Preface

The Cambridge Workshops on Universal Access and Assistive Technology (CWUAAT) are a series of workshops, each of which is held at Cambridge University's Fitzwilliam College every two years. This volume: *Designing Around People* comes from the 8th in this series of highly successful events, held March 2016 at the University of Cambridge.

The greatly appreciated aspect of these workshops is that they are a single session running over three days in pleasant surroundings with many delegates from home and abroad staying on site. CWUAAT allows speakers longer presentation times and question sessions, carrying discussion on through the day into plenaries. The shared social, temporal and leisure spaces generate an enjoyable academic environment that is both creative and innovative. CWUAAT is one of the few gatherings where people interested in inclusive design, across different fields, including **designers, computer scientists, engineers, architects, ergonomists, ethnographers, policymakers and user communities, meet, discuss and collaborate.** CWUAAT has also become an international workshop, representing diverse cultures including France, India, Mauritius, China, Norway, Thailand, Slovakia, USA, Belgium, UK, Denmark and many more.

In the context of developing demographic changes leading to greater numbers of older people and people with disabilities, the general field of inclusive design research strives to relate the capabilities of the population to the design of products. Inclusive populations of older people contain a greater variation in sensory, cognitive and physical user capabilities. These variations may be co-occurring and rapidly changing, leading to a demanding design environment. Inclusive design research involves developing methods, technologies, tools and guidance for supporting product designers and architects to design for the widest possible population for a given range of capabilities, within a contemporary social and economic context.

Since the last CWUAAT a strong trend has emerged whereby theoretical understandings, methods and experience gained in usability and accessibility research has become more relevant to mainstream HCI, and in particular to Human Machine Interfaces (HMI), a field largely the preserve of Ergonomists and Human Factors researchers. In the Cambridge EDC lab alone more than four new projects are currently running in conjunction with industry; in Aerospace, automotive and mobile device research, that do exactly this. The key to this new emergence is the concept behind Situationally Induced Impairments (SIID) first identified by Sears et

al. (2003) and Newell et al. (1997); and since developed in multidisciplinary labs. These make a comparison between impairment and disability arising from health origins (HIID) and that occurring as a result of situational impairments, such as through cold, vibration, poor light or by the necessity for the user to carry out a pressing primary task, such as driving or piloting an aircraft.[1]

Recent research developments have addressed these issues in the context of automotive HMI design, military aircraft cockpit workload, governance and policy, daily living activities, the workplace, the built environment, computer gaming and mobile devices. Furthermore, increasingly, themes from an architectural background addressing public spaces and a predominance of papers dealing with dementia show that pressing current issues in society are finding their way through to research motivation. These are strongly represented in CWUAAT. This now demonstrates the multidisciplinary approach that is required for the diverse, sometimes conflicting demands of design for ageing and impairment, usability and accessibility and universal access. CWUAAT is established as a dissemination platform for such work.

The workshop has six main themes, distilled from the response to the call:

I Reconciling Usability, Accessibility and Inclusive Design

It is important to make a distinction between commonly cited methods for user-centred design such as usability and accessibility, and inclusive design. In particular, usability approached deal with common nomothetic populations and hence can use small sample sizes. Inclusive design, however, explores the margins of mainstream populations and deliberately includes unusual multi-capability people, hence it cannot but sample widely. Accessibility has always been seen as catering for impaired users who by implication are seen as disabled in some way. It focusses on special adaptions for these people. Wentz and Lazar look at the impact of software updates and revisions on inclusion, highlighting this little recognised source of exclusion. Skjerve et al. uncover hidden exclusion resulting from insensitivity to social exclusion. Another interesting approach by Chrysikou sees mental illness as excluded by architecture that reflects a lack of openness in society.

II Designing Inclusive Assistive and Rehabilitation Systems

CWUAAT has always received a continuous stream of excellent, challenging and novel papers in assistive technology. For example, a walking aid for developing countries that adapts its shape and configuration to its users' evolving conditions (Nickpour and O'Sullivan); or a way of cuing individual leg movements during rehabilitation using haptic cues (Georgiou et al.). Telehealth systems have been heavily invested in but Chamberlain et al. explore how effectively designs have limited inclusion, through poor understanding of cultural context. Finally a literature

---

[1] Newell AF et al. (1997) Human computer interfaces for people with disabilities. In Helander M, Landauer TK, Prabhu P (Eds.) Handbook of human computer interaction, pp.813-824

Sears A. Lin M, Jacko J, Xiao Y (2003) When computers fade… Pervasive computing and situationally induced impairments and disabilities. In: Proceedings of the HCI International 2003, pp. 1298-1302

review by Liu and Dong examine whether and how virtual reality could be therapeutic in pain management, with positive results.

