# Intimate *Ubiquitous* Computing

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Date: **Sunday, 12 October 2003**
Time: **09:00 - 17:00**
Where: ***UbiComp 2003*, Blakely Room, Westin Hotel, Seattle, WA**
URL: **http://www.intimateornot.com**

Ubiquitous computing has long been associated with intimacy. Embedded in the literature we see intimacy portrayed as: knowledge our appliances and applications have of us; physical closeness, incarnated on the body as wearable computing and in the body as nanobots; and computer mediated connection with friends, lovers, confidantes and colleagues. As appliances and computation move away from the desktop, and as designers move toward designing for emotion and social connection rather than usability and utility, we are poised to design technologies that are explicitly intimate and/or intimacy promoting. This workshop will: critically reflect on notions of intimacy; consider cultural and ethical issues in designing intimate technologies; and explore potential socio-technical design methods for intimate computing.

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**ABSTRACT**

Ubiquitous computing has long been associated with intimacy. Within the UbiComp literature we see intimacy portrayed as: knowledge our appliances and applications have about us and the minutiae of our day-to-day lives; physical closeness, incarnated *on* the body as wearable computing and *in* the body as 'nanobots'; and computer mediated connection with friends, lovers, confidantes and colleagues. As appliances and computation move away from the desktop, and as designers move toward designing for emotion and social connection rather than usability and utility, we are poised to design technologies that are explicitly intimate and/or intimacy promoting. This workshop will: critically reflect on notions of intimacy; consider cultural and ethical issues in designing intimate technologies; and explore potential socio-technical design methods for intimate computing.

**Keywords**

Intimacy, computing, emotion, identity, body, play, bioethics, design methods, socio-technical design

**INTRODUCTION**

*Intimate. adj. Inmost, deep seated, pertaining to or connecting with the inmost nature or fundamental character of the thing; essential, intrinsic … Pertaining to the inmost thoughts or feelings, proceeding from, concerning, or affecting one's inmost self, closely personal.*

We inhabit a world in which the classic computing paradigm of a PC sitting on your desk is giving way to a more complicated and nuanced vision of computing technologies and power. This next era is predicated on a sense that the appliances and algorithms of the future will respond better to our needs, delivering 'smarter' more context-appropriate, computing power. Underlying such a vision is the notion that computers in their many forms will be pervasive and anticipatory. Arguably, to achieve this, computing appliances will have to become more intimate, more knowing of who we are and what we desire, more woven into the fabric of our daily lives, and possibly woven into the fabric of our (cyber)bodies.

In this workshop we address the notion of 'intimate computing'. We invite designers within the area of Ubiquitous Computing to: address and account for people's embodied, lived experiences; explore the ways in which computing technology could and should be *more* intimate; and join us in considering possible pitfalls along the design path to such intimacy.

### Intimacy as a cultural category/construct

What might intimacy have to do with technology and computers, beyond the obvious titillation factor? In the United States in particular and the west more broadly, there is a persistent slippage between intimacy and sex, which is not to say that there isn't a place to talk about the relationship between sex, intimacy and technology [see 15]. However, in this workshop, we want to cast our net more broadly. We are interested in other constructions of intimacy; intimacy as something that relates to our innermost selves, something personal, closely felt. Such a construction could include love, closeness, or spirituality. Or perhaps it is in the way we understand, feel and talk about our lives, our bodies, our identities, our souls. In all these ways, intimacy transcends technology, and has a role to play in shaping it. As we move towards designing for communication, emotion, reflection, exploration and relationship, we need to critically reassess our reliance in design on outmoded conventions and old models of computation and connection. We need to employ new metaphors and create new models.

**A BRIEF HISTORY OF (INTIMATE) UBIQUITOUS COMPUTING**

Having said that, there has been an idea of intimate computing for as long as there has been a vision of ubiquitous computing. The two are inexorably linked in the pages of the September 1991 issue of *Scientific American*. In that month's issue of the magazine, Mark Weiser, articulated his vision of ubiquitous computing – "we are trying to conceive a new way of thinking about computers in the world, one that takes into account the natural human environment and allows computers themselves to vanish into the background" [25]. In the article that follows, Alan Kay used 'intimate' as a modifier to computing in an essay reflecting on the relationship between education, computers

and networks [10]. He wrote, "In the near future, all the representations that human beings have invented will be instantly accessible anywhere in the world on intimate, notebook-size computers." This conjoining of intimate computers and ubiquitous computing within an issue of *Scientific American* dedicated to Communications, Computers and Networks is perhaps not a coincidence – both represents complementary parts of a future vision.

How has this conjunction been expressed more recently? Broadly, there are 3 manifestations in the (predominantly) technology literature. 1. intimacy as cognitive and emotional closeness *with* technology, where the technology (typically unidirectionally) may be aware of, and responsive to, our intentions, actions and feelings. Here our technologies know *us* intimately; we may or may not know them intimately. 2. intimacy as *physical closeness* with technology, both on the body and/or within the body. 3. intimacy *through* technology: technology that can express of our intentions, actions and feelings toward others.

In the first category, Lamming and Flynn at Rank Xerox Research Center in the UK in the mid-1990s invoked 'intimate computing' as a broader paradigm within which to situate their 'forget-me-not' memory aid. They wrote, "The more the intimate computer knows about you, the greater its potential value to you. While personal computing provides you with access to its own working context – often a virtual desktop – intimate computing provides your computer with access to your *real* context." [12]. Here 'intimate computing' (or the 'intimate computer') refers to the depth of knowledge a technology has of its user.

'Intimate computing' has also occasionally been used to describe a different kind of intimacy – that of closeness to the physical body. In 2002, the term appears in the *International Journal of Medical Informatics* along with grid computing and micro-laboratory computing to produce "The fusion of above technologies with smart clothes, wearable sensors, and distributed computing components over the person will introduce the age of intimate computing" [20]. Here 'intimate computing' is conflated with wearable computing; elsewhere intimate computing is even subsumed under the label of wearable computing [2]. Crossing the boundary of skin, Kurzweil paints a vision of the future that centralizes a communication network of nanobots in the body and brain. He states "We are growing more intimate with our technology. Computers started out as large remote machines in air-conditioned rooms tended by white-coated technicians. Subsequently, they moved onto our desks, then under our arms, and now in our pockets. Soon, we'll routinely put them inside our bodies and brains. Ultimately we will become more nonbiological than biological."[11]

Finally, intimate computing has also referred to technologies that enhance or make possible forms of intimacy between remote people that would normally only be possible if they were proximate. Examples include explicit actions (e.g. erotically directed exoskeletons [19]), non-verbal expressions of affection or "missing" [22], and computationally enhanced objects, like beds, that offer "a shared virtual space for bridging the distance between two remotely located individuals through aural, visual, and tactile manifestations of subtle emotional qualities." [5]. These computationally enhanced objects are all the more effective because they themselves are rich (culturally specific) signifiers. Dodge states of the bed, it is "very "loaded" with meaning, as we have strong emotional associations towards such intimate and personal experiences"[5].

## INTIMATE COMPUTING TODAY AND TOMORROW

So where are we to go with intimate computing in the age of ubiquitous and proactive computing and the tentative realities of pervasive computing [23]? Clearly, as we move to the possibility of computing beyond the desktop and home office, to wireless hubs and hotspots, and from fixed devices to a stunning array of mobile and miniature form factors, the need to account for the diversities of people's embodied, daily life starts to impose itself into the debate. We already worry about issues of privacy, surveillance, security, risk and trust – the first accountings of what it might mean for individual users to exist within a world of seamless computing. And then there are issues of scale – ubiquitous computing is a far easier vision to build toward. It promises a sense of scale and scalability, of being able to design a general tool and customize it where a local solution is needed. But intimate computing implies a sense of detail; it is about supporting a diversity of people, bodies, desires, ecologies and niches.

## THE WORKSHOP: Outlining A Research Agenda for Intimate Computing

In this workshop, we address the relationship of people to ubiquitous computing, using notions of 'intimacy' as a lens through which to envisage future computing landscapes, but also future design practices. We consider the ways ubiquitous computing might support the small scale realities of daily life, interpersonal relations, and sociality, bearing in mind the diversity of cultural practices and values that arise as we move beyond an American context.

We perceive four interrelated perspectives and strategies for achieving these goals: (1) deriving understandings of people's nuanced, day-to-day practices; (2) elaborating cultural sensitivities; (3) revisioning notions of mediated intimacy, through explorations of play and playfulness; and (4) exploring new concepts and methods for design. Below we elaborate on these perspectives:

### *1. Nuanced practices*

A sense of intimacy made its way into Wesier's thinking about ubiquitous computing. In collaboration with PARC's anthropologists, he and his team became aware of ways in which people's daily social practices impacted their

consumption and understanding of computing. They looked at the routine, finely grained, and socially ordered ways in which people use their bodies in the world to see, hear, move, interact, express and manage emotion and pondered "how were computers embedded within the complex social framework of daily activity, and how did they interplay with the rest of our densely woven physical environment (also known as the "real world")?"[27] This consideration of social frameworks and physical environments led Weiser's team to propose "calm computing" as a way of managing the consequences of a ubiquitous computing environment. Calm computing is concerned with people in their day-to-day world, with affective response (beyond psycho-physiological measures of arousal), with the body, with a sense of the body in the world, and with the inner workings and state of that body. This notion of calmness and calm technology thus echoes the sense, if not sensibility, of intimate computing. [26]

*2. Culture Matters*

Weiser also credits anthropologists with helping him see the slippage between cultural ideals and cultural praxis as it related to the use of computing technology in the work place. One of the issues that is very clear when we engage in a close reading of ubiquitous computing is how very grounded it is in Western practices, which makes sense given its points of origin and the realities of resource and infrastructure development. However, there have been several significant, unanticipated changes in the last decade, in particular the leapfrogging of developing countries into wireless networks and whole-sale adoption of mobile phones. It is important then to explore some of the ways in which intimacy is culturally constructed, and as such might play out differently in different geographies and cultural blocks [3;9]. We also need to explore cultural differences in the emotional significance and resonance of different objects.

*3. Can Ubiquitous Computing come out and Play?*

*"You can discover more about a person in an hour of play than in a year of conversation" (Plato 427-347 BC).* Play provides a mechanism to experiment with, enter into, and share intimacy. The correlation of play and intimacy is so strong that elements of one rarely occur without the other. It is during play that we make use of learning devices, treat toys, people and objects in novel ways, experiment with new skills, and adopt different social roles [16, 17, 18]. We make two important observations about play: (1) humans seamlessly move in and out of the context of play and (2) when at play, humans are more exploratory and more willing to entertain ambiguity in their expectations about people, artifacts, interfaces, and tools. Such conditions may more easily give rise to intimacy. Such a scenario represents a different design scenario from designing for usability and utility [6].

As ubiquitous computing researchers, we must be aware of this human tendency to play, and use it to our advantage. When does play occur? How does it begin and end? When is it appropriate or inappropriate? What elements give rise to play? The understanding of play may affect our views about the origin and experience of human intimacy.

*4. New paradigms for design*

It is hard to imagine that the computer, an icon of modernity, high technology and the cutting edge could in some ways be behind the times. However, its association with modernity marks it as old fashioned; as a product of modernity the computer is highly functional with a minimalist aesthetic. It approaches the modernist ideal of pure functionality with little necessity for physical presence. Computer chips become smaller and smaller black boxes offering more and more functionality, but not necessarily more intimacy.

Bergman states modernity has been admired for its "high seriousness, the moral purity and integrity, the strength of its will to change", but he also goes on to note "At the same time, it is impossible to miss some ominous undertows: a lack of empathy, an emotional aridity, a narrowness of imaginative range."[4]. Modernity in art, design, architecture and fashion are associated with aesthetics and design principles from the first half of the twentieth century [7]. Since then, movements in pop art, deconstructivism, and postmodernism have invited us beyond functionalism to new ways of thinking about how to make the impersonal computer more intimate. There are lessons in consumer product design; the founder of Swatch focused on the emotional impact of the watch to start his business, designing the watch as a fashion accessory and invoking the ideals of pop art "fun, change, variety, irreverence, wit and disposability" [21]. What might it mean to apply such lessons to the design of ubiquitous computing systems?

**Goals of the workshop**

Taking the above perspectives as a springboard for discussion, this workshop has the following aims:

- To bring together a multi-disciplinary group of practitioners to discus what it might mean to account for intimacy in ubiquitous computing and to consider issues like: How do notions of intimacy change over time and place? How do notions of intimacy differ as we engage in different social groups and social activities? When does intimacy lead to or become intrusion? Invasion? Stalking?
- To elaborate new methods and models in design practice that can accommodate designing for intimacy.
- To develop an agenda for future collaborations, research and design in the area of intimate computing and identify critical opportunities in this space.

**Workshop Activities**

We will balance presentations and discussion with collaborative, hands-on creative activities. These activities will include:

- Cluster analysis, including questions like what does intimacy cluster with semantically (ie: identity, uniqueness, personalization, friendship, connection)
- Designing intimacy within, upon and beyond the skin: build your own membrane/skin; designing supra-skin technological auras; designing for a reflective ethics

### Workshop Organizers

The organizers of this workshop come from a wide range of backgrounds, including cultural anthropology, computer science, psychology and design. Together they have considerable experience in workshop organization across several disciplines.

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# Reflections on Friendster, Trust and Intimacy

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## ABSTRACT
By asking users to articulate and negotiate intimate information about themselves and their relationships, *Friendster.com* positions itself as a site for identity-driven intimate computing. Yet, trust issues are uncovered as users repurpose the site for playful intimacy and creativity. To flesh out the tension between purpose and desire, i reflect on *Friendster's* architecture, population and usage.

### Keywords
Friendster, intimacy, social networks, trust

## INTRODUCTION
*Intimate. Adj.: marked by a warm friendship developing through long association* (Merriam-Webster)

While intimate computing may connect people with machines, the concept also has implications for how technology connects people together and with themselves. From email to SMS, Usenet to blogging, MUDs to *Friendster*, technology evolves to accommodate sociable interaction and personal presentation of self. Yet, the medium through which people interact digitally is so structurally different than the physical world that its architecture fundamentally alters social behavior. Technology does not simply connect people; it defines *how* people connect. Consequently, people continuously repurpose technology to allow for the kinds of intimacy that they desire.

In challenging the architecture, people's behavior highlights how, fundamentally, intimate computing hinges on issues around trust.

1) People must trust the technology architect's dedication towards protecting their identity.
2) People must trust the architecture to convey the appropriate context and validity of information, while simultaneously allowing for a variety of mechanisms for social exchange, identity presentation and relationships management.
3) People must trust others in the system to operate by the same set of social norms and refrain from abusing the architecture. They also want to be able to gage reputation and contextualize information presented.

In order to consider issues of trust in intimate computing, i discuss various aspects of the architecture, population and usages of a relatively new site called *Friendster*. Fundamentally, *Friendster* was designed to allow people to articulate their social networks so as to connect with potential dates. Although social networking sites have existed before, recent commercial interest has resulted in the emergence of a variety of new sites dedicated to helping people connect to their social networks for dating, jobs, recommendations and listings[1].

While there are may ways in which people connect to and apply their social network, i highlight *Friendster* because of its popularity, press coverage and diverse usage. Not only does *Friendster*'s service bridge the physical and digital world, it has generated new vocabulary for discussing relationships amongst certain crowds. *Friendster* is also valuable because of the increasing tension between its architect and population, as users try to present themselves within the system while the architect tries to define and regulate acceptable modes of intimacy.

## MY PERSPECTIVE AND GOALS
In order to understand people's perspective on and experience with *Friendster*, i have surveyed or interviewed over 200 people as well as engaged 60 people in 6 focus groups on the topic. Given the popularity of this meme, i've been able to gather hundreds of comments on people's blogs and have actively overheard conversations about *Friendster* in public spaces. I have spoken with programmers who have scraped data from the site to visualize it, as well as to those who have sold access to their network via *eBay*. I have joined mailing lists of *Friendster* fans and foes, as well as participated myself.

Through all of these activities, my social goals were: 1) to understand how people negotiate context when presenting themselves; 2) to understand the network structure of how a meme spreads and connects people; 3) to understand the issues involved in articulating one's social network as compared to a behavior-driven network.

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[1] Old: *SixDegrees.com*; New: *Ryze.com*, *LinkedIn.com*, *EveryonesConnected.com*, *eMode.com*, *Tribe.net*

## WHAT IS FRIENDSTER?

*Friendster* is a website that allows people to explicitly articulate their social network, present themselves through a dating-focus Profile (interests and demographics), post public Testimonials about one another, and browse a network of people in search of potential dates or partners. *Friendster* is built on the assumption that friends-of-friends are more likely to be good dates than strangers. The site was built to compete with *Match.com* and other online dating sites, with social networks as an added twist. While Stanley Milgram argues that everyone is connected within 6 degrees [4], *Friendster* only allows you to see or communicate with those who are within 4 degrees.

Unlike most dating sites, *Friendster* encourages users to join even if they are not looking for dates, under the assumption that they probably know a wide variety of friends who are looking and, thus, would serve as a meaningful connector and recommender.

*Friendster* launched into public beta in the fall of 2002. By mid-August 2003, the site had 1.5 million registered accounts and was still growing exponentially. Both mainstream and alternative press had covered the site, yet word of mouth was the dominant entry point for most people. It is important to note that users had a selfish motivation in spreading the meme, as their network grew by doing so. *Friendster*'s popularity is primarily cluster-driven. Thus, if a handful of people in a subgroup know about it, everyone else does as well.


Yet, even with a word of mouth network, users are quite diverse and their different intentions and expectations bring a variety of challenges to the site.

## FRIENDSTER AS A MEDIUM OF PRESENTATION

*Friendster* asks users to articulate and utilize their most intimate relationships, while simultaneously destroying the nuanced meaning of those connections. Additionally, *Friendster* assumes that users will authentically define their identity via their Profile so as to ensure more meaningful connections. While a tool for people to present their most personal selves and connect through their intimate relationships, *Friendster* fails to understand that publicly articulating one's social network and identity does not provide the same level of trust and meaning as the behavior-driven offline equivalent.

### Articulating a Social Network

In *Friendster*, one is asked to manually articulate one's network in a binary fashion: Friend or not. There is no indication of what it means for someone to be someone else's Friend, nor any way to indicate the role or value of the relationship. While some people are willing to indicate anyone as Friends, and others stick to a conservative definition, most users tend to connect with anyone who they know and don't have a strong negative feeling towards. Yet, this often means that people are indicated as Friends even though the user doesn't particularly know or trust the person. In some cases, it is necessary to publicly be-Friend someone simply for political reasons. In other cases, people want to connect broadly so that they may see a larger percentage of the network, since users can only browse 4 degrees from themselves.

Because people have different mechanisms for evaluating who is a Friend, it is difficult to gage the meaning or type of relationship between connections within the system. This inherently devalues the assumed trust implied by the term Friends. In turn, groups of people started using the term Friendster in regular conversation to describe one's Friends. For example, "She's not my friend, but she's my Friendster."

Such an articulation also disempowers the person presenting their network. As the hub of one's social network, power exists in the structural holes that one maintains [3]. By controlling what information flows between different connections, one is able to maintain a significant role in transactions that occur, and thereby control information flow. This is the value of a headhunter or a businesswoman's Rolodex. Even at the simplest levels, people often don't want certain groups of friends to be able to reach out and connect with others, or for work colleagues to connect with personal friends. By asking users to articulate and collapse their

network in a public way, *Friendster* is also asking them to give up their status as a social connector, or bridge.

### Presentation of Self

One's *Friendster* profile consists of five primary elements: 1) demographic information; 2) interest and self-description prose; 3) picture(s); 4) Friend listings; 5) Testimonials. By providing both the individual's perspective of self as well as that of their Friends, *Friendster* Profiles are much richer than those on other sites.

