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Acting Out in Context: Envisioning Users' Needs while Mobile

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Abstract

How can we anticipate and meet users' future needs for technological support while mobile when the practices around mobile technologies are emergent and profoundly influenced by their contexts of use? This paper describes Acting Out in Context, a method for envisioning the interaction between future technologies, mobile users and contexts of use. Acting Out in Context is demonstrated in a study of business professionals who 'act out' their needs as they travel to meetings. An outcome of applying the method is to draw our attention to the importance of understanding the breadth of users' needs for technological support while mobile rather than focusing purely on the design and evaluation of one particular type of technology or device.

Keywords

Acting out, envisionment, mobility, mobile technologies, user-centered design, design methods

INTRODUCTION

The increasing importance of knowledge and service work has been accompanied by a shift in the mobility of workers. Previously, a largely stationary workforce manufactured and transported physical products to customers. Today, much of the workforce is mobile and takes its expertise to its customers (Dahlbom and Ljungberg 1998). This shift has been facilitated by mobile technologies. Mobile technologies have been integrated into the everyday working practices of many professionals as they move from place to place meeting with customers and colleagues. Designing innovative technologies to anticipate and meet the future needs of mobile technology users is difficult because their technology practices are emergent, dynamic and contextual.

This paper presents Acting Out in Context, a method for envisioning the interaction between future information and communication technologies (ICTs), mobile users and the contexts of technology use. Acting Out in Context is an intensive yet 'light' method that builds on research in scenario-based and participatory design and theatre and futurist studies. Its use is demonstrated in a study of professionals travelling to meetings who 'act out' their needs. The participants employ low fidelity props to overcome typical difficulties that they encounter as well as possible future issues presented by researchers in mini-scenarios. The paper's main contribution is Acting Out in Context, a method for envisioning mobile users' interactions with yet-to-be-developed technologies in a networked environment. An important outcome of applying the method is to draw attention to the importance of understanding the breadth of users' requirements for technological support while mobile rather than focusing purely on the design or evaluation of a particular type of technology.

MOBILE USERS

The challenges of designing innovative ICTs arise from the complex relationship between users and technology. Users are unable to completely understand or express their needs, current or future (Davis 1998; Goguen 1994; Hocking 1996). These needs are not fixed but will change as users learn more about the possibilities of technology. New technologies are designed to afford and constrain use, both in the types of activities that users may undertake and the contexts in which the technology may be used. Users adapt to these affordances and change their activities to capitalize on the technology's capabilities. In addition, users may adapt (configure or personalize) technology to their particular needs, activities and contexts. Therefore, technology use is worked out through a process of exploration and adaptation and may emerge in unexpected ways (Carroll, Howard, Peck and Murphy 2001). These adaptations lead to new demands and requirements of the technology.

These challenges are exacerbated when envisioning interactions around mobile users. Supporting mobile users is more complex than designing fixed ICTs to be accessed by stationary users because of:

- The influence of multiple, changing contexts of use. Mobile and networked technologies facilitate connection between diverse people, technologies and data sources in different places at any time

- Emergent use practices. To date there is little stability in the uses of mobile technologies and so current practices quickly become obsolete (Dahlbom and Ljungberg 1998). The changing patterns of use are evident with young people's use of mobile phones. Mobile phones are pervasive amongst young people. It is apparent that their practices are shifting from a one-to-one to a many-to-many relationship between users and mobile phones. Increasingly the mobile is a commodity that is loaned, bartered, shared and sold. Analysing young people's practices around mobile phones suggests that they are creating a low-tech low-cost form of ubiquitous computing where connection is ever present through access to multiple available (but not necessarily personal) mobile phones.
- The increased likelihood of ad hoc behaviour. Mobile technologies facilitate ad hoc behavior (Carroll et al 2001) resulting in a gap between users' intentions and action. Access to ICTs while mobile allows users to modify their goals or plans in response to contextual triggers. Consequently, asking users what they will do in the future (that is, focusing on their intentions or asking them to predict their behavior) has limited usefulness.

