CONVEYING SOCIAL PRESENCE DATA ON THE DESKTOP WITH BUDDYSQUARES

BY

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Abstract

Being aware of the online presence of others is an important factor in minimizing feelings of isolation amongst those who spend a lot of time working or socializing online. The feeling of inhabiting an online social space is however typically absent from, or at best, poorly captured by today's instant messaging (IM) clients. We present the design and implementation of BuddySquares, an IM visualization and interface that supports presence awareness by displaying a coherent view of the IM social space. BuddySquares uses the chat logs of persistent IM conversations to extract data that reveals the nature of dyadic relationships between user and contacts. This data is used to construct a richer, *persistent* notion of presence, which is visualized in a minimal and abstract style on the user's computer desktop. We also present and discuss the results of a two-week, online field trial of the software, conducted to evaluate how well our goal of presence awareness in the interface is met by BuddySquares.

Acknowledgments

I would like to thank my advisor Karrie Karahalios for her creativity and expert guidance, the inspirational environment that is the UIUC Social Spaces Group, everyone who has downloaded BuddySquares and especially those who volunteered to participate in the study and finally Danny, the author of Mercury Messenger, for answering my technical questions.

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Chapter 1

Introduction

There are many different forms of digital text based communication available to us today, such as email, blogs and SMS. The adoption of Instant Messaging (IM) as a text based communication tool has been particularly rapid and widespread. No longer just the occupation of gossiping teenagers, instant messaging has moved into the homes and businesses of millions of people world wide and is depended upon as a convenient and light-weight method of keeping in touch [5] [6] [7].

The benefits and drawbacks of IM as a communication tool have been well studied and documented [8] [9]. Of particular interest has been the discovery of a dual role for IM, one which goes beyond traditional information exchange. Researchers have named this side to IM *outeraction*, which encompasses communication processes outside of information exchange itself, most notably awareness of availability of others and maintaining a sense of connection or *presence* [8].

The importance of this aspect of IM cannot be overstated, in fact researchers have gone so far as to rename IM to Presence and Instant Messaging (PIM), in order to emphasize the dual role [10]. Concerning this aspect of IM, almost all interface work has concentrated on developing techniques to promote availability awareness (e.g. [7] [11]), whilst little has been done to foster a sense of presence of others in the interface (although *IMVis* [12] is a notable exception).

This is a problem because as more and more of our day to day experience becomes digital and therefore less tangible, it is easy for feelings of isolation to set in, unless the interfaces to these digital tools can convey some sense of a user's online social existence (note that users may indeed be *physically* isolated from others). Efforts in other text based communication formats such as email (e.g. [13] [14]) have had some success in promoting the feeling of inhabiting and sharing a coherent online social space. The goal of BuddySquares is to do the same for IM.

The feeling of inhabiting an online social space is typically absent from, or at best, poorly captured by today's IM clients. Users are usually presented with the *buddy list* or *roster*, a list of the user's contacts accompanied by limited state data such as "online", "busy", "away" and "offline". We feel this one dimensional list is poorly suited to conveying the nature of the social space the IM user inhabits.

We have developed a visualization and interface for an IM client called BuddySquares, with the goal of giving the user an enhanced feeling of being in the presence of their contacts. We have also tried to make the BuddySquares interface compatible with the two other primary goals of IM: text messaging and availability awareness [8]. We have implemented our application as an *aesthetic, peripheral display* designed to run in the background on the user's computer desktop. We report on the findings of a two-week long field trial to assesss how well this application meets it's goals.

The content of this thesis is as follows. In the next chapter we cover background and related work. Chapter three details the design process of BuddySquares and includes a discussion on the nature of peripheral displays and a justification for choosing this design paradigm. Chapter four explains the BuddySquares end user experience. Chapter five describes the design of the field trial for BuddySquares. We end by discussing results from the study and offering concluding remarks in chapters six and seven respectively.

Chapter 2

Background and Related Work

We address two topics in this chapter. First, we give a brief operational overview of Instant Messaging (IM). We then proceed with a survey of the work that has documented the nature of the presence awareness role of IM and an overview of IM interfaces that have tried to incorporate some form of presence awareness data.

IM systems support quasi-synchronous, point-to-point, Internet-based text chat between users on the same chat network. The classic interface for an IM client is the *buddy list*. "Buddies", or contacts, are the people an IM user has selected for easy message sending, receiving and availability awareness. The buddy list displays the contacts' on-line handles (usernames) and availability, which is a state such as "online", "away", "idle", "busy" etc., drawn from some pre-determined list (see Fig. 2.1). The state can be chosen explitly by the user or else it is infered by the system, typically as a function of input device use.

The user can group their contacts into several user-definable categories, such as "friends", "family", "coworkers" etc. Significant availability events such as contact sign-in or sign-out are often accompanied by optional audio and visual cues.

IM conversations are persistent in nature. They are entered into by clicking on a contact from the buddy list. This displays a seperate window in which the conversation unfolds. Both incoming and outgoing messages are displayed in this window. Old messages scroll up towards the top of the window, but can be reviewed at any point. Most IM clients also log all conversations in text or XML files by default. Many also support group chat, by allowing conversation participants to invite other contacts from their respective buddy lists to join the current conversation.

In highlighting the important *outeractive* uses for IM (those outside of explicit information exchange), Nardi et al. [8] uncovered a unique collaborative virtual environment (CVE). Due to the light-weight nature of IM (in contrast to more expensive forms of communication such as email or telephone), users reported the feeling of inhabiting a special *communication zone* with their contacts, in which they are free to send or respond to instant messages at any point throughout the day. This communication zone was described using spatial metaphors which likened it to a shared physical office.

Figure 2.1: An example of a buddy list from Mercury Messenger [1]

For many, the importance of this virtual social space was not so much its role in information exchange, but more in establishing and maintaining a connection to others. People derive value from simply being aware of who else is "around". This connection was deemed especially important by those who were physically removed from colleagues and friends, as it helps maintain bonds, or in other words, convey a feeling of their *presence*. Experimental research has concluded that awareness of online presence of others can enhance the emotional well-being of isolated workers [15].

It is worth reflecting on the nature of the word "presence" in this context. When we talk of presence in this paper we are really referring to *social presence*. This is an important point as most HCI papers that make reference to presence are talking of *physical presence* in the context of virtual reality systems. Physical presence deals with the extent to which people feel they are in a virtual world. Social presence on the other hand deals with the extent to which people feel they co-exist and interact with other intelligent social agents [16].

If these agents are non-human, the problem of mediating social presence becomes one primarily concerned with making the user believe that the agents *are* human. Since user's of IM programs know that the majority of agents (their contacts) are human[1], our problem is concerned with how we can build an interface that best reflects (or reminds them of) this.

The traditional text-based IM interface suffers from the problem of not accurately portraying human presence in all of its subtlety. Of particular concern has been the inability to support the graceful way in which people are able to collaborate with each other when face to face. Research has shown that when all

[1]It is also possible to communicate with non-human contacts, or *bots*, that are controlled by simple computer programs

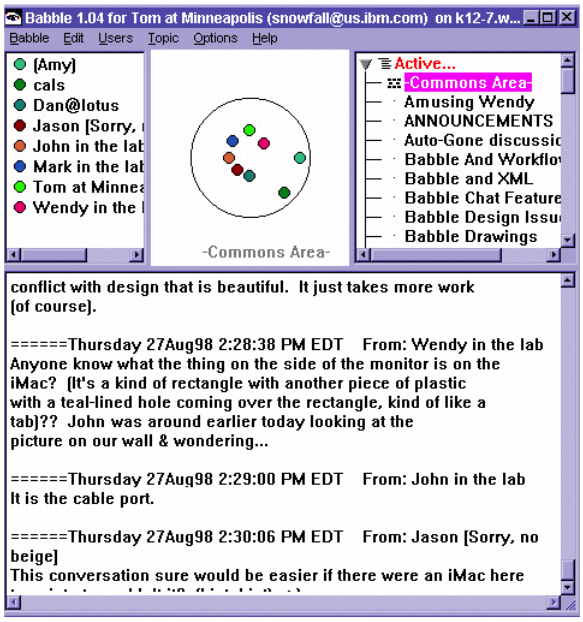


Figure 2.2: The chat program Babble [2] graphically indicates who is most and least active in the conversation. Those who are most active are in the center of the circle

of the subtle real world conversational cues that govern facets like turn taking and attention awareness are removed, things tend to quickly get awkward and unnatural [17].

Researchers have responded by attempting to include *social proxies* in the interfaces of computer mediated communication (CMC) tools [18]. A social proxy is defined as "a lightweight awareness mechanism that provides visual cues about the presence and activities of the participants" [19]. They have been used in the interfaces of IM clients with encouraging results.

For example, the chat program *Babble* [2] features a social proxy to support awareness of the activity of others signed into the system. Each contact is represented by a colored circle and are themselves arranged around a circle. Those most actively involved in a conversation drift towards the center of the circle while others who are less involved drift towards the edge (see Fig. 2.2). Contacts who are not part of the converation are shown outside the perimeter of the circle. This technique is effective in promoting accountability and turn-taking amongst conversation participants.

