

Interpersonal Awareness in the Domestic Realm

Carman Neustaedter, Kathryn Elliot, and Saul Greenberg

University of Calgary
2500 University Drive NW
Calgary, AB, Canada

[carman, elliotk]@cpsc.ucalgary.ca, saul.greenberg@ucalgary.ca

ABSTRACT

Family and friends naturally maintain an awareness of each other on an ongoing basis (e.g., knowing one's schedule, health issues) and many technologies are now being contemplated to help fulfill these needs. We use findings from a contextual study along with related work to present *interpersonal awareness*—a spectrum that differentiates how people desire and gather awareness for individuals across three different social groupings: *home inhabitants*, *intimate socials*, and *extended socials*. We compare this spectrum to workplace awareness and discuss how our study findings can be used to analyze and design domestic awareness technologies.

Author Keywords

Awareness, domestic environments, family and friends

ACM Classification Keywords

H.5.3. Group and Organization Interfaces: computer supported co-operative work.

INTRODUCTION

Home inhabitants naturally maintain some semblance of *awareness* of their family members and friends (Mynatt *et al.*, 2001, Tollmar and Persson, 2002, Beech *et al.*, 2004). For example, parents often need to be aware of their children's extra-curricular schedules to coordinate rides (Neustaedter and Brush, 2006), or a spouse may plan dinner depending on when their partner may be home. We also know that this awareness extends beyond immediate home members to include others such as friends and the extended family (Grinter and Palen, 2001, Mynatt *et al.*, 2001). Friends may want to know about another's schedule to plan a night out. Families need to know the well-being of an elderly parent who lives elsewhere (Mynatt *et al.*, 2001).

We use the term *awareness* here as this is how prior work studying domestic culture has characterized the types of knowledge we have just described. However, awareness is a widely used (and sometimes considered overused) term that encompasses many different situations (Schmidt, 2002). We have further classified awareness in the domestic realm as *interpersonal awareness* because the existing research shows that awareness in the

domestic realm is focused on existing *interpersonal* relationships between people. The means by which these relationships are formed and maintained is described in detail in the disciplines of sociology and social psychology (e.g., Smith and Williamson, 1977). Our interest lies in understanding how interpersonal awareness is acquired and used between individuals with established relationships, where all have a real need and desire to know about each other.

An extensive body of research already focuses on understanding awareness in the workplace (see Schmidt, 2002 for a summary). While we expect some of this understanding to apply in the home, we also expect that the nuances of how awareness is gathered and used will differ within the personal social context of family and friends. Thus, the work presented in this paper steps beyond awareness in the workplace. Instead, we investigate awareness in the domestic realm as it pertains to people and their personal social networks. Interpersonal awareness has yet to be presented in its entirety and, for this reason, we present breadth coverage of awareness in the domestic realm rather than depth coverage of any one particular area.

This paper has two main parts: an empirically-based *model of interpersonal awareness*, and a discussion of its value and implications for design. The first part forms the basis for how we think about the awareness space in domestic environments. Here we outline the spectrum of people within one's social network for whom interpersonal awareness is desired; the information that is maintained and its uses across this spectrum; and, the techniques people use to maintain the awareness. In the second part, we compare interpersonal awareness and workplace awareness to draw out design implications and then analyze existing awareness technologies to understand where they succeed or fail at meeting domestic needs.

METHODOLOGY

Our model of interpersonal awareness is based on the combination of existing theories, studies of domestic culture, and lessons learned from technology design. Our own contextual study forms a large portion of this analysis and we first detail its methodology.

Existing interpersonal awareness research (e.g., Mynatt *et al.*, 2001, Tollmar and Persson, 2002, Beech *et al.*, 2004) shows there are some individuals whom people desire more awareness for than others. However, what is not clear is how one's social contacts typically fall within this range and whether different levels of awareness need translate into different awareness maintenance techniques

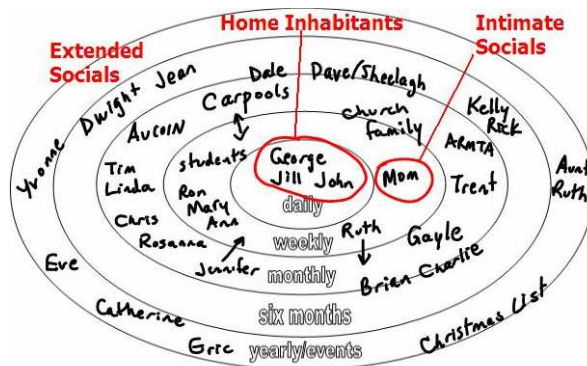


Figure 1. A participant's social target (reproduced).

or the need for different awareness information. For this reason, our method controls this aspect of range to understand how it affects awareness acquisition. This characterizes our study as a probe to understand awareness as a range of needs and provides an appropriate basis for comparing the techniques and information desired for one's differing relationships.

