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EMERGING RESEARCH METHODS FOR UNDERSTANDING MOBILE TECHNOLOGY USE

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ABSTRACT

Mobile devices, applications and services have become integrated into people's daily lives on a personal and professional level. Although traditional research methods are being used to understand the use of mobile devices and applications, methodological challenges still exist. Researchers have responded to these challenges in a range of ways, with an emphasis on developing methods that enable new ways of accessing, making available and collecting, data about mobile technology use. This paper identifies, defines, describes and presents, a preliminary framework for understanding the methodological responses emerging in current Mobile Human Computer Interaction (Mobile HCI) research.

KEYWORDS: *mobile research methods, mobile research frameworks, mobile HCI, data collection, usability, user experience, evaluation, mobile devices, mobile technologies, mobile computing*

1. INTRODUCTION

Traditional methods used in Human Computer Interaction (HCI) and Computer Supported Collaborative Work (CSCW) research are commonly applied and adapted to mobile environments. But variations and new methods are emerging in response to the particular challenges of mobile technology use. These result from both the complexity that physical movement and changing variables presents for data collection and research design (Kjeldskov & Stage, 2004) and the small scale and ubiquitous nature of mobile devices.

Traditionally, user-centred research has relied largely on data collection methods such as direct observation in the workplace. The fact that mobile technologies are not bound to the workplace only increases the research challenge. Observations of mobile technology use can require researchers to follow people to various and multiple geographic locations; into confidential meetings (Väänänen-Vainio-Mattila & Ruuska, 1998), trips to the movies or the park, business trips (Perry, O'Hara, Sellen, Brown, & Harper, 2001), into pizza delivery vehicles, on shopping excursions (Newcomb, Pashley, & Stasko, 2003) and into the bedrooms of teenagers (Grinter & Elridge, 2001) or long distance lovers (Kjeldskov, Gibbs, Vetere, Howard, Pedell, Mecoles, & Bunyan, 2004). The very nature of mobile devices means that we carry them with us, and we use them in a number of ways and situations both professionally and personally.

This paper contributes a preliminary framework for understanding the emerging methodological responses to the challenges of understanding the use of mobile technology. By gathering, grouping and describing the methodological options currently being exploited by researchers, our intention is to encourage and support further research and to offer a tool for interested researchers to exploit as they design and develop their own research projects. This framework sets out the array of traditional, modified, novel and combined approaches currently being used to accommodate the complexities of studying mobile technology use. We have identified gaining and negotiating access to data as particularly significant to

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researchers evaluating and designing mobile technologies. This is due to the variety of times, ways, and places mobile technology use occurs, and the personal scale of mobile devices. As a result the ways in which established research methods are being extended account for the difficulties of accessing and collecting valid data about mobile technology use. Furthermore, we found that traditional approaches, such as ethnography and field studies, are being rethought - not in terms of their approach, motivation or theoretical commitment - but in terms of the methods used to achieve them.

In their review of Mobile HCI research methods, Kjeldskov and Graham (2003) found very few examples of studies of actual use in real settings or of conceptual and theory building research. Our research builds on and extends the contribution of Kjeldskov and Graham (2003). However, this paper differs in that it explores new methodological approaches that are emerging in response to the complexities of mobile technology research, rather than categorising research approaches according to existing research methods. Kjeldskov and Graham (2003) also differentiate between different methods, based on their research purpose; for example, to evaluate, to understand or to describe. Although we are aware that these are different processes, and certain methods lend themselves to different stages of the design cycle, the issues of access and data collection for understanding mobile technology use are the same across each of these. These overall issues of making data available, whether for analysis, representation or to inform design, are the foci of this paper.

2. LITERATURE SEARCH

This paper is based on an extensive literature review of papers that reported on methods for studying and evaluating mobile technologies, from the following key conferences in the field of HCI between the years 2000 and 2004:

- Conference on Human Factors in Computing, CHI, ACM
- Conference on Computer Supported Cooperative Work, CSCW, ACM
- Symposium on Designing Interactive Systems DIS, ACM
- International Workshop on Wireless and Mobile Technologies in Education, WMTE, IEEE
- Symposium on Human-Computer Interaction with Mobile Devices, Mobile HCI, Springer
- Participatory Design Conference, ACM
- Conference on Ubiquitous Computing, ACM
- Conference on Mobile and Ubiquitous Multimedia, MUM, ACM
- Conference of the Computer-Human Interaction Special Interest Group of the Human Factors and Ergonomics Society of Australia, OZCHI