Methods that attempt to predict emergent technology use include designer introspection, prototyping, mockups, organizational games, future workshops and scenarios (Greenbaum and Kyng 1991). One thread of this research has involved users in the design process through role playing or acting out scenarios (for example Ehn and Sjogren 1991; Howard, Carroll, Murphy and Peck 2002; Iacucci, Kuutti and Ranta 2000; Sato and Salvador 1999). An initial trial of acting out scenarios surfaced a number of shortcomings of these approaches including the loss of rich understanding of current practices during the construction of scenarios, uncertainty about the roles and responsibilities of participants arising from the use of actors or user surrogates and the primacy of theatrical performance over envisionment (see Carroll and Tobin 2003 for a more detailed discussion). Some of these shortcomings were addressed by deriving a process model for envisionment founded on theatre and futurist studies (Carroll and Tobin 2003). However, the process model was conceptual and not empirically tested.

The envisionment method described in this paper applies the process model and extends it in order to cater for the dynamic and contextual characteristics of ICT use while mobile. Acting Out in Context was constructed to help envision mobile users' needs for support from future technologies. It should be noted that the development and application of Acting Out in Context involves intensive research, that is, the detailed study of a few subjects or cases to build deep understanding rather than examination of representative samples from which generalisable outcomes are derived (see also Brandt and Grunnet 2000; Iacucci, Kuutti and Ranta 2000).

This paper describes Acting Out in Context and its key elements. The use of Acting Out in Context to study business users' needs as they travel to meetings is described and critically reviewed. The outcomes of the study suggest that the method makes a valuable contribution to our understanding of users' needs in a broad sense, not just in supporting work-related tasks but in providing support for their everyday practices that may include work, leisure, social and personal activities.

ACTING OUT IN CONTEXT

Acting Out in Context (AOiC) is a collaborative method where interaction between users and researchers is focused on future practices and technologies. Users undertake everyday activities and use low fidelity props to act out their needs and desires for technological support. They are encouraged to 'think aloud' as they act, articulating what they are doing and why and identifying any technological support that they desire. The facilitator (a researcher or designer¹) ensures that the focus of the interaction reflects the design aims. The facilitator poses mini-scenarios that alter the activities (e.g. you have to arrive at a meeting more quickly) or provide obstacles that must be overcome (e.g. you have to meet two team members prior to your next meeting). The researchers observe users' actions in their everyday environments rather than eliciting what the users think they would do in a hypothetical situation. The researchers then respond and intervene to further shape the envisionment process.

A major motivation for developing AOiC is the belief that successful envisionment requires rich sensory input. The sensory input is provided by acting in the users' everyday contexts of use. Immersion in context – where noise, crowds, existing technology and limited space trigger technological needs as well as users' ad hoc behavior – is an essential element of the method. Other elements are explained in the following sub-sections.

Field data

AOiC builds on understanding of current practices that is derived from field data. Retention and communication of rich data about current practices in the design process is difficult. AOiC addresses a shortcoming of our

¹ Researcher and designer are used interchangeably as the method is intended for professional as well as academic use.

previous envisionment work where the richness and realism of current contexts of use were lost as detailed textual descriptions were reduced to skeletal scenarios. AOiC features a stable core of researchers who gather field data and participate in the acting out, thus transferring their understanding of current practices into the acting out. Also, AOiC features real users who are experts in current practices rather than actors or surrogate users.