Method: Participants were 29 people comprising ten different households. We sought diversity: five participants were teenagers, sixteen were young-mid adults aged 20 to 39, and eight were middle-aged adults between 40 and 60. For pragmatic reasons, we avoided participants under the age of thirteen. Participants varied in work/school backgrounds, ethnicity, and household composition. All stages of our contextual study took place in the participants' own home, as this setting reminded participants of their methods and desires for gathering awareness information of their household, family and friends. Over the course of about an hour, each study participant completed two main activities: a paper-based task and an interview.

(1) Paper-Based Task: We asked individual participants to articulate their social network as a function of how they wanted to maintain some sense of awareness for particular individuals. Awareness was loosely described to participants as a general sense of an individual's whereabouts and activities. This description was deliberately vague, as we were particularly interested in how participants created their own definitions of "awareness," though our methodology does indicate to participants that there is likely a range of awareness needs for their social contacts.

Participants were given what we call a *social target*. By way of example, Figure 1 shows the reproduction of one participant's completed social target. The target contains several concentric rings labeled with time frequencies: daily, weekly, monthly, six months, and yearly/events. We asked participants to write and locate on the target the names of individuals or groups that they wanted to stay aware of at a matching time frequency. Thus, the location of the name within a particular ring of the target indicates the frequency of the desired awareness. For example, in Figure 1 the participant wrote the names of her husband George, daughter Jill, and son John (all names changed to preserve anonymity) in the centre ring indicating that she wanted daily awareness information about them. We used

this task to generate discussion points for our interviews.

(2) Semi-Structured Interview: Next participants took part in a semi-structured interview in their home. We asked each participant about his/her social target where the discussion focused on understanding the relationships participants had with people on their social targets, what awareness information they wanted to maintain about these people, how they maintained this awareness, and how they would use this awareness information. The final stage of the interviews had participants show us where they store and use information in their home. Detailed findings from this phase can be found in Elliot *et al.* (2005); we highlight only the most relevant here.

Analysis: We analyzed activities and observations using the open coding technique (Strauss and Corbin, 1998) to compare participants and households. That is, for each observation we assigned it a code that stylized it (e.g., [H] for awareness about health), and used that code to mark any recurrence of it. Observations that did not fit were given a new code. This analysis methodology is widely used and accepted in the social sciences; thus, we now turn to our results instead of low level analysis details.

SOCIAL GROUPINGS FOR AWARENESS

We first detail the people within one's social network for whom interpersonal awareness is desired. Figure 1 illustrates a very typical social target from our contextual study where we see several people in each ring of the target. We note that the target represents people's perceptions of their current social situation, i.e., the *actual* frequency with which participants maintained an awareness of others, rather than a preferred frequency that was not in existence. It also shows a unidirectional awareness need, where in reality there will be natural interplay between individuals to regulate the amount of achieved awareness.

In our interviews with participants, we asked them to identify individuals on their social targets by the strength of their need or desire for awareness. Their responses led to two broad clusters of contacts: those for whom there existed a strong need for awareness, and those where the need was more discretionary. For some people, these clusters had subgroups within them, but in general these subgroups shared similar characteristics. After analyzing our data in terms of the types of awareness information people desired (discussed more later), we were able to further divide and label the two large clusters into three groups of social contacts: *home inhabitants*, *intimate socials*, and *extended socials*. These three groups are best viewed as broad clusters defining a spectrum of relationships vs. strictly bounded groups. Figure 2 provides a preview of results to come. We now describe each group in detail. Here we tend to use the words *need* and *desire* interchangeably. This is because we have found that, as it relates to interpersonal awareness, *desires* often strongly relate to what one perceives to be *needs*.