Yet, while a significant improvement, the Profile is still a coarse representation of the individual, which provides a limited and often skewed perspective [2]. It represents the individual's mood at the time of creation or update. The Friend information is rarely updated and people only remove Friends when there is an explosive end to the relationship, as opposed to the more common growing apart. Testimonials are only a tribute of the moment and reflect the same type of language one might see in a high school yearbook. Combined, *Friendster* Profiles and the network fail to evolve with the individual, yet that evolution is what makes one's network so meaningful.

Additionally, context is missing from what one is presenting. On one hand, an individual is constructing a Profile for a potential date. Yet, simultaneously, one must consider all of the friends, colleagues and other relations who might appear on the site. It can be argued that this means an individual will present a more truthful picture, but having to present oneself consistently across connections from various facets of one's life is often less about truth than about social appropriateness [1]. Notably, most users fear the presence of two people on *Friendster*: boss and mother.

Given these complications, it is both challenging to construct as well as to derive true meaning from others' Profiles. Without a sense of purpose, Profiles are quite varied and creative.

## FAKESTERS: BEYOND ACCURACY

From very early on, people began exploiting *Friendster's* architecture to create fake characters, "Fakesters." Three forms of Fakesters account for the majority of use:

1) Cultural characters that represent shared reference points with which people might connect (e.g. God, salt, Homer Simpson, George W Bush, and LSD);
2) Community characters that represent external collections of people to help congregate known groups (e.g. Brown University, Burning Man, Black Lesbians and San Francisco);
3) Passing characters meant to be perceived as real (e.g. duplicates of people on the system, representations of friends who refuse to participate).

When creating a Fakester, users go out of their way to be as creative as possible in articulating their Profile. People choose to be-Friend these characters when they connect with what is represented, value the creativity of the creator, or seek to expand their network.

Passing Fakesters are intended to represent non-participants or provide useful services. For example, a group of guys created a fake female character to give them good Testimonials and to introduce them to interesting women.

More problematically, some Fakesters are also created out of spite in order to confuse the network by having multiple representations of a single person, fraudulently operating as that person when interacting with others. Their venom is usually directed at *Friendster's* creator, who believes that Fakesters provide no value to the system. While he has systematically deleted fake Profiles ("Fakester Genocide"), Fakesters have started a "Fakester Revolution." Their antics include cloning fake characters and developing "Fraudsters" intended to pass amidst the real people, often fraudulently representing the creator and his friends.

### The Value of Fakesters

The argument against Fakesters is that they collapse the network, devaluing the meaning of connections between people on the system. This, of course, assumes that the network's value is in trusted links and that a Friend of a Fakester is going to be less trustworthy or compatible than the real, but virtually unknown, acquaintance of a friend. This also assumes that the primary use is in searching through the gallery for potential connections.

Most users do not browse via the central searchable index of Profiles; they navigate through Friends' Friends. Thus, they ignore Fakesters if they aren't interested. Yet, by and large, most people love the fake characters. They become little hidden treasures in the network and people go seeking out the most creative ones. Fakesters that represent groups allow people to more quickly find one's friends and acquaintances.

Those who create Fakesters value the opportunity for creative expression. Many also have "real" Profiles, but prefer exploring and relating to others via their masks.

### Fakesters and Trust

While people love Fakesters, they also reflect the fundamental weakness of trust on *Friendster*. Is anything actually real? Even Community Fakesters don't authenticate that the individual actually belongs and is accepted by the represented community. One user told me that Fakesters were actually great because they reminded him that nothing presented on *Friendster* is actually real.

## FRIENDSTER AS A SITE OF CONNECTION

People use *Friendster* to connect to others for a variety of reasons. Consistently, most users begin surfing Friendster by looking for people that they already know, either currently or in previous situations.

In doing so, it is assumed that there is value in reconnecting with long lost friends. For some, this is not true. One interviewee removed her account on Friendster when her high school boyfriend contacted her – she "didn't want [the] past dredged up." People often link to these found old Friends, even though they may now have little in common and cannot vouch for one another when friends want to connect.

Beyond individual connections, groups of people have organized FlashMobs, developed private "elite" clubs and started weekly pub gatherings through *Friendster*. Fakesters have connected in rebellion. In one somber situation, a man with a *Friendster* account passed away in his sleep. His unconnected friends were able to pass on information to one another via the site.

### Dating Via Friendster

The ways in which people connect for dating highlight the value people place in the network, and how they circumnavigate trust issues in order to develop intimacy.

#### *Hookups*

As with any online dating site, people surf the site for hookups as well as potential partners. While the suggested theory is that friends-of-friends are the most compatible partners, hookups often occur regardless of the network. Or rather, many looking for hookups prefer to be 3 or 4 degrees apart so as to not complicate personal matters. In addition to in-town hookups, *Friendster* users tell me that they also use the site to find hookups in cities to which they are traveling. This behavior is undoubtedly what instigated the mock site *STD-ster*.

#### *Who's your Friend?*

Sometimes, people unintentionally fail to introduce their single friends to one another. By having a public articulation of one's network, it is really easy to look at Friends' Friends and bug the intermediary about potential compatibility. While 3 and 4 degrees are often meaningless to people, there is a decent amount of trust in second-degree connections, simply because they can be easily confirmed via a shared connection.

#### *Familiar Strangers*

When Stanley Milgram coined the term "Familiar Strangers," he was referring to the strangers that one sees regularly, but never connects with [5]. Given additional contexts, an individual is quite likely to approach a familiar stranger. For many, Friendster provides that additional context. In browsing the site, users find people that they often see out. From the Profile, one can guess another's dating status and sexuality as well as interests and connections. Often, this is enough additional information to prompt a user into messaging someone on *Friendster* or approaching them offline.

### Commercializing Connections

Two users, believing in the value of their network, decided to try to auction connections on *eBay*. In their ads, they promised both *Friendster* and real-life connections to hipsters, artists, musicians, record labels, etc. One was far more serious, while the other was simply eager to make a point:

> Selling access to your friends network […] concretizes the commodification inherent to *Friendster*. […] The only real shortcoming is that the 'self' you're packaging on *Friendster* is a strictly delimited individual - but when I'm selling my network on *ebay*, the value is determined by my extended self, defined by its relationships and surfaces rather than content - in other words, the true me, in its full, fragmented, postmodern glory, all the more true the instant a dollar value is placed on it!

## FRIENDSTER AS A SITE OF INTIMACY

As a site for intimacy, *Friendster* has complicated the notion of trust. On one hand, it reveals one's most intimate relations, mixed with acquaintances, familiar strangers and past associates. Additionally, the site tries to capture one's most intimate notions of self, but fails to allow the individual to negotiate how that is publicized. Yet, by limiting access to those within 4 degrees, *Friendster* implies that a user's visibility is only available to trusted connections.

*Friendster* fails to realize that the trust implied in one's social network cannot be easily imported into a space modeled on performed identity and publicly articulated social networks. Yet, the site is ill-equipped to handle how people might connect via this new architecture.

Fakesters have created a playful space to explore identity and relations beyond authentication. Of course, this further highlights weaknesses of trusting articulated selves. Although intended to alleviate the blatant devaluing of connections, *Friendster's* "Fakester genocide" is seen as squashing creativity and trying to control the ways in which people regulate privacy, relationships, and self, so as to protect themselves in a public space.

As we think about intimate (ubiquitous) computing, we must reflect on how architectural changes fundamentally alter the ways in which people connect socially. While simply trying to help people connect in a more efficient and meaningful manner, *Friendster* has inadvertently uncovered a hornet's nest around articulated public identity, reshaped how groups of people verbally identify relationships, and solidified the importance of creative play in social interaction. Yet, amidst the confusion, intimacy flourishes, although often in unexpected forms.

## ACKNOWLEDGMENTS

Thanks to Peter Lyman and Scott Lederer for support, all Fakesters and Realsters for their stories, and Tribe.net, KRD, and Washington Post for funding the focus groups.

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# Intimate Media and Ambient Intelligence

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## ABSTRACT
In this paper we summarize findings from an Experience Design led investigation into the relationship between intimate media and emerging digital technologies carried out within the Multiple Intimate Media Environments (MiME) project. The challenge was to consider how the traditional activities involved in creating, storing and sharing intimate media could be enhanced through the possibilities offered by future and emerging digital media, tools and networks.

We introduce a definition of intimate media and a model that describes the human relevance and traditional process of creating collections of intimate media. We also describe one of the concepts from the MiME project called Glow Tags. The Glow Tags system is an example of new technology designed to enhance an existing and well-established human practice. Glow Tags are digital elements that can be added to intimate media artifacts distributed through the home. Glow Tags add a layer of digital information, connectivity and context sensitivity to a tangible collection of media distributed in the domestic environment.

## KEYWORDS
Intimate Media, Ambient Intelligence, Experience Design

## INTRODUCTION
The Multiple Intimate Media Environments (MiME) project [3] was an Experience Design [4] led project carried out in 2001-2002 as part of the Disappearing Computer call of the Future and Emerging Technologies arm of the Information Society Technologies programme of the European Commission. The challenge was to consider how the traditional activities involved in creating, storing and sharing intimate media could be enhanced through the possibilities offered by future and emerging digital media, tools and networks.. The project started by conducting ethnographic and other studies into the social mechanisms and human behavior around Intimate Media in the home. Conclusions from these studies were used to generate concepts for new computing solutions.

## INTIMATE MEDIA
'Intimate media' describes the things that people create and collect to store and share their personal memories, interests and loves. Typical examples include photographs, photo albums, diaries, letters, souvenirs and music, although anything could be intimate media, depending on the meaning and value attributed to it. That meaning can relate to a person's past, their present or even *potential futures*.

The deepest relationship people have with their material possessions is through associating them with experiences. The most mundane object can be imbued with emotional meaning.[2] If you ask what someone would save from their home if it were on fire, most people mention something that has sentimental value, which connects directly to their understanding of themselves and their history or identity, such as a photograph collection. Generally, people do not attach such a high 'value' to the technology in their home (TV, stereo, etc.), although it might have 'cost' more.

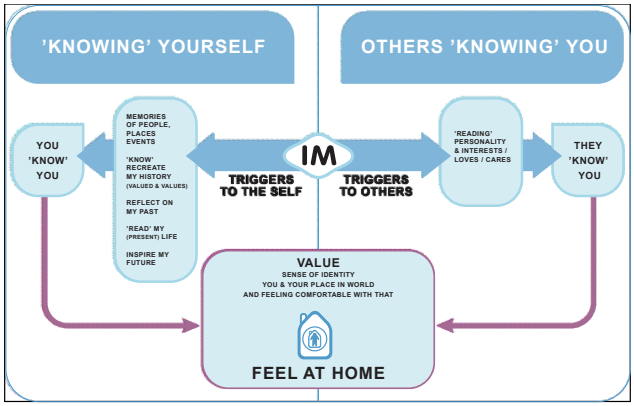


Figure 1 Intimate Media is central to a person's sense of 'feeling at home' in the world

Intimate media acts as a trigger to a memory process. Take a photograph, for instance. On the one hand, it is a pictorial record of a scene. But when the photograph is intimate media for someone, it carries much more information. It's the trigger for a whole range of emotions, stories and memories around that particular scene, also spiraling off into other scenes that happened around that time or involving those people, places or things. All of the senses

contribute collectively to this experience, from vision and hearing to touch, smell and taste.

### FEELING AT HOME IN THE WORLD

All of these activities, and others, contribute to a person's sense of feeling at home in the world. Achieving and maintaining this state is one of the powerful drivers of human activity. People actively create and nurture their framework of how they relate to the world and the people around them as a fundamental process. In essence, this is the human need to make sense of oneself and one's circumstances and to be able to communicate that sense of self to others.[1] This need relates to understanding the past, living in the present and preparing for the future.

### DIGITAL INTIMATE MEDIA

To date, most of the material collected in this way has been physical. Letters are on paper, images are painted or printed on photographic paper then held on the original negative, souvenirs are objects collected and displayed around the home or the workplace.. Increasingly, people are creating or replacing these materials with digital assets. Some of the most significant mediated interpersonal communications now happen by e-mail or Short Messaging Service (SMS) rather than by letter. Images are taken with digital cameras and camcorders and stored on CD-ROM or hard disks, and more often than not are never printed out (this has caused some museum curators to worry about the photographic record we are leaving for future generations).

What does this mean for the ways in which people create, manage and share their intimate media collections? How will people do this with their digital intimate media? Digital media is not available in the same way that the physical collections are; they will have to be presented to the 'real world' though translating technologies, such as a screen or loudspeakers. How will people be able to construct and arrange their living space with assets that are digital, stored remotely or accessed as a service and potentially short-lived?

### AMBIENT DISTRIBUTION

Bringing these assets into the virtual digital domain opens a range of new possibilities. For one thing, they are not locked into a particular physical location, and can be simultaneously present in multiple locations, or shared over time in multiple locations. They can be copied and shared easily. They can also be animated, or 'given behavior'. This means the intimate media asset can become active, can create connections to other assets or locations in which it could be presented, can interact with other data streams or sources.

So far, it has not been possible to emulate how people construct the space they live in with digital tools, simply because access to the digital world has been through highly specialized and predominantly non-intuitive devices – computers, keyboards, screens. Nevertheless, there are examples of ways in which people create, nurture and share their personality in the purely virtual world. These include personal websites, web communities, web diaries, and certain services like photo developers that create online photo albums. The popularity of these indicates a desire to express and develop the self and relationships in the digital domain.

The nature of Ambient Intelligence is that the benefit of these digital services would be distributed in the real world, spread throughout the environment and available to be accessed from diverse places (not just the personal computer). This brings a web of connections and potential interactions within real space, where people are familiar with constructing their 'external selves'.

### INTELLIGENT ANTICIPATION

A second quality of the distributed access to digital media and connectivity is the potential to nurture an 'intelligence' within that system. Within Ambient Intelligence, context and history will be shared between the diverse elements making up a person's collection of intimate media. Through a pattern-recognition and context-dependent filter, and particularly with nurture over time, connections of relevance to the owner will become established and active. The pattern of connections itself will become a piece of intimate media, in the same way that the arrangement of artifacts through the home does. This means that digital intimate media could become associated with real objects in the home, with distant objects or with other people's intimate media. It could lead to emerging patterns of media exposure or regeneration, for example, when an image of an old holiday spontaneously appears in a digital picture frame on its anniversary. The value of this type of intelligence is only complete when it leads to an evocation within the person, the arousal of an old memory or the sparking of a new thought.

The GlowTags concept from the MiME project is an example of this.

## GLOW TAGS

Glow Tags are designed to trigger personal memories. Taking the form of bookmarks, clips, ribbons or sticky labels, for instance, they can be attached to physical intimate media anywhere in the home. They store a small amount of information relating to the 'story' behind the intimate media in question, such as dates, people's names or locations and even digital images, sounds or short video clips.

Glow Tags are actually tiny computers that listen in to information flows in the home. Whenever they notice a connection between a current event and the facts they store (such as an anniversary or a voice-mail from a certain person), they glow, gently reminding us of that link and triggering a memory.

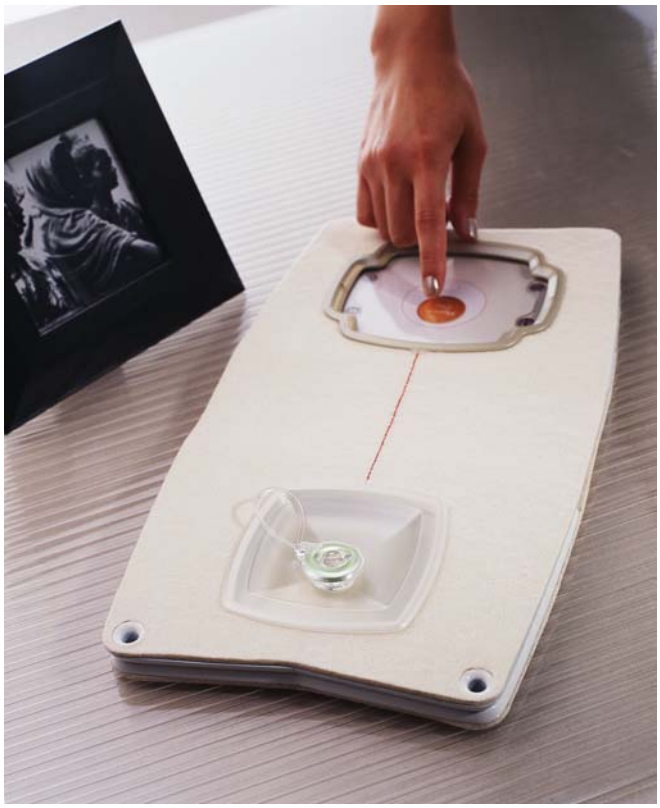
## EXPERIENCE AND INTERACTION DESCRIPTION

By themselves, the GlowTags are not sophisticated devices that will proactively address and solve a specific functional need. The main purpose of a GlowTag is to serve in a more subtle way as a *trigger* to the person who has placed it or who sees it.

The GlowTags store a small amount of *contextual* digital information. They will *activate* in certain circumstances, when they notice a connection, either a correlation of dates or an interaction with a certain person or related to a certain location. The activation will depend on the nature of the particular tag and the particular context that it has noticed. In general, this activation will consist of a very gentle notification of the tag's existence, either through a pulsing or glowing LED, hence the name GlowTag, or through sound or some other means.

The action of a single GlowTag is therefore a simple context related trigger alert. However, GlowTags are also able to communicate wirelessly with each other and with other home systems. This means that complex and emergent behaviours can be expected from a collection of GlowTags, particularly as the collection grows. For example, if one GlowTag decides to activate, it will broadcast the intention and the reasons why. Other GlowTags in the vicinity will pick up on that and may choose to activate sympathetically, perhaps because they also contain a reference relating to the original tag.

The GlowTag is not reacting to *use* and it doesn't know whether the fact that it's glowing is being noticed. Its' job is not to embody or re-play an experience or memory but simply to act as a trigger to some person's memory process. This approach places the emphasis and responsibility firmly on the individual to complete the memory and the experience. The rebuilding of the memory and the re-telling of the story remains within the person's own capabilities; the GlowTag and the object that it is attached to help this process by acting as *props*. If the person cannot remember the precise history that the GlowTag is related to, they can query the tag and find the factual information stored within it, but they will still have to build their story back from those facts.



## PRODUCT AND SYSTEM DESCRIPTION

GlowTags are essentially small processors with capabilities to enable the input, storage and reading of limited contextual information and to sense basic interaction. They contain an output method, for example a glowing LED or a speaker, and a limited range wireless communication capability.

The GlowTags are packaged in a variety of different ways to enable people to attach them to other objects. They could come as bookmarks, clips, ribbons, sticky labels or in many other forms. The technology in a GlowTag could also be developed and sold to manufacturers who could embed it in their own products.

The tags could be described as having three levels of existence, their physical form, an enhanced level due to the processor and digital memory capabilities and a further level due to their ability to network and communicate.

Without the processor or the network the GlowTag would not be triggered to glow but its physical presence, when noticed by someone, may well be enough to trigger a memory or story within that person. A solitary GlowTag, without connections to other tags or systems, would still have the ability to associate times, dates and other limited contextual information. It may also be able to *notice* when it is being interacted with and respond to that action in some way.

The network that GlowTags build up when within range of each other is perhaps the most interesting aspect. GlowTags can get access to information from various other sources that will provide more contextually related triggers for activation. For example, a GlowTag could get information on who is calling or who called from an intelligent telephone system. It could get information about the location of content being watched on TV or surfed on the Internet. GlowTags spread information amongst themselves so that when a particular tag is out of range, information may reach it via other tags.

