

THE UNIVERSITY OF CALGARY

Community Bar: Designing for Informal Awareness and Casual Interaction

by

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# Abstract

The Community Bar (CB) is groupware supporting informal awareness and casual interaction for small social groups of people with a common purpose. CB's design supports how communities of ad-hoc and long-standing groups are built and sustained: by maintaining awareness of one another and being able to casually transition into interaction. I begin this thesis by deriving design guidelines for awareness and interaction, primarily based on a comprehensive sociological theory. I then describe how CB was implemented according to the guidelines. I also describe the architectural design that supports awareness and interaction within a distributed group, including an extensible plugin architecture allowing customisation of CB's functionality. Finally, along with some colleagues, I conducted an in-depth field study of CB. We used results from this study to reflect upon the matches and mis-matches that occurred between the theoretical usage behaviour predicted by the design principles versus the actual usage behaviours observed in the deployed implementation.

# Publications

Some of the materials, ideas, and figures in this thesis have appeared previously in the following publications:

## Full Papers:

McEwan, G., Greenberg, S., Rounding, M. and Boyle, M. (2006) **Groupware Plug-ins: A Case Study of Extending Collaboration Functionality through Media Items.** Proceedings of the International Conference on Collaboration Technologies (CollabTech 2006), (July 13-14, Tsukuba, Japan).

McEwan, G., and Greenberg, S. (2005) **Supporting Social Worlds with the Community Bar.** Proceedings of the ACM Group 2005 Conference, (Nov 6-9, Sanibel Island, Florida), ACM Press.

McEwan, G. (2004) **Community Bar: Awareness, Interaction and Everything Between.** Western Canadian Computer Graphics Symposium (SkiGraph'04, Mar 28-31).

## Workshop Papers:

McEwan, G. and Greenberg, S. (2005) **Community Bar: Designing for Awareness and Interaction.** ACM CHI 2005 Workshop on Awareness systems: Known Results, Theory, Concepts and Future Challenges. Organized by Markopoulos, Panos, de Ruyter, Boris, and Mackay, Wendy. April, 2005.

McEwan, G. and Greenberg, S. (2005) **Community Bar Places for Collaboration.** In Luigina Ciolfi, Geraldine Fitzpatrick and Liam Bannon (Eds) “Workshop Proceedings Settings for Collaboration: The Role of Place”, held in conjunction with ECSCW 2005, Sept 18, Paris.

## Technical Reports:

Romero, N., McEwan, G. and Greenberg, S. (2006) **A Field Study of Community Bar: (Mis)-matches between Theory and Practice.** Report 2006-826-19, Department of Computer Science, University of Calgary, Calgary, Alberta, Canada, T2N 1N4, March 17th. (<http://grouplab.cpsc.ucalgary.ca/papers>) (In preparation for submission)

Young, J., McEwan G., Greenberg, S. and Sharlin, E. (2006) **Moving a Media Space into the Real World through Group-Robot Interaction.** Technical Report 2006-827-20, Department of Computer Science, University of Calgary, Calgary, Alberta, Canada, T2N 1N4. March 17th. (<http://grouplab.cpsc.ucalgary.ca/papers>)

## Videos:

Tee, K., Greenberg, S., Gutwin, C. and McEwan, G. (2006) **Shared Desktop Media Item: the Video.** Video Proceedings of CSCW – International Conference on Computer Supported Cooperative Work, November, 2006.

McEwan, G., and Greenberg, S. (2005) **Community Bar (The Video)**. Video Proceedings of ECSCW - European Conference on Computer Supported Cooperative Work (Sept 18-22, Paris).

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# Chapter 1. Introduction

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## 1.1 Context and Motivation

Various studies of white collar work sites report that a large portion of peoples' time is spent in unplanned, casual interactions with collocated co-workers (Kraut et al 1990, Whittaker et al 1994). In contrast to formal meetings, casual interactions are unplanned, brief, frequent, and usually engage small groups of people familiar with one another (Whittaker et al 1994). While seemingly mundane, these casual interactions prove important. They keep individuals informed about each other in social and professional contexts, they reinforce social bonds, and they make the transition to tightly-coupled collaboration easier (Kraut et al 1990, Whittaker et al 1994). These tightly-coupled collaborations easily take advantage of near-by work artefacts to progress naturally to artefact-centric work.

Casual interactions are stimulated by physical proximity. Kraut et al (1990) found that members of a group will acquire informal awareness of each other, such as knowledge about presence, activity, and availability, and this knowledge leads to opportunities for people to engage in light-weight casual interactions at appropriate times and in an appropriate manner.

However, the same study also found that casual interactions are severely affected by physical separation, with an exponential drop-off in their number over even small distances

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<sup>1</sup> Some of the material in this chapter has already appeared in McEwan (2004), McEwan and Greenberg (2005a), McEwan and Greenberg (2005b) and McEwan and Greenberg (2005c).

such as that between offices at ends of the same hallway (Kraut et al 1990, Whittaker et al 1994). This means that distributed communities of co-workers miss out on important interaction opportunities. In response, groupware developers have created a myriad of informal awareness and casual interaction tools; each tool typically providing mechanisms for displaying informal awareness information that can lead to casual interactions between distributed group members. Three popular examples are text-based Instant Messengers (IM) (Nardi et al 2000), chat rooms / MUDDS (Curtis and Nichols 1994), and video-based media spaces (Bly et al 1993). These genres of tools, especially IM, have proved immensely valuable in practice. For example, while most IM systems provide only a rudimentary indication of other people's presence, even this minimal information is enough to create opportunities for textual chats. The lesson is that even a very small amount of awareness information combined with a crude communication medium is enough to trigger the casual interactions desired by a community.

Yet even the most widely accepted of these tools are shallow caricatures in terms of how they support the social practices of the individuals and groups that use them. Instant Messengers treat one's social communities as a disparate set of buddy lists, where they favour isolated chats between two people. Chat groups and their variants have rigid notions of how groups are defined, how people become members, how people present themselves to others, and how conversations are publicized. From a social science perspective, communities are far more dynamic than that.

## **1.2 Goals and Methods**

My goal is to create tools that go beyond this basic support of casual interaction. More specifically, I have used social science theory to inform the design of a tool to support informal awareness and casual interaction within small groups of people.

My approach is to ground development of casual interaction tools in social science theory. In particular, the theoretical grounding that I use comes from:

- the research into informal awareness and casual interaction cited above (Kraut et al 1990, Whittaker et al 1994);
- the Locales Framework (Fitzpatrick 2003) which is one of the few comprehensive theoretical group interaction frameworks in the computer science field; and
- the Focus and Nimbus model of awareness (Rodden 1996).

From these sources I derived eleven design principles for design of informal awareness and casual interaction tools. I then combined these principles, which are overlapping and inter-related, into four *themes*. The themes identify and isolate the key messages of the eleven principles.

As I show shortly, I have applied these design principles, to the design of the Community Bar, a groupware tool that supplies ad hoc groups with rich awareness information and opportunities to transition to casual interaction. The Community Bar also leverages and extends three previously introduced design ideas. First, *media items* (Rounding 2004, Greenberg and Rounding 2000) are used as groupware building blocks to offer rich multimedia awareness and interaction capabilities between members of a group. Second, these items are embedded within the *sidebar metaphor* (Cadiz et al 2002), where a person sees awareness information of different groups at the screen's periphery, and can selectively drill down to more information and interaction. Third, the system is designed as an extensible toolkit that allows others to add to the base capabilities of Community Bar. This is important as different groups will have different interaction needs, and so third party developers should be able to add functionality to meet the particular needs of their group.

Finally, some colleagues and I performed a field study evaluation on the Community Bar system. We used the results of the evaluation to reflect upon the design principles as well as the effectiveness of their implementation in the Community Bar. The results were extremely positive with regards to the principles themselves and, while showing some areas for improvement in the implementation of the principles, are mostly positive for the Community Bar implementation.



## 1.3 Contributions

As suggested above, there are four major contributions in this thesis:

1. **Derivation of design principles for building informal awareness and casual interaction systems.** A large part of this contribution is documenting the process by which I identified and extracted these principles from the sociological theory.
2. **The Community Bar, an example system developed using the design principles.** The Community Bar demonstrates how I interpreted the principles for implementation.
3. **Evaluation of Community Bar and the design principles.** The study is used to reflect on and evaluate the previous two contributions.
4. **A toolkit allowing third party development of Community Bar media items.** The toolkit allows groups to customise the interaction functionality of Community Bar to match their requirements.

## 1.4 Thesis Overview

This thesis follows the progression suggested by the above research goals by first investigating the theory to extract design principles, followed by a description of the Community Bar design and implementation, and finishing with an evaluation of the implementation.

Chapter 2 begins with a description of the theoretical background used for this thesis. The theory is used to derive a list of design principles which are then combined into four themes to inform the design.

Chapter 3 describes the Community Bar application interface, with specific reference to how it implements the design guidelines from Chapter 2.

Chapter 4 is a small deviation from the main path of the thesis. It describes the architecture of Community Bar, discussing the technical requirements and how they were

fulfilled. During this discussion, the chapter also highlights another smaller, yet important, contribution of this thesis – groupware extensibility through Media Item plugins.

Chapter 5 reports on the evaluation of Community Bar and its design. The chapter describes a field study conducted by myself and some colleagues and the study's results. I then discuss how the results reflect on both the design principles and the Community Bar system.

Finally, I conclude this thesis in Chapter 6. I revisit the research goals and discuss how they have been fulfilled. I also speculate on future research that could be done in response to the work presented here.

## Chapter 2. Theoretical Foundations<sup>2</sup>

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Informal awareness and casual interaction applications are intended to help overcome the disadvantages that distributed teams suffer in comparison to collocated teams. They provide awareness cues and opportunities for informal interaction that are not normally available to distributed groups. However, deconstructing awareness and interaction to arrive at design principles for these tools is difficult.

In this chapter I derive design principles by looking at previous research into how small groups interact and maintain awareness. In section 2.1 I describe research results concerning the role of informal awareness and casual interaction in fostering collaboration. While this discussion is a useful motivator with many useful principles, it provides little guidance in the outcome of system and design trade-offs. In section 2.2 I describe the Locales Framework (Fitzpatrick 2003), a comprehensive sociological theory, to place the design of informal interaction tools within the context of how people work and collaborate in groups. Section 2.3 then describes Rodden's model of awareness (Rodden 1996), which provides more detail on the particulars of awareness, and integrates well with the Locales Framework. We will see that although the Locales theory and Rodden's awareness model are comprehensive and illuminating, they are primarily descriptive and contain little in the way of direct design guidelines. Consequently, after this discussion of theory, I derive a set of design guidelines that are implied from the theoretical descriptions. These design guidelines are used later in Chapter 3 to inform the design of the Community Bar.