Home Inhabitants

As the name suggests, *home inhabitants* contain those people with whom one lives: *significant others*, *family*

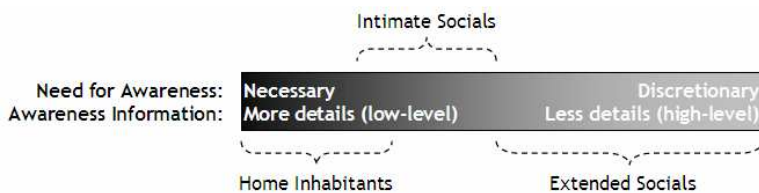


Figure 2. The range of awareness needs for three social clusters.

members, and roommates (Figure 2, left end of spectrum). The number of home inhabitants will naturally vary based on the household. All participants in our study said *they had a strong need to maintain a daily awareness of their home inhabitants*. The sole exception was a person who only lived with his mother part of the time under shared custody. We caution that while our study contained several households of roommates, the roommates we saw were all close friends. We expect that individuals who do not have close relationships with their roommates will correspondingly not have as strong a need for an awareness of them. As a typical example, Figure 1 illustrates how the participant placed her live-in husband, George, and teenage children, Jill and John, in the ‘daily awareness’ bull’s-eye of the social target because she desires a daily awareness of them

Intimate Socials

The *intimate socials* group contains *those people with whom one has a close personal relationship, but does not live with*. People still have a *strong desire for awareness* of those in this group (Figure 2, middle of spectrum). For example, the participant from Figure 1 maintained a close relationship with her mother, desiring awareness on a weekly basis. We asked our study participants to name the people (besides the home inhabitants) with whom they had a close relationship and a strong need for awareness. All participants not living with their *significant others* reported these individuals; all but two (93%) reported *immediate family members* (e.g., parents, siblings), three-quarters (72%) reported *close friends*; and, only three (10%) reported *work colleagues*. Other studies also found that people typically have a strong need for awareness of elderly parents (Mynatt *et al.*, 2001) along with children who have recently moved away from “home” (Tollmar and Persson, 2002). *While proximity is important for determining who is an intimate social, it is not the only dominant factor*. About two-thirds of our participants (66%) had intimate socials in the same city as they lived. About half (48%) had people from a different city but within the country, and about one quarter (24%) had people from a different and far-away country. Most participants said their main reason for desiring an awareness of intimate socials was because s/he was close to them as s/he was considered family.

The median number of intimate socials was surprisingly small: 3 for all participants (interquartile range, IQR=0-6, total range=0-12). Breaking this down further, it was 5 for teenagers (IQR=4-6), 3.5 for young-mid adults (IQR=1-6.25), and 0 for middle-aged adults (IQR=0-2.25). These numbers suggest that teenagers typically have more close friends for whom they desire awareness than other age groups. Counter-intuitively, middle-aged

adults generally have very few intimate socials. This is likely explained because most middle-aged adult participants had their own children, and their close contacts typically contained only immediate family members.

A strong need to maintain awareness of an intimate social does not necessarily imply a frequent need. While nearly all participants (90%) had intimate socials for whom they desire a near-daily awareness, over one-third of the participants (38%) had intimate socials for whom they desired only weekly awareness. Thus, we emphasize that *it is not the frequency of awareness that defines an intimate social, but the strength of a person’s need for that awareness*. For example, three participants had individuals in their daily awareness ring who were not intimate socials; while they received this information, their need for it was not particularly strong. Similarly, people may be satisfied with weekly updates of someone in their intimate circle: they have a strong need for this information, but weekly updates suffice.

Extended Socials

While the *extended socials* group can also contain the family and friends of interest to a particular person, *the relationship is much more casual and the desire for awareness is more discretionary* (Figure 2, right end of spectrum). All participants had friends who were extended socials. About two-thirds (66%) had co-workers/teachers, two-fifths (41%) had siblings, and about two-thirds (66%) had other relatives. For example, in Figure 1 the participant noted 26 individuals and 6 general groups of people (e.g., carpools, church friends) that fit this category. The median number of extended socials for all participants was 13 (IQR=8-19, total range=3-38), teenagers was 10 (IQR=10-10), young-mid adults 10 (IQR=7.5-14), and middle-aged adults 18.5 (IQR=16.5-27.5). A caveat is these numbers include individuals along with groups considered as single social units, yet they suffice to show that as one ages, the number of extended socials increases. This seems natural as one typically gains more family members and friends throughout a lifetime that are considered to be extended contacts and along with this comes more social responsibilities (e.g., Christmas cards, carpools).