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The GlowTag system also includes other elements, notably a *GlowPad* and a *GlowTagListener*. The GlowPad is used initially to input the information, or facts, onto a particular GlowTag. GlowTags can also be brought back to the GlowPad to read the factual information stored within it.

The GlowTagListener is a personal object, or an application on a personal digital product such as a mobile phone, which actively listens for GlowTags in its neighbourhood. If a GlowTag is activating but out of sight for some reason, the GlowTagListener will *hear* the GlowTag and pass the message on to the owner by alerting in its own way.

Although part of the way Glow Tags work will involve networking, it is not a network optimised for reliability or efficiency of information transfer but purely for inter-device communication. They are not completely reliant on the network to be useful as they can achieve interesting results by acting independently. Even though they store factual information, this is rarely exposed to the owner as this knowledge is predominantly used to decide when to activate. GlowTags are not designed to be intrinsically *useful* but rather to enhance and augment other items or media that already relate to the *intimacy* of memory. They will often rely on serendipity or luck to achieve the desired effect.


## ACKNOWLEDGMENTS

MiME was a project in the Disappearing Computer call of the Future and Emerging Technologies arm of the Information Society Technologies programme of the European Commission, led by Philips Design in partnership with Xerox Research Centre Europe and Nottingham University, carried out in 2002.



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# Reality Instant Messaging:
# Enhancing Intimacy Through Reality Streams

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**Abstract**

*Online chat technologies such as instant messenger and SMS have become extremely popular. There are 200 million instant messenger users worldwide, and 156 million SMS messages are exchanged every month in Europe. By 2005 Gartner predicts that instant messaging will exceed electronic mail as the primary form of online communication [3]. These applications are popular because they are simple and they are the few intimacy promoting applications freely available to users. Online chat environments, however, are missing a key ingredient that we take for granted in physical world chat – **reality**. When we socialize in the physical world we are surrounded by colorful and interesting events, e.g. a sporting event, a music concert, or an interesting drama on television. These events become conversational props that play an important role in driving and facilitating social interaction. The Reality Instant Messaging project injects these reality events back into online chat. In this way we enhance the reality streams by tying it to a social context, and at the same time we enhance the social environment by giving people something to talk about.*

## 1. Introduction

There has been much discussion about the information/content explosion brought on by the internet and the development of cheap storage and data collection tools. Processing and analyzing that content is the focus of entire academic disciplines and many new businesses. Much of that content, however, is not made available to the online social environments (e.g. instant messaging (IM), chat, and electronic mail) in which users spend the bulk of their time [1]. Current email and chat tools are limited to very basic operations for file attachments and file exchanges. The tasks of content consumption and social interaction are often distinctly separated in our online environment today. Yet the integration of content with a surrounding social context is very important. Technologies such as newsgroups and bulletin boards have proven that many users don't simply want to consume content, but they want to share that content together with others. Personal web pages, shared photograph, story, and art repositories, as well as web journals are further testament to the desire for socializing content.

Reality Instant Messaging (Reality IM) explores the next-generation chat environments in which live content and events are actively integrated into the social stream. By melding content channels together with social channels we:

1. *Enhance online social environments by giving people something to talk about.*

Content streams are important in chat because they provide topics of casual conversation, and also become foci for on going gatherings and discussions. Reality IM explores how online social environments can be enhanced by augmenting them with these content streams. Unlike bulletin boards, Reality IM automatically brings up relevant events based on a current live stream, rather than requiring participants to introduce and describe the topics themselves. This provides a very intuitive and natural way for sharing activities, similar to the real world, in which the current shared stimulus (e.g. a touch-down in a football game) drives the conversation and is automatically integrated into the social experience without any active introduction from any of the participants.

2. *Enhance interactive content by putting it in a social context.*

Wide-spread interactivity was one of the key changes brought on by the computer and internet revolution. Suddenly, content was not just consumed passively but could be interacted with and actuated upon in real-time, with real-time results. The continuing trend of embedded and ubiquitous computing enables not only interactive content, but interactive objects, which deliver a variety of services to consumers at the moment and location of need [7]. Current interactive services and activities, however, are only very loosely connected to a user's online social context. Some examples include bulletin boards, newsgroups, and multi-user virtual environments [5], in which participants share a common virtual world for the purpose of entertainment or training. Reality IM explores new techniques for enhancing and enriching online social interactivity including:

***Buddy surfing*:** The quality of an experience is based not only on its content, but also on the social context surrounding that content. Reality IM allows users to "*buddy surf*", i.e., it enables them to discover which of their friends are watching any given content stream. Viewers may opt for one stream or event over another not only based on quality of content but also because their closest or most interesting friends are watching that content.

***Social e-commerce*:** Shopping is one of the most popular social activities that people engage in, in the physical world. Friends come together and go to the mall, where they help each other in making purchases by offering helpful opinions and advice. Unfortunately, when shopping moved online, a lot of that sociability was lost. Shopping suddenly became an isolated activity, just like web browsing. Reality IM reintroduces interactive sociability into online shopping by getting a group of friends together based on activity, and relocating the relevant stores within that activity-synced, social context.

***Social interactive services*:** Group participation can make events very entertaining. Group participation is compelling because it allows users to enhance experiences by sharing it with their friends and to meet new people. It also enables joint interactivity (e.g. participating in a "wave" during a sports event) and friendly competition. A crowd can generate a great amount of energy and excitement which enhances an event. Geographic, temporal, and financial constraints, however, caused many users to start watching events alone, on television and other content devices. Unfortunately, television has traditionally been a very passive activity. With the introduction of interactive television (iTV), it is possible for viewers to start interacting with television content. However, early iTV services have been focused on traditional single user applications like those currently found on the desktop computer (e.g. email, web browsing, information download, stream recording). Reality IM introduces a new paradigm of television interactivity – one that involves social groups rather than single users. It places a lone viewer in a global living room that allows geographically distant friends to share activities and experiences as if they were sitting together watching a game in the same stadium or living room.

3. *Create a back-channel for collaboration and understanding user preferences*

One of the evolved uses for instant messaging is as a "back-channel" for participants to communicate in parallel with an ongoing phone or face to face meeting [11]. Work-related meetings, however, are only one possible stream that chat applications can effectively complement. Reality IM shows how syncing chat to a variety of other streams provides a back-channel for users to collaborate and store their collaboration sessions together with key events within the shared stream. This back channel can also allow companies to better understand the needs and requirements of consumers so that products and services may be better personalized and customized based on those needs.

4. *Provide a personalized, activity-synced channel to consumers.*

Banner ads are one of the great disappointments of the internet. Banner ads have been unsuccessful because the messages are neither targeted nor filtered, and they rarely reach the "right" user at the "right" time. In addition, the messages tend to be generic in nature and are not personalized to the history, preferences, and status of each individual user. Reality IM provides an "activity-synced" channel to users so that the proper services and products can be offered to them at the right time. For example, when a user is watching a golf game, he/she is expressing a general interest in golf, and more importantly, an interest in golf at that particular time. Unlike the world wide web, messaging channels are commonly one-to-one, and more personal in nature, so the information and services may be delivered in the "right style" with personalized content that takes into account user histories and preferences.

Reality IM provides these services to users through a "bot" (short for software robot) interface (*Reality IM bot*). Users only need to add the bot into their buddy list, using the same process as they would for a human buddy. Once the bot is added, users may start receiving the Reality IM services by opening a conversation window with the bot. Note that Reality IM services can also be delivered onto mobile platforms through IM, SMS, or WAP.

## 2. Reality IM Sports

Figure 1 shows a play-by-play interactive sports service that is delivered to consumers through instant messaging (IM). Sports-spectating lends itself well to Reality IM because it is a social activity that is widespread, real-time, and "lean forward" (*i.e.* encourages audience participation). When users subscribe to the Reality IM bot, they receive a list of their friends who are also currently watching the event (Figure 1, *buddy surfing*).

By tying users' buddy lists to the current live television stream we introduce the new notion of "buddy surfing." We are all very familiar with the concept of "channel surfing." Buddy surfing allows us to quickly skim through different television channels and check not just what content is currently available for viewing, but also which individuals in our buddy list are on each of the different channels. People want to socialize television content. For example, friends watch television together when they can, and co-workers congregate around the water cooler to discuss television content. So it is only natural that users would want the ability to surf channels not purely based on content but also on the social context surrounding that content.

In addition to tying the real-time sports stream to our online social network, we can also make that stream

interactive. As is shown in Figure 1, *activity-synced information download*, the IM session is synced to the real-time golf stream on a play-by-play or event-by-event basis. As events occur in the stream, they transmit to each user's reality IM window as text. When a new player comes up to the tee, users receive synced information about the player such as ranking and average score. Users also receive a summary of the current equipment the player is using.

Users may interact with a real-time stream whenever they desire. For example, they may request more information on the player or his equipment. Users also have the opportunity to compete with other users engaged with the same stream – for instance, by guessing whether that player will be able to meet par on the current hole (Figure 1, *activity-synced interactivity*). Once the play has begun, users may still interact at any time they choose to request more information, or cancel their existing guess. Some cancellations may incur a certain score penalty; the magnitude of the penalty will depend on the lateness of the cancellation, as well as the current status of the play. In this way, users can socialize and compete for points continuously throughout the event; however, participation is not required. Users may actively interact with the service, or choose to stay passive, let the messages scroll by, focus on the game, and only participate occasionally.

Note that the interaction is also tied into the social context of the users. In particular, whenever users make a guess, that information may be broadcast to their buddies (Figure 1, *social interactivity*). In this way, the application allows groups of friends to participate together, or to compete against each other for points, as if they were all in the same living room. Alternatively, friends may also shop together by getting comments from friends, getting updates on the current popularity of an item, bid against friends for an item, or show-off recently purchased items. Awareness is a very important part of online presence ([8], [14]), and Reality IM extends online awareness to include interest, activity, and transactional awareness. I.e., users can be made aware of what their friends are watching, which activities within the content stream they are most interested in based on the amount interaction they have with it, and what their bot transactions are (e.g., auction bids) with respect to the stream. Reality IM services like this are compelling because they allow social groups to come together around an activity that is of interest to all participants, no matter where they may be.

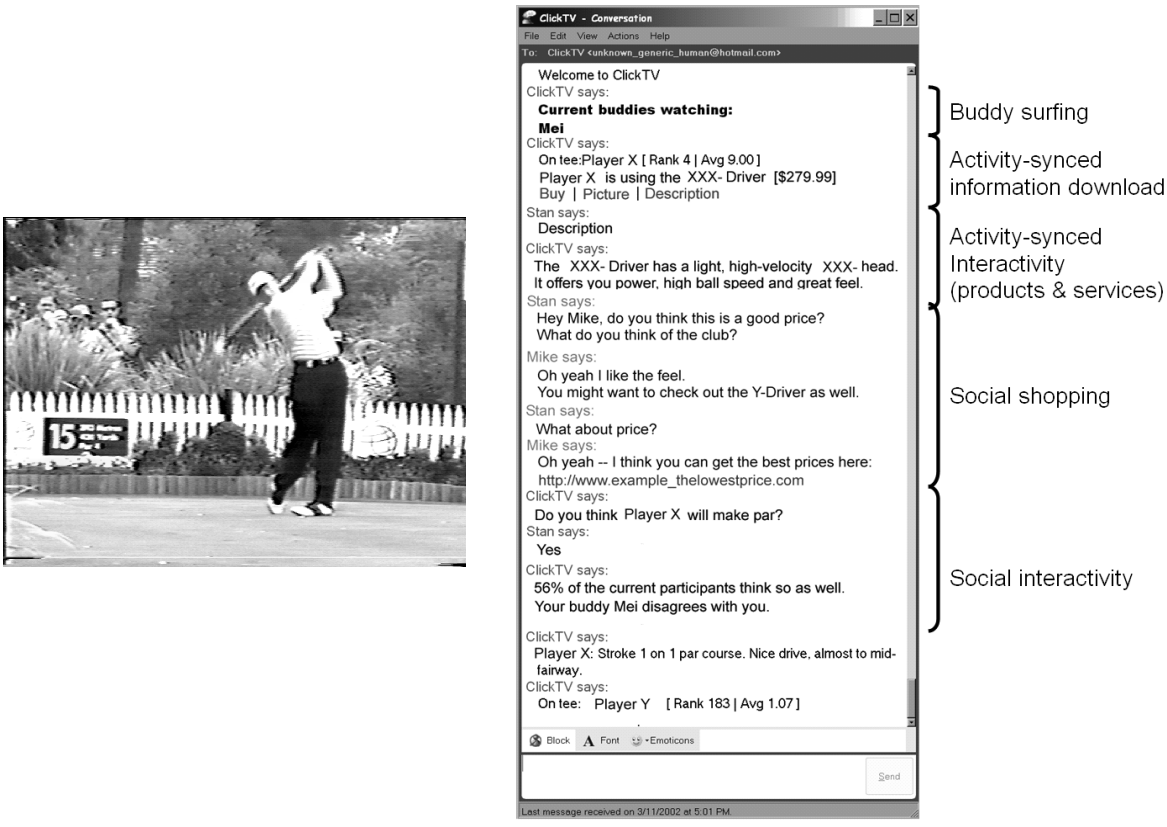


**Figure 1: A reality IM application featuring a play-by-play sports service. The IM session on the right is synced on a play-by-play basis to the real-time golf stream on the left. As events occur on the left, the IM window on the right automatically updates with those events. The system also allows users to interact with the real-time stream. In the example above, the user is given the opportunity to guess how well the current player is going to perform.**

The application currently uses a *walled garden* approach where users are offered a fixed number of alternatives for interaction. Entry of unrecognized commands will cause the bot to re-prompt the user with the current valid options. It is possible to create more flexible bots that may accept free-form responses [16]. However, the *walled garden* approach is simple and easy to learn, and not confusing to users.

While this paper only presents one scenario (in sports), Reality IM can be applied to many other streams. Certain streams that have clear distinct events, such as sports, music videos, and educational programs can be more easily integrated with Reality IM but ultimately any stream may be enhanced.

Many live streams (especially sports streams) already have the play-by-play events extracted from them in real-time [6]. Events may also be automatically extracted using sensors (GPS [15], cameras [13]) to capture the live stream state. Event extraction and translation techniques have been explored by a variety of companies and academic institutions [4],[9],[10], [12],[13],[15],[17]. In addition to live streams, there may also be scheduled event streams (e.g., a music video program, an educational program) which are relatively easy to integrate.

## 3. Conclusion

This paper mainly focuses on tying real-world content streams to our online social environments. While many of us spend a large portion of our time engaged in activities in the physical world, there are some of us who also spend a significant amount of time in virtual gaming worlds. The introduction of console boxes (e.g., Sony's Playstation, Microsoft's Xbox, or Nintendo's Gamecube) into the consumers' living rooms has brought on an interesting convergence between the internet, television, and gaming. These console boxes are very popular, and they have promoted gaming to a large number of users. In fact, there is currently a Playstation in at least one of every four American homes [2], and total revenue from gaming is coming close to that of movie ticket sales [2]. Thus, just as some of us want to be aware that our friends are watching the same baseball game as we are, others of us may want to be aware that our friends are hunting rabbits on a fantasy world, or virtually racing motorcycles on the Bay Bridge.

Presence and awareness should not simply stop where the physical world ends, but rather should extend to wherever consumers are spending their time, including online virtual environments. Just as it makes sense to allow users to share their "real world" experiences in online chat environments, it also makes sense to allow them to share their virtual experiences, especially since actions can be more easily tracked and stored in a virtual digital world. The IM system could be used as a common social framework that underlies the myriad of virtual worlds as well as our physical world.

Reality IM underscores the coming of a major trend, namely the establishment of services or products that sit between the three worlds that we live in today: the real/physical world, the digital textual data world, and 3D graphical virtual worlds. Throughout these three environments, the social network remains constant amongst its participants. This puts technologies like instant messaging in a unique position to tie together all three worlds. Reality IM illustrates how the stitching between the worlds may occur, and what new opportunities emerge from this new integration.

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# Tracing Technological Intimacies: UbiComp Assemblages

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**ABSTRACT**

Intimacy need not be located in specific technologies or in the relationships they afford, but may be traced through particular spaces, times and relations mobilised during the design and use of ubiquitous computing. In this short paper, I draw out the concepts of 'intimacy' and 'closeness,' as well as the processes of 'bringing near' and 'making present' a variety of people, objects and ideas. By using these terms to strategically trace intimate connections or assemblages in the research and development of bio-mimetic spider silk, I suggest a short set of questions and concerns to apply to the research and development of a wide variety of technologies. By understanding these intimate assemblages, I believe we may better understand the emerging social and cultural aspects of UbiComp, and design for greater accountability and responsibility.

**INTRODUCTION**

Used as the spider's safety line during web building, and serving as the web frame, spider dragline silk is five times stronger by weight than steel and more resilient than any polymer fibre. Since spiders are territorial carnivores, they cannot be farmed like silkworms, and large-scale production of spider silk has been unsuccessful. One might easily imagine that it was this combination of valuable material properties and elusiveness of mass production that inspired the reputation of spider silk as the 'Holy Grail of the materials industry.'

Not surprisingly then, in 2000 researchers at Nexia Biotechnologies, in Montréal, Québec, made international headlines by introducing Peter and Webster – two transgenic goats born with the 'spider silk gene incorporated into their genetic composition.' The genetically engineered goats secrete spider silk protein in their milk, and the protein is then isolated to be developed into spun fibres. The primary markets for Nexia's BioSteel® products are biomedical and military. Eventually, the spider silk protein should be used in biopharmaceuticals, and the spun fibres should be used for sutures, surgical meshes and artificial ligaments – woven directly into the human body. Nexia is also working in cooperation with the U.S. Army Soldier Biological Chemical Command (SBCCOM) to develop 'stronger and lighter composite materials for advanced engineering' and ballistic protection that lies closer to, and more gently upon, the body (Turner 2003).

Nexia's research and development of 'bio-mimetic spider silk' and interactive textiles offers a unique opportunity to re-examine our understandings of technology and intimacy. I would like to begin by taking a closer look at the roots and meanings of intimacy and, if you will pardon the pun, by weaving them together with related concepts, particular cultural practices and technologies. I will then outline a set of questions and concerns that may be applied to the research and development of a wide variety of 'intimate technologies.'

**INTIMATE ASSEMBLAGES**

At a technical level, weaving is to form by interlacing: warp elements are held stable while weft elements are moved through the framework. At the metaphorical level, we can also *weave the fabric of society*, although this implies that the collective body serves as the stable warp element and the individual body as the mobile weft – and I do not entirely agree with that assessment of sociality. A related metaphor would be *weaving our way through a crowd*, in which the practice of weaving can be twisted to involve moving a stable element through a mobile element: the person navigates the chaotic crowd to emerge (on the other side) 'intact.'

Technically, weaving also involves the production of a textile, or fabric, and so weaving is always already fabrication. According to the Oxford English Dictionary, to fabricate is to construct something new from existing parts; to assemble or aggregate disparate materials into a whole. We *devise* in our minds new combinations or applications, and we create *devices* (something devised or contrived and mechanisms designed to serve special purposes).

With traditional textiles, the intimacy of certain fabrics, such as lingerie or death shrouds, is evident in their close physical proximity to the body, as well as in their long established (if shifting) social boundary practices regarding the body. Emerging textile technologies or devices, such as those researched and developed by Nexia, also *fabricate* or *assemble* new forms of intimacy between the people, objects, activities and ideas mobilised in their conception, creation and use.