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<sup>2</sup> Some of the material in this chapter has already appeared in McEwan (2004), McEwan and Greenberg (2005a), McEwan and Greenberg (2005b) and McEwan and Greenberg (2005c).

## 2.1 Informal Awareness and Casual Interaction

Co-located teams, such as a project team inhabiting a common office space, have a tremendous collaborative advantage over distributed teams. Just by being in the same environment, members of the co-located team gain an informal awareness of each other's presence, activity and availability. As individuals use the physical environment and artefacts around them, they generate cues that communicate important information about their work to other members of the team. For example phone calls and informal meetings can be overheard, and whiteboard notes and calendars can be observed. They constantly engage in short conversations. More importantly, they are aware, in a very lightweight way, of when others are free to engage in such communication. By staying aware of what others are doing, with little effort or interruption to their own work, they can easily determine when opportunities for collaboration arise. Because they are familiar with each other, engaging in collaboration is easier (Kraut et al 1990).

Informal awareness also plays a vital role in providing opportunities for casual interaction, which then leads to successful collaboration. Studies by Whittaker et al (1994) characterise casual interaction as being unplanned, brief and frequent; involving small groups (~2-15 people) familiar with each other; fostering social bonds; and being primarily artefact-centric.

In general, distributed groups miss out on these awareness cues and hence opportunities for casual interaction. As a result, when members of distributed groups wish to converse they expend a relatively large amount of effort in explicit coordination of interaction that would have been comparatively spontaneous and lightweight if they had been collocated. This changes the tone of the interaction to a more formal style that is poor at supporting knowledge-based work in dynamic environments (Kraut et. al. 1990). Even very small separation between group members, as little as 5m, has a detrimental effect.

Awareness systems are made to try to overcome the collaborative limitations of physical distance to collaboration. By placing people within closer virtual proximity they

attempt to compensate for the physical separation and allow informal, casual, and serendipitous encounters which then lead into interaction.

## **2.2 The Locales Framework**

Informal awareness and casual interaction tools are most often designed by considering the practical aspects of casual interaction behaviour in isolation. As an alternative, this thesis explores a more theory based approach. I base the design of the tool on a theoretical framework of how people interact and work in a broader context. One of the few technology-focussed theoretical models that exist in the field of CSCW is the Locales Framework (Fitzpatrick 2003). The Locales Framework is based on sociological theory of how people interact and perform work in a complex social environment.

The Locales Framework describes how people and groups interact and work together, which provides a general structure for thinking about and analysing a collaborative situation. The framework is intended as a conceptual language to foster communication between sociologists (interested in analysis and explanation), and computer scientists (interested primarily in design). As such it provides a very high level description of the larger social context and dynamics of people and groups, rather than a low-level prescription for how to design CSCW systems. Yet the framework is an important foundation to design because it indicates the areas that need to be analysed and supported in the social setting, and it provides context for how each aspect of the work environment relates to the whole.

The following section is my summary of the Locales Framework as described in Fitzpatrick's book (Fitzpatrick 2003). I stress that this necessarily short description leaves out many of the details given in by Fitzpatrick; the book should be considered the definitive and complete source.

### 2.2.1 Overview

The Locales Framework is a complex theory, as it reflects the intricacies of social behaviour. To set the scene I offer a simplified overview of the main concepts of the Locales Framework in Figure 2.1. As illustrated, there are three primary entities of concern: *people*, *sites* and *means*. *People* organise themselves into *social worlds*, defined by the framework as a group with a common purpose. *Sites* are the places where the social worlds perform their activities. The *means* are artefacts used by people within the sites to support the activities. For example, Figure 2.1 shows four social worlds across the top row, labelled with the numerals 1, 2, 3 and 4. These four social worlds are related to each other through the people that belong to them, i.e. social world 1 is a superset of social world 2, and social worlds 3 and 4 overlap with one person belonging to both. The figure also shows four sites, labelled A, B, C and D. A is a virtual site – a shared filesystem, and B through D are physical – two different work rooms (B and D) and a seminar room (C). Each of these sites also contain many means, e.g. the virtual files in A, the computers and desks in B and D and the tables and whiteboards in C.

Next, *Locales* describe the relationship between sites and means in use by social worlds. This means that the locale is different if a different social world uses the same site and means, or if the same social world starts using a different site and means. For example, while social worlds 3 and 4 share the same site and means (seminar room D), the different uses of the room create two distinct locales, labelled V and VI in the figure. To take another example, social world 1 makes use of two different sites and means (filesystem A and work space B) which again creates two distinct locales (I and II).

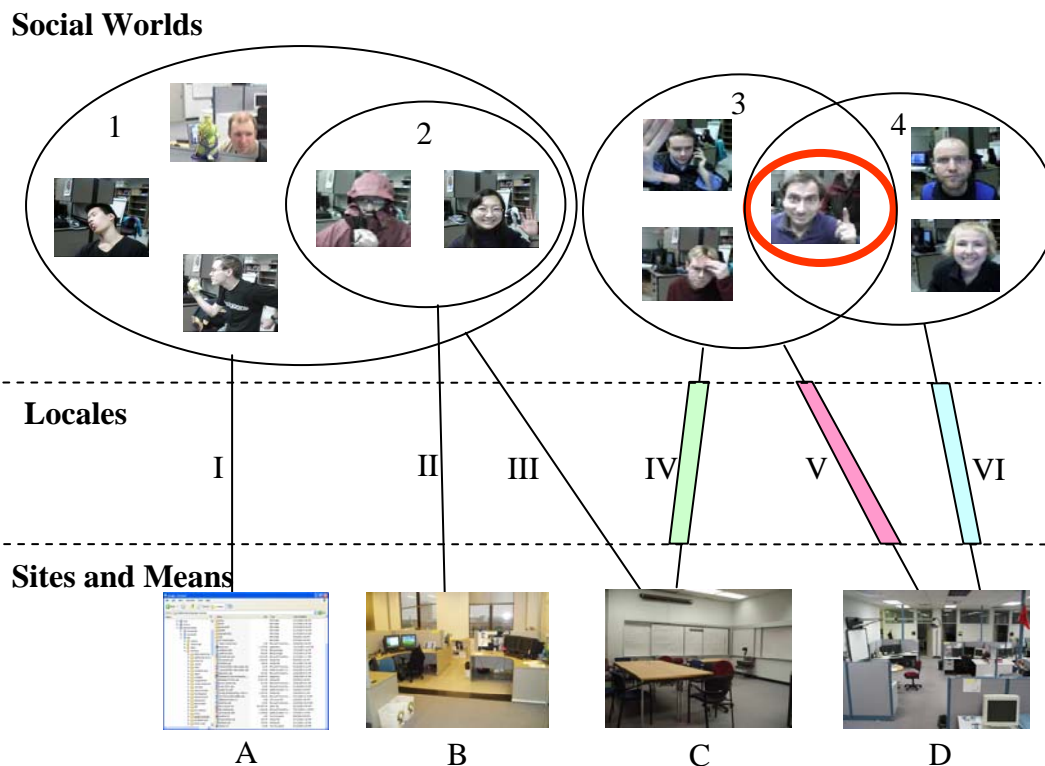


Figure 2.1: Relationships between Social Worlds, Locales and Sites and Means.

Figure 2.1 illustrates an overview of the inter-relationships between multiple social worlds, sites and means, and how these form locales. Figure 2.2 is a different perspective that shows how an individual actor perceives his simultaneous involvement in multiple locales. That is, *Individual Views* describe how an individual perceives her own social context. As can be seen in Figure 2.2, the individual view includes all the locales that the individual is involved in. In particular, Figure 2.2 shows the view of an individual from Figure 2.1 who is involved in three locales. This individual is involved in two social worlds (3 and 4) which, collectively, make use of two sites and means (C and D), creating three locales (IV, V and VI). The individual view contains a view of each locale, which in turn contains views of the people and the sites and means in that locale.

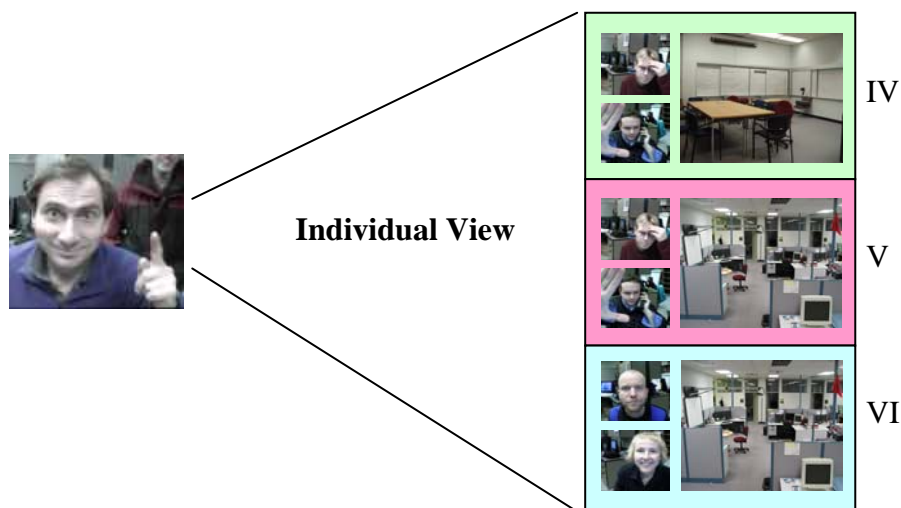


Figure 2.2: Individual View

Subsequent subsections describe other components of the Locales Framework that cover the details and complexities of social systems: centres and peripheries; civic structures; more detail on individual views; interaction trajectories; and mutuality.

### 2.2.2 Centres and Peripheries

The Locales Framework uses the unifying metaphor of *centres and peripheries* to describe social interactions. As we will see, the centre-periphery metaphor provides a much richer understanding of social work practices than the more common boundary metaphor (Fitzpatrick 2003).

Groupware systems usually segregate groups with boundaries, implemented as strictly defined containers. A common example is the use of the rooms metaphor (Dourish and Bly 1992, Gaver et al 1992, Greenberg and Roseman 2003, Rounding and Greenberg 2000). The rooms metaphor ties group membership and activities to a simplified metaphor of a physical room. The room acts as a hard boundary where individuals are either in the group and therefore participating, or out of the group and therefore disengaged. All group activity is solely contained within that area.



In the physical world however, rooms do not have hard boundaries. Rather, most rooms are “leaky”. People can stand in doorways and be part of two rooms. Noises can be heard outside the room, giving those in adjoining rooms some low-level sense of participation in the room activities. People can glance in and out of partially open doors, or through windows. Thus the room can be considered the centre, allowing different levels of peripheral engagement: inside the room; the transitions (i.e. doorway, windows); just outside; and surrounding hallways, rooms, etc. Similarly, interaction between people can be considered at different levels of peripheral engagement, i.e. those inside, those at the transition, and those outside.