The placement of extended socials varied throughout the social targets, indicating the *frequency of desired awareness is highly dependent on the individual*. We also found that people share their more significant life changes instead of smaller details with extended socials (specific instances of this are described in the next section). *While nearly all participants wanted more frequent awareness of their extended socials, they found it difficult to maintain* because of scheduling difficulties, distance separation, or the time limitations. A natural tradeoff exists between acquiring an awareness of more individuals and distractions, interruptions, and feelings of information overload; people may not actually want an awareness of more people in practice (discussed later).

INTERPERSONAL AWARENESS INFORMATION

We found the interpersonal awareness information that people like to maintain for their family and friends generalizes to knowledge of one's *context* at *varying levels of detail* depending on the individual and her interpersonal relations. People want to know this information in order to *coordinate*, promote feelings of *connectedness* or *comfort*, or simply to have *shared personal knowledge*. This information typically falls into three interrelated categories—*location*, *activity*, and *status*—where categories are often interrelated. These categories largely parallel existing definitions of context (Dey *et al.*, 2001), yet they contain subtleties specific to interpersonal awareness and, most important, *they differ between our three social groups*.

Awareness of Location

Imagine asking a family member or friend the question, “*where are you going?*” You would likely expect different answers depending on who you asked just like you would share different information based on who asked you. This is precisely what we found. *For home inhabitants, people want to know detailed location information*: day-to-day or sometimes even moment-to-moment knowledge of the specific whereabouts of a cohabitant along with an understanding of where one plans to be. For example, Kayla, a working mother from our study, liked to know if her teenage son was at a friend's house after school or if he had gone straight home providing her with a feeling of *comfort*. Sometimes only a general understanding of locations is needed: for Gwen, again a mother in our study, knowing that someone has gone out to run errands, but not necessarily knowing which errands, is enough information. This kind of knowledge helps Gwen *coordinate* household plans like dinner times. For many people, location information translates into knowing one's *presence* at a particular location (Tollmar and Persson, 2002). For example, Gary and Cathy, married with no children, both like to simply know that the other is at home because even if s/he is in another part of the home the knowledge is *comforting*.

For intimate socials, people want similar location details but at a lesser level of detail, typically daily or every few days, and often this awareness is of *past locations* or *upcoming ones*. For teenaged Kim, this meant knowing what her close friends had planned for the weekend so she could also *coordinate* activities with them. Adult children may desire to know whether their elderly parents are at home, have left home, or, in serious cases, are at the hospital (Mynatt *et al.*, 2001), again creating *comfort*.

For extended socials, people want to know even less details about location or may not even care about one's location except in special circumstances. Normally this involves knowing what city or area an extended social resides in or their location of work. For example, Linda told us she was often curious to know where her extended friends currently work.

Awareness of Activity

Now imagine asking a social contact, “*what are you doing?*” Again, you'd expect a variety of answers

depending on the person and their relationship to you. *For home inhabitants, people want to know about their daily activities along with their upcoming plans*. This includes knowing specifics about one's schedule of work/school and social activities. Work details generally include knowing the days and times that one is working, rather than knowledge of work appointments and meetings. For example, Sandra liked to know what specific projects her husband was working on (though not the fine details of the projects) and what days he had to work. Social activities typically include knowing the activity's day/time, the type of activity (e.g., watching a movie at the theatre, visiting a friend) and the other people involved in it (e.g., which friends *vs.* just strangers). As one would expect, we found parents were typically much more aware of the activities of younger children, and less so for older teenagers. Households must *coordinate* their day-to-day plans (Ling, 2000) and it is often necessary for cohabitants to schedule their activities and events based on the activities of each other. For example, Dale and Becky, parents of children aged 14 and 16, commented that they need to know their children's schedules in order to coordinate rides to various activities. Similar findings have also been found by Beech *et al.* (2004) and Neustaedter and Brush (2006).