Another example, *ChatCircles* [3] employs a "hearing range" as it's social proxy. This makes sense of space within a chat room, as only (the avatars of) contacts close to each other can read the text of what is being said. Conversations are therefore spatially bounded, much like in the physical world (see Fig. 2.3). The visibility and awareness amongst the users of this social proxy leads to smoother interactions, as it reintroduces certain valued conversational processes and sanctions. See Donath [20] for further examples of this type of

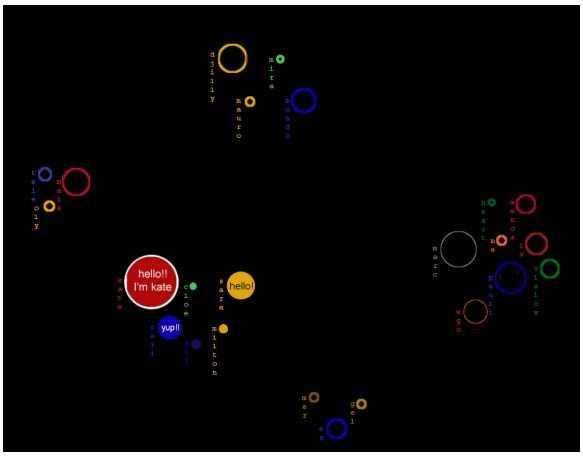


Figure 2.3: The Chat Circles [3] graphical interface includes a "hearing range" social proxy. Here we can see the user (outlined in white in the bottom left group) is aware of 5 different conversations, but can only see the text of the conversation belonging to the group she is in

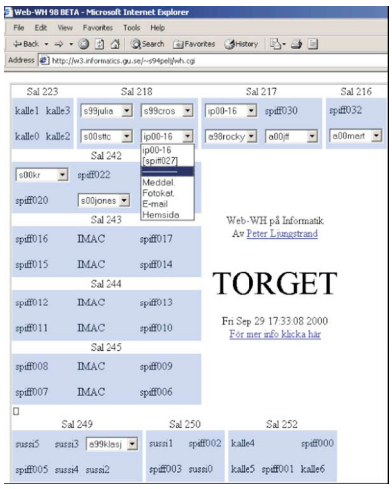
work.

IM chat interfaces have therefore been developing to better support the interactive, information exchange aspects of IM, but what work has been done to support the important *outeractive* role of maintaining a sense of presence? It is true that supporting activity and presence awareness in conversation has the fortunate side effect of improving presence awareness in general, but is anyone designing with outeraction specifically in mind?

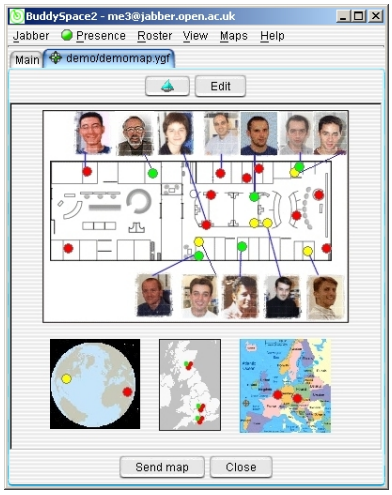
Several independent projects such as *WebWho* [21], *BuddySpace* [22] and *ActiveMap* [23] (see Fig. 2.4) have tackled the presence issue from the perspective that physical location information is of critical importance for presence awareness. The intended purpose of these IM applications is quite specific, in that they are well suited to answering questions such as "is person X currently in the same lab/building as me?". This helps aid the transition of the conversation medium from IM to the prefered face to face setting.

These projects all focussed on the work setting, yet the physical location approach seems less relevant for capturing IM presence data in the most general sense, where people are often scattered over several continents and time-zones and may be engaged in a myriad of different activities. Another project, *CoCoBrowse* [10], discards physical location in favor of *conceptual proximity* [24]. This still allows user's to judge how "close" to each other they are, but this time in terms of how close the files they are working with are to each other over a network. The results from this experiment are inconclusive.

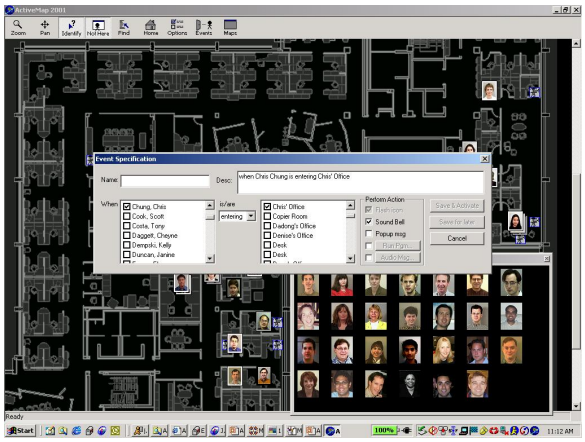
Hofte and Mulder have categorized the IM social space as a *Dynamic Personal Social Network* (DPSN), and claim that applications designed to work with DPSNs can be further categorized by several distinguishing characteristics, such as whether they intend to mediate or interpret DPSN data and whether



(a) WebWho [21] shows the location of the machines that users are logged into within a lab



(b) BuddySpace [22] attempts to plot users on customizable maps



(c) Active map [23] depicts the location of people within an office

Figure 2.4: A collection of IM interfaces that incorporate geolocation data

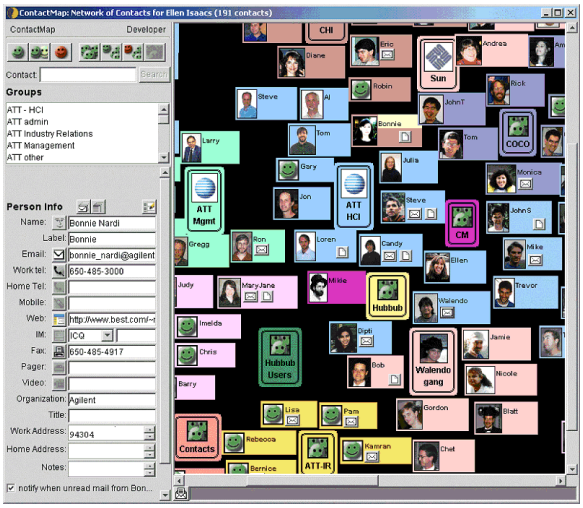


Figure 2.5: The primary unit of communication in ContactMap [4] is *people*. Contacts are grouped by various social and work organizations and placed into a *social desktop*

they are designed to aid with future decisions or recollecting the past [24]. The distinction between interpretation and mediation is an important one. Much has been said (e.g. [19], [25]) on the virtues of simple data mediation in social interfaces, as oposed to interpretation. The reason for this is that, based on our physical world experiences, we expect communication mediums to allow us some degree of plausible deniability for when we do not wish to respond to messages or be found at all. Along with this, we appreciate the ability to recategorize information based upon our *perceived* relationships - things that alogrithms cannot possibly automatically account for. System users have responded positively to designers who have taken note of this last point and provided reconfigurability in interfaces (e.g. [4], [12]).

Using Hofte and Mulder's categories, two final projects, *ContactMap* [4] and *IMVis* [12] could both be described as present-oriented, context-mediating applications. ContactMap provides the user with a *Social Desktop* view of their contacts (see Fig. 2.5) and has social reminding (of communicative commitments) as a primary goal. Contact map structures it's interface around *people* instead of *messages*. As the contacts are arranged in groups according to work projects or social categories, the user is implicitly reminded to respond to and keep in touch with various people as the map is browsed. Groupings and associations are largely drawn from email data however, which cannot communicate live presence in the way that IM can.

BuddySquares most closely resembles IMVis. IMVis is a visualization of IM contacts intended for a peripheral display. The visualization is a radial image that uses a 3d tunnel metaphor. Contacts are arranged around this tunnel according to how *available* for interaction they are. An IM status of "away" or "busy" will set the contact back towards the vanishing point of the tunnel, whilst

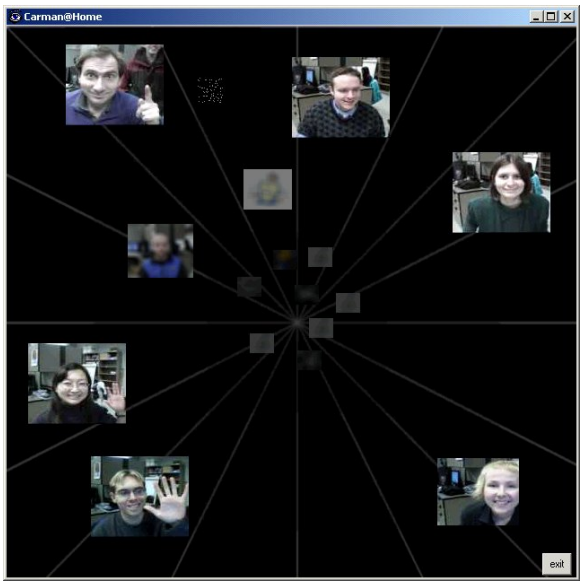


Figure 2.6: IMVis supports availability awareness by placing more available contacts at the entrance of a 3d tunnel and less available contacts towards the vanishing point

more available contacts appear at the entrance (see Fig. 2.6). Importantly, users may also reposition contacts within the tunnnel, allowing the algorithmic layout to be over-ruled by personal preference. A rarely available contact may be adjusted to the entrance of the tunnel if the user is more interested in that person relative to others. The motivation for the IMVis project was to support awareness of availability for interaction, rather than presence for presence's sake. Also, the prototype implemented suffered from several problems, such as ambiguous and occluded graphics and lack of scalability. These are issues we have tried to address in this project.

So, what measures most accurately define an IM social space and distinguish it from another? How can these measures be captured then visualized to best convey a sense of presence? In the next chapter we attempt some answers to these questions by presenting the design of the BuddySquares application, which has drawn from the lessons learned and experience of many of the above projects.