In addition we also draw on other major reviews, critiques and comparisons of mobile methods in published literature and theses. There is a significant existing body of work available on lab based methods for mobile research (e.g see Beck, Christiansen, Kjeldskov, Kolbe & Stage, 2003 for an extensive survey of lab based studies of mobile technology use; also Kjeldskov & Stage, 2004; Po, Howard, Vetere & Skov, 2004; Pirhonen, Brewster, & Holguin, 2002). Rather than replicate this work, our original literature search focused on those research methods used to study mobile technology use in real settings. One hundred and forty nine papers, reporting aspects of studying use, were selected as relevant to our review. A full list of these is available in our Technical Report which can be located at http://research.it.uts.edu.au/idwop/publications.html. We should note here that any discussion on research methods is constrained both by a lack of consistency with which methods are named and considered within the computer science literature, as well as by the frequent unavailability of detailed accounts of the method used. We have compensated by the breadth of our survey and by cross referencing similar work by the same authors and related research by others.

3. METHODOLOGICAL CHALLENGES

There is a lack of consistency in the way that mobility is discussed and *conceptualised* in Mobile HCI literature. Any definition of mobility makes possible certain perspectives on mobile technology use. These perspectives, in turn, affect the choice of methods researchers will employ to understand user experience. The inherent associations and biases of different approaches produce different types of data to support

different kinds of analysis, and enable different kinds of insights. Likewise certain assumptions have limited the scope of Mobile HCI research and steered the development of new methods in particular directions; for example, an emphasis on understanding mobility in terms of transport, geography and navigation (Kakihara and Sorensen, 2002; Weilenmann, 2001), rather than ways in which we coordinate getting to places and activities. Similarly, mobile devices and technologies have often been primarily seen as tools for accessing information, rather than as tools for making different types of communication and sociability possible (Harper, 2003).

Mobile devices have enabled the emergence of a variety of new communication and coordination behaviours. Our understanding of the way in which people use mobile technologies, to organise and define their social networks, cannot be reduced to events of physical relocation or information access. Our conceptualisation of mobile computing needs to be more sophisticated than 'using a computer while moving'; however such an understanding of mobility is not always manifest in current mobile computing research literature.

Many of the complexities related to gathering data about mobile technology use stem from the fact that we are no longer attempting to gather data in a fixed office environment. As researchers we need to account for the potential for physical movement and changing geographical location of users. But we also need to negotiate access to private and public spaces that are not defined by the rules of the workplace; for example, researching people's shopping habits in order to design improved mobile shopping assistants (Newcomb et al., 2003); understanding how groups of friends might use an SMS chat application to rendezvous at a particular location (Axup, Viller, & Bidwell, 2005); or gaining insight into why and how teenagers might use a mobile device to interact with an existing virtual community (Still, Isomursu, Isomursu, & Koskinen, 2002). These types of research environments require balancing the privacy concerns of participants with the need for researchers to gain access to data.

Direct observation, which can include note taking, photography and video recording, has historically been favoured by user centred design researchers because it is a method that situates the researcher in the context in which technology use occurs. But environments of mobile use are not always conducive to these methods. For example researchers following people around shopping malls with conventional video cameras can be disruptive, as members of the public may stop and stare (Isomursu, Kuutti, & Väinämö, 2004) and shadowing participants at the same time as trying to take notes can be rather impractical (Palen & Salzman 2002). In addition, mobile devices are designed on a personal scale for relatively discrete use within our personal body space; a mobile phone or PDA is intended to be used by one person at a time. Therefore, capturing or analysing the interface actions of the user, or observing a devices screen, can be physically impossible (Kjeldskov et al., 2005; Newcomb, et al., 2003; Mark, Christensen & Shafae, 2001).

4. METHODOLOGICAL RESPONSES

Researchers are responding to these methodological challenges by extending and combining existing methods and developing novel techniques. We have grouped the emerging responses under the following three categories:

1. *Mediated Data Collection*: Participants and mobile technologies mediate data collection about use in natural settings.
2. *Simulations and Enactments*: simulations and enactments are used to make available experiential information sensitised to real contexts of use.
3. *Combinations*: existing methods, and/or *mediated data collection* and/or *simulations and enactments* are combined to allow access to complementary data.