Within the Locales Framework, social world membership is not simply viewed as a binary function, but as a complex relationship between the *centre* of the social world, defined as the common purpose of the social world (see the earlier definition of social world) and each person. Boundaries can be established by creating cut-off condition in relation to the centre. For example, rather than just saying Amy and Charles are members of a group and Bob is not; we might say Amy is part of the core group, involved in organising and running its activities, Charles is a peripheral member, only participating sometimes. While Amy and Charles know Bob, and Bob is aware of the group, he is far out on the group’s periphery, and therefore outside the group membership boundary.

The centres and peripheries concept of variable strength relationships is not just limited to the relationship people have with social worlds. It also extends to relationships between people, between sites and means, between people and sites, between sites and social worlds, etc. Each pair of entities has a level of engagement.

Entities’ (people, social worlds, sites) relationships to centres are multi-dimensional. To properly characterise the relationship of a person to a social world, it may be necessary to take into account their commitment to the social world, their participation in social world activities, the communication means available between them and the rest of the members, how all these aspects change over time and so on.

### 2.2.3 Civic Structures

No social world operates in isolation. Members are involved in multiple worlds at once, social worlds exist within broader organisational structures, and sometimes smaller sub-worlds are contained within the social world. An analysis of the *Civic Structures* describes the relevant outside influences on the social world.

For example, the social world of the Interactions Laboratory at the University of Calgary (iLab) is influenced by many other social worlds through many types of relationships. These relationships include: membership overlap, such as the classes that iLab people teach; organisational structure, such as the Department of Computer Science and the University itself; collaborative involvement, such as with other research laboratories; and funding relationships, such as with the National Science and Engineering Research Council (NSERC). Each of these other social worlds, along with many others, has a large influence on how the members of the iLab social world perform their activities.

### 2.2.4 Individual Views

Individuals are involved in multiple different social worlds at one time, and within each social world they maintain a different level of engagement. The Individual Views concept, introduced in section 2.2.1, takes these two factors into account.

As an individual engages in work, he/she is rarely involved in a single task to the exclusion of all others (Fitzpatrick 2003). They will engage in multiple different tasks, across different social worlds, simultaneously. The level of engagement with each task varies over time.

There are two important aspects to be considered; a *view* on a locale, and an individual's *viewset* across multiple locales. A view is how an individual sees the people and the sites and means in a single locale. A viewset incorporates the individual's views of all their locales. For example, Figure 2.2 shows an individual's viewset consisting of three views - one view each for the locales IV, V and VI.

Each individual's view onto a particular locale may be different. The difference arises from their distance from the centre or how far they are on the periphery. Someone close to the centre may see all the information about the social world and the site and means, while another person on the periphery may only want to see coarser grained information. For example, if the person in Figure 2.2 became more interested in locale IV (moved toward the centre) he might begin to see video feeds of the people and more about the content of the meeting in the seminar room, and if he became less interested in locale V he might only see that there were two people in it without their pictures.

### **2.2.5 Interaction Trajectory**

*Interaction Trajectories* describe how all entities – social worlds, locales, people, sites, means – change over time. For example: social worlds change their members, goals, locales, structure, etc; people change their minds and moods; documents (as a type of means) are created, printed, modified, and destroyed. Knowing the past history, present situation, and future goals are all important for creating plans and strategies.

The trajectories of people and objects can cross and move together as they are involved in the same task. A document's trajectory becomes intertwined with that of the person working on it. If there are several people working on it together then their trajectories also become intertwined with each other. The degree of intertwining is known as *work coupling*.

Views, and consequently viewsets, change continuously as well. People's involvement with locales is highly dynamic. Each time a person engages in a task they will have a particular viewset onto their locales. When they change task, the viewset will change accordingly as their interest, and view, of each locale also changes. Changing tasks can be a fairly frequent activity, so we see that not only are views changing, but that they are changing often and quickly.

### **2.2.6 Mutuality.**

Awareness of people, spaces and resources is vital for collaboration within the social world. However, Fitzpatrick (2003) further teases apart the definition of *mutuality* into provision and reception of the awareness information. Members of the social world make information about themselves and their activities available to others. Others then perceive the information and become aware. This separation is important as not all provided information is always received. That is, awareness of others is the interaction of provision of information by a person, and another's reception of that information.

For analysing the social world and its structure, it is important to know the *mechanisms for mutuality*. The mechanisms are the means for provision and reception of the awareness information. Mechanisms are specified by medium (e.g. soundwaves through air, text chat), temporal coupling (e.g. synchronous/asynchronous), spatial coupling (e.g. collocated/distributed, layout), and work coupling (discussed previously in Interaction Trajectory).

## **2.3 Focus, Nimbus, and Awareness**

In section 2.1 I described how awareness is crucial if distant collaborators are to engage in casual interaction. If we apply the Locales Framework to the problem of affording informal awareness, we see that it implies that awareness cannot be described as a simple “on” or “off”, but only in terms of the interplay between information provision and reception. The problem is that the Locales Framework is presented at too high a level to assist much in understanding how awareness is composed. Understanding awareness at a lower level is necessary to design tools that support it.

Awareness is complex. The complexity can be seen even through the relatively simple example of an instant messaging (IM) system. At the lowest level there is the distinction between people that are known (on the contact list) and unknown (off the contact list). Amongst the known people there is awareness of online and offline status. Online people also display availability information, such as “busy” or “idle”, giving a

different type of awareness. IM clients also have other states, such as “be right back” or “out to lunch”, that provide information about future availability. Many clients allow the users to change all or part of their display names as well. The text names are often used by the client’s owner to indicate where they are, what they are doing, when they expect to be online, what their state of mind is, and much other abstract awareness information (Smale and Greenberg 2005). A much higher level of awareness within IM occurs when people are interacting through text chat tools. Sometimes they are also able to display static images that provide some extra awareness of the other person. IM clients may even allow video images and desktop sharing for extra context awareness during the conversation and collaboration tasks. Thus, even a simple IM client provides awareness at many levels and in many dimensions.

Also clearly seen in the IM example is that awareness is not dependent on a single person. Awareness is the result of an interaction and negotiation between two people. One person can control how they are represented in the tool by altering their online/offline status, changing their display name, requesting conversation, and so on. The viewer also has control over their own client by removing and adding contacts, collapsing groups of contacts, accepting and rejecting interaction queries from other users, or even something as simple as deciding when to scan the list.

Due to the multidimensional complexity of awareness, it is difficult to directly derive tractable design principles for systems that support the subtleties of awareness. Instead I appeal to an established theory that deconstructs the complexity of awareness for cooperative applications; the focus/nimbus model (Rodden 1996)<sup>3</sup>.

As we will see, the focus/nimbus model integrates well with the Locales Framework. The work is complementary, taking up the discussion of mutuality where the framework leaves off. Mutuality in the Locales Framework is described in terms of the interaction between provision and reception of awareness information. The focus/nimbus model also

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<sup>3</sup> The origin of the model describing focus, nimbus and awareness is actually work done by Benford and Fahlen (1993) where it was developed for interaction in 3D virtual environments. I reference the Rodden (1996) paper because it generalized the original work for application in non-spatial settings.

uses these concepts; calling the provision of awareness information *nimbus*, and the reception of awareness information *focus*. Both the focus/nimbus model and the Locales Framework (through the centres and peripheries concept) define awareness as a continuous variable.

### 2.3.1 Awareness from Focus and Nimbus

Awareness exists within an environment. The environment contains objects which give off some kind of stimulus. Some of the objects have sensory abilities allowing them to observe other objects. Sensing objects will be referred to as observers, though of course they (usually) can potentially be observed as well. Objects can control, to some degree, the stimuli that they produce. Observers generally have some control over what they sense and, in some cases, how they sense it. The environment has rules that define how the stimuli are propagated and the capabilities of the sensory equipment.

*Nimbus* refers to a field of a single type of stimuli produced by an object. *Focus* refers to a field of a single type of sense used by the observer.

Awareness is the overlap of all the foci of the observer with all the object's nimbi. The awareness can be zero when there is no overlap, minimal when few of the foci overlap with the nimbi or there is only a small overlap, to a maximal value when the observer can sense all of the object's stimuli.

For example, in Figure 2.3 person<sub>B</sub> presents information, which is called nimbus, represented by the circle, and person<sub>A</sub> is able to perceive that information with their focus, represented by the triangle. The overlap of the focus of A with the nimbus of B is the awareness that A has of B.

The values of the theory are: (1) awareness is defined by both the observer and the object; and (2) awareness is a continuous function.

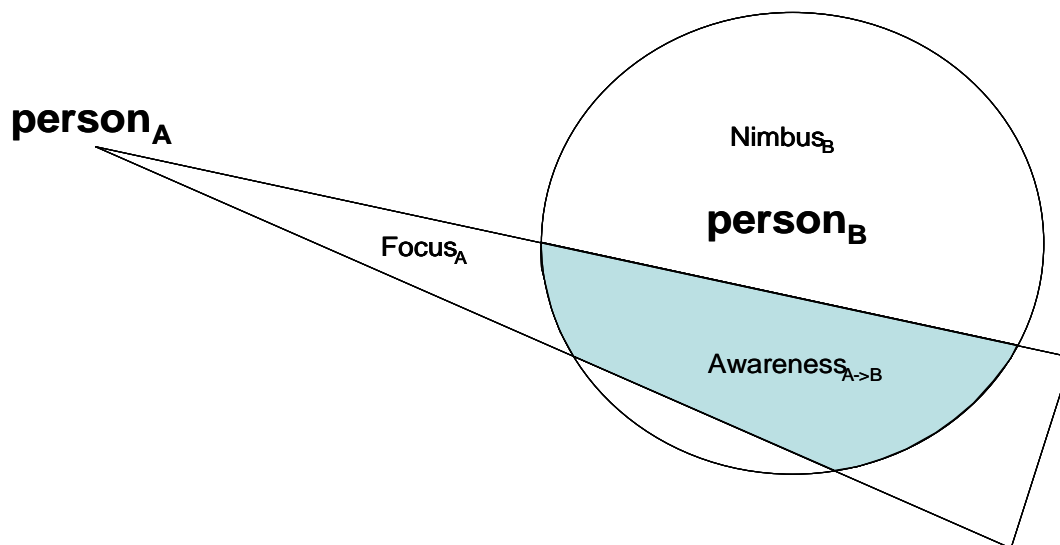


Figure 2.3: Focus and Nimbus Model of Awareness.

In a collocated setting, the environment is the four-dimensional physical world that we all inhabit. Objects (including people) have stimuli that propagate into the environment; for example they reflect and absorb light, have temperature, different textures and firmness, and make noises. Observers have sensory abilities that can perceive some of these stimuli; observers see, hear, smell, taste, and touch objects around them. The environment defines how the stimuli propagate; for example objects can be seen from a distance but only felt when in direct contact. People can control how they appear to others by the way they dress, style their hair, etc. and also by where they place themselves in the environment; using private and public spaces, walls, cubicles, etc.