Mini-scenarios

Scenario-based design influences this work. Scenarios are commonly used to reason about future situations of use (Carroll 1994). They may take many forms but typically are textual stories that users verbally 'walk through'. We have built upon scenario-based design in two ways. Firstly, acting out rather than walking through scenarios lies at the core of the AOiC method. In AOiC users undertake a 'living' scenario and act out an everyday activity that is meaningful to users. Secondly, we use brief mini-scenarios to pose a series of 'What if?' questions to the user. Mini-scenarios enable the researchers to introduce a wide range of contextual dimensions and possible future events in order to observe the users' responses. The aim is to stretch users beyond the limitations of their existing experiences and knowledge to perceive some of the possibilities provided by technology. Consequently AOiC allows us to move beyond merely reasoning about future ICT use to simulating, as closely as possible, users immersed in possible futures. Use of multiple senses provides the maximum creative stimulation for the participants. Users are placed in situations where they are reasoning (thinking and verbalizing about a mini-scenario, as in a traditional walkthrough), doing (acting in response to a mini-scenario) and sensing (responding to visual, auditory and emotional triggers in real-life contexts) (Carroll and Tobin 2003). This immersion allows researchers to examine mobile users' actions and responses to contextual cues when envisioning future needs and technologies. Therefore, in AOiC scenarios are used to support creativity in design rather than post-design testing of aspects of artifacts that is usual in such disciplines as HCI (see Bodker 2000).

Acting Out

Methods such as role playing (Ehn and Sjogren 1991), focus troupes (Sato and Salvador 1999) and acting (Oulasvirta, Kurvinen and Kankainen 2003; Howard et al. 2002) involve artificial or theatrical performances. This can lead to the primacy of theatrical performance over envisionment where participants feel obliged to perform and force ideas for innovation (Carroll and Tobin 2003). The pressure to perform hinders rather than encourages opportunities for creativity. Also, the primacy of performance limits the input of the researchers who become observers rather than collaborators in identifying opportunities for technological support. Therefore, in AOiC the users undertake everyday activities in their actual contexts rather than participating in theatre or trying to act the role of a user. Not only does this achieve a shift from performance to envisionment but also it shares the responsibility for generating ideas amongst all participants (users and researchers).

Context

Context is a significant influence on mobile use of ICTs and accordingly it has a crucial role in AOiC. The acting out occurs in context to ensure realism of interaction and allow the researchers to examine the influences of different dimensions of context on users' actions. Researchers introduce mini-scenarios that incorporate both current and possible future instances of context, thus stretching users' understanding from here-and-now to what-might-be. The dimensions of context that may be relevant to mobile ICT users are listed, classified and expressed in a context table that is populated with current instances of context for mobile ICT users as well as possible future instances. These dimensions (Carroll 2004) include:

- Spatial context refers to place and the characteristics of place including such environmental details as weather conditions and noise levels. It also refers to space (virtual or physical) such as meeting rooms and cyberspace.
- Temporal context includes both absolute (9am) and relative (before, faster) time and events scheduled (outstanding, current or pending) and past (historical).
- Technological context refers to the possible telecommunications infrastructure, applications and interactive systems and other accessible devices.
- Social context refers to the people (and collections of people) that are present or accessible including such characteristics as their purposes and activities as well as more abstract qualities such as trust, politics and culture.
- Behavioural context reflects the ways that users may act and interact with other people, objects and technologies

- Internal context refers to the users' motives, desires and needs, their state of being including emotional and cognitive issues, their knowledge of the current situation, the resources and people available, as well as knowledge beyond the current situation, and
- Structural context incorporates the norms, rules and etiquettes that shape, and are shaped by, users' actions. This includes organisational rules and accepted practices around use of personal technologies.

Props

Props are used in AOiC to mediate between the users, their desired activities and the contexts in which they act. The form factors of any representations of technology are likely to have a significant influence on users' acting out (Brandt and Grunnet 2000). Therefore we offer props that are bare representations of technology rather than high fidelity prototypes. Because the focus of AOiC is envisioning future practices and technologies rather than examining particular form factors, these props are selected to enable users to focus on the support offered by technology rather than its form.

Outcomes

The outcomes of AOiC sessions may be identified by users or designers as part of the acting out, as part of the users' or designers' debriefing or through later analysis of video- and audio-tapes and designers' field notes. The expected outcomes are indications of possible future technologies and their uses, contexts of use and impacts. These are always partial, fragmented and incomplete because future technologies and their emergent uses and contexts of use can never be completely predicted.