Chapter 3

Design Process

The one-dimensional buddy list is ill equipped to display the multi-faceted social landscape of an IM user (see Fig. 2.1 for an example of a typical buddy list). We have designed and implemented a real-time visualization and interface called BuddySquares. The goal of the visualization is to convey to the user the sense of being present in an online social space more effectively than is done by today's messaging applications. In this chapter, we document the design process which lead us to the end user experience described in chapter four. We also briefly explain how BuddySquares was implemented.

3.1 Defining the Social Space

In order to convey the virtual presence of an IM contact, their *state* needs to analyzed so that relevant information may be extracted from it and visualized in an intuitive way. Here, the notion of "state" goes beyond the conventional IM "available", "away", etc. boundaries to include other potential data sources. For example, we have already discussed how other applications have used geolocation data to enhance contact state ([22], [21], [23]). In an early prototype, we also experimented with the possibility of including geolocation data in BuddySquares, albeit in a more abstract topographic form. A mock-up of this prototype can be seen in Fig. 3.1. After experimentation, we concluded that geographic or conceptual (virtual) location data can be useful for narrower IM applications, but is less relevant for IM presence in the most general sense.

Other possible data sources include logging key strokes and mouse movements to gauge an "energy level", or examining the most active running computer processes to determine activity focus.

The problem with drawing from such rich state data is that it requires (potentially expensive) client side computation to produce it, which in turn implies that the application under development would need to run on *every* contact's machine in order to function properly. This was undesirable since we envisioned an extensive field trial and therefore needed BuddySquares to be compatible with IM clients already in use (the findings from [10] and [21] also advise against install-everywhere applications).

There are other issues relating to the feasibility of using such data sources,

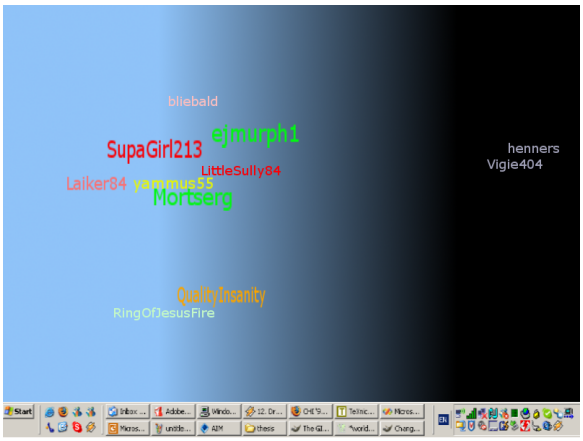


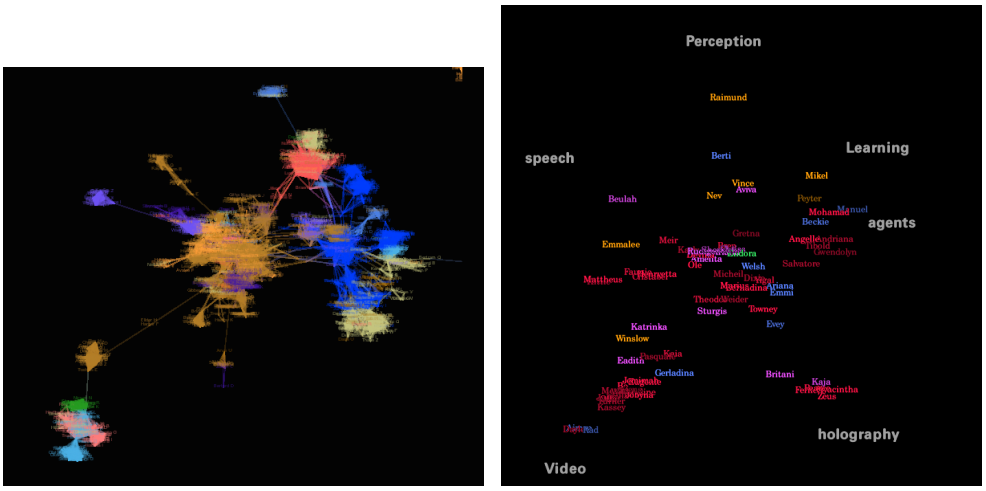
Figure 3.1: An early mock-up of a topographic version of our project, in which the position of contacts on the blue/black gradient indicates time of day and hence relative geographic position. We can see that it is afternoon for most of the contacts, but dark for "Henners" and "Vigie404", indicating they must be in a different time zone.

mostly connected to privacy. For instance, even if a user's contacts agreed to having detailed personal data computed and broadcast in real time, it seems unlikely that they would be willing to surrender ultimate control of their online portrayal to an algorithm. As identified by Aoki [25] and Erickson [19], it is important that social visualizations preserve the principle of plausible deniability. These considerations effectively limited us to drawing from state data that can be sourced from a user's own computer.

From here, we asked the question "what is it that defines and distinguishes an IM user's social space?". We contest that it is, more than anything else, the *people* inhabiting that space and their *relationships* to the user.

Cues for this stand-point were taken from a couple of systems that visualize the social networks formed from email use. *Social Network Fragments* by Viégas et al. builds a social network visualization from historical email data. The relative "strength" of the different relationships between ego and contacts is calculated by aggregating different characteristics of the email corpus, such as overall amount of email exchange and average "type" of email exchange (where, for example, an email directly addressed to the recipient is considered a more significant exchange than one addressed to a listserv). The resulting visualization, while of relatively little significance to outside observers, carries considerable meaning for the user (see Fig. 3.2(a)). In their study, it was observed that people could identify with the personal visualizations, which were used for self-reflection and story telling.

This system is influential for the way it portrays a unique online community via visualization of the dyadic relationships within it. Being constructed from historical data, it is however not suited to mediating "live" presence information. To use Hofte and Mulder's label [24], it is a *past-oriented* application. On the



(a) Social Network Fragments [13]

(b) VisualWho [14]

Figure 3.2: Two social network visualizations built from historical email data

other hand, a similar, earlier system by Donath, *VisualWho*, can be tailored as a presence awareness tool. This system visualizes an online community based on their affiliations to different mailing lists. Key-word "anchors", evoking the subject of different mailing lists, can be set on the display, to which contacts in the community gravitate, based upon how heavily they are associated to them as defined by the body of email data (see Fig. 3.2(b)). This time however, the user has the option to view currently online contacts only (as determined by entries in unix utmp files). In this mode, the visualization presents a "real time window onto the community".

In the spirit of these two visualizations, we claim that a relationship between two people is defined by the history of interaction between them. The nature of IM relationships is revealed by data hidden away in conversation log files. Several prototype systems were built to visualize IM contacts using different characteristics extracted from these files. Examples of measures we considered for use include "last seen online time", "average length of conversation" and "total time online". Following this process, we found that the essence of dyadic IM relationships can be effectively hinted at by two historical data points: last conversation time and size of overall conversation history.

Conversation history with a contact speaks of how significant a role that person plays in an online social space. Those that have the greatest overall amount of history have played the most significant roles, in terms of showing the greatest overall amount of presence. Last conversation times position those contacts within the "here and now", characterizing the space by revealing which contacts have most recently made their presence known to the user. BuddySquares grounds its visualization in dyadic relationships with contacts, as revealed by this data.

3.1.1 Persistent Presence through Persistent Conversation

We use historical IM data contained within chat logs to determine the nature of the various dyadic relationships a user has with their contacts. When visualized, these relationships convey a sense of the presence of their respective contacts. We are able to use such data since IM conversations are by their nature persistent - they are permanently stored within chat logs. Computing presence data in this way leads to a richer notion of presence than is typically found in IM clients today, a notion we call *persistent presence*.

Whereas a traditional IM client might inform a user "Bob is online", through the use of persistent conversation data, BuddySquares can instead convey more meaningful presence information as computed from the sum of previous interactions. This allows for more personally significant interpretations of BuddySquares visuals, an example of which might be, "my good friend Bob is online, although it seems we have not spoken in a while". We are using persistent conversation data to allow presence data itself to persist between sessions.

3.2 An Abstract Representation

In designing the visualization for BuddySquares, we kept the lessons learned from Tufte's works on graphic design forefront in our minds [26] [27]. Tufte has clearly demonstrated time and again, the importance of showing the maximum amount of data possible with as little accompanying ornamentation as possible, or in other words, the importance of maximizing the data-to-ink ratio. This paradigm calls for abstraction from all unnecessary clutter, leaving just the essential graphics needed to tell the story of the data in question.

The appropriate level of abstraction of course depends upon the type and complexity of the information to be visualized. We are attempting to visualize the abstract concept of *presence* and, in agreement with Vogiazou et al. [22], we contest that presence is for the most part a symbolic notion that can be adequately conveyed via simplistic graphical cues.

As discussed in the previous section, we are visualizing presence as revealed by two data points: last conversation time and overall conversational history. With this in mind, it was apparent to us that it should be possible to effectively visualize a symbolic notion across two data points using little more than basic shapes arranged about the screen in meaningful patterns. With this approach, complex representational graphics for contacts would only distract from the relational meanings as encoded by their positions.

Representational graphics, such as cartoon avatars, photos or even video, attach and broadcast strong social messages, even when oftentimes those messages are inaccurate [28]. Where photos were used in *IMVis* [12], the intended meanings were often found to be misleading. Also, photo realistic imagery can

induce certain expectations of anthropomorphic ability from an interface, which can lead to frustration when these are not met [29] [30]. Hollan and Stornetta provide a compelling argument for shying away from video or photo imagery [31]. They argue that the use of such mechanisms only serve to highlight the distance that separates remote users and hides any advantages that the new medium may have over face-to-face conversation.