A physical world example is shown in Figure 2.4. In the leftmost picture, Jim has a high nimbus and Kim has a high focus on him, so Kim's awareness of Jim is high. In the centre picture, even though Jim's nimbus is still high, Kim has directed her focus away so that she no longer has any (visual) awareness of him. In the final picture on the right, Kim has returned her focus to Jim but he has reduced his nimbus by hiding behind the piece of paper so her awareness of him is reduced.

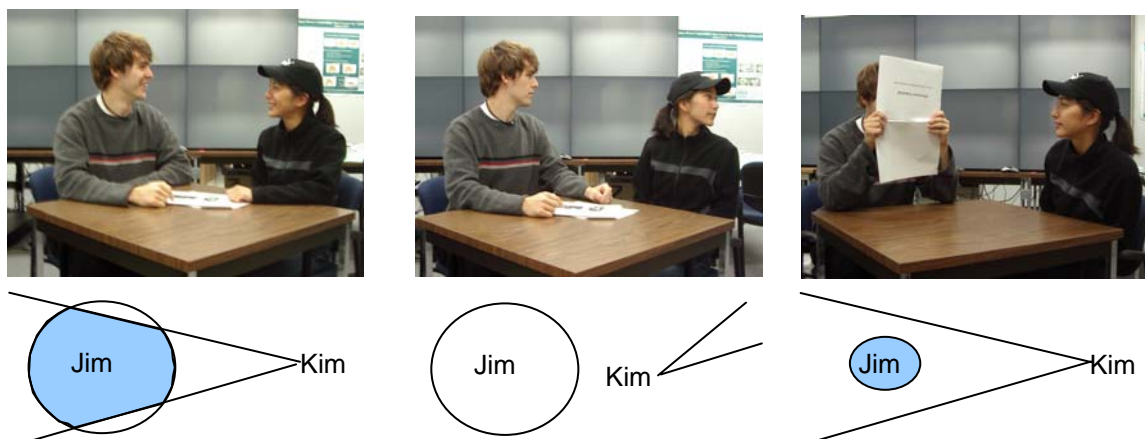


Figure 2.4: Jim and Kim demonstrate focus and nimbus.

In an IM system the environment is virtual and operates very differently from the physical world. Objects are virtual representations of people. Stimuli from these virtual representations include status, display names, text chat, files, video, pictures, and sometimes collaborative desktop sharing. Observers perceive these stimuli but in a personalised way. The observer decides how people are organised into groups in their view – a lot more control over perception than is afforded in the physical environment. Observers can remove people from view completely; offline people can be made invisible; alerts (when others come online or want to converse) can be turned on or off; amongst many other controls. The environment controls how these stimuli propagate and the control of the senses that each person has. People decide how and when to scan the awareness information, and how to attend further to particular items of interest (thus increasing focus).

### 2.3.2 Conversation

An interesting implication of the principles in the model is the transition from low-level awareness to conversational interaction. These two seemingly different states can be seen as points on an awareness continuum.

For example, if Alice wishes to start a conversation with Bob, at first she will direct her focus on Bob, becoming more aware of him. Bob's nimbus, the perceptual visual information about him, gives cues as to his availability. If Alice perceives that Bob is available for conversation, she will proceed by increasing her own nimbus, i.e. saying his



name (auditory nimbus) or sending an IM message (virtual IM nimbus), so that Bob's awareness of her is increased. Bob then directs more of his focus towards Alice, increasing his awareness of her. Once a suitable level of mutual awareness is reached, they engage in conversation. At the end of the conversation, their awareness of each other is negotiated back down to the level that it was before.

The interesting aspect of this interaction is the negotiation of the participants in affecting their own and each other's awareness to arrive at a place where they can interact. The socially active negotiation allows for unsuccessful attempts as well. If Bob is busy then Alice will (probably) notice it when she first starts the process and can terminate at that point. If she doesn't notice then there is also space within the negotiation process for Bob to refuse the interaction by indicating that he is otherwise engaged.

Inherent in the model is the ability of the observed to have control over the awareness of the observer through the control of nimbus. Alice did this when she attracted Bob's attention to the fact that she wished to talk to him.

## **2.4 Design Implications**

The prior work on casual interaction and the above theories describe social phenomena. However, they do not state criteria for groupware design. In this section, we transform the theory into groupware design principles. Lack of space precludes discussion of how each principle was derived from the theories, but the relationship between the two should be self evident. Most restate the major points discussed in the theories as design imperatives. Principles 1 to 4 are derived from the informal awareness and casual interaction literature, e.g., (Kraut et al 1990, Whittaker et al 1994). Principles 5 to 8 are from Greenberg et al's transformation of the Locales Framework into heuristic evaluation principles for groupware (Greenberg et al 2000). Principles 9 to 11 are from the focus and nimbus model of awareness (Rodden 1996).

1. **Information should be always visible at the periphery.** Awareness information needs to be constant and dynamic to maintain knowledge of the surrounding environment. However, it should not interfere with focus on other tasks.
2. **Allow lightweight transitions from awareness to interaction.** A primary benefit of having informal, peripheral awareness is to serve as a basis for casual interaction. As casual interactions have to be lightweight, unplanned, and frequent, any tool that supports them must also reflect these properties.
3. **Support small groups of intimate collaborators.** Informal awareness and casual interaction are beneficial to small groups of people (~2-15) that know each other well.
4. **Provide rich information sources and communication channels.** Awareness can be based on many different cues. The more information that is presented, the better people are able to interpret awareness information. Casual interaction also takes many forms and so there is a requirement for multiple ways of sharing and communicating.
5. **Provide centres (locales).** People work in multiple contexts simultaneously, switching between them. The design of informal awareness / interaction tools should provide centres or locales that comprise a site and means for social worlds.
6. **Provide a way to organise and relate locales to one another (civic structures).** Locales relate to each other in different ways. A representation of an individual's locales needs to allow the relationships between the locales to be expressed.
7. **Allow individual views.** Each person interacts with a set of locales in different ways. As their level of engagement across their viewset changes, so they should be able to change the presentation content of locales as well as the objects and people contained in the locales.
8. **Allow people to manage and stay aware of their evolving interactions over time.** Awareness and casual interaction information is especially time sensitive and must be kept up to date. Users also require knowledge of their current state in terms of past actions and future goals for planning.

9. **Provide methods for controlling focus.** As an individual's interest in their locales changes over time, he or she needs to be able to adjust his or her focus onto the locales as well as the people and artefacts within them.
10. **Provide methods for controlling nimbus.** Similarly, an individual needs to be able to adjust his or her nimbus (what others are able to see). That is, people need to adjust how they visible within their interaction context, or to restrict what others can see because of privacy concerns.
11. **Represent changes in awareness by varying information content and interaction affordances.** The user's awareness of another person, artefact, or place is represented by the information that is available about it. When the awareness is changed, either through a variation in the focus or the nimbus, the presented information content should change accordingly.

As simplified restatements of a rich previous work, these principles omit many of their subtleties if taken by themselves; thus I recommend that designers who use these should be at least somewhat knowledgeable of the underlying theory. I also believe that the richness of these principles lies in how they can be combined *vs.* considering each in isolation. My design of the Community Bar, described in Section 4, stems from four particular combinations of the principles, outlined below, that shaped my thinking of systems supporting casual interaction.

**Multiple social worlds through public locales.** Principles 3, 5 and 6 argue that each person inhabits multiple social worlds, which means that any system should somehow let a person inhabit these multiple worlds at the same time. Principles 3, 4, 5 and 8 talk about the richness of the information shared by these groups, which I believe implies that the people, artefacts, and conversations that define a locale should be publicly visible to all who are part of that group, at least by default.

To foreshadow what is to come, the Community Bar extends my earlier work in the Notification Collage project (Greenberg and Rounding 2001, Rounding 2004) by adding facilities for multiple locales, by presenting the information peripherally, by having all

information within locales publicly viewable by the social world, and adding focus / nimbus controls.

**Ad hoc groups.** The research on casual interaction and the Locales Framework (Section 2, and Principles 3, 5-8) tell us that social worlds are plentiful, that their membership (and member involvement) fluctuates, that they may interrelate to one another, and that they have different lifetimes (some are long standing, some form and dissolve rapidly). Yet most systems have very rudimentary notions of ‘groups’, let alone the richer concept of a social world.

A limitation in most systems is that the formation of ad hoc groups is unsupported or heavyweight. In the Community Bar design, a priority was to support quick, lightweight formation of social worlds by enabling people to rapidly setup and join both short and long-term locales.

**Lightweight transitions from peripheral awareness to foreground interaction.** Various principles collectively suggest a tension between a person’s desire for a minimal amount of unobtrusive yet dynamic awareness information of their intimate collaborators (Principles 1 and 3), the need to acquire and explore richer forms of that information or to open rich communication channels as desired (Principle 4), and the need to act upon that information and/or engage in communication (Principle 2). As we will see in the Community Bar, I relieve this tension by offering people a progressive view of information. Basic awareness information is placed at the periphery of their screen, and they drill down into that information to gain content and to engage in conversations.

**Focus/nimbus control of centre/periphery relationships and mutuality.** Finally, most systems give people a binary choice for their involvement. They are either in or out as a member, and they either see or don’t see awareness information (but see for an exception). This kind of design is directly contradicted by the principles. In particular, I believe the centre and periphery relationship – a central tenet of the Locale Framework – can be represented by the focus/nimbus model (Principles 9-11). Mutuality is the most obvious application of focus/nimbus and the context in which it has been described in this

paper. However, the model also applies to other aspects: membership of locales, individual views and viewsets, and interaction trajectory.

Again foreshadowing what is to come, people using the Community Bar can express their involvement with a locale by adjusting both their nimbus and focus. That is, they can afford or restrict what others see, and can also adjust their viewable details of the locale and its artefacts. In this way, membership of the locale is not binary. By affording or restricting focus/nimbus, membership becomes a fluid movement from centre to periphery.

In summary, the above discussion illustrates the collective implications of the eleven general design principles.

## 2.5 Orbit

The Orbit system (Mansfield et al 1997) is worth discussing here as it was the first system (and the only other system that I am aware of) to explicitly implement the concepts of the Locales Framework. The author of the Locales Framework, Geraldine Fitzpatrick, was a member of the Orbit project team. I was also part of the Orbit project team in the later stages of the project, so it has undoubtedly influenced this thesis work. In this section I will discuss the Orbit-Gold version as it was the most mature.