RESEARCH METHOD

Mobility may involve movement within a place, between places or further afield (Dahlbom and Ljungberg 1998). AOiC was employed in a study that focused on traveling from place to place and examined users' needs as they moved from their organizational headquarters to meetings at clients' offices within a large city (for details of the whole study see Carroll, Kjeldskov, Tobin and Vetere 2003). Employees from a regional Head Office of a large international technology company were selected as participants in the belief that they would be familiar with ICT innovations, receptive to the idea of creativity in envisioning technologies and exemplars of cutting-edge ICT practices. The practices of seven users including senior managers, sales and technical middle managers and a cognitive engineer were studied.

The research process is represented in Table 1. We recognize that there is no 'recipe' or infallible process for successful envisionment. An existing process model (Carroll and Tobin 2003) was adapted for the aims of the study and the characteristics of the research site. Interviews and Contextual Interviews (Holtzblatt and Beyer 1993) were used to collect data about the organizational context and users' current practices, preferences and needs. The data were analysed to form inputs to the Acting Out in Context.

Designers	Designers and users
	<u>Field work</u> Interviews Contextual Interviews
<u>Acting Out in Context</u> Construct context table Build mini-scenarios Select a range of candidate props	
	Prepare users Sample AOiC scenario
	Select props
	Construct mini-scenarios in situ Offer alternative props
	<u>Outcomes</u> Debrief users
Debrief researchers Analyse data Document findings	

Table 1 The research process

Field Work

Four users who travel frequently to off-site meetings were interviewed in a meeting room at the Head Office. The interviews provided an overview of the organizational context and descriptions of current work practices, including meeting scheduling and rescheduling, materials taken to meetings and current methods of coordinating between team members. They were effective in gathering the users' opinions and perceptions of current practices and ICT use.

Contextual interviews involve interacting with users as they carry out their everyday activities (Holtzblatt and Beyer 1993). They were held with three users traveling to meetings by car. Contextual interviews rather than participant observation were used as they involve more active intervention by researchers. Questioning the users as they work in their everyday contexts enabled the researchers to 'see through the users' eyes' (Nardi 1997). The high level of intervention achieved time and labor savings through a tight focus on the research aims. The contextual interviews enabled observation of the artifacts used by users in their activities and highlighted some of the users' needs for technology support as they traveled to meetings.

The field work provided understanding of current practices. This was used in two ways. Firstly it informed the construction of the context table (the dimensions of context as well as instances of these dimensions) from which mini-scenarios were derived. It also helped the researchers to select a range of props suited to the users' work practices (for example, in our previous work a fluoro-colored cycling jacket was offered as a prop; clearly this was not appropriate for this user cohort).

Context Table

A table was constructed listing the contextual dimensions that are relevant to mobile users practices and populated with instances appropriate to the users' work practices, their company and typical issues to be dealt with while mobile (these dimensions were refined and expanded as a result of reflection on this study; the refined dimensions are detailed in Carroll 2004). A sample of the table is presented in Table 2. The facilitator used this table to construct mini-scenarios that were addressed by the user as part of the acting out process.

Characteristics	Virtual Instances	Physical Instances	Relative Instances
Contextual dimensions			
Spatial	On-line Chat room	Victoria St Cafe	Unknown address Noisy
Temporal	Scheduled Past	3pm The 26th	Before Faster
Technological	Voice mail Corporate network	PDA Traffic lights	Working Secure
Social	On-line chat list	Project team Clients	Alone Private

Table 2 Sample contextual table

Acting Out in Context

Two AOiC sessions were undertaken. The first session involved to a sales leader and the second session a technology manager. In each session the user traveled to an off-site meeting. The meetings were genuine so all participants were under pressure to ensure that the user arrived on time. Two researchers met with the user in an office within the Head Office; the author acted as the facilitator and a second researcher observed. Another researcher joined them once the acting out had started and video-recorded the session.