By using simple graphical abstractions, we also conform to our wish of compatibility with existing IM clients and an application that only needs to be present on the user's computer (and not on the computers of their contacts).

By choosing this approach to visualization, BuddySquares follows in the footsteps of other recent social visualizations that have brought data to life using simple, abstract graphics. Examples of such work include *Newsgroup Crowds* and *AuthorLines* [32] and in particular, the *Chat Circles* [3] series of IM programs.

Simple, abstract design is only effective if the shapes and their relative positions to each other do indeed conspire to convey relevant information quickly and intuitively. With so much riding on the layout of our graphics, we turned to Gestalt theory to inform our design choices. Gestalt theory concerns the manner in which we perceive wholes out of incomplete elements. It emphasizes the importance of *context* in perception. The theory states that, due to context, things are better described as being "*more* than the sum of their parts" [33].

In essence, our visualization is constructed from individual graphical parts representing a user's different contacts. In isolation, each part provides specific presence information for that contact. All such individual parts together constitute a complete set of presence data. But the visualization as a whole should transcend such a set, to speak of a user's *online social space* - the "whole" of the data. Despite always being constructed from the same base elements, each use of the visualization will always have it's own unique context. Our goal was in designing a visualization to reflect this. For example, depending on the time of day, how many contacts are online and who those contacts are, a social space may feel crowded or empty, busy or calm, friendly or impersonal. Without a visualization that can convey this bigger picture, we are simply left with the sum of the parts - the set of presence data without the context.

Gestalt theory lays out several principles of perception, which we adhered to, in order to promote clarity and avoid misleading or confusing the user. For example, the principle of similarity states that things that share visual characteristics such as shape, size or color, will be seen as belonging together. In our visualization, contacts with certain presence attributes are differentiated from others by shape, and shape even distinguishes the user from the contacts (since our visualization is ego-centric, it makes sense that we make such a distinction). Similarly, the principle of proximity or contiguity states that things that are closer together will also be seen as belonging together. Recent conversations in our display are visually distinguished through proximal graphics.

3.3 An Aesthetic, Peripheral Display

We wished to design a visualization that would faithfully reflect the virtues of *social presence*. When we are in a social space such as a café or bar, we are aware of the fact that we are surrounded by others. This awareness requires little of our attention, since it is immediate from the abundance of sensory data that comes from a crowd. Our awareness of the presence of others in the physical world therefore requires little cognition and exists on the periphery of our attention. Presence data is also a valued commodity, since there is a certain "buzz" to be felt when in the company of friends and colleagues [15].

In order to best reflect these observed attributes of presence, the BuddySquares visualization attempts to be both peripheral and aesthetically pleasing. Since presence data is generally non-critical information, IM users should be made aware of it in such a way that also allows them to focus on a separate primary task.

A previous study by Guzman et al. [34] has shown *peripheral displays* to be viable for the communication of IM presence data. In that study, the authors interpret "peripheral display" to mean a separate, tangible object, removed from the computer desktop. Note however that, as Pousman and Stasko have pointed out, this is not the only possible interpretation of "peripheral display" [35]. In fact, we contest that by the above definition, Guzman et al. are in fact referring to a larger category of displays commonly termed *ambient displays*.

Ambient displays are tangible objects separate from a computer that "present information within a space through subtle changes in light, sound and movement, which can be processed in the background of awareness". Examples of ambient displays for non-IM presence awareness include *Lumitouch* [36] and *Super Cilia Skin* [37]. These objects use subtle visual outputs to convey changes in presence state for remote contacts. Such objects are designed to hold an aesthetic appeal and blend into the surrounding space, whether that is an office or a home. The goal throughout is to provide information that is not distracting, but is aesthetically pleasing. Some success has been achieved in designing ambient displays for IM presence awareness [34]. It remains to be seen whether a future iteration of the BuddySquares interface would lend itself naturally to an ambient display.

For now at least, we argue that the computer desktop itself is in fact an ideal canvas for a *peripheral display*. The desktop serves no other purpose than to be a workable and aesthetic space, one that is glanced at from time to time as switches are made between applications. It is often obstructed by windows, but is also easily accessible. By employing the desktop, we believe that we are indeed constructing a *peripheral* display, since the desktop is only seen from time to time, and therefore the information it displays cannot possibly be the primary focus of a person's attention.

The computer desktop is usually covered by a user definable image file,

known as the *wallpaper*. We decided to allow the BuddySquares visualization to *become* the desktop wallpaper, with the added function of being able to transmit IM presence data in the background (note that other desktop functions such as dragging and placing icons are preserved).

In order to make the BuddySquares display aesthetically pleasing, we followed several guidelines stemming from a theory of color used amongst graphic designers [38]. For reasons to be discussed in the next chapter, we use color to simply distinguish individual contacts within the visualization, that is, individual colors themselves are not used as data variables. In order to select as broad a range of appealing colors as possible, the program algorithmically draws a smooth path across the hue line of the HLS color model, picking colors at even intervals and keeping the lightness and saturation variables at a constant, less-than-maximum level. This ensures that color repetition is minimized, which is important to prevent inappropriate associations being made, as forewarned by the Gestalt principal of similarity.

We use a neutral gray as a backdrop to these colors to ensure sufficient contrast. Transparency is used to allow less prominent contacts to fade into the background and more available contacts to stand out. Steady animation is used to convey changes in the social space. Being almost entirely composed of multicolored squares, the visualization is intended to be striking in its simplicity, without being distracting, and attractive enough to justify as a replacement to regular desktop wallpaper.

Chapter 4

BuddySquares

In this chapter we explain the implementation of BuddySquares and detail the visual and interactive features that comprise the end user experience.

4.1 Visualization

The visualization is an ego-centric, radial image (see Fig. 4.1). Each of the user's contacts are represented as a square. These squares are automatically assigned different colors and are evenly spaced around a circle in alphabetical order by contact name. This circle is sized to occupy the majority of the desktop and the user is represented as a small dot in the center. The size of each square represents overall conversational history between the user and that contact, as revealed by the size of the Mercury Messenger chat log file. The proximity to the center of the circle (the user) indicates how recently the user spoke with that contact. This means that contacts the user has never spoken with (using Mercury Messenger) appear on the perimeter of the display, whilst contacts the user has most recently spoken with appear next to the dot in the center. BuddySquares distinguishes between two different availability states: "online" or "available" and "everything else". If a contact is available (according to Mercury Messenger) then their square will be solid, otherwise it will be hollow (see Fig. 4.3).

Earlier versions of BuddySquares used color instead of solidness to indicate availability state. The coloring scheme loosely followed a "traffic light" system, where red was used to signify busy and green signified available. Gray was then used to mean away or otherwise idle (see Fig. 4.2). This idea was scrapped since it was observed that the lack of color variation in the display hindered our goal of aesthetic appeal. In order to meet this goal, we instead introduced the random assignment of different colors to contacts.

BuddySquares is a real time visualization; changes in the user's IM social space are indicated via an animated display update. Various events could trigger such changes, for instance, a contact signing in, out, or becoming "unavailable", a change in last conversation time, or a significant change in conversational history[1].

[1] A "significant change" here is taken to be an "average" sized message exchange of about

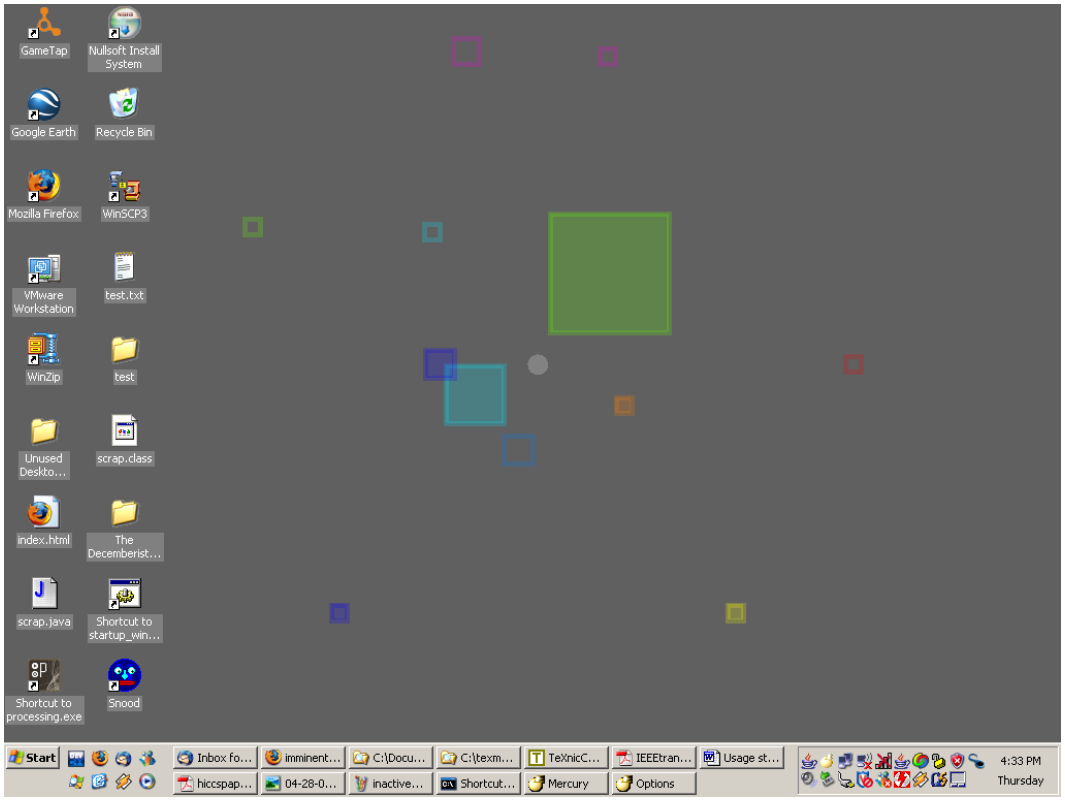


Figure 4.1: BuddySquares running in inactive mode and showing only online contacts