These three categories represent various approaches to accessing and making available data about different aspects of mobile technology use. They entail different roles and responsibilities for both researchers and participants. We explore these roles in more detail in the following section. Table 1 provides a summary of the approaches, identifies established methods from which these new approaches are derived, and supplies examples of their use in current research. For reasons of space we have allocated each example a number, which refers to the numbered reference list.

Table 1: EMERGING RESEARCH METHODS IN MOBILE HCI

Approach:	Description:	Derived from:	Examples:
Mediated Data Collection	**Where access to data about actual use practices is mediated by both participant and technology combined.**		
Do it	Participants do the data collection, using mobile devices.	Self-reporting, diaries, probes,	[18, 19, 23, 36]
Use it	Participants use the technology, and data about use, content and metadata is logged automatically.	Use/data logs	[9, 12]
Wear it	Participants go about their normal routines, but wear mobile recording devices (e.g sensors or cameras)	Video Observation, Use/data logs	[22, 29, 32]
Simulations and Enactments	**Tools for allowing immersion where data about existing or potential use is accessed through some form of pretending.**		
Simulations	Physical, ergonomic or environmental props are used most often within the lab, to simulate aspects of use in the real world.	Lab tests, scenarios, heuristics, prototypes, NASA TLX, emulators, simulators,	[4, 5, 11, 29]
Enactments	Traditional role-playing is extended by being enacted in situations where technology is used, or enhanced through visual imagery or storytelling.	Scenarios, role-playing, work shopping, prototyping, storyboarding	[21, 32, 37]

4.1. Mediated Data Collection

Mediated Data Collection happens in three basic ways:

1. *Do it:* participants actively collect the data.
2. *Use it:* data collection occurs automatically as a side effect of using the technology.
3. *Wear it:* participants carry/wear the data collection device.

Mediated Data Collection: Do It

Mobile HCI researchers are employing self-reporting methods such as diaries and cultural probes (Gaver, Dunne & Pacenti, 1999), where users record their experiences and activities. In self-reporting, participants take on the role and responsibilities of data collection. For example, Grinter and Elridge (2001) conducted a study into how teenagers used text messaging using a diary method. In order to overcome privacy issues, participants' logged their SMS activities in a hand written diary. This self reporting method gave the researchers access to data where conventional direct observation was not appropriate.

Cultural probes and diaries have also been augmented through the use of mobile technologies *themselves* as reporting tools. Mobile Probes (Hulkko Mattelmäki, Virtanen, & Keinonen, 2004), SMS Probes (Jönsson, Svensk, Cuartielles, Malmborg, & Schlaucher, 2002) and Experience Clips (Isomursu, Kuutti, & Väinämö, 2004) are all self-reporting methods that employ mobile technologies as data collection tools. For example Hulkko et al. (2004), developed Mobile Probes as a way for participants to document their shopping experiences using the inbuilt camera and SMS functions of their mobile phones. This information was automatically uploaded to a server that displayed the users' reports online in a predefined format. Hulkko et al. outline the advantages of such methods as: "...the possibilities to remotely and simultaneously observe several users, to automatize the sorting of the data and to create digital user databases for the stakeholders. Furthermore, users can become more active contributors instead of being only passive sources of data." (p. 2).

In addition, these types of self-reported, *mediated data collection* methods have also been used to evaluate aspects of user experience and usability for new prototypes in the field e.g (Isomursu et al., 2004). Self-reporting methods are useful both as a way to build a relationship between researchers and the community

that they are studying and/or designing for, and as a technique to enable remote data collection. The limitations and constraints of such methods include: the possibility of users having to learn new interfaces or technologies to operate self-reporting devices (Jönsson et al. 2002; Palen and Salzman 2002); the implications of participants recording in inappropriate places such as shops where photos/video are often prohibited (Hulkko et al. 2004; Newcomb et al. 2003); and the impact on indirect and/or involuntary participants when their activities are recorded without permission. Further research is required to understand the ethical and research implications, as well as the potential, of such self-reporting methods for use in private or sensitive spaces.

