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# Designing Ambient Intelligent Scenarios to Promote Discussion of Human Values

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Ambient technology evokes a near future in which humans will be surrounded by 'always-on', unobtrusive, interconnected intelligent objects. Always connected raises concern over human values. This study uses a privacy and trust framework to evaluate two Aml scenarios one health related and the other to the everyday task of shopping. Findings are discussed in relation to dimensions of trust, privacy and the impact upon human values.

## 1. Introduction

Ambient technology evokes a near future in which humans will be surrounded by 'always-on', unobtrusive, interconnected intelligent objects few of which will bear any resemblance to the computing devices of today. Devices embedded in the environment will communicate seamlessly about any number of different topics e.g. your present state of health, when you last ate. Interactions with devices and at the same time other people will become anywhere, anytime. The innovative design of Aml technologies will bring the 'wow' and 'must have' factors as more and more people accept and use them without considering their true benefits (we must acknowledge that the benefits to some people will be great, for example the housebound).

As systems become more ubiquitous and free the user from time and place, research suggests that although anytime, anyplace may be possible it may not always be acceptable (Perry et al 2001). Nijholt et al (2004) argue research tends to focus on the interaction with the device or environment and not with other people or how the user is willing, able or wants to communicate with the environment or have the environment communicate with them.

People have existing expectations about how technology works and social norms provide cues on how they should interact in any given situation (Jessup & Robey 2002). Therefore we must question whether Aml technology will change the way humans interact socially. As we move into an Aml society designers and service providers need to address the issue of human values and consider the social implication of Aml adoption and use.

To try to understand human values, we need to consider many concepts including: behaviour, trust, privacy, security, inclusion, social norms, respect, self-esteem, context, choice and control. This study considers two of these factors: trust and privacy. Two Aml scenarios related to health and the everyday task of shopping are used to explore these issues. Findings are then discussed in relation to human values.

## 2. Evaluating Privacy and Trust

Privacy is a multi-dimensional construct encompassing physical and social judgments (e.g. Pederson, 1999). There are four main dimensions of privacy relevant to Aml research: physical, informational, psychological and social. Each dimension of privacy i.e. informational, psychological, physical and social is evaluated in this framework using four concepts: reserve (not revealing information about oneself to unwanted others), isolation (being geographically removed from and free from unwanted others observations), anonymity (being seen but not identified or identifiable to unwanted others) and solitude (freedom from observation by unwanted others).

Trust and privacy are inter-related constructs – the more we trust, the more information we are prepared to reveal about ourselves (Teltzrow & Kobsa 2004). Social commentators recognise that trust is essential for society (Fukuyama, 1996). Trust is also associated with risk, generally the higher the risk the less people trust. An interesting picture is emerging about the ways in which individuals make trust judgments in technology-mediated interactions; however trust judgments are not always made on

a rational basis. As trust is multi-faceted several factors are important when understanding Aml use. The framework used in this study to evaluate trust is based on personalisation, motivation, expertise, familiarity, predictability, sensitivity and the actual source of the information.

	Stakeholder	Device	User
<b>Trust:</b>			
Personalisation			
Motivation			
Expertise			
Familiarity			
Predictability			
Sensitivity			
Source			
<b>Privacy</b>			
Informational			
Psychological			
Physical			
Social			

Table 1: Trust and privacy framework for evaluating Aml technology use

### 3. Scenarios of Aml use

Consider the following scenarios one related to health and the other to the everyday task of shopping:

1. Bob is in his office talking on his personal digital assistant (PDA) to a council planning officer with regard to an important application deadline. Built into his PDA are several personalised agents that pass information seamlessly to respective recipients. A calendar agent records and alerts Bob of deadlines, meetings, lunch appointments and important dates. As Bob is epileptic his health agent monitors his health and can alert people if he needs help. An emergency management agent takes control in situations when a host of different information is needed; this agent has the most permissions and can contact anyone in Bob's contact list.

Bob is going to meet his friend Jim for lunch when he trips over a loose paving slab. He falls to the ground and loses consciousness. His health agent senses something is wrong and beeps, if Bob does not respond by pressing the appropriate key on the PDA the agent immediately informs the emergency services. Within seconds the emergency services are informed of Bob's current situation and his medical history. An ambulance is on its way. Paramedics arrive, examine Bob and then inform the hospital of Bob's condition on their emergency device. The hospital staff are now aware of Bob's medical history and his present state, therefore on arrival he is taken straight to the x-ray department. A doctor receives the x-rays on her PDA. After examining Bob she confirms that he has a broken ankle, slight concussion and needs to stay in hospital overnight. After receiving treatment Bob is taken to a ward. His emergency management agent contacts John (Bob's boss) of his circumstance. The emergency management agent transfers the planning application files to John's PDA so the company do not miss the deadline. The agent also informs his parents letting them know his current state of health, exactly where he is so they can visit and that his dog needs to be taken care of. As Bob is also head coach at a local running club the agent informs the secretary Bob will not be attending training the following week. The secretary only receives minimal information through the permissions Bob has set.