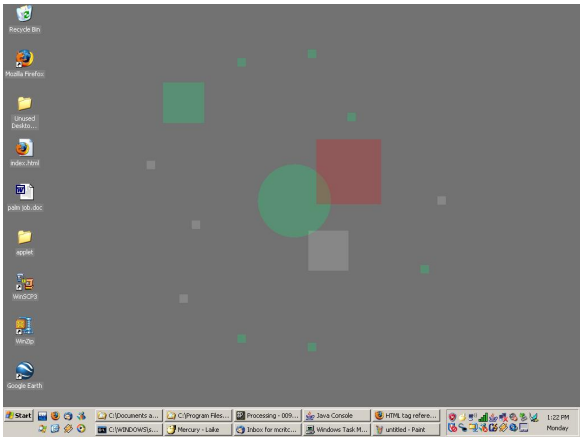


Figure 4.2: An early version of BuddySquares in which color was used to denote availability state. This scheme was eventually scrapped to make way for a more colorful display

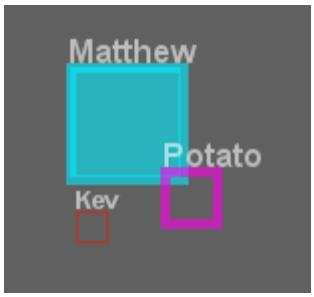


Figure 4.3: Varying degrees of availability. The solid square shows us that Matthew is online and available, Potato's hollow square means that he is online but not available, whilst the thin hollow square indicates that Kev is offline

The user has a choice between viewing just online contacts, or all contacts. A key press toggles between these two modes. Although depicting offline contacts does not communicate "live" presence data, we provided this view as an educational reference to the user. It reveals the maximum size of their IM social space and how their relationships with the contacts currently signed in compare with others that are currently offline, thus revealing "the bigger picture". Offline contacts are distinguished by thinner lines (see Fig. 4.3).

In the default and most basic mode (which we call *inactive* mode), the above description is the sum of the BuddySquares experience. The user is presented with a strikingly simple, abstract and occasionally animated image to use as their desktop wallpaper. Although devoid of any text and somewhat alpha blended into the gray background, this image can still convey a surprising amount of presence data to the savvy IM user. The overall number of squares speaks of how crowded an online social space is, while the sizes of the squares indicate how significant that crowd may be to the user. Frequent animations suggest a transition period in the day, for example, arriving at work, or back at home, or a lunch break. With knowledge of the time and a little memory, it's possible to identify which squares represent which favorite contacts.

4.1.1 Layout Algorithm

The algorithms used to compute square size and positioning do so on a relative rather than an absolute scale, so that a full range of positions and sizes is always used. The exception to this is when Mercury Messenger has yet to be used for text messaging, meaning there are no chat logs or conversation dates to use as data points. In this instance, all contacts will appear as small evenly sized squares around the perimeter of the circle.

Since proximity of a square to the center of the circle carries significance in the visualization, it was imperative that we developed an algorithm that could draw squares around a circle in a fair way. That is to say, it was not sufficient

10 bytes of text

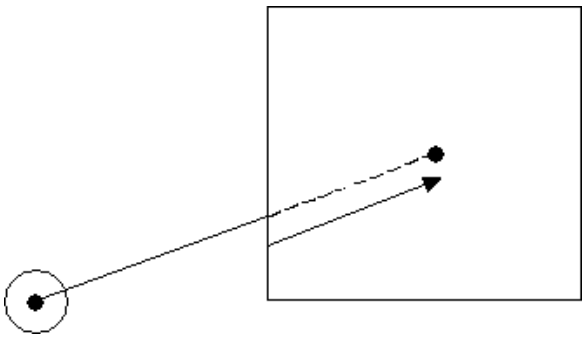


Figure 4.4: In order to measure the distance from the center of the circle to the closest edge of the square, the square is shifted the length of the dotted line in the direction of the arrow

to simply measure distances to the center point for each square on the display, since, as the squares are of different sizes and size is a dimension independent of proximity to the center, this would make large squares appear closer to and small squares further from the center than they should be.

In order to rectify this, we developed a technique that first naively measures the distance as a straight line from the center of the image to the center of the square. This line has a length proportional to how recently the contact represented by that square spoke to the user. We then trace back to find the intersection of that line with the side of the square closest to the center. Once this point is found, we push the square out a distance equal to the length of the section of the line internal to the square, in the direction of the vector of the line. This is the final position for the square. Fig. 4.4 illustrates this technique.

This technique is an approximation of measuring all distances from the center of the image to the nearest side of each square. However, it does have the effect of making the angle around the circle between each square slightly inaccurate, since squares are vertically and/or horizontally displaced somewhat during the shift procedure.

4.2 Interactivity

A goal of the BuddySquares project is to determine whether the usefulness of a social visualization for IM can be maximized by allowing it to double as an alternative interface to the IM client itself. If our visualization is indeed an intuitive display of the user's online social landscape, then also making it a functional interface prevents the user from having to switch from our visualization to Mercury's buddy list interface to get chat functionality. BuddySquares therefore has an optional *active* mode, in which the graphics become clickable and draggable and the sending of instant messages, amongst other things, is supported.

A key press toggles between inactive and active modes. In active mode,

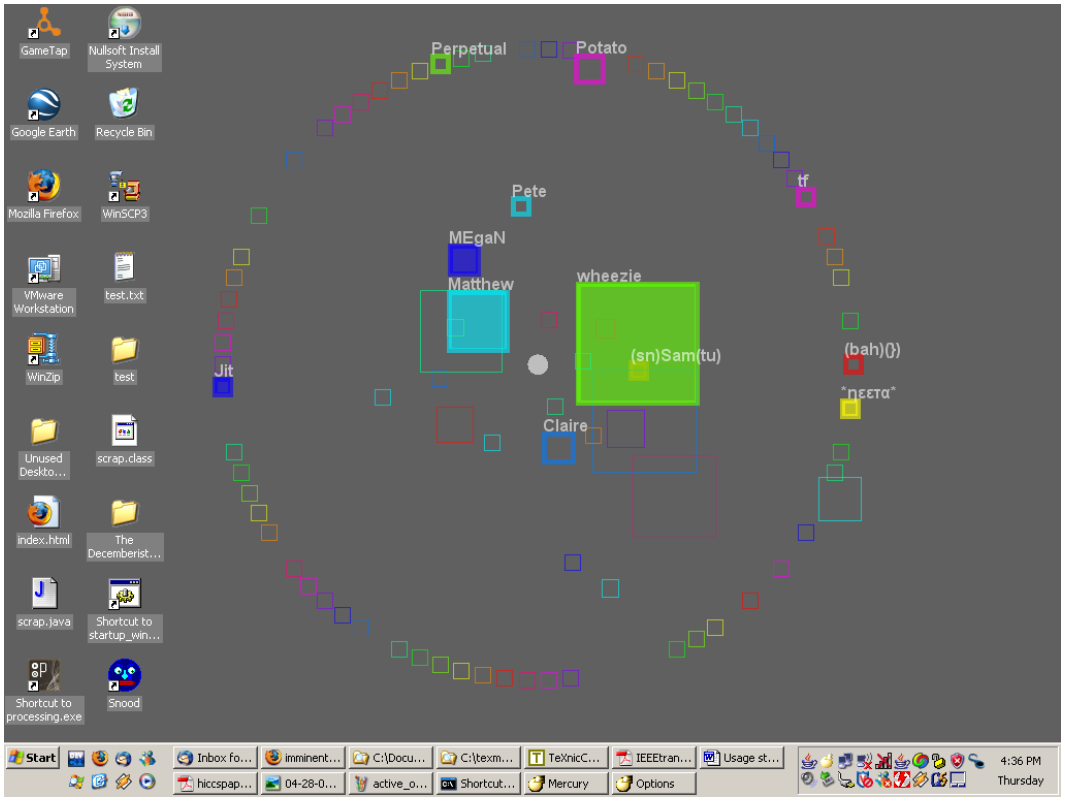


Figure 4.5: BuddySquares running in active mode and showing all contacts

colors become bolder and (MSN) contact names appear above each square (see Fig. 4.5). This signifies that the desktop is "live" and mouse clicks and key presses will affect it. If in "all-contacts" mode, the user can additionally toggle between displaying the names of all contacts, or just online contacts by pressing a key (see Fig. 4.6). The features of interactive mode described below are intended to give the user a degree of control over the appearance of the visualization, more detailed presence data and a mechanism for chatting.