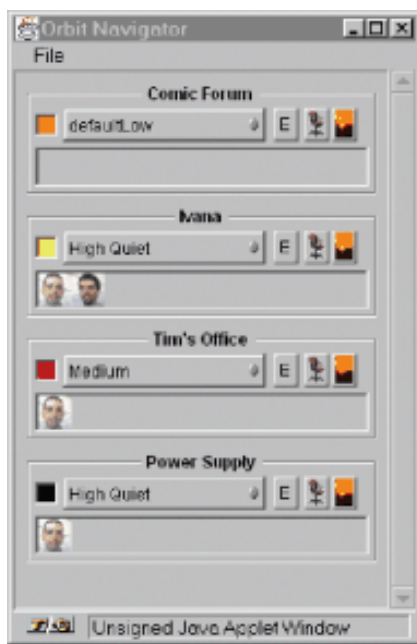
Orbit was designed as a complete, collaborative workspace system, focusing primarily on the framework concepts of locale foundations, individual views and mutuality. The interface consisted of two windows: the navigator (Figure 2.5, left) and the workspace (Figure 2.5, right). Orbit's design focussed on three Local Framework principles: Locale Foundations, Mutuality and Individual Views.

**Locale Foundations.** The navigator window shows a list of the user's locales, each colour coded. For example, in Figure 2.5 the user is a member of four locales, each with its own colour: "Comic Forum" (orange), "Ivana" (yellow), "Tim's Office" (red) and "Power Supply" (black). Each of the locales contains documents, which are shown as icons in the workspace window. Each of the documents have a colour chip that associates them with the

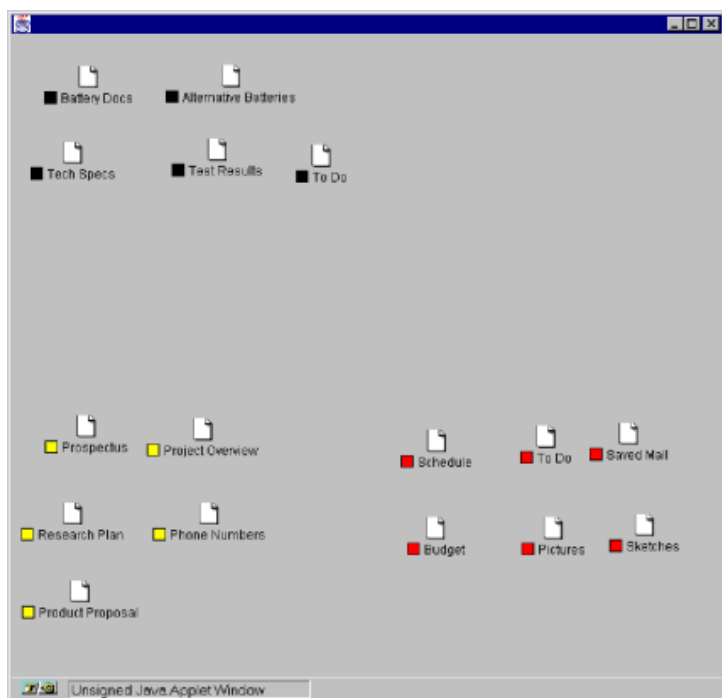
appropriate locale. For example, all of the icons in the top left of the workspace in Figure 2.5 are part of the “Power Supply” locale.

**Mutuality.** Orbit users were able to switch on and off a number of mutuality features. There were simple static pictures, seen in the navigator in Figure 2.5 in all locales except “Comic Forum”, that were simple presence indicators. There were also video feeds in a separate window (not shown) and a group audio feed could also be established. Text chat was provided through integration with the Tickertape tool (Fitzpatrick et al 1998). Nimbus control was implemented through enforced reciprocity, e.g. if I didn’t have your video turned on then you couldn’t see me through video.

**Views.** Each user was able to create, save and reload multiple views of each locale. A view definition included document visibility and mutuality options. Once the user has decided which documents are visible and which mutuality options should be turned on, they can save the view. They are then able to select a view quickly from a drop down list.



Navigator



Workspace

Figure 2.5: Orbit-Gold interface.<sup>4</sup>

In Figure 2.5, the “Comic Forum” locale is currently showing the “defaultLow” view and the “Ivana” locale is showing the “High Quiet” view. The selected documents are then shown in the workspace window, and the view’s mutuality options would be displayed. Users were also free to move the documents around the workspace window as they wished. In Figure 2.5 all the documents are clustered by colour/locale but this is not enforced. By mixing documents, viewsets can be manipulated.

The primary difference between the Orbit project and this thesis work is that the focus of Orbit was as a document collaboration system, while this thesis concentrates on informal awareness and casual interaction. As we shall see in the next chapter, this results in a design that concentrates on providing information about other people.

I also see two primary weaknesses in the Orbit design approach that I have tried to avoid in this work: firstly, Orbit was too explicit in its implementation of the Locales Framework principles; and secondly, Orbit tried to be “everything to everybody.”

The first weakness made Orbit very difficult to use as there were many heavyweight controls for all aspects of the framework, such as creating locales, modifying locale membership, creating views and importing artefacts. I have addressed this through the principles described above, by explicitly mentioning such things as the need for ad hoc groups and by stressing the lightweight aspect of the transition from awareness to interaction.

The second weakness concerns the fact that Orbit was implemented with the idea of being a complete desktop interface with added collaborative features. Because of resource and implementation limitations, doing this properly was not possible and so it was difficult to use Orbit. In contrast the Community Bar, seen in the next chapter, is designed to fill a supportive role with the intention of being used in conjunction with other tools.

The Orbit project investigated the many challenges involved in using the Locales Framework to inform design and it has had a large influence on the work in this thesis.

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<sup>4</sup> Images are taken from my collection of Orbit Project stock screen shots. They may appear or have appeared on various web sites.

## 2.6 Conclusion

In this chapter, I have described the foundation of Community Bar's design. Firstly, I briefly explained the rich body of work that motivates building an informal awareness and casual interaction tool. Secondly, I outlined the sociological theory that I use to decide how such a tool should be built. Finally, I described how I use this motivation and theory to infer design principles.

The design principles were based upon: (1) the research motivating informal awareness and casual interaction opportunities for distributed collaborators; (2) the Locales Framework; and (3) the focus/nimbus model of awareness. These sources informed eleven guidelines, which in turn were combined in four guiding principles:

1. Multiple social worlds through public locales;
2. Ad hoc groups;
3. Lightweight transitions from peripheral awareness to foreground interaction; and
4. Focus/nimbus control of centre/periphery relationships and mutuality.

In the next chapter, these four principles will be used to focus an explanation of Community Bar.



## Chapter 3. Community Bar<sup>5</sup>

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Community Bar (CB) is a groupware tool that provides informal awareness and casual interaction to a small group of distributed intimate collaborators. While ‘smaller’ interface decisions were heavily influenced by the continuous feedback provided by an evolving user community, the major design decisions about CB were based upon the eleven design principles, described in the previous chapter, that were derived from sociological research. The concrete interface design of CB is heavily inspired by Microsoft Sideshow’s sidebar (Cadiz et al 2002); it locates basic awareness information at the periphery while allowing quick drill-down into information when people want to move from awareness into interaction. CB then adds the idea of groupware media items found in the Notification Collage (Greenberg and Rounding 2001, Rounding 2004). These become the building blocks of media-rich locales.

In the rest of this chapter, I first give a brief overview of CB’s interface and then delve into details to describe how CB implements each of the four groups of design principles that were outlined at the end of the previous chapter: Multiple social worlds through public locales; Ad hoc groups; Lightweight transitions from peripheral awareness to foreground casual interactions; and Focus/nimbus control of centre/periphery relationships and mutuality.

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<sup>5</sup> Some of the material in this chapter has already appeared in McEwan (2004), McEwan and Greenberg (2005a), McEwan and Greenberg (2005b), McEwan and Greenberg (2005c), McEwan and Greenberg (2005d), McEwan et al (2006), Romero et al (2006) and Young et al (2006).

### 3.1 An Overview of CB

The CB interface is structured around the following principles. It appears as a *sidebar* divided into *places*. Each place contains several *media items*, which can be viewed in three different ways. The *tile view* appears in the sidebar, where it shows basic awareness information about others. When something of interest occurs in a tile view, people can drill down into the information and interact with it by expanding tiles into a *tooltip grande* (also known as *transients*). Even more information and opportunities for interaction can be obtained by expanding the tooltips further into a *full view* separate window. The content and interaction capabilities of the tiles, tooltips and full views may also depend on whether the viewer is the *owner* of the media item, or an *audience* member. These are detailed below.

**Sidebar display.** The basic profile of CB is a space-conservative bar on the side of the screen that can never be covered by other applications (Figure 3.1, right side; shown in full in Figure 3.2). Borrowing from the sidebar metaphor introduced by Cadiz et al (2002) and popularized further by Google Desktop (<http://desktop.google.com>), the idea is that the

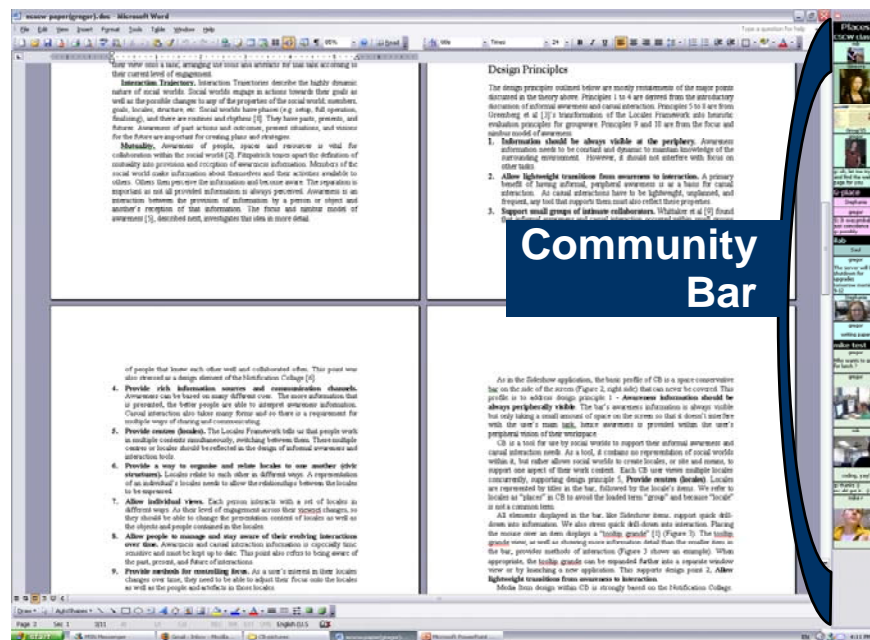


Figure 3.1: Community Bar is a peripheral sidebar on the screen.

sidebar is always on display at the periphery of a person's attention. Its position at the side of the display means that it does not intrude into a person's foreground work. Yet, because it is always visible, it is easily scanned at a glance, and changes (e.g. motion, colour) can attract attention when desired.