Each session began with dialogue between the participants (researchers and the user) about the goals of the project and the AOiC session, the format of the acting out (the use of props and mini-scenarios) and the roles and responsibilities of those involved (see Carroll and Tobin 2003).

The two researchers then enacted a sample scenario to demonstrate acting out as well as our expectations of the roles and responses. In the sample scenario, a researcher sent a presentation stored on the Web to a projector and located the appropriate notes. He selected several props, explained the reasons for his choice and 'thought aloud' as he acted. The facilitator posed a mini-scenario relating to a client's question that required collection of diverse information. The first researcher showed how the props could help him in enacting the mini-scenario. The user was invited to join in the acting out so that the roles of user and researcher were blurred: the user could see that the responsibility for envisionment was shared amongst all participants. At the end of the sample

scenario, the salient aspects of acting out – the use of props, mini-scenarios and ‘thinking aloud’ while acting – were summarized by the facilitator.

Next, a range of props was presented to the user. Each prop offered a different medium for interaction: reading, writing, looking, listening and speaking (tablet and PDA-sized blocks of wood, sunglasses, earphones and a wearable microphone). In both sessions the user selected a tablet-sized prop and then set off to the meeting.

The users employed the prop to demonstrate the kinds of technological support desired while in transit. For example, one user pointed the prop at a ‘hot spot’ within the tram to connect to the company’s database to access client data. In response to a mini-scenario describing a car accident that affected his travel, a user ‘wrote’ on the prop with his finger and said: *“Alerts – there’s an accident up there, open it up, map of where the accident happened. Yes, that’s relevant to me, and get information about delays and how to get around the accident.”*

OUTCOMES

At the end of each AOiC session, the user was debriefed. The facilitator summarized the key outcomes and needs; these were validated by the user.

The researchers then debriefed; this was recorded by audio-tape as well as field notes. This debriefing consisted of summarizing observations as well as brainstorming possibilities and was an especially rich source of insights. The audio- and video-tapes were transcribed and analyzed along with the field notes. A range of needs and opportunities for technological support were identified. Clearly, given our focus on mobile users traveling to meetings, much information relating to meetings and travel was gathered. Users also expressed their preferences for form factors of mobile devices. Other outcomes are classified as work-related tasks and the themes that are ‘wrapped around’ these tasks.

Meeting-related tasks

Meeting-related tasks encompass preparing for the meeting, communicating with those involved and then following-up after the meeting. Typical meeting preparation involves reviewing background notes, investigating any important issues and noting the user’s objective from the meeting. If the user drives to meetings then this preparation must be completed in the office. However, *“more often than not, last minute issues arise in the hour before a meeting”* so colleagues are contacted to try to gather information about the issue, that is then communicated to other members of the team attending the meeting. Usually the users arrive a little early for meeting; one user described how she jots down her ideas and would like to access her email and make appointments to use her time efficiently. *“It would be good to be able to message people, using AOL, preparing to and from a meeting, especially following up on things that happened.”* After the meeting, this user contacts her colleagues to let them know how the meeting went. Access to email in a networked environment would allow her to do this while the issues are fresh in her mind rather than her current practice of returning to the office (which may not be until the next day). Not only would this prevent her forgetting details but also she believes that it looks more professional.

Travel information

Two important tasks were locating the meeting and ensuring a punctual arrival. Most meetings were held in known locations but location-related information was seen as valuable for non-routine tasks: *“Online mapping would be very good to locate new clients – I may know the general area of the office but it would be great to be able to pinpoint the specific location.”* A ‘location map’ would be useful to highlight nearby café in order to meet up with colleagues before a meeting. One mini-scenario concerned a meeting that was shifted to a new location. The user tapped the prop, viewed the street directory, ‘typed’ in his location and said: *“OK, find where the new location is”*. He added: *“it would be great to have an ETA [estimated time of arrival] so that, in the case of an accident or holdup, I could call the client and warn that I will be late.”*

Form factors

The form factors identified during the acting out correspond to established technology ideas. All users (in the field work as well as the AOiC) expressed a need for a converged device to replace the mobile phones, PDAs and laptops that constituted their everyday equipment for meetings; they carried extensive paper-based materials as well. One interesting observation was that both users declined to change the prop or to augment it with another prop during the AOiC sessions.