For intimate socials, people want details about past or upcoming social or work activities, rather than knowledge of current activities. For example, Kayla, a mother from our study, wanted to know what her girlfriends had been up to *last week* and if anything “major” happened at their job simply to maintain a level of *shared personal knowledge*. Intimate socials also use activity awareness to *coordinate* but to a lesser extent than home inhabitants. For example, teenagers Carrie and Lee want to know the availability of their friends, so they can “hang-out” with them. Detailed current knowledge of the availability of one's intimate socials was generally only desired by teenagers or significant others who did not live together, e.g., fiancés, girl/boyfriends. In the case of, Paul, a graduate student living at his parents' home, awareness of his fiancée was much more like awareness of his cohabitants because of the close relationship with her.

For extended socials, people want to know activity information at an even higher level still. This typically equates to knowing major events or life changes, e.g., changing jobs, moving to a different city, getting married, having children. Awareness of activities of extended socials most often provided feelings of *connectedness* or *comfort*. For example, in the case of an aging elderly parent, knowing she is active can provide a sense of comfort that she has not fallen or is sick in bed (Mynatt *et al.*, 2001). Activity awareness was generally only used by extended socials for *coordination* at a macro level, e.g., planning visits or holidays to see these people.

Awareness of Status

Now imagine asking a social contact, “*How are you doing?*” The answers would again vary where we have found they will often *relate to one's location or activity* as people almost always have feelings or attitudes associated with events or situations in their lives. *For*

home inhabitants, status involves knowing how one feels about most aspects of their lives in addition to knowing how healthy one is and knowing about personal relationships (e.g., who is dating whom). Parents have a strong desire to make sure that things are going well for their children and, as providers, to ensure they have what they need. For Becky, she is concerned daily about how her children are feeling because she wants provide emotional support when needed. Often this will involve knowing how they are feeling about school, such as whether a test result went well or if they are feeling overwhelmed with homework. Significant others share similar information about their lives, which can also make them feel more *connected* to one another (Gaver, 2002).

For intimate socials, the same status information is desired but typically about only a selection of activities or health information. This often equates to knowledge about a shared interest or outing, a particular relationship, or a health problem. For example, Kayla's daughter, Shannon, recently moved out of town to go to college. Kayla and Shannon talk on the phone at least once a week and often their discussions will surround Shannon's latest boyfriend. Dale and Becky are often quite concerned about the health and well-being of Dale's mother who recently suffered a stroke. They try to talk to her every few days to ensure she is still feeling fine where this knowledge is used to monitor and assist.

For extended socials, most people primarily want to know status information about health changes. Extended socials are much less intimate and feelings are not typically shared, at least not in great detail. In some cases, knowledge of status can even translate into a *lack of comfort* or worry if "bad news" is found out about a social contact, e.g., a relative is ill.

TECHNIQUES FOR MAINTAINING AWARENESS

The third aspect of interpersonal awareness that we describe is *techniques for maintaining awareness*: the methods people use to acquire and maintain interpersonal awareness. We found that interpersonal awareness is typically maintained using one or more of the following techniques: *visual cues from domestic artifacts*, and *direct or mediated interaction*. These techniques are not hierarchical in nature; rather, each technique offers contexts for which it is particularly well suited and each comes with its own limitations.

Visual Cues from Domestic Artifacts

Households are displays where people leave imprints of their lives and activities throughout the home (Hindus *et al.*, 2001, Taylor and Swan, 2005). Here *home inhabitants receive awareness information from the presence or absence of particular domestic artifacts from routine locations* (Elliot *et al.*, 2005). Often these cues are noticed as background activities requiring little thought or active attention. For example, Mark, a college student living at home, explained to us how when arriving home he would automatically check, without much thought, whose cars were at home as he entered the garage. This information led him to quickly understand which family members were around. His father, Jeremiah, similarly

commented that he could tell if his sons had gone out mountain biking (a common activity) by peering into the garage to see if the bicycles were gone. Other participants we interviewed used similar strategies with items like keys or wallets left in routine locations. Related research has pointed out that the *status* of domestic artifacts also provides *location* awareness. For example, the status of a light (on/off) can often indicate the presence and location of household members: if the light is on, likely someone is in that room (Tollmar and Persson, 2002). Naturally, inference errors can occur when gathering awareness through these types of visual cues, yet despite this, people still rely heavily on cues presented by domestic artifacts for maintaining awareness of home inhabitants. Further depth analysis of the use of domestic artifacts for awareness can be found in Elliot *et al.* (2005).

