order to lead to solutions for each topic. One specific outcome was the review of submitted papers and the preparation and publication of this volume.

In conclusion, the aims of the workshop, as put forward by the call for contributions and these position papers were fully and critically examined by all participants. The outcomes of the discussions and the break-out groups form a coherent and viable approach to the future development of Cognitive Ergonomics.

8   Acknowledgements