4.2.1 Draggable Graphics

Whittaker et al. identified the importance of allowing users the freedom to rearrange a graphical representation of contacts to their liking [4]. A successful interface is one which anticipates user desire to re-categorize visual information according to different schemes, such as by *group* (friends, colleagues, family etc.) or another more personal scheme. This avoids the frustration of not being able to visually correct a layout that follows the rules of an algorithm, but cannot cater to *perceived* significant relationships. For example, a user may be unhappy with a close friend consistently appearing on the perimeter of the display just because the preferred method of communication with that person is not IM. This observation is consistent with Erickson's claim of the importance of deception

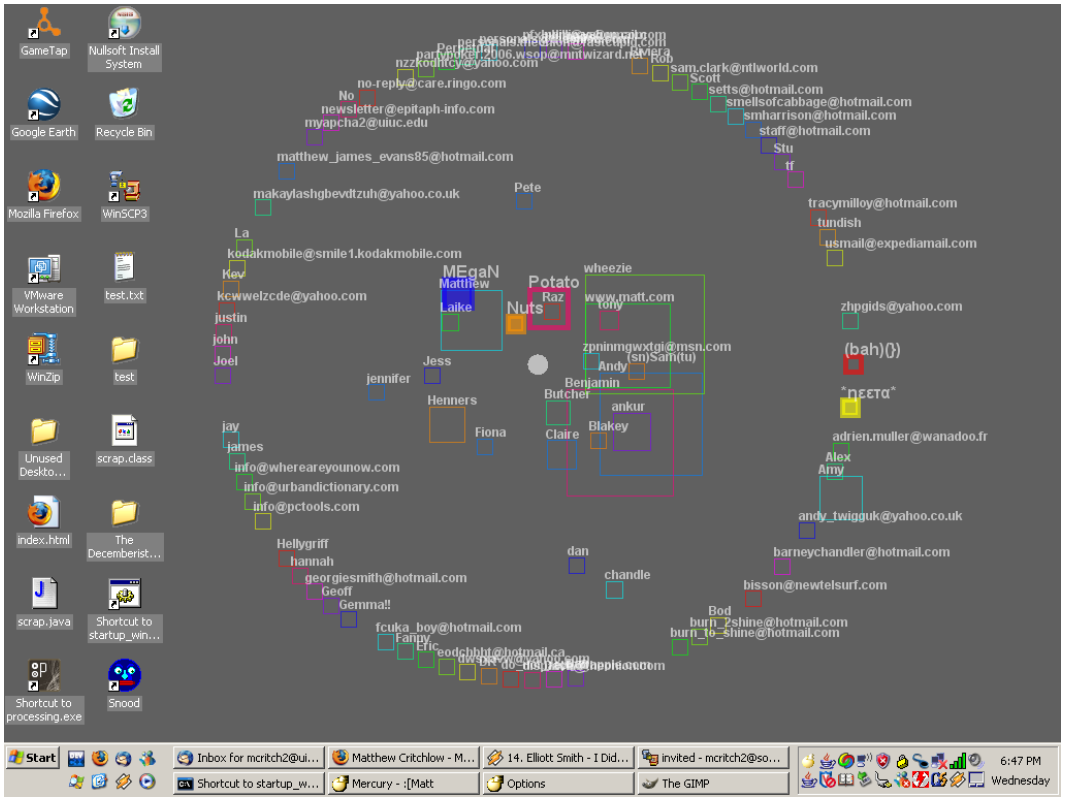


Figure 4.6: BuddySquares running in active mode and showing all contacts and all names

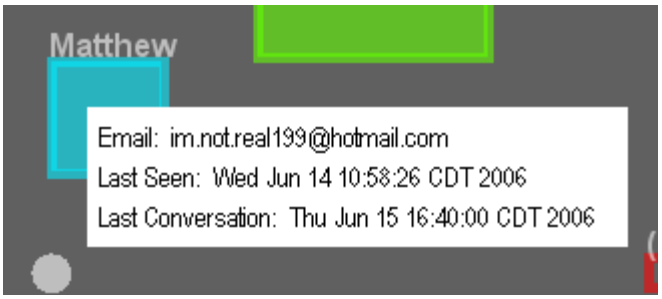


Figure 4.7: An example of a mouse-over information box giving detailed presence data

and mediation rather than interpretation in a social interface [19].

To meet this requirement, BuddySquares features clickable and draggable graphics in active mode. Individual squares can be moved about the desktop at will. These squares will stay in their new positions despite any new activity or animation in the visualization. A certain key press signifies that the algorithmic interpretation of square positions should apply again and that the squares should drift back to their default locations.

4.2.2 Mouse-Over Boxes

In active mode, hovering the mouse over any square for a couple of seconds invokes the appearance of an information box for that contact. This information box contains detailed presence data for the interested user's information. This data is currently "Last seen time" and "Last Conversation Time" (and full email address) An example of an information box is given in Fig. 4.7.

4.2.3 Messaging

In order to support the ability to chat to contacts without leaving the visualization, BuddySquares has a built-in message sending and displaying mechanism in active mode. The text of any incoming messages from a contact will be displayed over their square. The message is displayed for a length of time proportional to the message length, then disappears (see Fig. 4.8). The Mercury Messenger messaging procedure is unaffected however, so the message will also appear in a separate conversation window for that contact (although by default we minimize the window to the task bar - a setting that can be altered by the user). This means that, although the messaging style for *BuddySquares* is ephemeral rather than persistent (much like in [3]), conversations are still persistent by virtue of the underlying Mercury Messenger behavior. However, protracted chat sessions in which the user leaves the display or multitasks, are better served by the persistent Mercury Messenger chat interface.

To respond to a message (or start a conversation), the user selects the recipient of the message by clicking a square with the mouse. The selected contact is

Figure 4.8: An instant message being displayed over the contact's square. A message of this length would be displayed for approximately seven seconds and then disappear

visually highlighted and a small input box appears at the bottom of the screen into which messages can be typed and sent by pressing the return key. Multiple separate conversations are supported by this approach, with the proviso that it is imperative the user has selected the correct recipient before pressing return.

Once a conversation has begun, the square of the chat partner will drift toward the center of the display (if it is not there already), indicating a recent conversation with that person. A consequence of this is that the center of the display can quickly become crowded and text messages can become obscured. The ability to drag squares somewhat rectifies this. The user can position a chat partner in a free area of the display for the duration of a conversation, optionally pressing the "reset layout" button once finished (see 'Draggable Graphics" above).

The messaging functionality of BuddySquares is provided as a convenience to users who are observing the display and also wish to chat, saving them from having to switch to the Mercury Messenger interface. The significance of conversation in BuddySquares however goes beyond mere convenience. Although the content of past conversations is not accessible via the BuddySquares interface, it is still very much a part of the visualization, albeit in a heavily abstracted form. It is data contained within chat logs that allows BuddySquares to incorporate *persistent presence* in the display. The heavy abstraction of conversation histories is also essential in order to quell privacy concerns. As a peripheral display on the user's desktop, BuddySquares may be visible to a great number of friends and colleagues. It is clear that, by default, a user would want to keep the content of their conversations private from others.

4.3 Implementation

BuddySquares is a program extension or *plugin* for the free MSN messaging client *Mercury Messenger* [1]. The implementation of BuddySquares is in two

halves. The visualization manifest as desktop wallpaper is a Java applet linked from an html file. This applet communicates with a Mercury Messenger plugin that listens for events and computes state data for contacts. This implementation has several ramifications for the use of BuddySquares, which have been significant for the field trial:

- The user must have an MSN Messenger™ account or Microsoft Passport™ in order to communicate over the MSN network.
- The user must use Mercury Messenger as their chat client.
- The user must have the Java Runtime Environment™ installed on their computer.
- The user's operating system must allow html files with embedded applets to be set as the wallpaper.

Although these requirements may sound restrictive, they can typically be met by the average Microsoft Windows™ user (at no financial cost).

Chapter 5

Evaluation

In order to assess how well BuddySquares meets it's goal of presence awareness through the visualization of a user's IM buddy list, we conducted a two-week field trial of the BuddySquares software. In this chapter, we describe the design of and findings from this user study.

5.1 Method

The BuddySquares user study was conducted exclusively online. Participants were required to download the BuddySquares software from our website [39] and use it in place of their regular MSN chat client for a period of two weeks.

In order to get a sample that closely resembles the global demographics of IM users, potential participants were screened by an online *pre-study questionnaire*. As well as collecting basic demographic data (sex, age, occupation, location), this questionnaire also probed IM habits. It asked for frequency of use of IM programs and in particular MSN™ IM programs (since BuddySquares is itself an MSN™ program). It also asked for frequency of email use, since this is another good indicator of how accustomed potential participants were to online communication. The pre-study questionnaire allowed us to invite certain respondents to join depending on how well their responses matched the demographic requirements of unfilled participant positions. The next section details the participants selected through this process. Participants were offered a $10 gift certificate as an incentive to completing the study.

Participants were encouraged to allow BuddySquares to send usage statistics to us during the study. If enabled, BuddySquares logged the date, time and duration of each use of the software and sent this data back to our server, along with the following statistics concerning that usage session:

- percentage time spent in *active mode*
- percentage time spent in *all-contacts mode*
- maximum and minimum number of contacts seen online
- number of messages sent using the BuddySquares interface
- whether or not the visualization layout was manually adjusted

At the conclusion of the two week study period, participants were required to complete an online survey of their experience. The survey questions were part Likert and part free form. They were designed to reveal the manner in which the software was used and any potential advantages or disadvantages it has over traditional IM interfaces. The quantitative data was meant in part as a means to corroborate the answers given to the survey questions.

5.2 Participants

The study was advertised via fliers and emails. Paper fliers were put up around the university campus and 130,000 digital fliers were posted on a popular university social networking website [40], over a period of 10 days. Targeted emails were sent out to hundreds of people within the HCI research community.

In response to this campaign, the BuddySquares website got 129 *unique* hits. 49 of these visitors navigated to the download page and 34 of these went on to download BuddySquares. We had 23 unique visitors to the user study page. Of these, 8 people filled in the pre-study questionnaire. All 8 were subsequently invited to join the study, 6 of which consented and became study participants. Only 3 of these participants enabled BuddySquares to log and send statistical data back to our server and 4 completed the study by responding to the post-study survey.