The size of the prop stimulated many comments and was perceived as ideal for people in transit: *“a device like this, not as big as a laptop but larger than a PDA...”* As the user described the size of the device, she tapped the prop and illustrated how she would write on it. The second user reinforced this when acting out: *“Again, this is*

why you need the bigger device. If you're looking at a map with public transport, road etc, you need to have a big enough area to see the context of that information." In comparison, an IPAQ is too small and involves too much scrolling; with a device the size of the prop "you can do reading or writing for work." This user found the prop very convenient to carry while in transit.

Issues of privacy and security influenced preferred input and output forms. When traveling on crowded public transport, the users would employ text rather than voice to interact with clients: "You don't know who's sitting beside you, it may be another client or competitor. I'm far more comfortable writing to someone, typing it in." In such situations the user would contact the client and ask that they use text to communicate due to privacy issues. It is noteworthy that this user would use email but not SMS to clients but uses SMS to contact her colleagues.

Finally, users wanted to pull in information to their props rather than having advertising or irrelevant information pushed onto them: "GPS, people, systems knowing where I am. Could be handy but I'd prefer to be able to search for stuff that's around me and me connect to it rather than it being automatic and sensing stuff. I want to limit the information coming in. Information a bit like spam ... I get too much information coming in as it is. If I want information, I'll go and ask for it and bring it in."

Wrapping

The users' attention was not focused solely on the meeting or travel details while traveling to a meeting; there was a 'wrapping' of broader issues around these tasks that were addressed as well. Firstly, the users paid attention to their work as a whole. This included planning the rest of the day or week, contacting colleagues about problems or future meetings, keeping up-to-date with ICT advances and communicating with other members of a work team. This necessitated remote access to the company's intranet (not currently possible) as well as more general information about the industry or economic situation. For example, both users suggested that access to the business sections of major newspapers would be valuable while traveling.

Secondly, users desired technological support to meet their personal needs. They wanted entertainment while in transit. One user expressed a desire to listen to music, "especially if it is noisy and I have to read over my notes to prepare". Despite this, the user chose to use the tablet-sized prop throughout her acting out. She described this need verbally rather than demonstrating it using the earphones that were available; this is an example of how the users resisted adding to the prop once the session had started. She also demonstrated how she would attend to personal needs such as contact with friends and family, personal development and access to her private calendar.

EVALUATION

The underlying rationale of AOiC is the desire to drive technology innovation from users' needs and desires rather than purely from the capabilities of technology. The method incorporates the principles of user-centred design and heeds the four issues for user-centred design presented by Greenbaum and Kyng (1991): to take users' work practices seriously, to deal with users as people rather than performers of functions, to study users and their practices in context and to include the social aspect of work. These issues have been addressed with a focus on future rather than current work practices and technological needs through the AOiC method. In this section AOiC is evaluated in terms of the outcomes, the method and shortcomings that were noted.

Outcomes

A range of needs was identified in the study including:

- functionality related to meetings and travel information
- access to multiple technologies while mobile (including the company's database, email, on-line newspapers, music, text messages and voice)
- convergent mobile devices to replace the multiple artifacts currently carried (electronic and paper); and
- a broader 'wrapping' of needs around meeting-related functionality.

The process of envisionment of interactions with future technologies surfaced a far broader range of needs than expected. While in transit, the users did not focus merely on travel and preparation for the upcoming meeting. They multi-tasked, seeking support for more general work tasks and social activities while providing entertainment or protection from intrusive contextual influences. Thus, the users wished to continue their everyday, office-based practices as they traveled to meetings. They wanted ICTs to provide them with a 'mobile office' including communication via voice, email and text messages; daily or weekly scheduling, current tasks and client addresses; social and leisure activities including music, text (newspapers and books), personal development (often accessible via the internet) and private calendar. The users demonstrated their needs for a

converged, mid-sized mobile device that would interact with a networked environment to provide a range of information, communication and entertainment functionality.