Intimacy is spatial, temporal and phenomenal: we perceive it through immediate embodied experience and through our senses, rather than by logic. To be intimate is to be closely acquainted in space and time. The word root is the Latin *intimare*, to 'impress or make familiar,' which in turn comes from *intimus* or 'innermost.' To be intimate is also to be 'inside' or invisible to others, private and personal. And yet as a verb, to intimate is to 'make known,' or to imply, to hint, to make present.

To be close is to be 'only a short distance away or apart in space or time,' or to be brought together, very near. Its roots are the Latin *clausum* 'enclosure' and *clausus* 'closed,' but not necessarily *claudere* 'to shut out.' To be proximate is to be 'closest in space and time, or relationship,' from the Latin *proximare* 'draw near,' and *proximus* 'nearest.' Something experienced as close need not be visible, but it must be sensed as *present* or *near.* To be present is also to be or occur in a particular place, to exist or occur now, or to be habitually performed. To be near is to be a short distance and time away, similar to or almost so. To be close is also to be impressed, embraced, entwined or folded together. To assemble is also to come together, from the Latin *assimulare* 'bring together' or to make similar. An assemblage is a collection of several or many, or a multiplicity. The root of multiplicity is the Latin *multiplex* 'consisting of many elements in complex relationship.'

Of interest here is the repeating notion of being together in close connection, and of being actualised through particular associations in space and time. If emerging textile technologies comprise hybrid collectives of humans and non-humans (cf. Latour 1999), as I believe they do, then I should begin articulating what exactly constitutes these intimate assemblages of people, objects, activities and ideas.

**TRACING THE SPIDER/GOAT/HUMAN**

The assemblage that is mobilised to create and use Nexia's BioSteel® products is vast, but not beyond tracing. For the purpose of this paper, I would like to quickly trace what I refer to as the spider/goat/human. This hybrid not only embodies intimacy at the molecular level but brings into intimate association a broad range of individual, social, cultural and material forces.

If I begin with the spider I may conjure historical and possible future tensions between 'man' and 'nature.' Spiders and their webs appear in the mythological history of a wide variety of spatially and temporally distant peoples and cultures. In these myths, spiders are beautiful and fearsome, delicate and brutish, always exemplary weavers or engineers, sometimes of the universe itself. With the advent of Western science, spider silk became known as one of the world's strongest – and least exploitable - materials. Even when scientists have successfully mimicked raw spider silk, spider spinning mechanisms, or spinnerets, have proven much more difficult to replicate. Put differently, in myth and science, the 'natural perfection' of spiders and their webs has historically been beyond the ability of 'man' to reproduce.

In the tradition of scientific progress, and following much work in genetics and biotechnology, Nexia's primary interest in the spider is in its cellular make-up, and specifically in the identifiable genes that produce the proteins which create different types of spider silk. By achieving knowledge of the molecular composition of the spider, scientists may claim a more intimate knowledge of spiders than ever before. Yet as they get ever 'closer' to the spider, their intimacy with the creature remains immediately invisible and intangible. It can only be experienced at a distance - mediated, for example, by technicians using microscopes and computers in lab settings. As such, Nexia's 'spider' is known only through contextual assemblages of people, materials and ideas.

The 'spider assemblage' also stretches beyond the lab, and brings into intimate relationship less obvious practices and concepts. For example, in order to gain an intimate, genetic knowledge of the spider, scientists, industrialists, businesses and governments negotiate the methodology, funding, regulation and application of this research. Particular procedures and policies emerge to enable and sanction the construction of scientific knowledge and its relevance in everyday life (cf. Knorr-Cetina 1999, Stengers 1997).

To complicate matters further, Nexia's 'spider' (actualised as spider silk genes) acts only as part of Nexia's BELE® (Breed-Early-Lactate-Early) goats. The transgenic goats are goats like any others except they have been genetically engineered to produce spider silk proteins in their milk. Enter the spider/goat hybrid, and the assemblage grows to include the history and future of animal domestication and milk production, as well as continued and refined

expressions of international scientific, industrial, business and government intervention.

Nexia also works with the Canadian and American military forces to turn their 'spider' silk into spun fibres destined for use by humans - internally in the form of sutures, surgical meshes and artificial ligaments, and externally as soft and flexible textiles for ballistic protection. By directly weaving the spider/goat fibres into the human body, the spider/goat/human hybrid emerges, and brings even more social, material and ideological elements into the assemblage, and creates further intimate relationships. At this point, the spider, goat and human perform a 'molecular intimacy' (material and yet experienced only at a distance). Other intimacies include 'close' and 'present' connections between cultural and social histories, institutions, practices and beliefs. For example, the spider/goat/human(soldier) invokes the history and future of combat, armour, and ways of wounding or killing the body. This particular hybrid is also 'greater' or 'stronger' than the singular soldier – a body 'improved' by science mimicking, and exceeding, nature.

In sum, it is within this spider/goat/human hybrid that I may look to locate the intimate relationships mobilised and actualised in the research, development and use of Nexia's 'bio-mimetic spider silk.' Rather than approaching emerging technologies as new tools or even discrete objects, I look instead to intimate assemblages of people, materials, activities and ideas. And I understand these assemblages to comprise rhizomatic, or root-like connections (cf. Deleuze and Guattari 1987).

This approach encourages greater social and cultural responsibility for technological innovation as it draws out often hidden connections between practices and events. What once may have been considered beyond the scope of concern (or too 'distant' in space and time), such as the eventual breaking-down and subsequent disposal of technological devices, may be brought 'closer' and planned for from the moment of conception. This contextual knowledge can also help ameliorate other risks inherent in emerging technologies. Finally, by engaging intimate assemblages we may foster the serendipity, playfulness and creativity necessary for innovation.

## TRACING OTHER TECHNOLOGICAL INTIMACIES, OR FIVE QUESTIONS TO ASK ABOUT ANY UBIQUITOUS TECHNOLOGY

One of the greatest challenges for ubiquitous computing is to account for the ways in which we experience everyday intimacies with technology. I would like to close with five questions that attempt to begin 'folding' technologies, or bending them over on themselves and into other elements, in order to trace out the assemblages mobilised in their design and use.

1. Who, what, where and when come together in the conception, research, development, distribution, use and disposal of UbiComp? What 'touches'?
2. Who, what, where and when are made distant? What does not 'touch'?
3. Who, what, where and when are privileged? And threatened?
4. How are these intimate associations played-out?
5. Where might we locate accountability in these connections?

By asking these questions of any ubiquitous technology, we may expand and explore our understandings of intimate relations and their technological components. Finally, we may use these questions to guide the socially responsible design of emerging ubiquitous computing.

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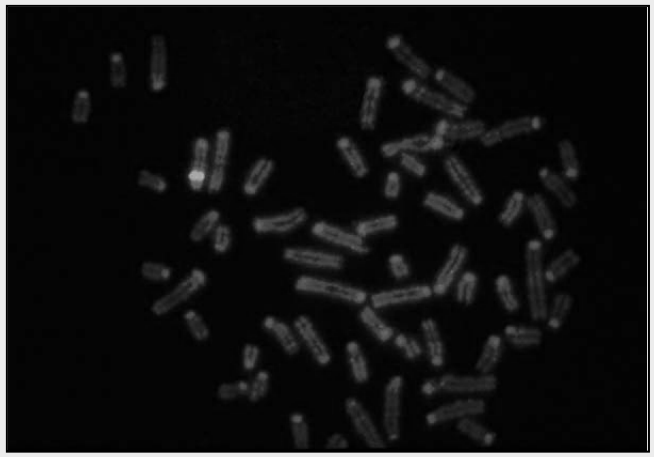
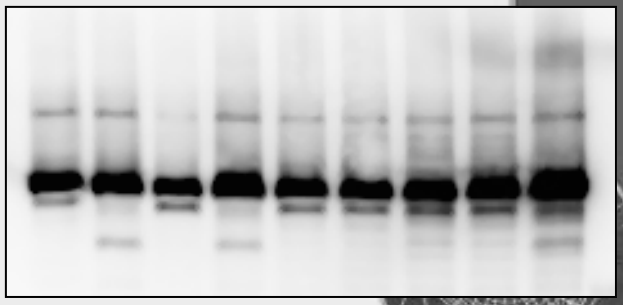
# BioSteel® Protein Expression

Sperm with BioSteel® Gene

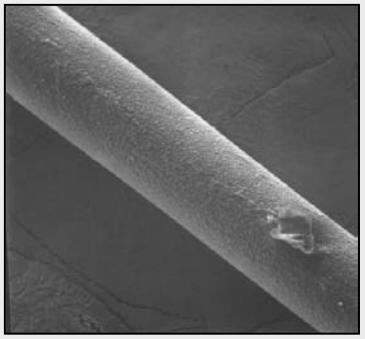


BioSteel® in Chromosome

Goats Produce BioSteel® Milk



BioSteel® Protein



Fibre

Products

# The Sensing Beds

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**ABSTRACT**
The Sensing Beds domesticate communications devices by placing them in the bedroom. The beds mediate between two romantic partners who are not co-located by sensing body position in each bed and using a grid of small heating pads to warm the congruent points in the other bed. As an experiment in telepresence, they bridge the physical distance between two people who would normally share a bed, but find themselves sleeping apart. As an experiment in slow technology and emotional communication, they articulate users' existing concerns about intimacy, trust and knowledge.

**Keywords**
Intimacy, body, limited communication, telepresence, networks

**INTRODUCTION**
Intimacy and distance is an ever-fruitful source of inspiration for networked projects, from *Feather, Scent, Shaker* (1996) [1] to *LumiTouch* (2001) [2]. Often these projects use multiple physical objects as "digital, but physical, surrogates" [3]. That is, they embody a physically absent person's presence and/or action by altering their appearance or behavior.

These surrogates often communicate not just the presence of the user but also more specific information about the user's state of mind. The Sensing Beds, enter the intimate space of the bedroom as passive observers. We may not use our stoves every day, or sit down in our living rooms, but we all lie down in a bed at least once a day, usually at the around same time. An unavoidable part of our daily routine, the bed is an excellent site for low-bandwidth, low-effort communication.

The Sensing Beds applies this concept to the ever-more-common phenomenon of the long-distance relationship through the emotionally meaningful site of the bed. The bed, which usually unites a couple, here displays the presence of a distant loved one through heat. Sensors located in one mattress pad track the position of its occupant. The position data is transmitted every five minutes to the other bed where heating pads are activated at the same coordinates. Each sleeper thus synchronously feels the ghostly warmth of the absent partner.

**SLOW-TECH**

The beds are an example of what has been called *slow technology* [4]. They respond over hours, not milliseconds. Their effects mimic the pace of unenhanced life: the slow warming of a newly occupied bed; the cooling of an empty one. Designed to frustrate conventional expectations of immediate, obvious interactivity, the beds react sluggishly and unpredictably. Their artificial heat can be confused with their owners'; their communication is at best delayed by seconds, even minutes.

Slow technology regards the passing of time as an opportunity for engagement, not an obstacle to be overcome. As Hallnäs and Redström write, "we should use slowness in learning, understanding and presence to give people time to think and reflect. Using such an object should not be time consuming but time productive."

Thus the Sensing Beds are designed not for efficiency or clarity but for emotional resonance — what Dunne and Raby describe as the "translucent connections" between people. [5] They use the moments before sleep as an opportunity to reflect on what is absent — the person who has become a ghost in the bed.

## THE BED

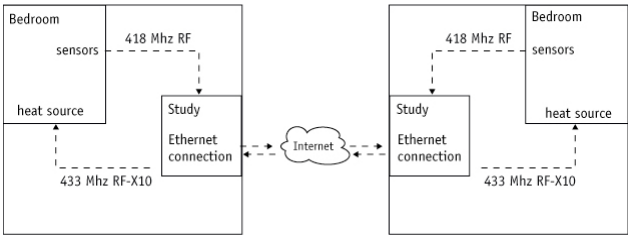
Using the bed allows us to capitalize on its cultural associations and practical functions. In English, the bed is a frequent metonymy for marriage; a loveless relationship is often imagined through a "cold bed." The physical attributes of the bed – cold or warm, empty or crowded – also describe the relationship. Our behavior in bed both results from and contributes to romantic intimacy. In bed, we are presumed to be at our most unguarded – whether asleep or awake.

The Sensing Beds track just this kind of intimacy-producing behavior: unconscious movements during sleep, early bedtimes, late rising. We may not use our stoves every day, or sit down in our living rooms, but we all lie down in a bed at least once a day, usually at the around same time. An unavoidable part of our daily routine, the bed is an excellent site for low-bandwidth, low-effort communication.

Like the hollows and lumps in the mattress left after years of cohabitation, the sensors and actuators of the Sensing Beds are buried underneath the mattress pad. Our approach differs from previous approaches, especially that of Chris Dodge [?]. Dodge focused on the pillow as a "physical avatar" for the absent partner's physical presence, equipping it with heating pads and vibrating motors. He also used curtains around his bed installation as screens for visual projections. Unlike Dodge, we locate intimacy not in the "physical artifacts" around the bed, but on the mattress, the common space shared by a couple. The flat plane of the mattress serves as a kind of ambient display, read not through the eyes but through the skin.

## IMPLEMENTATION

Designed for American domestic use, the beds require only inexpensive, readily available technology and could be deployed immediately. The Sensing Beds are two full-size beds in different locations, each with identical sensing and actuating functions. Each bed has a grid of foam pressure switches under the mattress pad. A microcontroller underneath the bed processes the data. If there is an ethernet jack nearby, an embedded server integrated with the bed microcontroller sends the data via TCP/IP to an identical module in the remote location. If there is no Ethernet jack in the bedroom, the bed microcontroller transmits the data over RF to a microcontroller with an embedded server located closer to a jack. Our prototype assumes the second case, since few contemporary homes (as opposed to labs or offices) have Ethernet jacks every few feet. In the second location, a module near a jack receives the position data and uses the X10 protocol over RF to turn on and off small AC powered heating pads located at congruent points below the mattress pad of the second bed.




In May, the beds were prototyped as a set of paired benches directly facing each other so that users had both visible and tactile proof that the system worked as described. The two benches were each equipped with three position sensors and three heating pads hidden inside cushions. Each bench had three cushions, each with an embedded pressure sensor that activated a heating pad under the corresponding bench. This prototype uses heat to signal presence in much the same way as Dunne and Raby's bench concept [5]. In this case, the heat is not a precursor to further communication; it *is* the communication. Users were given information about how the benches worked, but not the purpose of the benches or what the results of use would be.

Over two days, more than 40 pairs of people tried the benches by sitting on the twinned cushions. The heating pads were unexpectedly powerful: after about ten minutes of use the cushions became uncomfortably warm and users had to stand up. But the illusion of physical presence held: users not only accepted that the heating pads *represented* remote physical presence but also often acted as if they were literally *feeling* another person's body heat. In some cases, they reported visceral disgust, or disquiet. A few compared the sensation to the unpleasant residual warmth left on recently vacated seats. Others approached the situation more analytically. Using comparative perceptions of heat they attempted to figure out how recently other cushions had been vacated, and how long the previous remote sitters had been there. In effect, the users were trying to create hypotheses about their relationships with other users from fragmented and ambiguous physical evidence, even though they had been told any evidence would necessarily be inconclusive.

## MISCOMMUNICATIONS TECHNOLOGY

The Sensing Beds deliberately limit the data they sample. They do not recognize who is in the bed, or whether the bed's owner is in the room. Their heat may be a comforting reminder of a lover's presence — or perhaps create insecurity. Predictable data is comforting, while differences (Why is the entire bed warm? Why has the bed been cool all night?) in routine can bring distrust. Sometimes ambiguous data is more disturbing than no information at all. Knowing more about a loved one does not always make us happy.

The beds are not placebo objects; they must work as planned in order to facilitate the real emotional relationships between two people. They can only be comforting when they are supported through emotional trust built with other, more active, communications methods: the phone, the email, the Instant Messenger (IM).

The Sensing Beds derive their meaning from people, not the other way around. They echo and amplify a relationship's dynamic. The questions users of the prototype asked about the beds (is are they a communications tool? a teddy bear? a surveillance device?) reflect different attitudes towards communication – and miscommunication – in romantic relationships.

The uncertain warmth of the bed is a metaphor for the uncertainty of trust over distance. Would you rather trust the technology, or your partner? Whose body warmed the bed? When was it last occupied? Is the heat from another body or one's own? The Sensing Beds give only the vaguest outline of an answer.

*A user touches the seat cushion next to him in order to figure out when the corresponding cushion on the other bench was last occupied.*

The beds work slowly because they follow the pace not of desire, which is immediate, but of intimacy, which takes time to grow and flourish. In designing to support relationships between people, it is easy to forget that intimacy is not a task; it cannot be sped up or made more efficient. We have to remember what popular music has known it for years: *you can't hurry love* — no matter how ubiquitous the devices we use to promote it [6].

## ACKNOWLEDGMENTS

Tom Igoe, Bana Abou-Richeh, Amichi Wolf.

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# Of Blogs and Journals: How We Capture Our Most Intimate Thoughts

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**ABSTRACT**
The idea of recording thoughts and emotions in a diary and journal is an important theme throughout many cultures the world over. Journaling provides people an outlet to share their most intimate thoughts, with themselves or with others. As ubiquitous computing researchers strive to design intimate technologies, journaling is an area that could serve as an important example of intimate physical and virtual artifacts and activity.

**INTRODUCTION**
The keeping of a private journal might afford a person a level of intimacy with a physical artifact and virtual confidant that is deeper than any relationship had between the author and another person. The sharing of a journal or diary can bring a level of intimate communication between the reader and the author that potentially no other form of communication can. An exploration of on and off line journaling can enable researchers to more deeply understand the relationship between people and their most intimate thoughts as well as between people and the mediums with which they choose to record and potentially share those thoughts.

Journals and diaries are a part of the public consciousness of many societies. Children and teens might eagerly await their first diaries, and adults might examine their diaries as they grow older. Journals can serve as a confidant or counselor, eagerly listening to the accomplishments and the trials of their owners' daily lives. Diaries like the one Anne Frank wrote during her family's time in hiding from the Holocaust can be used as first person accounts of historical events, sometimes tragic and deeply personal. Journals might be shared with the world after their authors have died, leaving a window open into the past for the readers. They might even be shared with the public or just small groups while their authors still live.

**Figure 1: Stacks of old journals can provide an intimate portrait of an individual's life**

As a young girl, I can remember cherishing the small hard-back diary with a lock on it that my older sister had given me as a birthday present. Throughout the years, I have recorded thoughts in a variety of journals, each one physically suited to my mental and emotional state at the time. For example, during the first year after moving from my parents' home, as I struggled to assert my adult status, my journal was leather-bound, lined, and significantly more formal than any I had used until that point or have used since. I have a stack of these journals, some much more full than others, but each of utmost importance to me. At times, I read one from a particular stage of my life hoping to relive that time for a moment. Others, I never read, because it is just too painful. And yet, I still find comfort in their physical presence in my life.

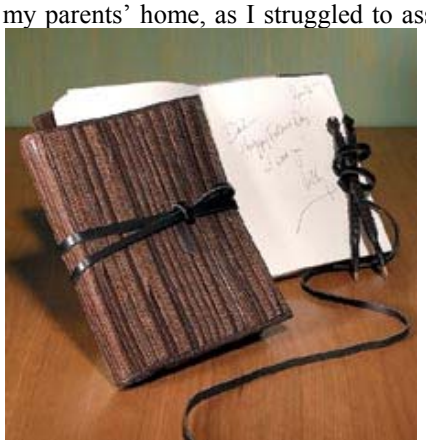


**Figure 2: A leather bound unlined journal.**

One explanation for the intimate connection between reader and author of a journal is that the author originally wrote to the journal without thought of who might read it. Often the barrier to intimacy in a relationship comes from attempts by the individuals to portray who they want to be or who they believe others want them to be rather than who they are. Given no one to impress, a journal author may be truly honest, an important step towards intimacy in any relationship. Coupling this honesty with acceptance by the reader of who the author truly is can make for an intimate relationship even when the two have never met.