**Places.** People are able to create and/or join one or more *places* within CB. Each place appears as a distinct area within the sidebar, containing several media items. A place is a public area for a group of people to interact. In the language of the Locomotion Framework, a place is a virtual locale that defines a site and means for a particular social world. For example, Figure 3.2 shows one person's viewset of four online places, titled: "CSCW class", "G-place", "ilab", and "mike test". The place names, the membership of people to that place, the choice of media items within them (explained shortly) and the content of these items are completely defined by the group on a moment by moment basis. What is especially important is that all members of a place will see the same media items with the same content, although they may view the content in different ways.

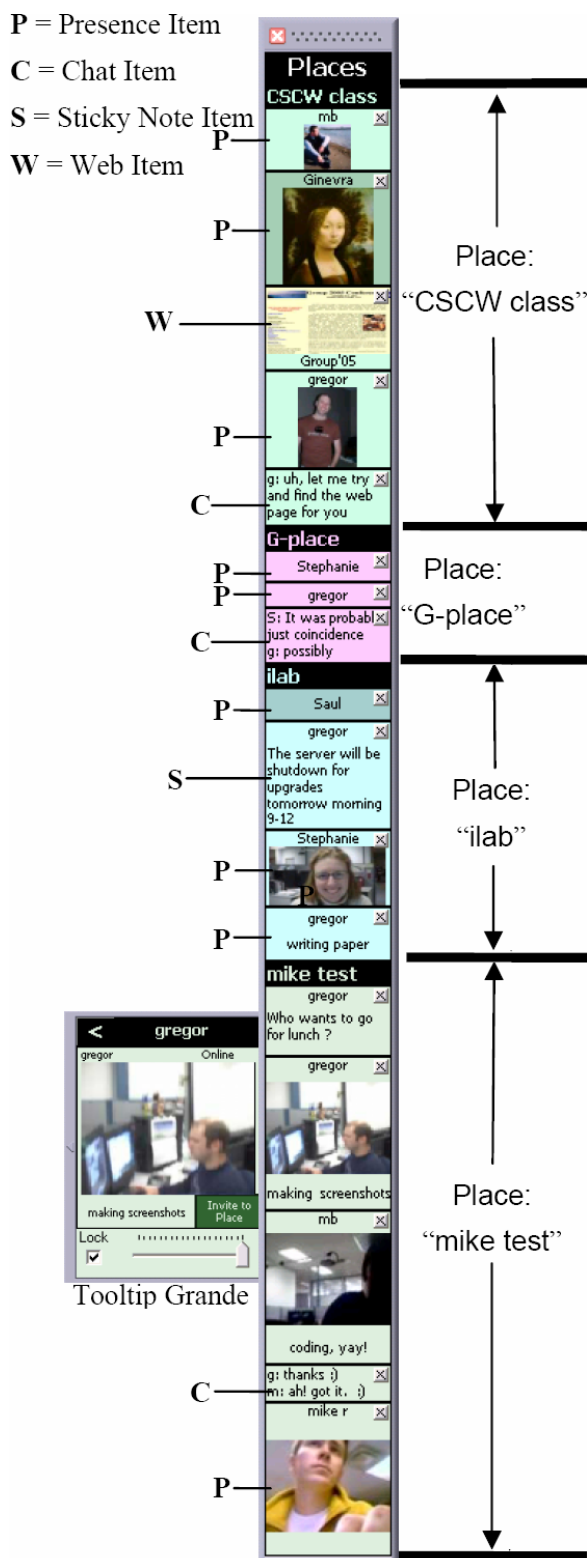


Figure 3.2: The Community Bar

However, different people may be members of a different set of places, which means that each person has an individual viewset of multiple places that they have joined.

For example, in Figure 3.2 “gregor” and “Ginevra” are both members of the “CSCW class” place, so both see all the media items within it. Gregor is also a member of the other three places, so he also sees them in his viewset. Ginevra, however, is not a member of these other places, so she does not see them in her viewset. “mb” sees something different: he is a member of both “CSCW class” and “mike test”, so he sees both of these places. As the figure shows gregor’s viewset, it is also possible that Ginevra and mb are also members of other places that gregor can’t see.

**Media Items.** Each place contains a number of multimedia items (Greenberg and Rounding 2001, Rounding 2004), representing things like people in the world (as live video, photos or names), public conversations (as chat dialogues or sticky notes), or group artefacts (e.g., web pages of common interest). These media items are the means for each locale. Media items are displayed in one of three ways, described below.

**Tile View.** Tiles are the view of the media item displayed in the sidebar itself. The purpose of the tile view is to provide basic awareness information. For example, the “CSCW class” place in Figure 3.2 shows three presence item tiles, each showing a name and a static picture to identify the people they represent. The darker shading on Ginevra’s presence item shows that she is idle, i.e. has not used her mouse or keyboard for a certain amount of time. The place also contains a web item, which shows a comment and a snapshot of the web page itself, and a chat item, which shows the last little bit of the conversation. Each of the tile views shows enough information to enable the viewer to have some basic awareness of the locale activities and to decide whether they want to engage further.

**Tooltip Grande/Transient View.** When a tile captures a person’s attention, he or she can drill down to explore and interact with that information using the tooltip grande (Cadiz et al, 2002). The tooltip grande is a popup window that appears when the user moves their mouse pointer over a tile view. Displayed in the tooltip grande is the transient view of the media item, which displays more information than the tile and offers capabilities for

interaction. The tooltip grande appears and disappears almost immediately as soon as the mouse pointer moves in and out of a tile, allowing a person to quickly scan all the transients simply by moving the mouse down the sidebar.

The purpose of the tooltip grande and transient view is to allow people to quickly inspect information and to perform quick, transitory interactions. For example, the tooltip grande in Figure 3.2 displays the transient view of gregor’s presence media item. While the tile shows a low-fidelity, infrequently updated video snapshot, the transient view shows a higher fidelity and faster frame rate video, as well as allowing the person to invite gregor to a place.

**Full view.** For even more detail and interaction capabilities, a person can raise the *full view* by clicking on the title bar of the tooltip grande. This view is typically a new window, staying on the screen until a person explicitly destroys it, though for some media items the full view is displayed in a separate application (e.g. the web page item which loads the web page in the browser). The full view shows all the information available, presents all the media item’s available functionality, and provides a less transitory mode of interaction than the transient view. For example, the full view of gregor’s presence media item shows high fidelity streaming video and provides a “Push to talk” function (Figure 3.3, top).

**Owner vs Audience.** There are two major roles defined when viewing media items; the *owner*, which is the person who posted the media item to the sidebar, and the *audience*, which is everyone else. An example of the different views of my presence item is shown in Figure 3.3. The full view of the item as seen by the audience, i.e. people other than myself, is shown in Figure 3.3A, right. It contains even higher resolution and higher frame rate video, my picture, and offers its viewer the ability to enter into a vocal conversation through the ‘Push to Talk’ button. My view of the same item is somewhat different (Figure 3.3B, right), where it offers controls to change how others see me, e.g., as a photo or as a video.

Similar capabilities exist for other media items. For example, the tile, transient and full views of the chat item are visible in Figure 3.6. Of special note is the full view of a Place, which fits all the transient views of a place’s media items into a window as a

rectangular grid (same as the Place Tooltip Grande view shown in Figure 3.5). In this manner, the full view of a Place almost completely implements and therefore subsumes all capabilities of the Notification Collage (Greenberg and Rounding 2001, Rounding 2004).

**Focus.** Finally, all tooltip grande popups contain a ‘focus’ slider control (e.g., as seen in the tooltip grande containing the transient view of my presence item in Figure 3.3A) that allows the user to control their personal view of items. Moving the slider from right to left not only shrinks the media item’s tile view in the sidebar, but it also semantically changes the information in the view so that it is appropriate to its reduced size. Similarly, the owner of a Presence media item can adjust a ‘nimbus’ slider control in the separate window view (Figure 3.3B, in the full view) to specify a level of detail which others can only see up to but not beyond. Audience viewers can personalize this view by using their focus slider to reduce this information even further.

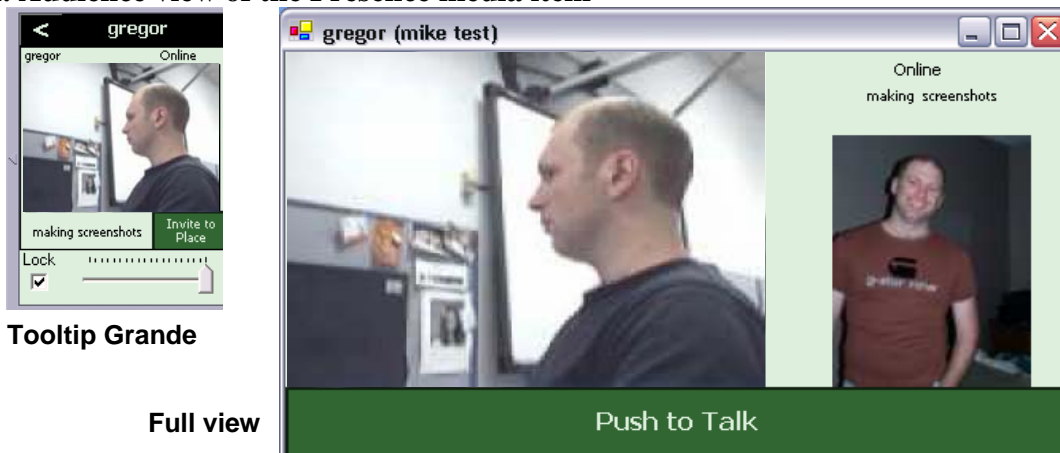
## 3.2 Multiple social worlds through public locales

CB contains no explicit representation of social worlds. Rather, it leaves social worlds in the social sphere and supports them by allowing creation of the *site* and *means* to support that world’s interaction context. These *sites* are the ‘Places’ within CB, while the *means* are the media items within them and their contents. In effect a locale is created as people join the place, thus establishing the relationship of the social world to the site and means.

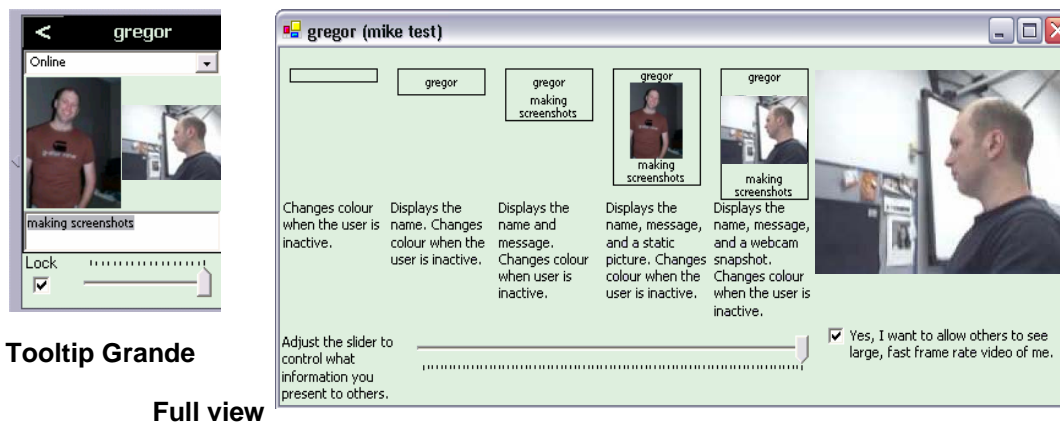
CB supports multiple locales (Principle 5), as clearly shown in Figure 3.2: this particular individual’s client displays four Places concurrently. Each individual will have their own particular set of Places visible on the display comprising his or her viewset. The inter-related aspects of these worlds (if any) also define their civic structure.