These findings are consistent with those of Luff and Heath (1998) for users' need for mobile (handheld) devices that mediate between mobile users and a diverse set of fixed systems spread throughout the physical context of work. They are also consistent with observations of the use of mobile technologies amongst young people that reflect blurred boundaries between work, educational, social and personal activities (Carroll et al. 2001).

AOiC proved to be an effective method for stimulating envisionment of future mobile technologies and practices with this user cohort. While fieldwork provides a sound understanding of current practice, AOiC contributed an understanding of users' needs in relation to possible future practices – the set of inter-related purposes, tasks and activities that will occur as they negotiate the changing and unpredictable contexts of their working days. We have called this the 'wrapping' around the users' tasks to emphasise the need to transcend a task or goal focus and address the rich complexity of everyday practice. This addresses Greenbaum and Kyng's injunction to move from narrow task-focused analyses to a consideration of work as rich, inter-related ensembles of activity. The tension between a narrow, task focus and a broader practice-based view was apparent when the design implications of the study were examined. The technical solutions proposed included a narrowly-focused, location-sensitive handheld device; this had been posed prior to any interaction with users and reflects a designer- rather than user-centred approach to design. A broader focus was reflected in design sketches of a multifunctional foldup tablet and a networked system that stores a user's preferences for support in different contexts and is accessed by 'dumb' handheld devices.

The Method

Users play an active role in AOiC: it involved the users *doing* everyday activities and *showing* their needs – using a finger, pretending to push buttons or pointing at an external information system – for informational and technological support while travelling. For example, the stated desire for converged mobile devices was reinforced when users declined to employ multiple props while acting out.

The users dealt well with the acting out. One key to this success involved building rapport between the researchers and users prior to the acting out sessions. Both users were involved in the fieldwork, one in an interview and the second in a Contextual Interview. They were then willing to enter into the spirit of envisionment: "*I guess we're talking about ideal situations: not what can be achieved with current technology.*" This provided a means of stretching the users' understanding from what they currently know to what they can imagine about the future.

Studying users in context provides access to their actual, minute-to-minute experiences rather than their analyzed, summarized and recollected accounts of what they do (Beyer and Holtblatt 1998). Contextual methods are more likely to reveal routine or 'invisible' activities. For example, needs arising from unoccupied time while waiting for transport or after arriving early for a meeting only became apparent in the AOiC sessions. Contextual methods also enable designers to examine the impact of context on users' activities. An increase in noise triggered a response from the user who suggested that listening to music through earphones would help to block out noise while she worked. Further, it was only while acting in context that a user realised the quantity of information that could be available in a networked environment. His response was to request some means of structuring the information so that he could access it as needed rather than having it 'pushed' onto him as he traveled to meetings.

The ability to manipulate contextual influences, to combine possible future dimensions of context and pose mini-scenarios that involve transitions between these dimensions of context pushes the focus of acting out from the present to the future. This allows designers to anticipate some possible future technological supports for mobile users as outlined above.

AOiC provided specific information relating to ICT use in context and the emergent needs that arise from the interaction of the user with the prop in context. The surrounding environment acted as an additional prop in the performance. The interaction between the mobile prop and the surrounding environment triggered discussions of users' needs and wants: "*I'm here and I have this problem and would like this information accessed from our corporate database...*" In particular, these identified location-specific information needs: the information needed while wandering within the Head Office was different to that needed at different locations while in transit and different again to that needed outside the location of the meeting.

When acting in real contexts of use rather than in theatre spaces or laboratories, scenarios cease to be a-contextual stories. Users are acting in 'their' world; this acts to redress the imbalance of power and control typical in ICT design. The designers participate in the users' world, seeing technological needs and opportunities through users' eyes and actions. This can lead to true participatory design where users and designers are participating in each other's worlds.