I believe this human compulsion to journal is fueled primarily by the need to establish intimate connections: with the past, with other individuals, and with an inner self. Journals and diaries are both intimate devices and artifacts in and of themselves and vehicles for the creation of intimacy between people. In this paper, I will explore some of the reasons that journaling is such a powerful tool for intimacy.

## TRADITIONAL JOURNALING

Merriam Webster defines a journal as "a record of experiences, ideas, or reflections kept regularly for private use." Traditional journals are written by a single author in an initially blank book or notebook. They tend to be handwritten, although digital and printed typed journals do of course exist. Journals tend to be written as letters with no real audience in mind. The cliché of "Dear Diary" beginning each journal entry, may in fact be fairly accurate.

Journals allow individuals to keep a literary record of their growth processes, allowing the authors to discover their own personalities and tendencies. The journaling process itself also often allows the authors to clarify their thoughts significantly. Abstract ideas or goals may solidify with the act of writing them out. Journaling also encourages curiosity and in depth reflection on the topic.

Traditional journals are extraordinarily intimate artifacts for individuals. Writing in a journal is a means of expression in which the authors can share their thoughts without fear of judgment. Not only does this allow people an outlet for their emotions but this level of safety and privacy also encourages people to explore their talents and ideas (poetry, fictional writing, even scientific ideas) without fearing criticism or reproach.


**Figure 3: An example of a web log (blog) used as a conference trip report, from www.ariadne.ac.uk/issue24/ web-focus/weblog.gif**

## ON LINE JOURNALING

A blog, or web log, is a series of posts on line usually arranged in chronological order like a journal. Blogs may be the thoughts of an individual or the product of a group. They may be anonymous or signed. Blogs may also be topical or more general, just like journal entries. The major differences between blogs and more traditional diaries are:

- They are intended to be publicly shared and can be viewed by people who have never met and may never meet the author(s).
- They are virtual artifacts, existing in digital rather than physical form.
- Interactive nature: People can post comments back to the author of the blog.

Despite these differences, blogging shares a number of characteristics with journaling and is also used as a form of intimate expression in many cases.

## THE JOURNAL ARTIFACT

The process of choosing the physical artifact that will become someone's journal can be dramatically different from person to person. Journals, often received as gifts or chosen in a hurry, may not take on any special physical meaning until used for some time. On the other hand, many people take a great deal of joy in selecting just the right diary.

For some, the way a journal feels when touched may be the most important feature. A smooth leather finish may evoke a very different set of emotions from a slick hardback diary or even a rumpled paperback version. For others, the smell of the paper or leather may be the most important. While spending some time in Hawaii, I purchased a hand-made journal that smelled of native orchids. Even now, years later, when I read through that journal the touch and smell of the journal reminds me of the vacation.


**Figure 4: An example of locked diaries that might be given to young children. In some societies, the choice of color and decoration associates strong gender roles with these diaries.**

The decorative effects of particular journals can also be very important. The sentiment expressed on the outside of a journal might enforce or diminish the sentiment expressed inside, because the author sees the cover with

each journaling session. As the public recognizes these issues, a new generation of journals and diaries are appearing. These often make sociological or political statements, reminding the author of a particular perspective.


**Figure 5: An example of a journal designed to promote empowerment of teenaged girls in the United States.**


**Figure 6: Humorous journal covers**

The design of the pages on which authors record their thoughts can be extremely important in conveying the right meaning, either privately or publicly. With physical artifacts, this design may include the consistency, color, and size of the paper, whether or not the paper is lined, and many other factors. In the case of blogging, the style of the blog may become even more expressive. Using web development techniques, such as HTML and JavaScript, bloggers can enhance their sentiment with effective use of on line design. Using web technology, bloggers can do more than just choose the journal that is right for them and actually create the journal from nothing. For less technical people some web sites (such as blogstyles.com) provide templates. In this way, technically novice bloggers can still express themselves in a rich format, adding to the intimacy of the communication.

## PRIVACY AND PUBLICITY

People often struggle with the delicate balance between privacy and publicity in daily life. Journaling can be a powerful means for accomplishing both. A diary can serve as a place of refuge where you share your most personal thoughts with yourself and no one else. At the other end of the spectrum, a public free blog may be a place where you share your intimate thoughts with the world, gaining publicity and creating connections through personal communication with a large and disparate group of people. Sometimes, blogs are anonymous thereby creating publicity around an anonymous individual or pseudonym rather than the authors themselves. Those who keep diaries, however, are most likely to report a level of sharing somewhere between those two.

A private journal may serve its author by being a place to explore passionate emotions and somewhat extreme thoughts before resolving a more neutral and appropriate response to a situation. This final result may later be shared with the rest of the world, but the process by which the author arrives at that point may be kept private.

A private journal might also serve its author by remaining private during a struggle and becoming public, once the situation improves, to help others in a similar struggle. A cancer patient and close friend kept a diary throughout her treatment process. She believed the details of her daily struggle were much too private to share during the process. A year after she was pronounced healthy, however, she decided to share her diary with other patients so that they might find comfort in solidarity. By sharing these private details, she was able to create an intimate bond with the patients that might not have been possible using the more traditional support group venues.

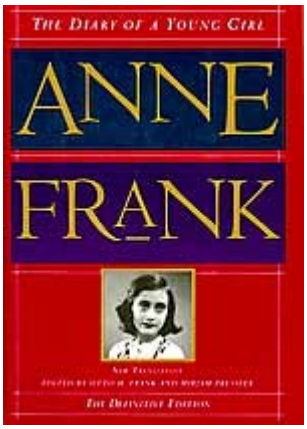
Sharing a journal with the world may also serve other, potentially less altruistic motives. For example, a political campaign is currently capitalizing on the blogging trend with its own blog (www.blogforamerica.com). This blog is a collaborative effort produced by the staff of a presidential candidate. While this blog is not as personal as many others that exist, people may in fact feel a more intimate connection to this candidate than they might through the use of more traditional commercials and campaign tactics.

Discussions about privacy and publicity need not be dichotomous in nature. One could imagine a world in which journals could be shared with only certain individuals or only pieces of journals are open to the public while others remain private. Through employing appropriate security policies and protection software, digital artifacts may be secured for use by only certain authorized parties. However, the very nature of our networked world may mean that once something has been publicly released to the world, intentionally or not, it is there forever, and there is no way to make it private again.

## COMMUNITY BUILDING

Journaling can be a powerful tool for exploring the self, but it can also be a powerful tool for building intimate relationships within communities. Journals shared with the world, while the author is living or not, may serve as a point of history and/or discussion around which to rally a community. Interactive journals shared while being written, such as blogs, may serve as forum for discussion and community building in real time.

**Figure 7: The Diary of a Young Girl, by Anne Frank, is perhaps one of the world's best known diaries.**




When I was assigned "The Diary of a Young Girl" by Anne Frank to read as part of a school project, my mother read it with me. She interrupted my reading at key points to tell me the history of my own relatives and their struggles. She showed me photographs of relatives who had survived. Through Anne Frank's diary, I was able to form a more intimate connection not only with a group of relatives whom I would never know but also with a community to which I belong.

A more modern, but equally controversial, example of community building through journaling, is the web site TardBlog (http://tardblog.com). This site is a web log written by a real life special education teacher. The authors post stories that ostensibly happened and involve special education students in a particular school. By doing a quick read of the "Love and Hate Mail" section, a visitor can quickly see that the site has built a strong community, two in fact. One of these communities, filled with special educators, people with disabilities, parents of children with disabilities, and a number of other people, strongly supports the site and applauds its authors. Expressions of feelings of understanding, relief, and solidarity fill the pages. The other community, composed of a similar mix of individuals, strongly objects to the blog through their letters and comments. Each of these communities appears to have an intimate connection amongst its members and with the site.

These are only two examples demonstrating journals as community building tools, there are a number of on- and off- line journals have been and will continue to be used in this manner. Examples of them permeate corporate and academic cultures where "unofficial handbooks" exist, both in bookstores around the world and on the Internet, which is filled with blogs of nearly any topic imaginable. As blogging grows in popularity, the possibility for building collaborative blogs and community building tools only increases.

## SPECIAL PURPOSE JOURNALS

Most of this paper focuses on general journaling and its role in the promotion of intimacy. Special purpose journals, however, should not be overlooked as intimate devices or as means for intimacy promotion. Many individuals record details in special purpose diaries such as those for capturing daily food intake, exercise plans, restaurant reviews, travel experiences, and any number of other activities.

During a time period in which a doctor was trying to diagnose a somewhat atypical set of symptoms, I kept a detailed journal of medications, food, and exercise as well as times that I experienced those symptoms. This data, augmented with data from medical monitoring equipment eventually led to a proper diagnosis. Before the journaling began, however, we had little hope of understanding the problem, and I was subjected to a number of uncomfortable tests. The journal was a way for me to create an intimate connection between my body and my doctor, fostering a level of understanding that I do not believe would have been possible without the detailed journal. At the same time, the level of intimate details about my daily life in that journal made it a very special and private commodity, which I guarded very closely until I released it to my doctor.

## CONCLUSIONS

Embedded in the social fabric of groups the world over is the idea of recording one's private thoughts for personal or public use at a later time. Journaling on and off line allow people to create intimate connections with other people, to explore their own beliefs and growth process more deeply, and to express their ideas and emotions without reproach. Journaling appears to be a positive phenomenon across cultures for the expression and creation of intimacy and the development of community and self. For me, journaling is a powerful way to understand my own life and to share it with myself and others months or even years later.

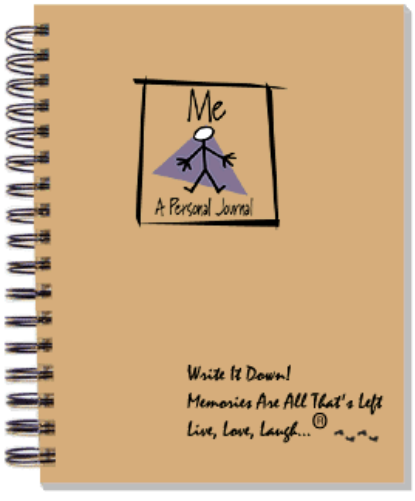



**Figure 8: My next journal awaits me now.**

# Scale, Form, and Time: creating connected sociable spaces

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**ABSTRACT**

In this paper, we describe how scale, form, and time affect communication style. We interrogate each of these factors with respect to three different communication systems: Visiphone, Chit Chat Club, and Telemurals. Each of the three installations break away and brake apart the traditional audio and video wall along these axes to further understand remote interaction. The projects are similar in that they are all audio-graphical two-sided interactions that provide a mutual experience, context, and a social catalyst for the participants.

**Keywords**

Communication objects, telepresence, ubiquitous computing, sociable spaces, social catalyst

**INTRODUCTION**

There have been a number of "media space" projects that connect geographically distinct locales with some combination of audio and video [1] as well as studies of the relative affordances of audio, video, and other media [3][6].

Much of this work has been done in the context of work environments, which differ from sociable spaces in many regards from privacy requirements, activities, and appropriate interface complexity and style. While most studies of technology for the home have tended to focus on labor-saving devices and home automation, some useful ethnographic studies have examined the importance of communication in a domestic environment and the types of technology that support it [10].

In the following pages, we describe three different interfaces and the features that make them not only sociable but more intimate.

**VISIPHONE**

Visiphone is a graphical interface for mediated audio conversations that is designed to support continuous, ubiquitous connections between people in different locations [2]. The graphics show the existence of the audio connection, provide feedback that one's voice is loud enough to carry across the channel, and indicate that someone on the other end of the connection has spoken. They also serve more subtle purposes, providing a focus for attention and visually representing the rhythm of the conversation itself. Our goal was to create an aesthetic object that enables users to perceive conversational patterns that are present but not obvious in traditional communication interfaces.

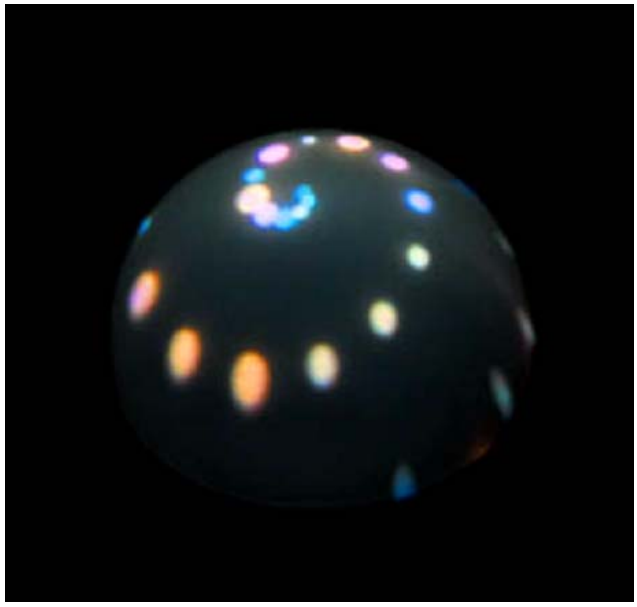

**Figure 1:** Visiphone dome visualizing conversation.

Each Visiphone station has a dome or surface on with the visualization is projected (see Figure 1). When a live connection exists, the dome displays a continuous moving spiral of circles. The central dot represents the present moment. If it is a small gray dot, there is no sound going between the two spaces. When the sound is originating locally, the current circle is orange; when sound originates at the remote location, the circle is blue. The size of the circle is proportionate to the volume of the audio. If sound is coming from both locations, the colors are shown as concentric, blended circles. The dots spiral outward from the center, so the display shows the history of the last half minute or so of conversational rhythm.

**Scale, Form, History, and Intimacy**

Several sizes and shapes of the Visiphone were created. How they were used was influenced greatly by the scale, the shape, and duration of the history of the conversation.

**Figure 2:** Large angled Visiphone display.

Figure 1 depicts the dome shaped Visiphone; Figure 2 depicts the flat angled Visiphone. The form of these different interfaces suggested that they be used in a different manner. For example, the dome shape encouraged people to draw nearer to the display and to grasp it with their hands. The flat angled display was viewed from a distance as well as close-up. This larger display was suitable for a larger auditorium setting where people faced the moving display. Alternatively, people would gather around the dome from all sides.

The size too altered public and private uses. The three inch diameter dome was suited to private conversations and was often cupped in the palm of the hand. People tried to rotate the dome to go back in time. The eight inch version was usually surrounded by several people; it was of a good size to rest both palms on it and many people did just that. The twelve inch display was usually viewed at a distance.

History affected the color palette of Visiphone. If the display was larger and the spiral longer, sustaining a volume became more difficult. One could easily dominate a conversation with a short history of circles. A shorter bead length implied more immediacy.

## CHIT CHAT CLUB

The Chit-Chat Club is an experiment in bringing people together in a mixed physical and virtual environment [7]. Online chatrooms and real world cafes are both venues for social interaction, but with significant differences, e.g. the participants' knowledge of each other's expressions and identity and the more governing introductions, turntaking, etc. Our goal was to create, thru careful design of the physical environment and computer interface, a place that gracefully combines these two cultures; the analysis of how well this space actually functions will further our understanding of social interaction, both online and in person.

Cafes function very well as informal public gathering places. One can enjoy the company of others or be quite comfortable alone. And they are great places to sit and watch people.

The online world also functions as a public gathering place. As in the cafe, conversation is one of the primary activities - but with some striking differences. Online, conversing with strangers is quite common and there are few barriers to such interactions, while in the real world such encounters are less common and occur couched in complex social rituals. In the online world, one is fundamentally alone: although there are many others virtually present, one's sense of their presence is minimal. In the real world cafe, the number of people is fewer, but their presence is far greater.

These two worlds come together in the Chit Chat Club. It is a real cafe, with real tables, real coffee and pastries. Yet the customers seated round the tables may be present physically or virtually. Some of the chairs are ordinary seats, accommodating the human form. Others are seats for avatars equipped with monitors and network connections.

### Form, Scale, and Intimacy

Chit Chat Club was designed through several iterations. Care was taken to make the avatar seats human scale. If the seat is bigger and looks down on the person, it is intimidating; if it is much smaller, it is often ignored. This way, the remote participant occupied a similar space as the physical participants.

**Figure 1:** Chit Chat Club attendees: physical and virtual.

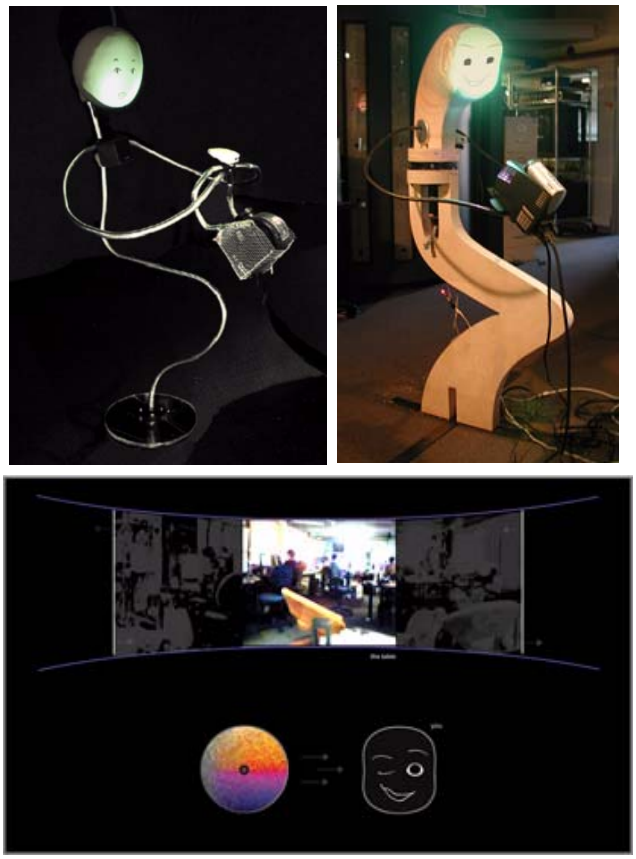

**Figure 2:** Top left: original avatar seat. Top right: motorized avatar seat. Bottom: remote user interface.

The seat was made to look anthropomorphic. There was a head, a seated body and arms. We did not want it to look so human that participants would expect human attributes, but we also wanted it to be accepted as an interesting seated visitor. The second avatar seat was motorized so the remote user could direct the gaze. This offered more control to the remote user.

The customizing of the facial features added a level of intimacy to the interaction. Remote users could choose from a series of features how they appear at the physical cafe. The face palettes were hand-sketched, claymation, and cartoon-like.

Chit Chat Club did not alter much in the time domain unless the seat was being ignored, in which case it would look away in spite.

## TELEMURALS

Telemurals is an audio-video connection where a communication space is created by breaking apart the pixels and speech of the participants at each end and reassembling them abstractly [9]. The initial setup is straightforward. Two disjoint spaces are connected with an audio-video wall. Video and audio from each space is captured. The two images are then rendered, blended together, and projected onto the wall of their respective space. The difference between Telemurals and traditional media space connections are the image and audio transformations that evolve as people communicate through the system and the blending of the participating spaces.

Participation is required for this communication space to work. To reinforce a sense of involvement, we provide the system with some intelligence to modify its space according to certain movements and speech inflections. First, the image is rendered non-photorealstically. Second, words spoken in both spaces are captured, converted to text, and rendered on the screen in blocks left to fade away over time. The immediate feedback of seeing one's spoken word alter the window lets them know they are adding to and affecting the shared environment. More complicated image manipulations are affected by changes in pitch and volume of the voice.