III Measuring Product Demand and Peoples' Capabilities

Measuring product demand, as the flip side of understanding people's capabilities, has always been an essential part of inclusive design. Together they allow a sensitivity analysis of exclusion or difficulty. A classic example is Waller et al., who devise a novel method for assessing visual exclusion for icons using a method of walking backwards to beyond resolving distance. A more modern approach by Ning and Dong extends data collection into scanners and big data in order to tackle outliers in sampling. An exciting and effective design study shows how good design for Dementia really needs to understand requirements. The resulting "Day clock" product is uniquely configured and is an unusual victory over casual thoughtless design that does not take the users' needs into account. Similarly, Rogers, looks at care for Dementia in Scotland, through the eyes of each user's "perfect day", collecting a huge amount of valuable data using this simple design-led approach in conjunction with stakeholders.

IV Designing Cognitive Interaction With Emerging Technologies

Cognitive science is now an integral part of design of human machine interfaces and interaction interfaces, primarily through considerations of working memory, mental models and visual search. At a basic level, users themselves are developing and theorising about the designs that are effective, utilising the latest technologies in HCI. Exciting new dimensions are being opened up by extending mainstream science into interaction design. New research work on cognitive control of prehension is being used in movement kinematics for the individual (Holt et al.). Emotional computing theory can assist therapy robots with non-verbal communication. Cognitive science developments tend to be at the cutting edge of research and Karam and Langdon, for example, are no different, as they explore the limitations of haptics that simply vibrate, and posit a new interaction realm of somato-sensory, cross-modal interactions.

V Designing Inclusive Architecture: Buildings and Spaces

Arguably, one of CWUAAT's most successful development areas has been in buildings and public spaces and architectural design. This has been due to participation from KU Leuven, whose professional approach has seen some truly remarkable insights in both care and ageing through the architectural perspective. In this volume they critique users' responses to modern designs of small-scale housing for the elderly (Coomans et al.) arguing that follow-up studies may reveal failure to meet requirements. In a second study, Van Steenwinkel et al., a critical appraisal is made of dementia care facilities focussing on how older and outdated buildings present difficulties for support of dementia. Other contributors examine the important role of architecture for visually impaired navigation (Williams et al.), and how architecture and the design and usage of space is critical to stroke rehabilitation (Anåker et al.).

VI User Profiling and Visualising Inclusion

Another growth area for inclusive design has been in the use of personae and associated methodology for developing and understanding of users' lived experience. Kunur et al. use ethnographic design as a lead-in method of developing usage cases for automotive HMI for cars of the future. They argue for an agile and inexpensive process that can be employed in a technology design area traditionally closed to human centred design, and demonstrate its concept. A complementary paper by Morris and Mueller shows how good quality user data can be collected and used as a key element in developing wireless technology that is responsive to inclusion. In particular, the extension of user profiles to disability and wider capability ranges can be an effective tool to engage technology stakeholders.

Another type of user profiling is possible when objective data about user capabilities and performance; such as eye-tracking, are used to drive adaptive interfaces to better match cognitive demand and reduce occurrences for cognitive overload (Chakraborty et al.). This adaptive approach to inclusion is increasingly popular, has featured in past CWUAAT volumes, and relies critically on accurate objective profiling to avoid clashes.

This book contains the reviewed papers from CWUAAT 2016 that were invited for oral presentation. The papers that have been included were selected by extensive peer review carried out by an international panel of currently active researchers. The chapters forming the book represent an edited sample of current national and international research in the fields of inclusive and architectural design, universal access, HMI, and assistive and rehabilitative technology.

We would like to thank all those authors and researchers who have contributed to CWUAAT 2016 and to the preparation of this book. We would also like to thank the external reviewers who took part in the review process. Many thanks are also due to the reviewing members of the Programme Committee who have renewed their intention to support the workshop series. We are grateful to the staff at Fitzwilliam College for their patience and help.

Pat Langdon, and
The CWUAAT Editorial Committee
University of Cambridge
March 2016