AOiC is the outcome of several iterations of designing, applying and evaluating envisionment methods. When constructing AOiC, we heeded the lessons – both positive and negative – from our earlier experimentation with theatrical performance. Consequently AOiC has an underlying process model that is the outcome of iterative experimentation and reflection (see Carroll and Tobin 2003). Issues such as retention of the richness of the field data, the advantages of acting out versus performance, employing mini-scenarios to stretch users' understanding, the role of contextual influences and use of low fidelity props have been considered. The elements of AOiC have been selected as the result of deep thought rather than ad hoc pragmatism. The outcome of this experimentation and reflection is a 'light' field method that is less labor- and time-intensive than ethnography. Intervention through mini-scenarios achieves time savings and a tight focus on the project aims. Therefore AOiC provided a realistic and practical method for envisioning mobile users' needs for future technologies and practices in future contexts of use.

The Shortcomings

Several shortcomings of AOiC were noted. The acting out involved users carrying a prop, being observed and filmed by strangers and drawing attention from other passengers while trying to demonstrate and articulate their needs and imagined future needs. In this situation, envisionment received only partial attention from both the users and the researchers. This suggests that contextual methods should be complemented with methods that are applied out of context; this would allow participants to give their full attention to envisionment and provide the researchers with greater influence on the acting out process (see Carroll and Tobin 2003).

Also, we observed that it is difficult to 'stretch' the users beyond their knowledge of familiar form factors. The users' envisionment appeared to be limited by their knowledge of current ICT and infrastructure and, as a result, possibilities for support were overlooked. This may be a consequence of the research site: the users' business is technology and their professional skills are built around current and soon-to-be-implemented technologies. More effective stretching of the users could be achieved through more thorough preparation of users prior to acting out. For example, video clips or prototypes of some of the imminent and likely technological innovations that relate to mobility could be shown to users. Alternatively, high fidelity props that imply a limited set of likely functions (such as TV or emotional indicators on a handheld device) could be employed. These strategies bear a risk that participants' attention may be directed towards form factors or specific functionality rather than stimulating a broad range of possible technological supports for mobile users.

CONCLUSIONS

This paper has presented Acting Out in Context, a method for envisioning the interactions around future technologies. The motivation for developing the method and its key elements are explained, as well as its application to envisioning the needs of users in transit to meetings. An outcome of its use is a description of the users' social, personal and business needs as well as those related more immediately to meeting and work-related tasks. Such an outcome is consistent with previous research and suggests that focusing on tasks when determining the needs of mobile ICT users is inappropriate. As shown in this research, use of mobile technologies does not just involve tightly-bounded tasks but also includes personal, social and emotional 'wrapping' that is crucial for understanding and explaining ICT use in a world characterized by increased blurring of work and private lives.

The AOiC method and the research findings reflect the principle of treating users as people rather than performers of functions (Greenbaum and Kyng 1991). Extracting a sub-set of users' needs and designing and evaluating a prototype to meet these would add yet another device to be carried by users. In the AOiC sessions, the users demonstrated a desire for simplicity and convergence in a networked environment. Consequently, researchers and designers need to consider the entire set of users' needs and wants when mobile and generate innovative solutions to meet them rather than evaluating the usability of yet another technological gadget.

Evaluation of AOiC suggests that it is sensitive to the highly contextual and emergent nature of mobility. It provides a way that needs for future technologies can be induced from current and envisioned future practices rather than from the beliefs, assumptions or theories of technology designers and marketers. This is particularly valuable given the trend towards ubiquitous or pervasive computing. Designing the technologies that constitute these networked environments and understanding possible users' practices within such environments is extremely difficult. A user-centered method such as AOiC provides one means of envisioning these.

To date, our acting out methods have been applied in single, intense episodes of action. One area for extension of the method is to apply it, with other forms of field work, in a longitudinal study to tease out more of the emergent needs and impacts around innovative mobile technologies. This would feature periodic episodes of acting out and a stronger focus on group interaction.

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