Mediated Data Collection: Use It

When *mediated data collection* techniques such as use/data logs are used, researchers and participants are relieved of the burden of data collection. Data, and metadata about use, are automatically generated as a side effect of using the device. For example, Curtis, Luchini, Bobrowsky, Quintana, and Soloway (2002) developed a tool to log and time-stamp the actions of students using a handheld device as part of their learning program. Curtis et al. (2002) attributed the success of their research to the in-depth analysis that could be supported by a complementary combination of log files, student artefacts and observation.

Use logs have always been available to digital technologies, but mobile technologies add new dimensions to what, and how, information can be logged. For example, there are platforms such as AWARE (Aware 2005), which filter SMS's based on location and proximity information. Cell tower ID's can give a user's location and Bluetooth can identify the other active devices that were nearby at the time the SMS was sent. While these methods are subject to similar ethical concerns as self-reporting methods that employ digital technologies, this approach also poses its own issues for consideration. Automated data collection methods differ from methods in which information is volunteered by users. Although users initially give permission to have their actions recorded, they may decide later that they want to exempt certain actions from being recorded. Such concerns also apply to data collection tools that are worn by the participant, as described in the next section. More research is needed to understand best practice for research design with these emerging tools.

Mediated Data Collection: Wear It

Data collection can be mediated by mobile technologies that participants wear on their bodies. Mini cameras are one such tool. Participants are required to wear or carry the device. Data collection occurs automatically as they go about their daily activities. Mark et al. (2001) designed a mini camera that fitted into a pair of glasses worn (along with a battery pack) by the participant. This method enables a form of remote video analysis and overcomes the impracticalities of following workers to various different locations. However, limitations include how long people can wear such devices, and whether the content that is captured provides enough peripheral information.

Mini cameras have also been used as a way of capturing screen display and interface actions that are hard to observe when people are using personal mobile devices. In a field study of nurses using handheld devices, Kjeldskov, Skov, Als and Hoegh (2004) combined conventional and mediated data collection methods. A mini camera was attached to the handheld device and a microphone recorded the nurses' comments. The small camera was able to capture high resolution video of the screen display and interface data, which was sent over a wireless network to a researcher who followed in range. Not only did these mini mobile recording devices enable the capture of high resolution video of the device itself, they also facilitated the collection of data at a level appropriate to the environment. The videoing of patients in a hospital setting is almost always ethically inappropriate; therefore a conventional video camera could not have been used. The mini camera method enabled the capture of very specific video data relating to the use of the mobile device while preserving the privacy of the patients.

Remote sensor driven technologies are also being developed to overcome issues of access. Researchers are seeking to improve observation techniques through various types of room-mounted, object-mounted and body-mounted sensors (e.g Intille, Tapia, Rondoni, Beaudin, Kukla, Agarwal, Bao, & Larson, 2003). For example, Context Aware Sensors (CAS) allow for sensors to be triggered depending on contextual cues, such as when using a Global Positioning System (GPS) to determine when a person gets close to their local store (Intille et al., 2003). These methods remove the burden of self-reporting from the participant

and offer the opportunity to undertake longitudinal studies of use in natural settings. Intille et al. (2003) acknowledge the data collected from such automated tools is only significant when contextual information about user activities is also available, and like all *mediated data collection* methods benefits from use in combination with other methods.

4.2. Simulations and Enactments

Rather than focusing on methods for accessing data, *Simulations* and *Enactments* emphasise methods and techniques that allow prototypes to be tested and reflected upon through experience. For example, simulating physical movement while testing prototypes in a lab (Beck et al. 2003); expanding traditional usability testing methods in the field (Goodman, Brewster, Gray, 2004); conducting mobile heuristic walkthroughs (Vetere, Howard, Pedell, & Balbo, 2003); scenarios with a mobile prototype in the context of use (Iacucci, Kuutti, & Ranta, 2000); and representing dynamic context visually (Pedell, 2004). They are particularly helpful for researching future technologies where an actual use context does not yet exist, or when natural settings can not be accessed or controlled sufficiently for the purposes of observation and evaluation. Both *simulations* and *enactments* rely on a form of pretending, role playing, body storming, make believe, or imagination as researchers and participants simulate or act out a set of tasks, or a particular use scenario. These types of enactments enable a shared perspective between researcher and participant.