Direct and Mediated Interaction

When people are co-located with their social contacts they naturally converse and share awareness information through face-to-face interaction. People enjoy face-to-face interaction because, naturally, they like talking directly to their family and friends (Hindus *et al.*, 2001, Tollmar and Persson, 2002). *Face-to-face interactions are used heavily by home inhabitants because they are often collocated.* Here simple conversations as people go about their activities at home can provide awareness. For example, many of the mothers we interviewed talked about checking the family calendar in the evening or morning and then discussing its contents with family members to bring people 'up to date' on family activities. Significant others have even been found to streamline their conversations to develop short-hand interactions involving brief instructions, which are generally only understood by family members (Ling, 2000).

The use of face-to-face interaction declines for intimate socials as they are not collocated as often as home inhabitants. *Face-to-face interactions with intimate socials typically occur during social outings or shared activities.* While people are together, like home inhabitants, they will discuss their activities which in turn provides an awareness and shared understanding. *Extended socials often have few opportunities for awareness gathering through face-to-face interaction* because they are seen on a much less frequent basis, (e.g. visits to far away family). Though we did find that face-to-face communication allowed people to learn indirectly about extended socials. For example, children may learn about the health of a grandparent by talking with their mother after she had visited the grandparent. There are, of course, exceptions to these general cases: sometimes contacts are seen frequently, yet few details are shared because of the nature of the relationship (e.g., carpools).

Mediated interaction is vital for providing social contacts with awareness information when they are not collocated. Even in the case of home inhabitants, they are not always home at the same time (e.g., someone is at work) making it impossible to gather awareness through face-to-face interaction. In this case of *time separation*, mediated interaction is crucial. Nearly all participants from our study used some form of *handwritten notes to provide*

awareness information for their home inhabitants, most often because it was very simple to do. Here individuals write a note to a cohabitant or the entire household using media like sticky notes, message pads, scraps of paper, the family calendar, or whiteboards (Elliot *et al.*, 2005). The most crucial aspect of leaving notes that we found was the *location* of the note itself. Households typically have well established routines for locations (Crabtree *et al.* 2003) where they can help determine who a note is for (Elliot *et al.*, 2005). For example, Kayla described a situation where she wanted her teenage son to see an important note when he arrived home from school. She stuck it on the television because she knew that watching TV was one of the first things he did when arriving home.

Technologies like telephones, email, and instant messaging (IM) are used by individuals to maintain an awareness of their social contacts, this time for all social groupings. Here mediated interaction is used to overcome challenges of *distance separation*. We found people almost always choose the technology that is both easy for them to use and likely to reach their social contacts. *Telephones and mobile phones were convenient for reaching contacts at work or while mobile.* Information would be exchanged much like in face-to-face situations. We found that middle-aged adults favor the telephone because new technologies seem “foreign” or daunting to them. Yet many found other technologies like email very useful especially for contacts overseas when phone rates become expensive. Other non-technologies like letters (for postal mail) fulfill similar purposes yet only one person reported using these.

Heavy computer users would routinely use email or IM to exchange information. People enjoyed using email as it allowed them to share awareness information asynchronously (also found by Tollmar and Persson, 2002). For Kayla, sending an email to her son from work to home was easier than trying to catch him on the phone because he may not have arrived home yet, or he could be at a friend’s house. Our participants told us that IM provides near synchronous conversations when both parties were around, but when not, provided an easy way to leave an asynchronous message for another. Tricia and Shawn, a young common-law couple, both have an IM client running on their computers when at work. This provides a very quick and easy communication channel to make plans or update the other on their day’s activities. Brandon, like many teenagers we interviewed like using IM because of its near synchronous nature. He also found IM allowed him to have multiple simultaneous conversations with different people, and he could even be doing other activities like playing video games! Similar findings have been found by Grinter and Palen (2002).

COMPARISON TO AWARENESS IN THE WORKPLACE

In general, we have found that interpersonal awareness is: *a shared understanding of the location, activity, or status of one’s personal contacts.* Yet this information is needed at varying frequencies, levels of detail, and for different reasons depending on the relationship. Our *model of interpersonal awareness* adds value for we can now use it to compare interpersonal awareness to workplace

awareness, a popular target for CSCW system designs that is most comparable as it also promotes awareness of others.