### Scale, Time, and Intimacy

The Telemurals projections were human-scale. This made it possible for the display to occupy a large wall of a room and blend in with the passersby. Participants would sometimes dance together remotely and perform kicks onto their remote companions. This also helped users negotiate space and proximity within the space and between their remote companions.

The silhouettes encouraged people to begin conversations. This is ideal if the people involved don't know each other. We realized over some time, that to sustain a conversation, especially with an acquaintance, people wanted to see more of their remote companion. Telemurals handled this by gradually fading from few features to many features the longer a person talked and the more they moved. This became a reward in a sense for investing time into a conversation and encouraged participants to continue speaking.

The first fading algorithm progressed form a solid colored silhouette to a photorealistic image of the participants. We discovered that this was disturbing to the users. The change given this interface was too drastic. We altered the fading through several iterations so that the more one spoke and


**Figure 1:** Telemurals blended space. Local participants


**Figure 2:** First attempt at fading algorithm. Fades from single color to black and white photorealistic.

moved, the more detail was shown in two-tone color. This made for a more intuitive and aesthetic display.

It should be noted that Telemurals was a public display. This display would necessitate clear boundaries to be used for intimate interaction.

## DISCUSSION

Scale, form, and time are by no means the only features responsible for directing the intimacy of interfaces. They are three factors I have found invaluable in designing such communication systems.

In these projects, scale influenced the number of people that used the device. If the device was an object, smaller implied more private as was the case with the smaller Visiphone.

The form and size of the interface signalled to people whether to stand back or come in closer. Some Visiphone forms such as the dome were more inviting for tactile interaction. In fact, some users insisted that there must be some form of tactile interaction and persisted in trying to move the dots with their fingers.

Chit Chat Club encouraged people to sit down at the level of the avatar seat to interact. With the first avatar seat, people at both ends had to negotiate to alter the gaze of the avatar seat. This prompted more interaction, however, the remote user was more content with the ability to control where they looked. Gaze alone added to the connection between person and avatar seat.

Time provided a perspective in Visiphone. In Telemurals, it represented seeing the remote participant with more clarity as the interaction progressed. Thus, if people were interested, they could keep talking. This acted as a catalyst to further interaction.

When discussing such interfaces, we should also consider the environment in which they exist. The setting plays a great role in how that space and the objects within that space are used.

## ACKNOWLEDGMENTS

We thank the Sociable Media Group for their discussions during the making of these projects, the Things That Think consortia and the Digital Life consortia for their support of this work.

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# Designing for Intimacy: Bridging the Interaction Challenges of Conversation

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## ABSTRACT
This paper explores design issues encountered when providing augmented interpersonal conversation services among family and friends. We are investigating how an environment made aware of the location and activities of its occupants can better support direct human-human communication. The Family Intercom provides a test bed to explore how this context supports a variety of lightweight communication opportunities between collocated and remote family members. We use communication models to inform our design of interactions and the interventions most appropriate to the support of audio-only communication. Current audio technologies define a design space for synchronous audio-interaction services, and infer design guidelines based on the desired spontaneity of the interaction and the situational awareness disclosed. Our exploration of alternative means to enhance family conversation has spanned several prototypes, the investigation of communication models, and the development of guidelines for the design of intimate communication technologies.

## INTRODUCTION
Human-human communication is an essential part of our lives. Advances in communication technology have enabled anytime-anywhere connections between people, but not always in the most socially acceptable fashion. While there are many tools enabling direct communication, there is little support for the appropriate social mediation of communication between persons with a trusting relationship, such as a family. For human-human communication, we are interested in how awareness of location and activity can facilitate both intra- and inter-home communication. We want to provide a variety of lightweight interfaces that facilitate a human's ability to decide whether a proposed conversation should be initiated or not. Our intent with the Family Intercom project is to explore how context-aware communication can support intimate family communication, whether collocated or distributed.

Our investigation of intimacy in audio communication leverages technology and methodology. The long-term research goal is to better understand how to support communication within a family and other small, intimate groups. Our initial approach was to construct prototypes, intending to subject them to authentic use, to learn what mediation strategies and feedback facilitate intimate communication. However, authentic use of new technology has been difficult to achieve. We have also employed models and research from the social sciences to influence our prototype designs. Applying language models and cultural patterns to the current array of audio technology, suggests a design space and guidelines, that vary according to the intimacy of the relationship of the conversation participants.

### Modeling Language Use for Intimacy
Interpersonal communication is characterized by both simultaneous interaction with another person and a mutual influence on the persons involved. There exists a correlation between the level of intimacy in communication qualities and the nature of the relationship [1]. In an intimate relationship, the communication qualities are more open and personal, including:

1. Personalization - known only to participants,
2. Synchronization – smooth, effortless interactions,
3. Difficulty – resolution of tension or conflict.

Incorporating these qualities into communication technology, may support close relationships and their movement towards relationship growth.

The collaborative conversation model develops "common ground" to minimize the effort of communication [2]. Just as with any group process, there is a varying cost for using different media types and their corresponding benefits. For instance, when providing a reminder, an email text message will persist, while a spoken reminder will fade away. Clark and Brennan describe these differences as eight constraints on the grounding process, where constraints are desirable to reducing ambiguity in conversation (adapted from [2]):

- Copresence - A and B share the same physical environment.
- Visibility - A and B are visible to one another.
- Audibility - A and B communicate by speaking.
- Contemporality - B receives at roughly the same time as A produces.
- Simultaneity - A and B can send and receive simultaneously.
- Sequentiality - A's and B's turns cannot get out of sequence.
- Reviewability - B can re-view A's messages.
- Revisability - A can revise message for B.

If one of these constraints on the collaborative process is missing in a particular medium, there will be a higher cost to the conversation, perhaps a loss of closeness or intimacy.

Synchronous audio communication, or conversation, has benefits from audibility, contemporality, and sequentiality constraints. A full-duplex connection has simultaneity for audible communication, but not for body language and gestures. Speech fades and is not able to be modified in real-time, audio-only incurrs the cost of ambiguity due to lack of reviewability and revisability. Augmenting technology may alleviate lack of copresence through shared situation context across locations. The visibility constraint is purposely absent as a tradeoff for autonomy. One could envision the use of technology, such as "real-time audio buffering" to provide limited review capability and aid in disambiguating the message. These eight constraints of the collaborative model are useful in analyzing the benefits and shortcomings of technology support of intimate conversations disambiguating conversation over a device such as an intercom or mobile phone.

### Design Space of Communication Applications

From the perspective of context-aware audio communications, the constraints supporting grounding may be clustered into two types: situational awareness and spontaneity of interaction. Audibility, copresence and visibility each portray a part of the situational awareness. Contemporality, sequentiality, and simultaneity are factors of the interaction speed and the connection type. Grouping the constraints by function suggests a two-dimensional space for communication applications based on distinctions between "context awareness" and "interaction spontaneity" (table 1). Along the awareness dimension, absolute privacy of information is at one end of the continuum, with public disclosure of information at the opposite. For example, an intercom preserves privacy as it has no information about the activities or people co-located with the intercom station (except what can be heard through the audio channel), but a video phone discloses information about the situation at the phone (*i.e.* what is seen and heard through the communication channel). Along the "spontaneity" axis, communication may require an explicit user action to create a connection such as selecting the appropriate phone number and manually dialing the number. At the other end of this dimension, would be speaking to the occupant of an office from their doorway. The state of the door and any view through the door will provide availability context, along the awareness axis. The axes do not imply greater worth on any part of the range of associated values, but do provide a means to compare the qualities supported by each communication affordance.

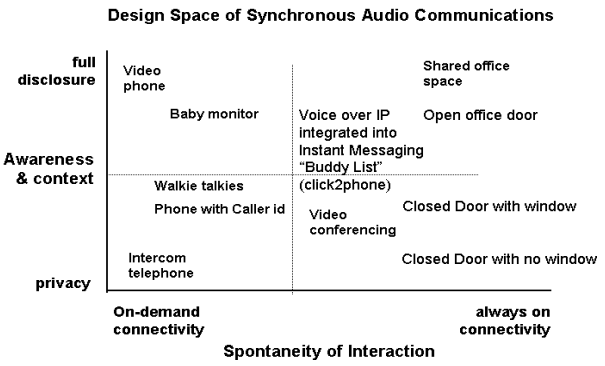


*Table 1. Synchronous Audio Design space*

### Family Intercom Prototypes

While models provide guidelines for design, the development of prototypes to be subjected to real users can reveal how the technology evolves in everyday use. The Family Intercom project includes a series of prototypes to investigate situation-aware, family communication within and between homes [5]. The intent is to provide interfaces that facilitate a person's ability to decide whether a proposed conversation should be initiated or not, increasing the intimacy of the relationship.

### Within Home Intercom Prototype

The initial context-aware intercom prototype was installed in the Aware Home, where our model of interaction is hands-free by providing voice interaction. A conversation is initiated between two persons, with no knowledge of location. The conversation connection then follows participants as they move from room-to-room, with no explicit user action. We created a hands-free interface to the intercom using voice recognition of simple commands to initiate conversations from any spot in the home.

### Between Home Intercom Prototype

The second prototype supports between home communications through an augmented digital [6] image in one home that provides context and communication mediation with another home. The Digital Family Portrait, that displays a qualitative perception of activity for the remote family member [4], was augmented to provide an interactive communication portal to the Aware Home (figure 1a). The portrait portal includes a flat touch screen enabling any household member to initiate a two-way audio connection to the remote family member pictured and to view the communication status (figure 1b). The context available is asymmetric; only identity is available in one home, but richer activity information from the other. We use an internet voice connection and simulated availability status to mediate the initiation of conversation from home-to-home. This prototype couples the communication interaction to an artifact in the home, using the portrait to mediate conversation initiation.

Figure 1 (a) Digital Family Portrait portal to intercom

Figure 1(b) – Between Home Family Intercom with open connection

**Between Home Mediated Intercom Prototype**

The intent of the mediated intercom, our most recent interaction prototype, is to facilitate the person deciding whether or not this is a "good" time to initiate a conversation between homes. The user-gaze attention interface (figure 2c) provides feedback to the caller to help him or her determine whether it would be appropriate to continue with the set-up of the audio connection. In one home, the vision-based eye tracking system tracks user gaze towards a collection of framed family photographs on a typical household table. Figure 2a, shows the grouping of family portraits and figure 2b shows the cameras used for eye tracking. In the second home, the remote panel is based on the Digital Family Portrait, that also displays a portrait and a qualitative perception of activity for the family member pictured from the first home [1]. When a family member notices the digital portrait of their family, they simply touch the portrait to create a connection. The remotely collected eye-gaze data is displayed to provide context for the caller to gauge a time when the remote member desires family conversation (figure 2c). The visual attention tracker conveys patterns of the callee's eye-gaze towards family photos, facilitating more intimate conversation initiation between the users. In previous prototypes, only room location of the callee was available via radio-frequency (RFID) tags worn by the family member. Gaze system accuracy was compared to actual human determination, via video tapes. Our first verifications, show the eye-tracker matched the human determination of gaze 87.5% (n=4). The gaze tracker may be used to infer finer time intervals when conversation is more desirable.

Figure 2(a) Aware Home eye-gaze set-up.

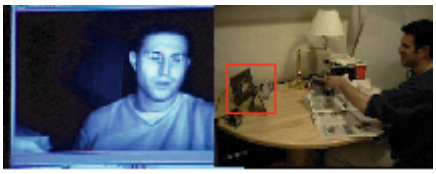

Figure 2(b) Subject using eye-gaze set-up reading and looking at photos.

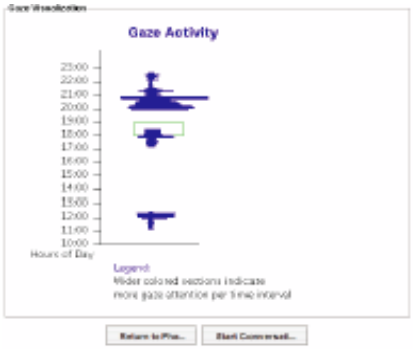


Figure 2(c) Gaze activity visualization at remote family location, box is current time

**Applying a Conversation Design Framework**

Our vision to design intimate conversation support using a sensor-rich environment is shaped by language and communication models and the design space of audio devices. For the types of communication activities we intend to support, there are two dimensions of tensions to balance: privacy vs. awareness and persistent vs. on-demand connection. The conceptual guidelines derived from applying the framework to devices and media spaces:

- Provide appropriate awareness, balanced against persistence of connection.
- Support mediation and signals with minimal intrusion, by learning about the user and the context of use.

These challenges deal with the social concerns of human-to-human communication, rather than the technical infrastructure required for such a system. The design tension between sharing awareness context to support conversation events vs. what is needed to provide spontaneity of connection is one guide to help the designer narrow the design alternatives. There is often a trade-off of reciprocity of revealing situational awareness to ease the time required to connect.

Minimizing the intrusiveness of conversation requests while providing enough information for the human to make a timely decision about participating is another design goal. The interaction should allow for reciprocal contextual signaling; both initiator and recipient will receive awareness information, prior to audio-connection creation, enabling more graceful social interaction from either conversation endpoint.

### Discussion

We began our investigation of family communication with a focus upon the technology issues. While there are serious problems to overcome in developing applications with the latest hardware, an equally difficult problem is how to support intimate human-human communication?

We are using the experience sampling method to look at the factors that determine individual availability for a conversation with a family member. By sampling information about current activities and location, we will be able to investigate the relationship between the individual's availability and their activity, location, and persons in the room. If such a correlation exists, is the individual aware of this indicator to their accessibility? Would the person be willing to share some of this environmental information with specified family members or close friends to enhance the conversation opportunities?

Additional issues involve who initiates the conversations and how they use home spaces to manage private vs. public conversations. Ethnographic studies in the home highlight the value placed on communicative activities between collocated household members, often in small time blocks and dispersed over multiple spaces within the home. Other studies of home technology underscore the problem of "space overload", that is when technology is fixed in a particular location, as opposed to being distributed throughout the home, problems can arise over shared use of the space. This localization does not afford the interaction and coordination of activities common in the everyday routine of a household. Longitudinal studies of phone usage show some gender differences, an expectation of knowing when to call, and the need for private conversations [3]. What can computation add to mediation strategies that will be useful to family members initiating and managing conversations within and across homes? What do the family members expect one another to know about their availability preferences and how do they use the home areas to manage private conversations? Can ubiquitous audio technology provide a natural negotiation of space and preferences for intimate, personal family conversation?


### ACKNOWLEDGMENTS

This work is supported by the Aware Home Research Initiative, an industrial consortium coordinated by the Future Computing Environments Group at Georgia Tech. We thank our colleagues who work in the Georgia Tech Aware Home for their help with various aspects of this work, especially the developers of the Digital Family Portrait [1] and the vision-based eye tracking system [7].


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# My Trombone

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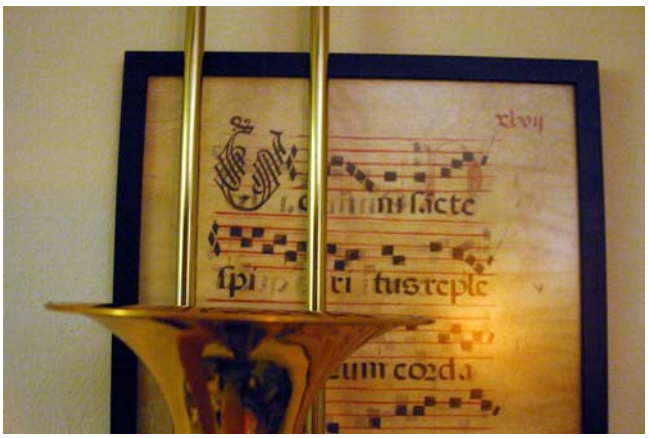
**ABSTRACT**
Similar to many musical instruments, the trombone is an intimate device that forms an extension of the self allowing people to create music using their own breath and emotion. Music itself is an extremely powerful concept, allowing both the personal expression and communication of emotion. The lips, breath, and hands are all required to operate in a coordinated manner to make music with the trombone – an immersive experience that encompasses the performer. Improvisational jazz has formalized and popularized emotive expression through music by allowing a solo performer to speak their emotions through the instrument. The device, merely a well crafted-piece of metal, allows an intimate form of expression that would be more difficult (although still definitely possible) unaided.

**HISTORY**
The trombone is a fairly old brass instrument – the modern form of which dates back to the 15th century. It derives from the trumpet, but is unique in the family of wind instruments in that it utilizes a slide to change pitch, instead of a more common valve system. The size of the instrument yields a middle-pitch sound, occupying roughly the same vocal range as male bass or tenor. Trombones are traditionally characterized by a strident tone, due to their roughly tubular cross-section, and their ability to produce a tremendous volume. The baritone horn is a similar-range instrument with a more mellow tone, due to its more conical cross section. Trombones are found in most forms of western classical and jazz music, normally seated in the back of the symphony, or the second tier of a big-band jazz layout.

Music itself is an extremely venerable concept – existing across species and human cultures. Birds use it as a powerful form of communication: no need for words when a song will do. Music is known to affect developing babies before they can understand language, and sooths the savage beast. Music is an important force that culturally identifies a generation, motivates political movements, or brings people together through tradition. Likewise, the development of music has been strongly influenced by its surrounding culture, reflecting its religious, social, and/or political context.



**PRINCIPLES OF OPERATION**
To play the trombone, the musician places his/her lips up against the mouthpiece and exhales while producing a buzzing sound. By controlling the lip muscles, the pitch, tone, and timber of the note are affected. To play a high note, the muscles are contracted to squeeze air through a tight space. To play a low note, muscles are relaxed, allowing the lips to move freely. Volume is controlled by the intensity of the breath: increasing or decreasing the amount of air pushed through the instrument. Breath control is an important part of playing the instrument – support from the lower diaphragm is needed to produce the uniform air stream required for soft notes, and a lot of air is needed to produce loud notes. The lips and breath form a very intimate coupling between instrument and performer. Like other instruments, or any tool in general, a good musician becomes one with their instrument. With wind and brass instruments, the player literally can't speak while playing – the same mechanisms used for normal communication have been co-opted by the device for musical expression.

The hands are used to alter the length of the instrument, specifically by moving the trombone's characteristic slide in and out. Moving the slide out increases the length of the resonate cavity, lowering pitch of the produced sound. Additionally, by positioning the slide halfway between the nominal positions or moving the slide during play, notes can be played out-of-tune or made to glissando or bend. This tonal flexibility, although technically possible for many other instruments, is second nature for the trombone. Typically, the left hand is used to firmly grip the instrument while the right hand operates the slide. The strong link between the hands and the fingers, arguably a human's primary manipulation tools, again forms an intimate relationship between the musician and instrument. It's very hard to do anything else while playing the trombone – except walk around.

**SENSES**

Playing any musical instrument, especially a wind or brass instrument such as the trombone, simultaneously involves many senses. Obviously, there is hearing. The lips form a tactile bond with the mouthpiece, bringing both intimate control, as well as pain, to the experience. Vision forms a love-hate relationship with music, being necessary initially to read and understand music, but often proving a barrier in the long run. Since it utilizes so many of the senses, and in fact completely overwhelms so many of them, playing the trombone can be a very intimate and encompassing experience.

Musical expression involves sound and hearing. An instrument such as the trombone moves the generation of sound very close to the performer, inexorably melding the sound produced with the performer as an individual. Only singing, using one's own vocal cords, forms a more intimate bond with music. Furthermore, not only is the sound produced, but it is felt through the body – the vibration of the instrument can move straight through the jaw towards the ear. Just like your own voice, listening to the trombone recorded is as much a foreign experience as listening to your own voice recorded. Produced sound blends with other nearby sounds – it's not your note in isolation, but you in consonance or dissonance with others within the choral structure of the music. It's not the instrument that's out of tune, or out of key, but *you,* the musician, who is not playing along.