The demographic data from the pre-study questionnaire revealed that all 6 of our study participants were students living in Illinois, of between 18 and 27 years of age. This is not surprising considering the heavy targeting of the university campus during the advertising campaign. We had 3 male and 3 female participants. All of the participants reported using email everyday and all but 2 of the participants stated a preference for AOL Instant Messenger^{TM} (AIM) over MSN, using AIM for over 35 hours a week. Of the other two participants, one reported using AIM for less than 7 hours per week; the other uses no other IM programs, both use MSN for less than 7 hours per week. The other 6 participants all use MSN for between 22 and 35 hours per week, with one participant using it for over 35 hours per week. All participants typically encounter between 0 and 10 contacts when logging into MSN, except for one participant who typically encounters between 16 and 20 contacts.

5.3 Results

5.3.1 Usage Statistics

As noted above, only three of the participants enabled BuddySquares to log and send data. In total, statistics concerning 5 individual usage sessions of the software were gathered. We now highlight some distinct features from this data set. See Table .1 in the Appendix for the data in full.

The longest recorded session lasted 123 minutes and began at 23:24 at night. During this time, a maximum of 3 and a minimum of 1 of the subjects' contacts were online. However, none of the interactive features of BuddySquares were utilized, in fact, BuddySquares remained in inactive mode for the duration of the session. The same subject logged another session of length 13 minutes that began at 10:26 in the morning. Five contacts were online for this session. The subject spent 67% of her time in active mode, during which she sent 11 instant messages (using *our* interface) and rearranged her contacts via the dragging feature. This session constitutes the only recorded use of the instant messaging and dragging features of BuddySquares.

Another participant logged 24 minutes of use over 3 sessions. He consistently saw between 6 and 7 of his contacts during these sessions. For two sessions he spent between 54% and 63% of his time in active and all contacts mode and for the final session that figure rose to 98%.

The final participant who enabled data logging recorded one session of length 3 minutes in which no contacts were seen and no system features were utilized.

In total, we recorded 234 minutes of BuddySquares use. 20% of that time was spent in active mode and 16% in all contacts mode.

5.3.2 Survey Results

Four of the study participants completed the post-study survey. The survey consisted of 26 Likert scale questions and four free-form response questions. The Likert questions were designed to report upon the system's ease of use and value, while the free form questions allowed participants to provide extended feedback and insight. See Table .2 in the Appendix for the full Likert results.

According to the results, users only extracted marginal enjoyment from using the system, preferring their regular IM program to BuddySquares. They did however consider the information the interface displayed to be interesting and accurate, although they were less sure about its usefulness.

Users seemed to respond favorably to the creation of a novel interface for their buddy list. For example, consider this free-form response to the question of what advantages BuddySquares has over traditional IM programs:

> "Design of the shape and idea, which can talk with friend by using wallpaper is nice. For example, I don't want to watch messanger when I'm doing homeworks, but I want to receive messages from my friends. This style is confortable for my computing style."(sic)

Another user praised the ambient style:

> "I liked the different approach to representing my contacts online and how I could observe my contact status in a more ambient fashion."

Importantly, participants found the interface to be easy to understand and control. Free-form responses also confirmed this, an example of a typical re-

sponse to the question "explain what the relative positions, sizes and colors of the graphics on the screen meant to you" is

> "...The sizes represented how much I talked to that particular person in my contact list and a fuilled box meant the person was online and available for chatting" (sic).

Concerning the interactive features of BuddySquares, the results show only a marginal preference for the active mode and the all-contacts mode. Users reported that they would generally leave the display in inactive mode when not interacting with it. Users indicated that they did not often send instant messages using the BuddySquares interface, although the ability to drag and drop contacts and the pop-up information boxes proved more popular.

Although users in general found the display to be aesthetically pleasing (one user commented "I love the visualization"), they were not fans of the use of the desktop, finding it impractical and unfavorable to have to replace their wallpaper. In response to the question of what would improve the system, one user simply replied

> "Making it into a seperate program, and NOT replacing the desktop". (sic)

Another commented

> "The main problem with having Buddysquares as my wallpaper was that most of the time when I am using the computer, I usually have some application maximized which blocks the view of the application." (sic)

Another user echoed the desire to use BuddySquares as a stand-alone program:

> "I think it is difficult (but I want) to start BuddySquares without starting Mercury. In current system, anyway I need to use Mercury to see the past massage and to notice someone begin to talk me"(sic).

Significantly, the dislike of the desktop approach does not appear to have been due to frustration caused by the display being blocked by desktop icons, nor was the display felt to be overly distracting.

Users generally agreed that they used the system as a way to monitor the presence of their contacts. Overall, users indicated that they learned something about their IM relationships through the use of our system. Responses to the free-form questions indicate that one of the things the use of BuddySquares makes most apparent is that we generally only converse with a small subset of our contacts. Once participant commented

> " I noticed that I generally speak to a select few people on my contact list consistantly. Everyone else is simply on my list, or just someone I chat with sporatically." (sic)

and another realized that she

> "only talked to a small group of buddies in my list".

Chapter 6

Discussion and Future Work

In this chapter we will reflect upon both the results of the study and informal feedback provided by colleagues, and consider implications for the goals and future iterations of BuddySquares.

The first and foremost point to note in this discussion of BuddySquares is the small scale of the user study conducted. Only procuring six participants for the study following it's advertising campaign was disappointing. The situation was further hampered by low frequency of use of the software throughout the study period and by certain participants choosing to withhold both quantitative (statistical) and qualitative (survey response) data. It is also true, as indicated by the demographic data as well as personal experience, that the prevalence of MSN messaging is dwarfed by AIM messaging in our campus community. These factors left us with a corpus of data that is far from conclusive and much more anecdotal in character, and we treat it as such. Future work certainly includes conducting a redesigned study, perhaps with a higher level of participant control.

The problem with conducting our study exclusively online appears to have been that our product was not yet mature enough to offer the sufficient value that would have ensured a much greater response and higher frequency of use. At the time of writing, BuddySquares is certainly still in beta stage and there are plenty of corners to smooth, areas to polish and features to add. Whilst it remains in this prototype stage, it is now clear that a user study of a more traditional usability nature, where participants are physically present, would yield more reliable results. That is not to say that the comments and statistics provided by our participants cannot give us valuable insight and feedback for the design of the software at this early stage.

We can also attribute some of the blame for lack of use to the fact that BuddySquares is not a stand-alone piece of software. Two study participants clearly stated that they would much prefer to use BuddySquares without having to use the Mercury Messenger program that it is based upon. Without further investigation, we cannot be sure of exactly how much the experience of using Mercury Messenger influenced results about the use of BuddySquares, but the data clearly indicates that this has played a factor in tainting our results.

Despite these generally low enthusiasm levels for the use of BuddySquares itself, study participants were more enthusiastic about the look and purpose

of the software. Feedback suggested that the ambient approach to revealing contact status was favorable and at least one participant gave tacit support to our idea of making presence awareness a peripheral matter, stating "I don't want to watch messanger when I'm doing my homeworks, but I want to receive messages from my friends. This style is confortable for my computing style." (sic).

There was positive feedback for the alternative visualization of the buddy list. One user noted "I like the different approach to representing my contacts online". By creating a display that focuses on the communication of presence, users reported learning something new about their IM habits and relationships with their contacts. A common theme was surprise at the relatively small subset of contacts one actually converses with on a regular basis, something the BuddySquares visualization is well positioned to reveal. Such feedback provides encouraging evidence that efforts to design more presence awareness into IM interfaces are worthwhile and valued.

There is some agreement amongst the participants that the abstract nature of the BuddySquares visualization holds aesthetic appeal. This was a bone of contention between colleagues during the design of the visualization, some of who claimed the display was too simplistic and should instead allow users to be able to select unique graphics for each contact. These graphics would be more representative of the contatcs' characters, it was argued. We have several reasons for avoiding that approach, many of which were discussed in chapter three. In particular, this idea may not scale well, as the BuddySquares visualization can become quite crowded at times and could become distracting and less visually appealing if squares were replaced with disparate images. Although no one within the study called for customizable avatars as such, one participant did note that an improvement would be to "maybe customize color schemes and background". Future iterations of BuddySquares could therefore do well to cater more to user desire for customizability.

Although the visualization may have gotten generally favorable feedback, its position as the desktop wallpaper did not. During design and development, a common concern amongst colleagues was that the available space on the desktop for the display would not be sufficient due to the abundance of desktop icons. This turned out to be a problem for some but not others, that is to say, some participants had relatively clutter-free desktops, while others did not. It is true that BuddySquares is more suited to "neat" desktops, on which icon placement is kept to a minimum. Just like in the physical world however, the "neatness" of a desktop is governed by personal taste and working style and without a bigger sample we cannot tell just how far reaching of a problem occlusion due to desktop icons would be.

Lack of space was not the only reason participants responded negatively to our desktop design. Most also took issue with being forced to replace their wallpaper image with our visualization. This could be because a user's wallpaper

image, being fully customizable, is strongly linked to personality and identity, and user's resent over-zealous applications that strip them of that form of expression. Even though participants generally liked the visualization, it was not their choice to use it as a wallpaper image.