Workplace Awareness is a naturally gained understanding of who is around in the workplace and available for interaction and collaboration (Greenberg, 1996). It is primarily gathered through unconscious acts as one goes about his or her workday, for example, by looking around a shared office (Fish *et al.*, 1990, Schmidt, 2002). Thus, workplace awareness is easily gained by those in close physical proximity (Kraut *et al.*, 1988, Whittaker *et al.*, 1994). There exists a range of needs when it comes to workplace awareness: those who frequently collaborate require more awareness than those who do not. As a result, a variety of technologies are used to help individuals monitor awareness especially when colleagues become separated by distance. These range from IM, to media spaces, and a host of applications in between. Given that people are most often situated in front of a computer at work, these systems are generally designed to run on a desktop PC, but can also be found on large communal displays (Whittaker *et al.*, 1994).

A Spectrum of Designs Unique to the Home

As our model of interpersonal awareness indicates, awareness in the home, like workplace awareness, is also desired for a *spectrum of relationships where people have different awareness needs depending on the relationship.* Like workplace awareness groupware, it would be a serious mistake to design interpersonal awareness groupware with the mindset that one solution fits all. Instead, awareness groupware for the home should *offer a spectrum of design solutions to address the specific needs of home inhabitants, intimate socials, and extended socials.* These designs can help families coordinate shared activities, be made lightweight to overcome the time burden for discretionary contacts, and can even be embodied in domestic artifacts so that information is presented within a person’s domestic ecology (like current awareness gathering techniques).

Like workplace awareness, interpersonal awareness involves maintaining location and activity awareness, yet, unlike work, in the home this information is not focused on collaborative and goal-oriented tasks. Rather, *interpersonal awareness is centred on the everyday coordination of mundane things like family activities and social outings.* These are typically fueled by personal and social needs. We also now know that *interpersonal awareness often contains a status component:* people like to know how their social contacts *feel* about various aspects of life or how they are doing. This status is generally not found in workplace awareness though this is not to say that people do not maintain status awareness of co-workers like they do friends. The important difference is that awareness of status is much more secondary in the office when compared to location and activity awareness.

Interpersonal awareness, like workplace awareness, can be acquired through background activities (subconsciously viewing cues from domestic artifacts). Yet, *often the maintenance of interpersonal awareness*

becomes a foreground activity involving increased attention demand. People may actively probe others they are interested in for particular information, regardless of whether they are collocated or not. While people enjoy talking to their social contacts, when maintenance repeatedly becomes a foreground activity, it can become very time consuming.

Designing Interpersonal Awareness Groupware

These findings point to the need for interpersonal awareness technologies to augment people's existing awareness gathering routines. However, it is clear that the focus of awareness in the home is different than at work; thus, *awareness groupware designed for the workplace cannot simply migrate into the home*. Designers should pay particular attention to tailor interpersonal awareness systems to domestic needs, which we have presented. For example, *new designs for home inhabitants should focus on providing detailed and frequent awareness of activity and location* since status information is already gained very easily by home inhabitants. *Designs for intimate socials should focus on detailed activity, location, and status awareness but for past and upcoming days*, rather than the present as this is needed less. These groups are generally small so it is not likely that these systems need to support awareness acquisition for large groups. On the other hand, *one has many extended socials and designs for them should be geared to provide an awareness of many individuals but at a fairly high level of detail with infrequent updates*. Unlike at work, people in the home are not often situated in front of a computer (aside from telecommuters) and it is not necessarily the case that a mouse and keyboard are readily available for interaction. This suggests that interpersonal awareness groupware should be designed as *information appliances which are easily moved or spread throughout the home and use tangible or pen-based interaction*. We stress that design solutions should not replace existing awareness-gathering techniques. Rather, technologies designed specifically to support interpersonal awareness can be used by individuals to augment existing awareness gathering techniques and to create new opportunities for awareness.

ANALYZING AWARENESS TECHNOLOGIES

We now have the knowledge to analyze existing awareness technologies to understand why they succeed or where they fail at providing awareness for family and friends. Our analysis consists of comparing the user needs found in our model to a system's capabilities.