Similarly, the close coupling between the lips and the instrument make for strong tactile interactions between performer and trombone. The expressiveness of the lips, which are used for controlling the complex process of speech, is used to control the expressiveness of musical expression. Physical pain is also a strong component of playing the trombone. The jaw, throat, and lip muscles used to form notes get tired – fatigued – just like the leg muscles of a runner. Playing high/loud notes requires strength, and playing for a long time requires endurance. In the extreme, lips can become chapped and even bleed (bringing in the sense of taste). This contact, ranging from tight control and expressiveness to blood and pain, represents the intimate nature of the trombone as a musical instrument.

Sight, which is often an overwhelming sense that brings in extreme amounts of information, is both necessary and distracting for musicians. Initially, sight is fundamental to reading music – learning the tune through the little black dots (*i.e.,* musical notes) that appear on the page. Although not strictly necessary, written music provides a history and cross-cultural migration: it is the written word of the oral storytelling tradition. For group performances, sight is often necessary as a communication mechanism – it's not possible to vocally describe what to do (softer, louder, slower, faster) because the aural channel is already occupied. However, in the long run, sight can interfere with musical expression because it is distracting – some musicians, especially in a solo jazz context, will close their eyes while playing to focus better.

The deep involvement with several senses makes playing the trombone a very tangible and enthralling experience. On the downside, it's hard to do anything else while playing the trombone, you can't talk, and you can't use your hands

(about all you can do is move around). This deep involvement results in a very intimate interaction with the trombone, opening the door to highly emotive expression.

**EMOTION**

For many people, music is a highly emotional form of expression. Most music only communicates lightly in the intellectual realm, sometimes with a suggested story or plot, but instead relies primarily on emotional communication. Often, this communication is a message between the composer and listener, delivered with emotional coloring by the actual performer(s). Jazz improv, which requires the musician to both create and perform at the same time, forms a direct channel from performer to audience. Although at times there need not be a direct relationship between the performer and audience, for example when music is recorded and not live, the contents of the communication can still evoke strong emotions on both ends.

The trombone, like many musical instruments, offers a wealth of expression that is difficult to verbally describe. There are variations in embouchure, rhythm, tuning, *etc.,* that rely on the close relationship between the player and instrument, which form the heart of the music. Although all the notes may be correct, the result can still sound flat and dull if these techniques are not used to drive feeling into the sound; like in verbal communication, it's not always what one says, but how one says it. A performer is better able to express their emotions precisely because of this subtlety: the don't have to, and in many cases can't, *think* of what to play, or how to play it, instead, they must *feel* and let the instrument translate the emotion into music.

Unlike performing pre-composed music, jazz improvisation requires the musician to devise what to play, as well as how to play it. And, typically, they are also performing solo, drawing upon their inner self to form the music instead of trying to coordinate with a musical ensemble. Jazz improv does exist in a framework: the notes of the formative melody, and the chords and rhythm of the accompaniment. However, these factors often only supply a loose framework for the solo, and they are often described in very emotional terms such as "melancholy" or "romantic." For example, the popular song "Caravan" can only suggest the mysteries of the Orient and sweltering nights, but it is up to the soloist to bring depth to the expression and enthrall the audience by creating a particular instantiation of the framework. Each jazz solo is unique: if they are recorded or transcribed, then they lose some of the personalization and intimate expression that was a part of the original performance.

To some, emotion is the essence of music. It can be a highly emotional experience for a listener: choosing music to listen to based on their mood, or the mood that they would like to have. It can be a highly emotional experience for the musician: the force they use to drive their performance. The instrument then becomes a tool for expressing intimate feelings, relating the device to the performer in ways outside of the simple tangible senses.

**SOCIETY**

The musical experience, although very personal and intimate, is also highly social. Ostensibly, the musical communication is between the performers and the audience: they put on a show, and the members of the audience show their appreciation as they listen, motivating the performer further. However, the inter-relationships between musicians can often be more important to the performers; the audience is there to provide a purpose but does not closely tie in with the underlying expression. Furthermore, in some circumstances, instruments are often borrowed, traded or shared, highlighting the use of the instrument as a *tool* for intimate expression, and not intimate in itself.

The intimate nature of the musical communication between the performer and audience allows emotions to be conveyed across time and space. This effect relates both to the subtle nature of the generating expression as well as the emotional consumption by the audience. However, although both sides of this relationship are themselves intimate, the communication channel between them is often very impersonal. Typically, there are many more audience members than performers, and there is no close contact between the two. Many forms of music (outside of jazz improv), readily lend themselves to recording and later playback, which can form a very impersonal relationship. Furthermore, this relationship can be very asymmetric, with the listeners forming non-reciprocated close bonds or attachments to the performers.

In many ways, the relationship within a group of musicians is stronger than that between musicians and their audience. It's often more important who one is playing *with*, rather who one is playing *for*. While performing, good jazz musicians will "play off" on another: listening to what

somebody else does in order to strengthen their own performance. So, although the audience is important and can create better live performances, musicians will often relate closer to one another than to the audience. Additionally, there is a culture of *stuff* necessary to support the practice – oils, creams, writing implements, cleaners – and these items are traded and shared among musicians, forming closer bonds and social obligations.

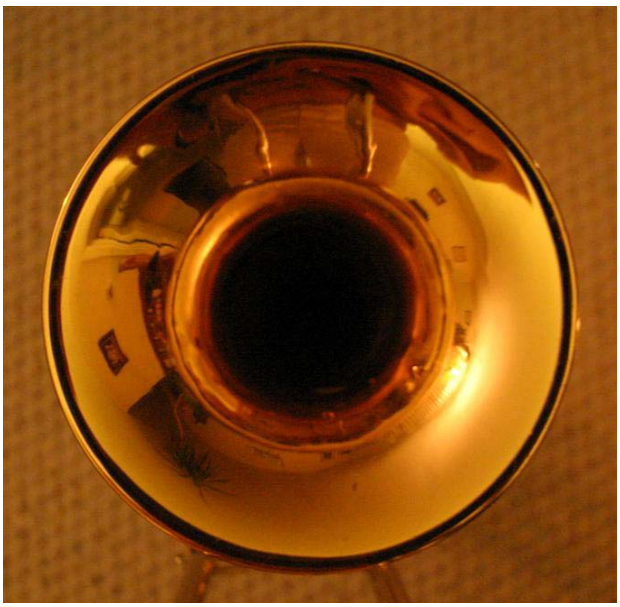

Although an instrument like the trombone is a very intimate device, it is not very *personal* in the sense that one trombone is very similar to another: there is very little customization of the device. It is not uncommon for musicians to borrow an instrument or to simply buy a new one if the old one becomes sufficiently damaged. When someone feels something is "wrong" with their playing, it is often difficult for them to tell if it is the instrument, or themselves, that is causing the problem. In these cases, it is perfectly reasonable to give the instrument to another player and ask "is this working ok, or is it just me?" So, by the very nature of the intimate relationship between musician and instrument, it is hard to tell where the problem is, which results in depersonalization through sharing. Similarly, the impression a musician gives when he/she plays is often a reflection of them, not of their instrument – the instrument is only noticeable in extreme cases – again, it's an intimate relationship between the instrument and musician, but the instrument itself is not necessarily special, customized, or personalized.

There are many contrasts that come out from the involvement of the trombone in society, either performer/audience or inter-musician. There is a strong asymmetric relationship in the emotive communication through music, and the instrument itself may be an intimate tool, but personal. These contrasts highlight ways that an instrument might not be a "perfect" emotive device.

**INTIMATE DEVICE**

The trombone is an example of how a musical instrument is a very intimate device. It has a long and deep history, reflecting both the importance of music and the impact of a concrete artifact. Fundamental to the way it operates, it forms a close physical bond with the performer. It engages many of the senses, requiring close physical contact, inexorably involving sound, and forming a love/hate relationship with sight. Emotionally, it is a tool both for personal expression and communication. And, as a device, it remains strangely non-personal while maintaining a close relationship with its owner.

Although it is not in any way electronic, it is interesting to see how electronic systems both interact with the trombone and also how the design of the trombone might influence the design of other intimate technologies. Most obvious are the ways that amplification and recording are used to convey musical expression. In the other direction, the close physical connection to the instrument, through the lips and breath, is not something typically found in digital devices. Another unique feature is the *subtlety* of interaction, which requires extensive practice, but also allows deep emotional expression. Electronic interfaces that follow this model of interaction more closely might enable new forms of intimate interaction not possible with present systems.



**DISCLAIMER**

The thoughts and ideas in this paper are reflections of my *personal* experience with playing the trombone. They may or may not reflect the experience of other musicians – it's not a scientific discourse by any means. Also, my experience has primarily been with things like the marching band and informal jazz situations – so I'm sure some things are quite a bit different for other musicians (esp. professional artists). Thanks to John, Gillian, and Vijay for their insightful and helpful comments on the topic.

# Utilizing Online Communities to Facilitate Physical World Interactions

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**ABSTRACT**
Online interactions provide a rich source of content from which reputations and communities can be created. With the proliferation of various networked devices through which people can access the digital world from an increasing variety of physical contexts, there is a new potential to utilize these reputations and communities to create interaction opportunities in the physical world. We are creating *blogger bridges* to enable members of a community of online journalers to safely notify others in the community of their proximity—using a method of *progressive revelation* via networked devices—in order to facilitate serendipitous encounters among community members who are gathered together in a particular location. We describe the kinds of communities that can support such bridges, define a mechanism for enabling progressive revelation, discuss possible technical solutions, and discuss plans for deployment and evaluation in a real community of use.

**Keywords**
Computer-supported cooperative work, human-computer interaction, ubiquitous computing, situated computing, community software, privacy, trust.

## 1. INTRODUCTION

The Internet has spawned a variety of mechanisms for people to interact using computer-mediated communication (CMC) technologies. Examples of such mechanisms include electronic mail, text chat, electronic bulletin boards and newsgroups, and electronic commerce. These new ways of interacting "online" have created opportunities for communities to quickly form around shared interests on a global scale [6, 4, 8].

One form of online interaction that is gaining increasing popularity is the weblog ("blog"), where individuals maintain an online journal over time, filling it with personal writings, commentary, or hyperlinks. Communities of bloggers link to and comment on each others' blog entries. Anyone can start a blog, using either freely downloadable software such as Greymatter or Movable Type or using a web service like LiveJournal or Blog*Spot.

Until recently, most online community interactions—indeed, most online interactions, in general—have taken place via desktop computers. With the proliferation of mobile telephony and wireless connectivity, the range of physical contexts in which these interactions can occur is vastly increased [7]. As more and more devices of various kinds become connected to the Internet, we will see an abundance of new opportunities for bridging the gap between online communities and the physical world [1].

We are designing *blogger bridges* to establish links between online communities and their members as they navigate the physical world, creating serendipitous interaction opportunities for people who previously may have only had opportunities for interaction in the digital world. We introduce mechanisms for *progressive revelation*, so that people can gradually—and safely—reveal something about themselves and their presence to other members of their online community who happen to be in their physical proximity, as well as verify that the people they meet are who they claim to be.

The rest of this paper will describe the kinds of communities that can support such bridges, define a mechanism for enabling progressive revelation, discuss possible technical solutions, and discuss plans for the deployment and evaluation in a real community of use.

## 2. SCENARIO

Imagine the following scenario. Sven maintains a blog online. He's created a profile for himself that lists his interests, including baseball and stamp collecting. He's also provided links to his "friends" – other bloggers that he knows (offline or online) whose blogs he reads and whose opinions he trusts.

One afternoon, Sven is relaxing at a coffee shop when his mobile phone vibrates to indicate he has a message. His phone indicates that it has detected another blogger in the vicinity that he might wish to meet. Though the blogger's identity is not revealed, Sven is informed that they have several friends in common and are both interested in stamp collecting.

Since he is not very busy, Sven replies that he is "willing to meet". The other blogger apparently does the same, and Sven receives another message with the blogger's name – Arlene – and picture. They bond over a coffee, chat about the vagaries of politics and rare stamps, and keep in touch thenceforth.


**Figure 1. Revealing oneself to a fellow blogger via mobile phone. (a) Initial notification: ignore or go deeper? (b) Common interests revealed.**

## 3. DESIGN

What is required to make this scenario possible? The above scenario carries a number of implicit assumptions about the interaction between Sven and Arlene. We consider three essential ingredients in a successful blogger bridge: the community, the interaction protocol, and the device.

### 3.1. The Community

Sven is not willing to risk wasting his time – or worse – chatting with just any random person. He elects to meet Arlene both because they share some common interests and because their common friends implicitly "vouch for" Arlene. Similarly, Arlene may be hesitant to reveal herself to a stranger in public, but is willing to take a chance on a stamp-collecting friend of a friend. This essential trust and knowledge of another person is grounded in their shared online community. To provide a basis for this trust, the community should ideally support three things: profiles, reputations, and social networks.

When participating in an online community, a person need not reveal his real-world *identity*; instead, one establishes a *persona* in that community. The persona may be nearly identical to one's real-world identity, or it may be partly hidden or even invented. This disconnect between the persona and real identity allows people the freedom to reveal unusual interests or espouse controversial views online without fear of repercussions. A *profile* is the presentation of this persona; it may include a list of interests as well as details like age and location. Profiles are, of course, voluntary (and may be invented), but they allow people to advertise their interests and detect compatibilities with others at a glance.

A *reputation* [10] is the accumulated evidence over time as to one's character and personality. It could consist of a person's own writings, others' opinions of him, or any accumulated evidence of participation in the community. The existence of a reputation over a long period of time establishes a person's consistency and staying power, and a long history of participation is difficult to fake. A reputation allows others to verify that a person is who he says he is. Is he an established member of the community? Can he be trusted? Does his behavior match the claims of his profile?

A *social network* [15] is the web of connections between people involved in a community, chiefly representing friendship or trust between people. A person with no friends is suspicious (as might be a clique of people with no outside friends), while a friend of a friend might enjoy the benefit of the doubt.

### 3.2. The Interaction Protocol

The interaction between Sven and Arlene is a multi-step process. Sven must find out enough about Arlene to make his decision before he gives away much of his own information; Arlene, similarly, wants to know more about Sven before she reveals herself. Although this may appear to be an impasse, we propose an interaction protocol that allows Sven and Arlene to gradually reveal themselves while minimizing risks. The task of the interaction protocol is to allow Sven and Arlene to learn enough about each other to decide what to reveal and to verify that they are who they say they are.

Our approach to this problem is called *progressive revelation*. Progressive revelation is a protocol (actually, a class of protocols) for exchanging information with an initially untrusted agent while maintaining control over how much is revealed. A small piece of shared information may establish enough trust to exchange something larger, which may eventually lead to sufficient trust to reveal identities and meet. Returning to the scenario in Section 2, Sven may be unwilling to reveal his identity to just any stranger. However, he is willing to reveal his interest in stamp collecting to another stamp collector. He might still be hesitant to reveal his full identity to someone just on the basis of a shared hobby, but once he learns that he and Arlene have some mutual friends, he decides he can trust her enough to drop the mask.

A process of progressive revelation may be assisted by a *trusted third party* who knows the identities of both participants and may therefore be able to tell them what they have in common (e.g., mutual friends) without revealing their identities. This third party need not be an actual person but could be, for example, an internet server holding information about members of the community. When two people encounter each other in the real world, their mobile phones could contact the server for information about each other that will help them decide whether to meet. If the third party is not available at the time of encounters (for example, if the device has no network

connection), a similar purpose may be served by pre-filtering. A person might be willing to specify in advance that members of the community who meet certain criteria can be given certain information about him. For example, Sven might be willing to reveal himself to all friends of friends; these people would be provided encrypted tokens, and Sven's mobile phone would automatically reveal information to anyone with a token.

A protocol in which each person may choose whether or not to participate is of little use if people feel pressured to go along. For example, when in public, people are free to reject conversation from others, but will often put up with a fair amount of unwanted conversation to avoid appearing rude. This effect is heightened when the conversationalists are acquainted and concerned about acquiring a reputation for rudeness. Our interaction protocol must therefore take into account such social considerations. For example, we should support *plausible ignorability* – the ability to appear to have not noticed someone rather than explicitly rejected them.

### 3.3. The Device

The interaction between Sven and Arlene is mediated by mobile devices (in this case, their mobile phones). We identify six attributes that are important for a device to serve as a blogger bridge: portability, availability, proximity detection, expressivity, discretion, and computing power.

To facilitate serendipitous meetings in a variety of environments, a device should be highly *portable*. An ideal device might also be capable of being always on, like a mobile phone, though a device that is carried around and sometimes turned on, like a laptop, may be sufficient. The device should also be widely *available* – fairly inexpensive and easy find – to encourage widespread use. To work at all, the device must have a way of *detecting proximity* of other devices, whether it be through direct means (e.g., Bluetooth) or by contacting a server that knows where each device is. The device should be *expressive* in the ways it can notify the user, to meet personal preference and changing contexts, but should also be *discreet* so that notification does not reveal the user and preserves plausible ignorability. Finally, the device should have sufficient *computing power* to perform any necessary operations, which may include encryption/decryption and storing data about many other users.

Possible devices include: laptops with wireless connectivity, mobile phones, personal digital assistants (PDAs) with peer-to-peer or wireless connectivity, and simple custom devices (such as Motes [2]) with local connectivity. While mobile phones offer good portability, availability, expressivity, and discretion, they may not have sufficient computing power for our needs. Also, only some phones offer Bluetooth for proximity detection. On the other hand, laptops have more than enough computing power but are not always on. PDAs and custom devices may offer a middle ground, but are not as widespread as mobile phones.

## 4. RESEARCH AGENDA

We plan to proceed in three general steps: gathering more information, deployment, and further research.

### 4.1. Gathering More Information

Before we can deploy and evaluate our proposed system, we need to both verify some of our assumptions and learn more about our target user community. We have identified LiveJournal as a promising community, for several reasons: (1) LiveJournal has user profiles with explicit interests, represented as keywords; (2) it supports social networks through explicit friend lists; and (3) it has reached critical mass, with hundreds of thousands of users. The questions we wish to answer include:

- Are LiveJournal users interested in meeting each other?
- Are shared interests a compelling reason to meet?
- Are shared friends a compelling reason to meet?
- What is the density of LiveJournal users in the Seattle area? At the University of Washington?
- What kinds of devices do LiveJournal users already own?

We intend to address these questions with surveys distributed to as many LiveJournal users as possible, as well as with individual interviews and with analysis of user profiles and friend lists. Our initial survey, targeted specifically at LiveJournal users, consists of questions about demographics, their use of LiveJournal and other web technologies, meeting people online and offline, and what kinds of personal information they have revealed or would be willing to reveal.

### 4.2. Deployment

We intend to implement and deploy prototypes to enough users to both test the technology and observe the social effects. Accordingly, we need a community of sufficient density in a particular area to allow for serendipitous encounters. The exact community as well as the nature of the technology used will depend greatly on what we learn while gathering information. However, we intend to deploy to some subset of the LiveJournal community, likely those who are students at the University of Washington in Seattle. Our two most likely device options are Bluetooth-equipped mobile phones and laptop computers with WiFI access. Both are becoming increasingly common among university students; phones offer better mobility, but a laptop deployment might be easier to implement and get off the ground. Our deployment is intended to address several different kinds of questions: (1) do the devices work as intended? (2) does our interaction protocol work as intended? (3) what is the user experience? (4) what are the social effects in the larger community? Answering these questions will require interviews and some qualitative evaluation as well as some quantitative measurements.