A final gripe against the desktop approach concerned its intended peripheral nature. Although the visualization was specifically designed to run in the background and be covered by other windows, there to be glanced at from time to time, at least one participant found this approach uncomfortable. That participant commented "The main problem with having Buddysquares as my wallpaper was that most of the time when I am using the computer, I usually have some application maximized which blocks the view of the application. Maybe some means of keeping it up front or off to the side or maybe some sort of transparency would be nice." (sic)

This comment indicates that perhaps peripheral-by-nature-of-being-obstructed is a less familiar and comfortable concept than peripheral-by-being-separate. It is likely true that, when wanting to look at a peripheral display, turning your head to the side to observe some external display is easier and less disruptive than minimizing all windows on the desktop.

The idea of a smaller, always-on-top mode mentioned in the above comment also indicates general unease at having some live application computing and displaying things out of sight in the background. During development, colleagues also pondered whether the inclusion of such a mode would be necessary. We opposed the idea at the time simply because we wanted to emphasize the display's non-critical character - it's O.K. that you can't see it most of the time. If future data reveals comments of a similar nature however, it may be necessary to develop a resizable or minimized mode for BuddySquares, in which the visualization is shrunk to occupy a user defined area of the desktop and is allowed to remain on top, possibly by heavy use of transparency.

We believe a more promising avenue of future work is to look at transplanting BuddySquares from its desktop incarnation to a traditional ambient display version. This ambient display could most obviously be a separate computer screen off to the side of the user's main screen. A more satisfactory option would be to project the visualization onto a neighboring wall, in the style of the "ambient fixture" *Water Lamp* [41]. This would allow the visualization to become truly peripheral, by taking it from the small display screen that must always be at the center of attention in order to be processed, to a much larger area on a wall. The transition from virtual to physical wallpaper would help users in identifying the visualization as peripheral, since walls act as the backdrop to all indoor activities. The large scale that can be achieved with a projection would also help in allowing the information to be processed in the background. Users would be constantly aware of such a display, yet it would only monopolize attention during periods of change, as reflected by animation.

The visualization is particularly well suited to projection in a public space

for two further reasons. Firstly, there should be no major privacy concerns connected with the projection of BuddySquares. Thanks to its abstract design, the visualization by default reveals very little information to the unaware observer and can only be deciphered to any significant level by the user and possibly very close acquaintances. Since active mode reveals significantly more detailed information, a user may feel the need to be more cautious about activating it in public, depending on the space and its inhabitants. To counter this problem, we envisage a feature that allows active mode to be displayed on the user's computer screen, while inactive mode continues to run as the projected version. Finally, since the visualization is intended as an aesthetically pleasing image, it should in theory be desirable as a wall decoration. There is obviously great variation in the interior decor of rooms, therefore greater user customization of the visualization, especially with regards to color, would help sell BuddySquares as a wall projection.

An ambient display for BuddySquares could also be a completely different external object. Ambient displays have been constructed using many common household and office objects and have utilized such varied sensory data as light, sound and even touch [34]. Of course, the successful objects are those that share some intrinsic connection to the data they convey and thus feel natural and communicate effectively. It is less clear what form such an object would take for BuddySquares. A move in this direction would obviously require heavy prototyping and testing at an early stage, in order to identify a suitable design.

Participants were generally indifferent to the active mode of BuddySquares and the features it makes available. In particular, the instant messaging capabilities of the program were very infrequently used. This may be attributed to the somewhat unfamiliar procedure of having to click on a respondent's square before each message is sent. Forgetting to do so could mean unintentionally messaging the wrong contact. Certainly, one such experience would be enough to dissuade a user from trying again! Future versions of BuddySquares will employ a double mouse click as the mechanism to send a message to a contact, thus making the command much more explicit and less prone to error.

More likely the cause for the low messaging use, aside from the relatively small number of contacts our participants encountered, is the ephemeral nature of BuddySquares chatting. Users are comfortable with the idea of a scrolling window per conversation that stores a record of what has been said, and this technique certainly does hold certain advantages. Since, when a conversation is started in BuddySquares, the underlying Mercury conversation window is also always launched, the temptation is great to move the chatting to that arena.

The lack of success for the chatting mechanism is not a crucial drawback for BuddySquares since, as explained in chapter four, the ability to chat was provided as a convenience to save an unnecessary switch of interface. Participants did however respond positively to the dragging ability of the program, lending further evidence to the importance of user customization in a social

visualization.

Chapter 7

Conclusion

Today's IM interfaces do an inadequate job of communicating the online social space inhabited by the user. Social presence data is an important commodity, as it can lessen feelings of isolation for those who spend large amounts of time working or socializing online. This thesis discussed the design, implementation and evaluation of an IM interface called BuddySquares that aims to better convey the feeling of being in the presence of IM contacts.

By analyzing the data trace left by persistent conversations, we were able to extract information that reveals the character of dyadic IM relationships, which lead us to the notion of *persistent presence*. By visualizing this richer presence data as a dynamic, two dimensional radial image on the computer desktop, we created a new IM interface that distinguishes individual online social spaces and makes them more personal and real for users.

In accordance with the symbolic nature of presence data, we developed a minimalist and abstract visualization, taking cues from the graphic design work of Tufte and IM programs such as *Chat Circles*, as well as the principles of perception as laid out in Gestalt Theory. We positioned our visualization peripherally, since presence data is generally non-critical and peripheral information.

We built an *active mode* for BuddySquares that turns the visualization into a working IM interface, allowing instant messages to be sent, detailed presence data for individual contacts to be revealed and the ability to rearrange the layout of the graphics. The aim was to build a social visualization of maximum usefulness, by incorporating critical IM functionality directly into the graphics.

A two-week online field trial of the software was conducted involving six participants. The results, although inconclusive, indicate support for the idea of building IM interfaces that better communicate presence data. Our aesthetic approach was somewhat validated, although greater customizability of the visualization was desired. The idea of using the computer desktop as a peripheral display was met with resistance, suggesting that future work, aside from conducting a more controlled and extensive study, should involve investigating alternative external, ambient display devices for the visualization. Of these, we conclude that BuddySquares would be especially suited as a wall projection, due to its aesthetic appeal and the abstract design that guards the user's privacy.

Appendix

Tables of Results

Sessions	Duration (mins)	Max Online Contacts	Min Online Contacts	Active Time (mins)	Active Time (%)	All Contacts Time (mins)	All Contacts Time (%)	Dragging Feature Used?	IMs Sent
Participant A									
6/21/2006 10:26	12.50	5.00	5.00	8.38	67.07	0.00	0.00	yes	11.00
6/22/2006 21:36	94.66	3.00	2.00	22.64	23.92	22.54	23.82	no	0.00
6/22/2006 23:24	122.89	3.00	1.00	0.00	0.00	0.00	0.00	no	0.00
Average	76.68	3.67	2.67	10.34	30.33	7.51	7.94		3.67
Total	230.04			31.02	13.48	22.54	9.80		11.00
Participant B									
6/20/2006 22:57	0.80	7.00	7.00	0.50	62.85	0.48	59.77	no	0.00
6/20/2006 22:58	18.70	7.00	6.00	18.32	97.96	18.29	97.80	no	0.00
6/25/2006 1:36	4.19	6.00	6.00	0.00	0.00	0.00	0.00	no	0.00
Average	7.90	6.67	6.33	6.27	53.60	6.26	52.53		0.00
Total	23.69			18.82	79.44	18.77	79.22		0.00
Participant C									
6/19/2006 23:44	2.54	0.00	0.00	0.00	0.00	0.00	0.00	no	0.00
TOTAL	**253.73**			**49.84**	**19.64**	**41.31**	**16.28**		**11.00**

Table .1: Usage statistics gathered during the user study of BuddySquares

Statements (N = 4)	**1 (%)**	**2 (%)**	**3 (%)**	**4 (%)**	**5 (%)**	**Mean**
I enjoyed using BuddySquares	25	0	0	25	50	3.75
I used the program in place of my regular MSN chat program	25	0	25	25	25	3.25
I often ran the program for periods in excess of 3 hours	25	50	0	25	0	2.25
I prefer the program to my usual instant messenger of choice	25	25	25	25	0	2.5
I found the interface easy to understand	0	0	50	0	50	4
I found the interface easy to control	0	0	25	25	50	4.25
I found the program responsive to commands	25	0	50	0	25	3
The program often crashed or I often had to restart the program	25	0	25	50	0	3
The information displayed on the interface was interesting	0	0	0	25	75	4.75
The information displayed on the interface was useful	0	25	25	25	25	3.5
I believed the information displayed to be accurate	0	0	0	50	50	4.5
I preferred the active to the inactive mode	0	0	50	25	25	3.75
When not interacting with the program, I would leave it in inactive mode	0	0	50	25	25	3.75
I often used the program to send instant messages	25	50	0	25	0	2.25
I often used the program to monitor who was online	25	0	0	75	0	3.25
By using the program, I learned about my relationships with my contacts	0	25	25	25	25	3.5
The program altered my instant messaging habits	0	25	75	0	0	2.75
I think the display is aesthetically pleasing	0	25	0	50	25	3.75
In active mode, I liked the pop-up information boxes	0	25	25	0	50	3.75
In active mode, I liked the ability to drag my contacts	0	0	25	25	50	4.25
I preferred viewing all contacts to just online contacts	25	0	0	75	0	3.25
Running the program as the desktop wallpaper was practical	50	25	0	0	25	2.25
I didn't mind replacing my desktop wallpaper with the program's display	50	25	0	0	25	2
The display was heavily obstructed by desktop icons	25	25	25	0	25	2.75
The program often distracted me from other tasks	25	0	50	25	0	2.75
I will continue to use this software	50	0	25	25	0	2.25

Table .2: Responses to the Likert scale questions of the post-study survey. 1 = strongly disagree, 5 = strongly agree

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