Simulations rely on predefined tasks and generally use quantitative analytic methods including measuring aspects such as timing, error rates, and workload. Traditional lab based user testing is criticised for isolating technology from the context in which it will be used. Technology use is contingent on the variables of any given situation which means that data from lab testing does not necessarily translate well outside the lab context (Beck et al., 2003; Intille et al., 2003; Kjeldskov et al., 2005). But because lab testing enables the controlled collection of comparable data, researchers have expended considerable effort to develop ways of making lab testing more relevant and viable for the evaluation of mobile technologies (Pirhonen et al., 2002; Kjeldskov and Stage 2004; Kjeldskov & Skov, et al., 2004; Po et al., 2004).

The common factor in *simulations* is the use of techniques to "reflect or recreate a mobile use situation" (Beck et al. 2003, p. 107). *Simulations* range in their level of sophistication, which is measured by the extent to which the environmental and ergonomic factors of the actual use context are recreated. For example, in conventional laboratory based testing users are seated at a desktop computer. In Baber and Westmancott's (2004) trial of a multiplayer game, participants were asked to get up and move around while they were using the device. Props, such as treadmills, simulate aspects of mobile use related to physical movement and ergonomics (Pirhonen et al. 2002; Beck et al. 2003; Kjeldskov & Stage 2004). On a much larger scale the sophisticated e-Home simulation investigated by Koskela, Väänänen-Vainio-Mattila, and Lehti (2004) also has characteristics of both field and lab experiments. Two participants lived in a real/simulated home for six months in order to test the usability and usefulness of a mobile phone as a remote control to their smart home.

While the study by Koskela et al. (2004) provides rich data on the usability and the potential usefulness of such a device, most *simulations* are still unable to account for many aspects of actual use situations beyond superficial ergonomics. *Simulations* enable the controlled capture of comparable and measurable data that is sensitive, in varying degrees, to aspects of use in a natural setting: access to data is more feasible, established mechanisms such as observation and video recording can be used, and quantifiable data can be produced and compared. Simulation techniques and experiments might elucidate factors of ergonomics and device input while mobile. However the key limitation of *simulations* is that "social context" is missing from most simulation experiments (Beck et al. 2003). Many *simulations* emphasise motion and navigation, at the expense of broader contextual considerations. For example the purpose of someone's journey, or what type of place someone might be trying to locate may not be taken into account.

Enactments tend to be more qualitative in their approach. Researchers facilitate, rather than drive the process. *Enactments* use tools such as role-play, imagination and enacted scenarios to make available information about existing user experiences of mobile technologies, and ways in which mobile devices and applications might fit into future use practices. *Enactments* often make such information available by

playing out scenarios about potential devices in the context in which they might be used (Iacucci et al. 2000; Messeter, Brandt, Halse & Johansson 2004). Iacucci et al. (2000) developed Situated and Participative Enactment of Scenarios (SPES) for this purpose. In SPES researchers observe participants in their daily activities as they improvise possible scenarios with a mock-up of a potential mobile device. These scenarios, which are recorded and fed into the design process, are valuable because they have been created in collaboration with the user, and are subject to the variables of the context in which they will be used (Iacucci et al., 2000).

Like *simulations*, *enactments* involve 'doing'. They reveal quite different data to that of other conventional methods such as observation, interviews and focus groups. The understanding about *use* is experiential and based on participation, or "way of playing with data in embodied ways" (Oulasvirta, 2004 p. 251). However because *enactments* are not constrained to controlled experimental environments like *simulations*, they still encounter the limitations typically experienced with direct observation methods. In particular, these include how to record or capture the scenarios that are being enacted in the field without the researcher impacting excessively on the context of use (Iacucci & Kuutti 2002).

4.3. Combinations

Combinations of the above approaches, as well as combinations including established techniques such as interviews, focus groups and questionnaires, are also being used in Mobile HCI to access data about user experience. Different methods allow researchers to access different data, some rapidly, some in depth, some in real-time. In a study of teenage mobile phone use Carroll, Howard, Vetere, Peck, and Murphy (2002), used a range of existing methods including questionnaires, diaries, focus groups and direct observation. Each of these methods gives access to different types of information about users' experience. Focus groups, bringing together small groups of people to talk to each other, draw out different types of information than when participants speak directly to researchers, such as in interviews. In contrast, direct observation involves researchers being present during, and studying, people's everyday practices and activities. Carroll et al. (2002) consider the success of their research to stem from this combination of existing methods; focus groups which provide concentrated interaction with the subjects of the research and direct observation which provides naturalness of setting and reliability of findings.