Trust evaluation: Three agents on Bob's PDA control the amount and type of information revealed to others. For Bob motivation and predictability are the main factors that influence use. His PDA is personalised, familiar and predictable – he knows the agents will take control and help him. The stakeholder, in this case the hospital, is expected to act in a trusted way by treating Bob's health information as sensitive. Trust associated with the hospital is gained by source credibility, their expertise and predictability.

Privacy evaluation: All four dimensions of privacy need to be evaluated in the health scenario. When related to health physical privacy is an important issue. To understand the need for physical privacy; reserve, anonymity, isolation and solitude are all implicated in this dimension. Reserve and anonymity

are implicated with both psychological and informational privacy. All four concepts (reserve, anonymity, isolation and solitude) are required when trying to understand the need for social privacy.

*2. Anita arrives at the local supermarket grabs a trolley and slips her PDA into the holding device. A message appears on screen and asks her to place her finger in the biometric verification device attached to the supermarket trolley. Anita places her finger in the scanner and a personalised message appears welcoming her to the shop. She has used the system before and knows her personalised shopping list will appear next on the PDA screen. Anita's home is networked and radio frequency identification tags are installed everywhere. Her fridge, waste bin and cupboards monitor and communicate seamlessly with her PDA creating a shopping list of items needed. The supermarket network is set so that alerts Anita of special offers and works alongside her calendar agent to remind her of any important dates. As she wanders around the supermarket the screen shows her which items she needs in that particular aisle and their exact location. The device automatically records the price and ingredients of every item she puts into trolley and deletes the information if any item is removed. When Anita is finished she presses a button on the PDA and the total cost of her shopping is calculated. Anita pays for the goods by placing her finger on the biometric device and her account is automatically debited, no need to unpack the trolley or wait in a queue. The trolley is then cleared to leave the supermarket. Anita leaves the supermarket, walks to her car and places her shopping in the boot.*

Trust evaluation: Anita is motivated to use the shopping system as it saves her time and also is familiar with it as she has used it before. As her home is networked she considers the system and device to be predictable i.e. her shopping list will be exactly what she needs. the system is personalised by the use of biometric verification and tailored to her needs. the stakeholder, in this case the supermarket, is motivated for shoppers to use the device as it increases sales and can target customers will personalised special offers. Trust is also gained by the supermarket's source credibility, predictability and being sensitive to the information they hold about Anita's shopping habits.

Privacy evaluation: All four dimensions of privacy are implicated in the shopping scenario. Reserve, anonymity and solitude are all associated with both physical and social dimensions of privacy. Reserve and anonymity need to be considered with the psychological and informational dimensions.

#### **4. Conclusions**

To evaluate the social impact of Aml use trust and privacy issues need to be understood. The framework used in this study to evaluate trust and privacy has revealed different contexts, stakeholders, device type and actual user all need to be considered. This is important if we are to fully understand user interaction with Aml technologies.

To establish trust and privacy the following questions need addressed when related to information exchange: Who is receiving it? Who has access? Is the receiver credible, predictable and sensitive? Where is the information being sent and received? Does the user have choice and control? How does the device know who to communicate with e.g. through personalised agents? This raises interesting questions regarding permission setting within an Aml context – regarding the extent to which individuals should be allowed to make day to day decisions about who or what to trust on an ad hoc basis, or should employ agent technologies that represent their personal trust and privacy preferences and communicate these to other agents (Marsh 1994).

As humans are inherently social beings and our actions are always directly or indirectly linked to other people findings from this evaluation raise some interesting questions related to human values: Will people begin to rely to heavily on Aml technology? Will people be comfortable exchanging all types of information even when of a very personal nature? Will the way we socially interact change and social norms along with it? Will society become one where people feel more at home interacting with their fridge instead of other people? Will Aml technology blur the boundaries between home and workplace boundaries making society one of efficiency and productivity taking over from love and leisure time?

Aml technology does bring benefits e.g. less time pressure, no queuing for goods, memory aids. However the disadvantages in our social world might be far greater e.g. less social interaction, reliance on machines, less privacy.

We need to fully understand the true advantages and disadvantages of Aml technology. To understand the focus should be on human values and the interaction between people. For over twenty years researchers have emphasised the importance and the need for the HCI community to understand values (e.g. Shneiderman 1990, Fink 1983). As Gaver (2001) notes technology needs to be designed so it supports values: individual, social and cultural. The HCI needs new methods and approaches to deal with the changes Aml will bring. An interesting way forward could be to look into frameworks used in the area of community psychology. Community psychology is explicitly value-laden, focusing on the individual, the community, wider society and importantly social responsibility.

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