Each Place comprises different sets of media items, and thus offers each social world with its own distinctive means. Through these items, people can present themselves to others, engage in conversation, and interact with group artefacts as desired. Each person can act in distinct ways in each of the Places they inhabit.

### A. Audience view of the Presence media item



### B. Owner view of the Presence media item



### C. Progression of the Presence tile (in the sidebar) views.

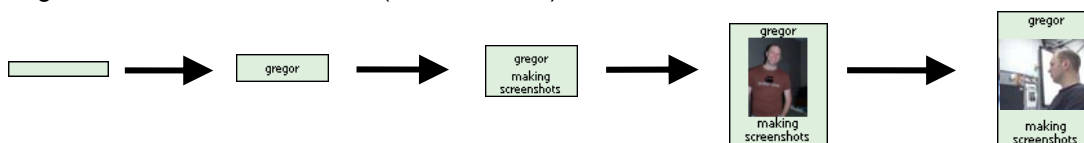


Figure 3.3: Various views of the presence item. The top / middle show the tooltip grande and full views for the participants other than the owner / the owner respectively. The bottom shows different awareness levels of the Tile view.

Within a Place, all information and interactions are public to every person in the Place, supporting true group mutuality and interaction (Principle 3). In this sense we provide an interaction style similar to that of chat rooms. Locale members are able to share awareness information, send broadcast queries (e.g. “Is there anyone who knows about X?”), overhear conversations and join those of interest to them. The fully public nature of a

Place is a critical aspect of Community Bar’s design and it sets it apart from IM where conversations are private.

### 3.3 Ad hoc groups

CB supports quick, lightweight formation of social worlds by allowing people to rapidly set up both short and long-term Places, to join and populate them, and to add information and activities to them that become their ‘means’. Unlike most groupware systems, this means that ad hoc groups are well supported, at least in principle.

New places can be created and named by any person at any time. As shown in Figure 3.4, this is done easily by form-filling the field at the top of the ‘Places’ tooltip grande. Once created, anyone can join or leave a Place by selecting or deselecting it from the offerings in the list. For example, in Figure 3.4, Saul is in the process of creating a new Place

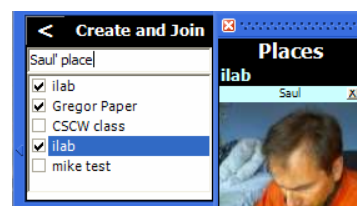


Figure 3.4: Places tooltip grande for creating and joining Places.

called “Saul’ place”, and he has joined three of the available five Places. When someone joins a Place, a Presence item is automatically created for them within the Place, giving them a visible presence in the locale. Places persist until the last member leaves, although an option exists to keep a Place around even though no one is part of it. Place membership persists across sessions; when a person is not logged on, she is listed to others as an offline participant (e.g., see Figure 3.6, right side). This accords with membership in locales, for people will belong (albeit at the periphery) even when they are not present.

People can invite others to locales, by selecting the ‘Invite to Place’ button in the Presence item’s tooltip grande (see tooltip grande in Figure 3.2 and Figure 3.3A). The invitation shows up as an item on the invitee’s bar, and the tooltip grande provides an option to accept, in which case they automatically join the locale.

These three facilities – creating, joining and inviting – provide support for not only long-standing social worlds but ad hoc groups as well. For example, let us say two people in an existing place start a conversation, where they realize that this should best be



continued apart from the current social world. They may quickly create a new Place and join it. One person may then invite a third person in from another Place. They can easily populate this place with media items containing information relevant to the purpose of this world. Depending on the whims of the group, this Place may exist for only a short time, or could have long standing existence. The effort involved in this scenario is low, i.e. it is similar to IM systems that allow more people to be invited into a conversation. However, unlike IM the locale that is created has a lifetime that can go well beyond the momentary conversation and it can be populated with other means relevant to the group (i.e., other media items and whatever information people add to it).

### **3.4 Lightweight transitions from peripheral awareness to foreground casual interactions**

I used the Microsoft Sideshow sidebar metaphor as CB's visual shell because its creators designed it specifically: (a) to show awareness information at the periphery (through the sidebar), and (b) to drill-down and eventually interact with more detailed views of that information (through the tooltip grande and through what we call the full view (Cadiz et al 2002)).

The tiles presented in the CB sidebar display rich yet not overwhelming awareness information, and thus afford mutuality (Principle 4). Tile views are small and of low fidelity but display enough information for people to maintain a low level of awareness of the presence, activity, and availability of others in the social world. For example, we have already seen how presence items show low quality video snapshots, static pictures, name, and/or status of other people. Other media items present information about announcements, web pages of interest, events, and conversations within the social world; some of these are visible in Figure 3.2.

However, the Community Bar's use of the sidebar differs from Sideshow in significant ways. While Sideshow displays information collected from personal information services, the Community Bar's media items are posted by individuals within a Place; thus

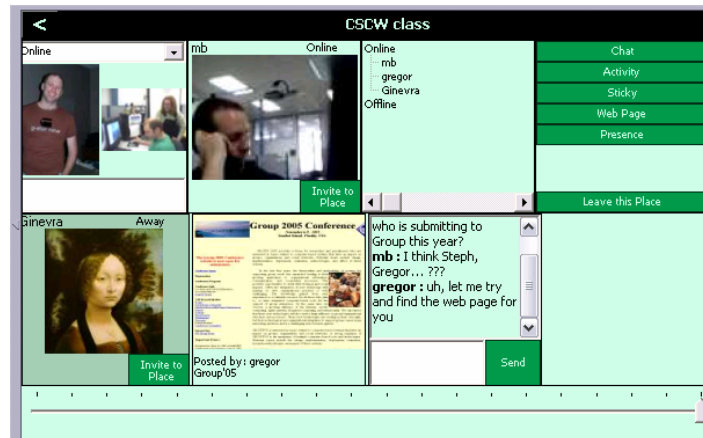


Figure 3.5: Place Tooltip Grande

CB provides communal awareness of a group's members, its conversations, and its artefacts. Second, CB not only lets people drill down to view information detail held by that group, but these can ultimately lead into direct public interactions (Principle 2). Third, individual items increase their colour saturation if their contents have changed. Thus a person can tell at a glance if anything in the bar has changed since he or she last looked at it. The item reverts to the normal item colour after its tooltip grande is raised, as this suggests that the person has at least scanned its contents. In summary, unlike Sideshow, all CB media items and their information are fundamentally groupware subsystems that lead naturally from awareness information to interaction opportunities.

For example, consider the Chat media item, and how it compares to those found in IM systems or chat rooms. Any person can create a new chat dialog, by selecting options available in that Place's tooltip grande (Figure 3.5, see menu in the top right). Figure 3.6 shows the various views of the chat items. Its sidebar tile view is quite small, and just shows an abbreviated form of the last few conversational statements, prefixed by the initial of the contributor. As discussed in the next section, the sidebar view of this dialog can vary in size, in which case fewer lines will be visible; this is illustrated in Figure 3.6, left. As people converse, the saturation of the chat item's background colour increases; this indicates that the conversation is progressing (not illustrated). The person raises the tooltip grande version of the media item (Figure 3.6, middle) to see somewhat more of the now-scrollable conversation, and the full name of the contributors. Perhaps most importantly, they can now add to the conversation simply by typing into the message entry form. The

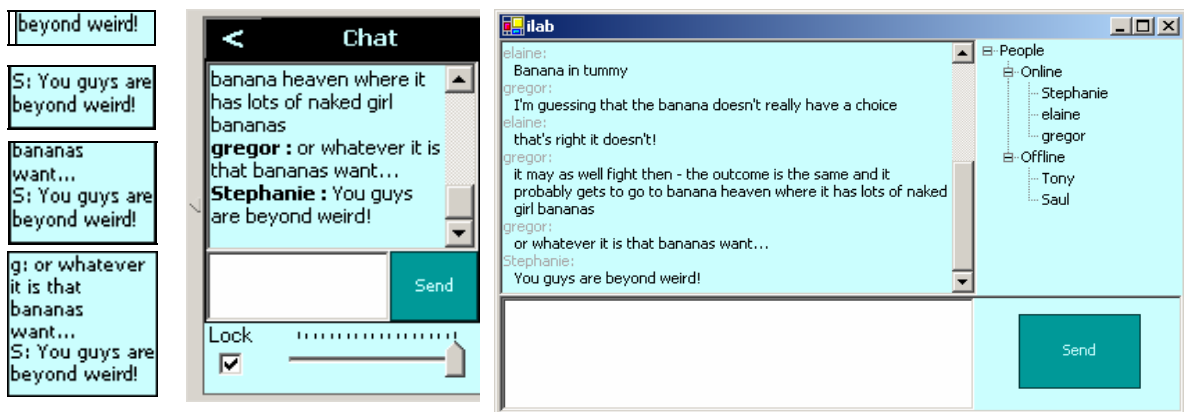


Figure 3.6: Views of the chat item: Various tile sizes (in the bar), tooltip grande, and full view full view, seen at the right of Figure 3.6, shows even more information: who is online (i.e., everyone who can see the conversation) and offline (who may see the conversation at a later time if the item is still around), who is typing the message, more of the conversation (which is now formatted using white space), and a larger area for text entry. Unlike the tooltip grande, this view stays on the display until it is explicitly dismissed. This final view is usually the only one available in chat rooms or IM systems. Finally, and unlike IM, the chat and its history is visible to all members of the Place, regardless of whether they are actively engaged in the conversation. This is important because the awareness is yet another opportunity for people to track what is going on and, if desired, move into interaction.

All other media items work in a similar progressive manner. Collectively, this progression of views and how they are situated and drilled down from the sidebar allows the user to quickly stay aware of all peripheral information within a Place, and to easily move into interaction with information and people of interest at the time. The selection of view is part of their ability to adjust their individual view (principle 7).

### 3.5 Focus/nimbus control of centre/periphery relationships and mutuality

If one considers the previous discussion from a focus/nimbus perspective, it should be clear that a person is actually increasing their focus (and their awareness/mutuality) as they drill

down through the various media item views, from the sidebar to the tooltip grande to the full view.