Analyzing Awareness Appliances

Researchers have already begun designing information appliances with the specific purpose of providing interpersonal awareness. One example is Tollmar and Persson's (2002) 6th Sense Lamp, which allows families to gain an awareness of children who have recently moved away from home. Here a son's presence in his apartment causes his mother's 6th Sense lamp to glow. We now know from our interpersonal awareness model that this design is successful because it provides users with an awareness of the *location* of an *intimate social* where the goal of the system is to provide feelings of

comfort. This is the information and level of detail that is actually desired by intimate socials. Moreover, it presents this awareness in a manner that is natural to home inhabitants: the information is embedded within a domestic artifact situated so that it is publicly viewable in the home. In the 'everyday world' people are currently only able to maintain an awareness of cohabitants through domestic artifacts; the design of the 6th Sense lamp and similar awareness appliances have extended people's existing routines in a socially appropriate manner.

On the other hand, we can see that the design of the 6th Sense lamp is limited to intimate socials. It is not appropriate for one to sense other home inhabitants, as people generally desire a more detailed awareness of their cohabitants than the design is able to afford. Similarly, this design is not appropriate for an extended social, for the 'recipient' would see this excessive detail as a distraction, while the 'sender' could see it as a privacy intrusion. Indeed this reveals an asymmetry issue: a young adult leaving home may shift his perception of his family to extended socials in a quest for independence, while the parents adjust to seeing him as an intimate social rather than a cohabitant. While parents may want this lamp, the young adult may not.

Analyzing Instant Messaging

IM is used to gather interpersonal awareness for individuals in all social groups, albeit some more than others. While IM systems were primarily designed to support interaction, people are able to gather awareness through availability states (most are crude however, e.g., online, away, busy) or direct conversation. By itself, the level of awareness detail provided by availability states is not enough for home inhabitants and intimate socials, yet direct conversation may fill the gaps for these groups. For extended socials, the awareness gained from direct conversation may be too detailed or too frequent. For example, a relative whom you consider to be an extended social may attempt to chat with you on a daily basis to 'see how things are going' simply because it is now easy to do. By doing so, they may interrupt you at work, and/or enter into conversations about detail that are not particularly interesting. In essence, IM makes it possible for extended socials to be more like one's intimates, yet this is not necessarily what people desire because awareness maintenance and resulting conversations can then become quite time consuming or interrupt other aspects of life. Other mediated interaction technologies like the cell phone or email have the same basic problem.

Earlier we mentioned that nearly all our participants wanted more frequent awareness of their extended socials. IM, cell phones, and email all present cautionary tales. In everyday life, physical distance, time, and other factors mediate who one can actually reach. Digital media bypass everyday physics, meaning that people can and do have more frequent awareness of their extended socials. While this adds richness to people's lives, it comes with interruptions, distractions, information overloading, and so on. Thus our analysis reveals the mixed blessings of such technologies. Online technologies like blogs (including photo sharing services) offer an interesting

alternative where awareness information can be read or viewed at one's leisure. Here people have the choice to look at the information and may choose not to if feeling overwhelmed.

We have only analyzed two systems as examples in this paper, yet feel it is possible to analyze other systems in a similar manner. Of course, this type of analysis does have the caveat that there are more factors that affect a design's success than actual product features (e.g., the routines involved in the design's use), which can often not be designed for *a priori*. Despite this, we are able to use our understanding to predict and evaluate a design's success at a high level.

CONCLUSION

In the context of the home setting, we have shown that there is a whole spectrum of relationships, each with different needs for interpersonal awareness and each having different methods for maintaining it. This illustrates that a spectrum of design solutions is needed to address interpersonal awareness needs and we can't simply migrate awareness technologies from the workplace into the home. The information we have revealed immediately informs a requirements analysis and allows us to analyze existing designs.

A possible critique of this work is that a large portion of our results are based on our own study of a modest number of Canadian households. Yet, we saw many commonalities despite the diversity of the households chosen. We also saw our results coincide and extend existing awareness research. Given this, we hypothesize that a more detailed study over a broader and larger pool of households would uncover the same results. Similarly, we feel that our findings do generalize to broader Western culture, although the actual methods used for maintaining awareness may differ (e.g., mobile phone usage in Europe currently far exceeds that of North America). Of course, this needs to be verified by future studies.

Our findings may appear to illustrate what is obvious in nature to some. This is as we had hoped, for we are both articulating and verifying the everyday mundane activities that people are familiar with. Much is left to be done: we have provided breadth coverage of interpersonal awareness that provides a foundation for future depth research and analysis. The next steps for domestic awareness research involve building on our model with ethnographic and design studies to draw out the specific subtleties of awareness acquisition and maintenance that our breadth coverage is unable to provide.

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