Combinations of conventional and established methods such as interviews, focus groups and questionnaires have been employed by researchers to collect data on existing user practices, opinions, needs, experiences and requirements, to elaborate on findings collected from direct and mediated observation and self-reporting, and to triangulate data. We anticipate future research that explores how various *combinations* of emerging and conventional methods can specifically enable new knowledge about the use of mobile technologies.

5. DISCUSSION

In this paper we have documented how emerging Mobile HCI methods are making available data about user experience and enabling this data to be collected in different ways. *Mediated data collection* includes a range of approaches for collecting data remotely by relying on the participant or mobile technologies themselves. *Simulations* enable knowledge about physical movement, device input and the ergonomics of using a device while mobile. *Enactments* enable researchers to know more about why we carry these mobile devices with us and what these devices give us the potential to do. However we have also identified a pattern or tendency in some research to employ established usability methods such as performance measuring in order to determine usability, and then to use methods such as interviews and user satisfaction surveys to make claims about user experience. This highlights an important issue with regards to the types of claims that can be made about various methods and the data they make available. *Simulations* and *enactments*, for example, offer overlapping approaches to accessing different types information about mobile technology use through experiential forms. However these methods can only account for some aspects of use. *Mediated Data Collection* and *Combinations* also allow access to a range of information about user experience. In order to measure usefulness, or understand how technologies will be appropriated by people however, studies must take place over time. Methods that can be used during longitudinal studies, including ethnographies, are very important in this respect, but tend to contrast with

the expectations and practices of industry. Interestingly the area in which longitudinal studies most commonly occur is in the education sector where a combination of established methods and *Mediated Data Collection* are used e.g. (Curtis et al. 2002; Davis 2002).

The mobile HCI community is steadily building research methods for understanding mobile technology use that rely on a range of different methods combined with valuable new opportunities created by mobile technologies themselves. In future research we hope to explicate the preliminary framework, that we have presented here, by examining how the use of these different approaches, possibly in combination, can be used to overcome both the physical and privacy/ethical issues of accessing data for mobile research.

Although other researchers (Beck et al., 2003) report finding very little variety in the use of new techniques for Mobile HCI, we have found this not to be the case. The possibilities for research to understand mobile technology use in real settings are richer than might first appear from Kjeldskov and Graham (2003) broad review of mobile research methods. As self-reporting techniques become more sophisticated, those using mobile technologies are increasingly being asked to also act as the observers of their own use. Interestingly, neither of the reviews by Kjeldskov and Graham (2003) or Kjeldskov and Stage (2004), refer to forms of self reporting, which our survey has found to be a significant tool for studies of mobile use. It may be that this significance was yet clear when these earlier studies were written. However, developing more technologically sophisticated and contextually appropriate ways for participants to provide their own field data is an emerging area in mobile research methods. In addition, novels ways in which complex data about use can be automatically extracted through *mediated data collection* methods are also a significant research direction. The use of mobile technologies to record data, including images and video in public and private spaces, raises interesting and challenging issues for research design and research ethics. For example, responsibilities for data storage, access, future use and ownership take researchers through an often unanticipated maze of competing interests from private and public domains that existing research ethics committees are ill-equipped to manage. In particular, various forms of *mediated data collection* and the types of practical and ethical questions they pose represent a significant area for ongoing and future research. This paper provides a possible framework from which these issues can be explored.

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OZCHI 2005

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Foreword

Welcome to the interactive proceedings for OZCHI 2005. This CD contains information about the conference, the conference proceedings, and other key information about the conference.

OZCHI is the annual conference for the Computer-Human Interaction Special Interest Group (CHISIG) of the Human Factors and Ergonomics Society of Australia, and is Australia's and New-Zealand's leading forum for work in all areas of Human-Computer Interaction. For historical interest or reference, a listing of previous CHISIG conferences is provided. Where applicable, the list shows publication data for previous Proceedings.

Summary Proceedings Information

Greater detail about the proceedings is available on the proceedings information page.

All long and short papers underwent a double-blind review process by a minimum of two members of the OZCHI international reviewing committee.

These proceedings have been made available at the ACM (the Association for Computing Machinery) Digital Library, within their International Conference Proceedings Series - http://portal.acm.org/dl.cfm. Additional copies may be ordered from: secretary@chisig.org

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