### 4.3. Further Research

We expect our deployment to reveal a number of areas for improvement. Furthermore, once we establish the plausibility of the basic idea, we intend to pursue further research in several directions. One area would be to explore other places in which establishing connections would be welcome [7]. Two possible additional tests of our approach are a citywide deployment and deployment at some kind of large, densely-packed event. Both will present technical challenges as well as suggest new directions for research.

We would also like to explore the possibility of using more information than a person's profile and social connections. For example, we might mine the content of blogs to create a model of interests based on what people actually write about. We may also be able to discover connections between people (from mutual links, for example) even in communities without explicit friend lists.

Finally, we would also like to expand to other communities, weblog-based and otherwise. Even communities of very different types may be able to support our approach, especially if we are able to infer profiles and social networks automatically.

## 5. CONCLUSION

We have described our motivation and plans for Blogger Bridges: physical devices that can be used to build bridges between people's real-world identities and their online personae in physical contexts in which they may want to mutually reveal aspects of themselves to other, physically co-present, members of their online communities. We introduced the progressive revelation protocol to help ensure that the revealing actions are taken in a gradual and safe way, and highlighted the need to maintain plausible ignorability so as not to embarrass any of the prospective interaction participants.

Our plan is to iterate on the design, implementation, deployment and evaluation of different instantiations of blogger bridges in different communities, seeking to understand how the technology can help enhance users' experience of place (and each other). It is our hope that this use of technology can help people better recognize that we are often surrounded by far more kindred spirits than we are aware.


## ACKNOWLEDGMENTS

The authors wish to express their gratitude to David Nguyen and Jenna Burrell for their thoughtful reviews and suggestions for improving this paper.


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# Appropriate Expressions of Intimacy: Lessons of Digital Jewelry and Large Displays

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**ABSTRACT**
One aspect of intimate devices is that they must be both easy-to-use and personal. In our work at the Almaden User Sciences and Experience Research (USER) group, we've built a number of devices that are both small and intimate (digital jewelry), as well as large and public (large interactive displays). Surprisingly, there are lessons to be learned from both extremes. Small, personal devices need an appropriate physical interface – in terms of size and capability – to be simple in use. Large, public devices sometimes need the ability to be used in a semi-private style, which requires an ability to temporarily limit the display to a smaller, more personal and intimate interface. How intimate or public a device is largely a consequence of its physical design, which signals intent, and its physical placement in the world, which signals access.

**Keywords**
Interface design; physical design; private use; social signals

**INTRODUCTION**
The successful design of ordinary computational devices rests largely on their fit to task: how well does the thing do the job? In the case of *intimate computational devices,* the task isn't the ordinary one of applying megaflops to data manipulation. Intimate devices may not "solve" a task, but may signal some aspect of their owners life or status. Ultimately, if the intimate computational device isn't attractive or personally satisfying in some way, it will fail in adoption. While design matters for most consumer objects, it is especially crucial for these. Intimate devices can be computationally clever, but unless they're designed in some aesthetically pleasing way, all the wizardry is moot. These devices tread a middle ground between personal expression and utility.



In our explorations of increasingly smaller devices, we've ended up designing and constructing several very personal (and attractive) devices that have interestingly complex interaction issues.

At the same time, we have also been exploring the realm of very large, public devices that are built into common areas and intended for public uses. Surprisingly, we have found commonalities between the small and large interfaces. In both the very large and very small interfaces cases, design attention needs to be paid to both the physical attractiveness of the package, but also the social signaling aspects of what's private and what's intended for public use.

**DIGITAL JEWELRY: EXPLORING THE SMALL**
Our work on the design and use of ever smaller devices led naturally to investigating the tiniest devices with a personal computing aspect: jewelry that was computationally linked to personal state. [1]

Figure 1: Glowing e-rings with multicolor LEDs can be set to show special colors and sequences of lights when particular events occur. The ring changes state according to messages sent to it from the jewelry server.

In the USER lab[1] we built several different kinds of very personal, intimate devices that purposefully explored the boundaries of ordinary personal computing, very small physical interfaces and attractive objects of artistic and design merit.

Our series of "e-rings" are able to change color and illumination when signaled by a ring server. The user describes a condition that can be sensed (such as the arrival of email from a particular person, a change in stock price, etc.) and a display that should take place (such as a shift from current color to slowly pulsing red or solid green).

Aside from the hardware construction issues to be solved (power and wireless connectivity), the biggest problem is how to set up the association between triggering events and ring behavior. Classically, small personal devices like watches and pagers have used all on-board input devices. But DIP switches, small rotary wheels and tiny buttons stretch the limits of physical manipulation skills and challenge the user's understanding of what's being programmed. (Can *you* program all of your electronic watch capabilities using just the 4 tiny buttons provided?)

As an extreme instance of complex programming combined with a minimum of input devices, e-rings make the input problem very clear: as devices grow smaller and more sophisticated, our fingers stay a constant size and our ability to understand the setup grows ever more limited.

### *A way out: Appropriate interfaces*

Clearly, programming e-rings with a combination of nearly microscopic switches and a one-pixel output channel wasn't going to work. But since the e-ring has wireless connectivity, we realized that the programming interface could be exported to a "digital jewelry box." (Figure 2)

The jewelry box gives our e-devices a place to dock and be programmed by the touch-display in the lid. Through this larger and appropriately-sized interface, the user can select a e-device, then select the events and the display pattern to be shown at event time.

In essence, we gave up on the cognitively challenging task of cramming all behaviors into an ever-shrinking input array, and chose instead to make a clearly and understandable interface on another device.

This has led us to the general principle of *appropriate displays for devices*, that is, exporting the interaction to a device input and display space that can be easily used, rather than trying to do everything in a tiny interaction area. We believe this will become an increasingly important design principle as devices grow increasingly sophisticated and the setup / programming required continues to expand. This principle would apply not just to jewelry and jewelry boxes, but more generally to any small display / small input surface that has larger programming and configuration tasks.

Figure 2: The *digital jewelrybox* is a place where wireless intimate devices (such as rings or necklaces) can display their interfaces in an easily accessible way.

## LIVING WITH DIGITAL JEWELRY

In our designs, digital jewelry wasn't intended to portray a cyber-techno style, rather, we consciously tried to make the pieces attractive in a typical jewelry aesthetic – and not count on punk or extreme fashion styles.

*Blend in:* This meant that the devices shouldn't bring on special attention as technology devices with techno-visual or packaging design features…. or at least no more than a standard watch. In trying to hide the overt technology we had to solve a number of practical problems such as power and antennas.

But such a stand meant taking on several user interaction issues as well.

*Simple in setup:* These devices could not be complicated in use, setup or day-to-day maintenance. In fact, they have to be only slightly more complex than traditional jewelry, which is to say, not at all. It became quickly apparent that while users might tolerate programming numbers into their cell phone, they clearly do not want to have yet-another-device that needs system management.

*Simple to use:* Digital jewelry must be only slightly more complex to use than regular, static jewelry. If it's to be of any interaction interest, such jewelry needs to be programmable – simply! – in some way. And of course, it's very easy to overload the user's ability to recall what a displayed color pattern means. In long term use, e-rings

[1] Jewelery work was primarily led by Cameron Miner, with assistance from Denise Chan, Davia Lu, Kim May, Alison Sue and Christopher Campbell.

(and similar devices with highly encoded output patterns) will tend toward the simple and memorable, avoiding highly varying patterns and complex event triggers that activate them. (We expect that few users will opt to learn Morse code, although displaying Morse code text output on an e-ring would be technically simple.)

*Subtle in use:* It's pretty simple to make devices that are loud, flashy and aggressive. And it's hard to do the opposite, especially for devices such as e-rings that are intended to signal events or changes in the world. At the same time, e-rings are often not positioned in especially visible ways, so the visible signal needs to be obvious enough to notice, yet subtle enough to not be too distracting. Personal choice dominates technology considerations.

*Social signals:* Intimate devices used in public ways signal many aspects about their owner's life. Rings and watches connote status and lifestyle, as well as personal taste and style. Devices signal social standing as well as accessibility and importance. (Think of the doctor's belt-mounted pager(s) as indicators of status.)

Active devices also signal their user's willingness to let certain kinds of information about their life into the public sphere. Even when pagers are in silent mode, they make active signals evident -- the gesture of quickly looking at the pager display is an important social indicator. At very least, it connotes a sense of importance about an information feed into the wearer's life that exceeds the need to pay complete and active attention to live, face-to-face interaction.

While pagers, cell phones and hip-mounted devices give off social signals when they're attended to, they typically do not publicize the information displayed. (On the other hand, typically half of the cell phone conversation is public, often despite efforts to mask or hide the conversation. If we could figure out how to keep that private as well, I sure we would.)

Intimate devices that cross the boundary between private and public functions are an interesting case, and lead us to consider what's private information and what's public. Our work with large displays treads this boundary explicitly.

### LARGE DISPLAYS: Private and public information

At the other end of the size and public/private spectrum are large interactive displays [2] that inherently large, unusually public devices that are seemingly the opposite of intimate.

But in recent work we've been exploring the use of large displays for community awareness and as a kiosk for instant messaging – an activity that is normally very private.

### IM Here: A community IM resource

Our most recent large display tool is *IM Here*, which provides awareness information about the work group (who's in, who's out), a rotating display of posters and information about what's happening this week.

In addition, a walk-up user can double-tap on a person shown in the awareness display and open an IM connection.

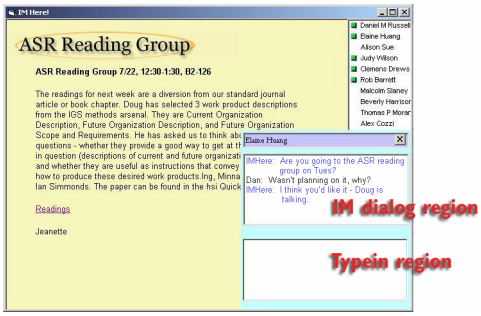


Figure 3: The IMHere client runs on a large interactive display in a public hallway setting. Group awareness information is shown in the upper right corner, with a double-tap on the person's name opening an IM session for personal IM connections, as seen in the lower right.

Here the distinction between public and private (or explicit and intimate) becomes muddied. Clearly people are sharing their status information through the awareness display, and thereby signaling their participation in the cultural group as much as though they'd worn a uniform. At the same time, when a walk-up user creates an IM session to someone, is that session public or private?

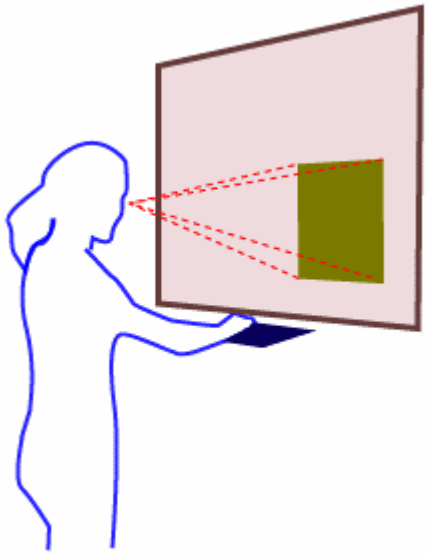

Figure 4: IM Here chat sessions take place in a subportion of the overall display with the user clearly working in-place. Do passersby recognize this as an overtly private conversation even within a public space?

And like digital jewelry, the IM Here display is always on, always ready – simple in setup and use, intended to be attractive and a complement to the style and activity of the place it's located. In this case, we have placed it in a small

foyer (a short hallway, really) that leads into our lab's frequently used common space. A large display has been in this area for quite some time, blending smoothly into architecture of the building.

## COMMON LESSONS BETWEEN SMALL & LARGE

In the case of IM Here, social signaling suggests that the person is engaged in both a public activity (using the IM Here display), but also a private activity (doing an IM chat) with someone. The setting is clearly a mixed signal that must suggest to the user a degree of restraint in IM conversation is appropriate. Passersby recognize this mixed property by the nature of the device and its use. The large display connotes publicly viewable content, yet the purpose of use (IM) and style (close-up) of use is intimate. As seen in Figure 4, the IM session takes place in an obviously smaller portion of the overall display, suggesting a kind of separate, set-aside interaction space. Just as people sometimes sit closely together in an body pose of intimacy - head and shoulders hunched together to define a close-off, personal space – so we hoped that the smaller region of the larger public display might also create a more intimate space within the surround.

In our initial observations, IM Here users seem to practice restraint in their use of the display (not typing anything too private), and at the same time, passersby don't seem too inclined to read over the shoulder of the user. But it's not an absolute indicator in the same way that body poses can signal a temporary private space within a larger public area. Social conventions exist for interrupting a personal tête-à-tête, and social practices restrict one from just listening in on such a meeting. [3] Yet we find that passersby frequently comment on the activity of the IM session, suggesting that a certain amount of reading is going on (perhaps just a quick scan to determine topic and IM partner).

Since the IM Here display is located in a public and shared space and is most commonly used as a way to gather people for a public event, it seems that the signaled conventions for IM Here are substantially different than would be expected for more personal content (e.g., email) or a more intimate space (e.g., an office). [4]

## SUMMARY

In both the digital jewelry and large display uses, information is shown in an ostensibly public space, yet the interaction can still be fundamentally private. We believe that the degree of intimacy and privacy is signaled by the physical design: smaller displays aimed toward individual use being inherently more intimate, while those that are also outward facing take on a partially public role. Even so, intimate displays that need visible external actions for use (such as pagers, which need to be withdrawn and attended to) have significant public signaling affect.

And at the same time, the physical location of a display also determines much of its public vs. intimate characteristic. Smaller displays embedded in a larger, public frame (such as seen in public access kiosks) can connote a mixed public *and* private use pattern.


## ACKNOWLEDGEMENTS

This work would not have been possible without the extraordinary talents of Cameron Miner, who did much of the work reported here on digital jewelry. In addition, Denise Chan, Christopher Campbell, Kim May, Davia Lu, Paul Maglio, Stephen Farrell, Alison Sue, Elaine Huang, Rich Gossweiler and many others made major contributions to these works.


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# 3° and the Net Generation: Designing for Inner Circles of Friends

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**ABSTRACT**

We describe the design and implementation of software codenamed 3° that connects a small group of close friends and family, people who know and trust one another, so they can extend real-world social interactions and do fun things together in a whole new way. 3° is a beta test of an innovative application based on new networking technology developed by Microsoft.

**Keywords**

computer-mediated communication, shared browsing, emotional design, social translucence, co-presence

**INTRODUCTION**

The 3° user experience was inspired by our research on the computing habits of the "Net Generation", people under the age of 24 who have grown up using the Internet. This is the first generation to which the Internet is commonplace, so ubiquitous as to be incorporated into their daily lives. As a result, their attitudes and behaviors are radically different compared to previous generations. They have internalized technology and will be doing new things in new ways. "NetGenners" are important early adopters of technology, and understanding their needs is critical for understanding future technology directions.

**NETGEN RESEARCH**

We have learned that the NetGen user's online social behavior reflects their offline behavior, which tends to revolve around friends, fun and music. They are spending less time watching TV [3], and more time interacting with technology and the Internet. Their technology usage is more extensive, integrating many different forms of communication, entertainment and productivity. They expect technology to connect them with their inner circles of friends and enable them to interact with them in interesting and expressive ways. Our research has shown that NetGenners want to socialize, do things together, meet new people through trusted context and express their identity and moods with their social cliques whenever and wherever they are online.

**Communication**

While face-to-face communication is ideal, the NetGen have told us that cell phones and instant messaging (IM) are preferred for real-time interactivity. In fact, this generation is a master of "continuous partial attention" – They have up to seven IM conversations going while listening to music, surfing the web and talking on their cell phone.

Email has decreased in popularity and is often used for communicating with family, teachers and coaches, and long-distance friends in different time zones. Many have moved on to create online journals as a way to keep everyone informed at once. They say it gives them an easy to use, trusted forum for expressing their thoughts, emotions and rants to their friends, and their friends can check in at their leisure.

**Identity**

Just as this generation's online social behavior is similar to their offline behavior, so is their expression of identity. Their online personality is aligned with their offline personality, and therefore, is not concerned with hiding their identity online. They prefer to connect to the internet with one, proprietary screen name, but will use different screen names as means of social management when they don't want to be bothered or appear online to certain people.

**Privacy**

For the NetGen, privacy is not a "top-of-mind" concern for most of the NetGen. While they may fill out a profile, they often leave out their last name and address to avoid being contacted by strangers. They may also block people, particularly strangers, but this is usually seen as rude.

Several reported that when they think of needing privacy, it is to keep their parents, siblings or unwanted friends out. For example, they like the fact that they can control who can read and comment on their online journals. They are wary of giving credit card information online while shopping, with unwanted email seen as primary consequence.

## DESIGN AND IMPLEMENTATION

3° combines the atmosphere of face-to-face communication with the flexibility of digital media by providing a group setting for people to interact – just like being at a private party; letting them invite their friends to hang out and catch up. With 3° you can…

- Throw a personalized animation ("winks") on friends' desktops
- Easily send digital photos to friends
- Initiate group chat with MSN Messenger
- Listen to a shared play list simultaneously with a module called musicmix, created from music that they own. (A similar experience to being at a private party where everyone brings their own CDs.)

### User Experience Design

With 3°, people establish groups with IM buddies and do fun things together with up to 10 people; the application is persistent on the desktop and the group uses shared group icons and skins. Each group is represented by an icon on the desktop, from which they can launch group chat, "wink" by throwing an animated gif onto friends' desktops, send photos, listen to music together and a variety of other activities are in the pipeline. Through this process, friends keep in touch with friends.

In order to support small group behavior, the user experience is designed to let natural social negotiation and group formation emerge. Anyone in the group can invite new members, change the group icon or change the group name. This way the group can grow without having to wait for others to come online. While a member cannot be deleted or removed from the group, the user can leave the group. The same is true for musicmix -- the skin and playlist is shared and anyone can change or add to the experience. The heart of the user experience is shared and synchronous – what I see and hear is what you see and hear.


Figure 1: Desktop with several 3° groups with activity notifications and a musicmix session

What's most important is that the relationships are at the center of the computing experience and the activities plug into the people – the opposite of what happens online today. We've shown many customers to get their feedback and evolve the product – one customer explained it best. He said, "It makes me feel like we're in the same room together".

### Peer Networking

3° is built upon the Windows platform including the Windows XP Peer-to-Peer Update that was made available in the second quarter of 2003. The Windows XP Peer-to-Peer Update is a set of platform technologies designed to run on Windows XP to enable the use and deployment of distributed, peer-to-peer applications based on new Internet standards. In addition to the Update for Windows XP, there is a software development kit that will become part of the Windows Platform SDK.

## CONCLUSIONS

The 3° beta has been available over 6 months now and we are getting great feedback from users. We have received anecdotes that users are meeting new people and discovering new music through their friends. Small group organization feels organic and natural, similar to the way they are formed in the offline world. We've also heard that a visual language is emerging amongst groups of friends through their use of winks. One user sends a "good morning" wink to her best friends group every day to let them know she is there and ready to play. Another said he uses a "fart" wink to poke fun with his co-workers when things get stressful.

Users say they like the shared, synchronous experience because it allows them to negotiate amongst themselves in a way that matches how they interact offline. Just like at a party, if a person doesn't like someone or the music they are hearing, they walk can away. Blocking or deleting people is considered rude, so with 3° groups we've heard that "cyber ditching" is happening. If someone is annoying or not liked, then members leave the group and create a new one with the agreement that this person is not invited anymore.

We are also learning that it is not just the NetGen that finds this kind of social experience compelling. Families are using with each other and other generations are using it to discover new music as well. We've heard that such an experience could also support productivity activities. Businesses are interested in using it for small work groups, and teachers are interested in how it could support group projects.

Since most information is anecdotal, we would like to get more quantitative information. We plan to run a research study to better understand exactly how the application is being used and what impact it is having on relationships.

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