However, CB offers other means to give a person explicit control over their focus on the items and places they are viewing (principle 9), as well as control over their nimbus within each Place (principle 10). By adjusting their focus, they can reduce or expand their awareness of information within a place. By adjusting their nimbus, people can alter how they project awareness information of themselves to others; in turn, this gives the group feedback of how a person situates herself on the center/periphery spectrum of a particular social world. Focus and nimbus interact to produce the actual view a person sees on the sidebar.

Each tooltip grande contains a slider control (visible in Figure 3.2, Figure 3.3, Figure 3.6) for adjusting the focus, while the owner's presence item full view has a slider for nimbus control (Figure 3.3B, right). As the Presence item is a direct representation of a person, it makes sense for the owner of the item to have control over how they present themselves in the locale. The full view also contains a checkbox marked "Yes, I want others to be able to see large, fast frame rate video of me." Nimbus control works to limit what others can see. Unchecking the large video checkbox means that other members of the locale are unable to view the large video normally seen in their full view of that person. Moving the nimbus slider control to the left also limits how others are able to view the owner's information on the sidebar. The pictures across the top of the Presence full view show how others can view the presence item tile view. As illustrated in Figure 3.3C, it reduces it to slower and smaller video, then to a static picture, and then to a name and text message, and then only to the name of the person. The top part of this form in Figure 4b is live feedback on how the view has been restricted – the possible views are blacked out as they are removed.

Viewers of this item can see up to – but no more – than the amount of information allowed by this nimbus projection. However, a viewer can further reduce the fidelity of the tile view as well as the space taken up by it by moving the focus slider. Internally, CB combines the focus and nimbus values for a particular item to calculate an 'awareness

value', which controls the size that the item has available to display itself in the bar. The item then displays as much information as it can in the space available. As seen in the various bar views of the Presence item in Figure 3.3C, when there is very little space the item is blank and only shows online/offline status by changing its colour saturation level. As it is given more space it is able to show a name, then a text message, then a static picture, and finally a small video (assuming the nimbus value allows it). Other types of media items also change size and vary their information content depending on the available space, for example the chat item tile view at different sizes can be seen on the left side of Figure 3.6. Varying the content according to the space, which is equated with desired awareness here, is an implementation of Principle 11.

CB also automatically reduces the focus on items when there are too many items to fit on the side of the screen. Its compromise is to calculate awareness values where all items just fit in the display. However, a person can adjust this further through the focus slider provided on each Place's tooltip grande. For example, if they are more interested (i.e., more in the center) of one place than another, they can increase their focus on it; the focus on all the items within that Place are uniformly increased. This automatically reduces a person's focus on other places when screen space is at a premium, i.e., it moves the person more to the periphery of those places until all elements fit on the display.

As mentioned, the full view of a Place contains the tooltip grande view of all media items, on permanent display. This is another means for people to increase their focus onto one or more places.

Providing control over focus and nimbus in these simple, lightweight mechanisms – which are actually much easier to use than this wordy description would suggest – allows each person to manage their mutuality with other people, to fluidly control their centre/periphery membership in each locale, to change their engagement with artefacts, and to adjust their individual views. They do this dynamically as their needs and interactions evolve.

## 3.6 Stock CB Media Items

We will see in Chapter 4 that new CB Media Items can be easily created by third party programmers. However, CB comes with a set of stock Media Items that provide generic awareness and interaction capabilities that seem applicable to all communities.

### 3.6.1 Presence Item

The Presence Item (Figure 3.3) provides awareness information about other users. A lot of its functionality has already been discussed in previous subsections of this chapter. The Presence Item is the most complex of the stock items as it is representative of a person and so provides nimbus controls as well as the usual focus control. Also, because this item is a representation of a person, it is automatically displayed when someone logs into the Place.

The tile views (Figure 3.3C) are the same for owner and audience. The tile displays information content that fits the vertical size available. Hence, when the tile is large (focus and nimbus are set high) the display shows video snapshots updated every ten seconds, along with the owner's name and their display message. It will also change the colour saturation when the owner is "idle", i.e. they haven't touched their keyboard or mouse for ten minutes. When the tile size is reduced (when the owner reduces their nimbus or the audience member reduces their focus) the video snapshot is shrunk to fit and at a certain threshold is replaced by a static picture<sup>6</sup>. When the tile is reduced further the static picture is shrunk to fit until it is so small it is no longer clear. The picture is then removed so the tile only shows the name and message. Then, as it gets smaller, first the message and then the name are removed, until finally the only information presented is the colour change showing the idle state.

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<sup>6</sup> In more recent versions of CB the static picture is not shown unless the owner (a) doesn't have a webcam, or (b) the owner explicitly sets their nimbus to only show a static picture. Instead the video snapshots remain and get smaller until the tile reaches the size where the static picture would normally have disappeared. This change was in response to user feedback.

The audience views of the Presence transient and full views (Figure 3.3A) provide increased information about the owner and opportunities to interact. In the transient, the audience can see a higher resolution and faster frame rate video of the owner (assuming they are making video available) and also have the “Invite to Place” button. In the full view, the audience is able to see an even higher resolution and frame rate video, and the owner’s static picture. There is also the “Push to the Talk” button, which allows the audience to send audio messages to the owner.

The owner’s transient and full views (Figure 3.3B) are designed to allow the owner to control their nimbus, i.e. what they are showing of themselves to the audience. The transient allows changing the message, status and picture (the picture is changed by clicking on the picture shown in the transient). The full view enables them to select whether audience members can see the big video in their full view, and also offers greater control over the possible audience views of the tile.

### **3.6.2 Chat Item**

The Chat Item (Figure 3.6) provides the primary means for the group to interact directly. Group members are able to engage in public text-based conversation. All views of this item are the same for owner and audience, as the Chat Item belongs to the group as a whole. Because it is so fundamental to the group interaction, a Chat Item is automatically added to all newly created Places. Of course, Place members are free to create more Chat Items whenever they want.

The Chat Item views are shown in Figure 3.6 and the different views have already been described in some detail in subsection 3.4.

### **3.6.3 Sticky Item**

The Sticky Item (Figure 3.7) is similar to the Chat Item in that it is intended for text based communication. However, the Sticky is not intended to support conversation, but rather announcements. Thus, only the owner is able to add text, enabling a one-to-many message.

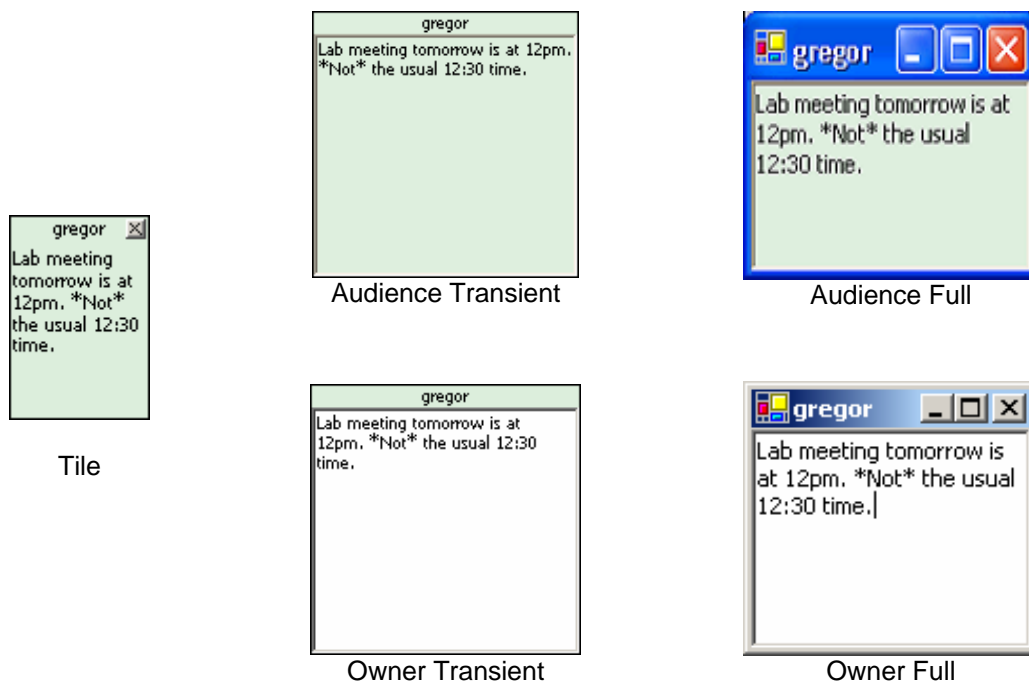


Figure 3.7: Sticky Item

The tile view is the same for owner and audience. It simply shows the name of the owner at the top and the message below. If the owner changes the message, the tile changes to a bright colour until the audience member raises the transient view. When the tile is shrunk by changing the focus, the message is removed and only the owner's name is shown. When shrunk further, the name is removed as well.

The audience's transient and full views simply show the message again in a larger window. If the message is big enough to take up more than the window size then a scrollbar is shown.

The owner's transient and full views show editable text boxes so that the message can be changed.

### 3.6.4 Web Item

The Web Item (Figure 3.8) enables Place members to share WWW URLs. The owner can post a web page and audience members are then able to load the web page into their own web browsers.





Figure 3.8: Web Item

The tile view shows a capture of the web page or, when the item is too small, just the comment. The transient view shows a larger picture of the web page as well as the owner's name and any comment they may have entered.

The audience's full view opens the web page in their default browser. The owner's full view is a dialog box that allows them to enter or modify the URL and to enter a description. If the owner clicks the button with the "world and arrow" icon, the web page is opened in their default browser.

### 3.6.5 Photo Item

The Photo Item (Figure 4.6, shown in the media item development environment) enables the group to share pictures. In contrast to the Sticky and Web Items, it supports a many to

many communication. Any member of the Place can add pictures to the item. All of the views are the same for owner and audience.

The tile view shows the last picture added and the name of the person who added it. Anybody in the Place can add new pictures by dragging and dropping them into the tile. When a new picture is added all the views are updated to show the new picture. The new picture is also copied to a local directory for every Place member currently online.

The transient view in the Tooltip Grande shows a higher resolution picture and displays the image filename. In Figure 4.6, the filename is “030-Mar00EmeraldPeak.jpg”, revealing the date and location of the photo.

The full view shows the picture at a higher resolution again. It also provides the “Photo Viewer” button, which opens up the default picture viewer (usually Windows Picture Viewer) on the directory that all the CB pictures have been copied to, allowing the user to browse through past images at full resolution.

### **3.7 Conclusion**

This chapter describes how I have applied Chapter 2’s design principles to arrive at an implementation – the Community Bar system. I have structured the description of the system around the design principles four themes to illustrate how the high-level, abstract design principles can be used to inform a concrete design and implementation. Of course, there could be considerable difference between how I believe things should work in theory and how Community Bar is actually used in practice. Later in Chapter 5, I use the results of a field study of Community Bar use to reflect on this process of realising the guidelines in software. The study results show there were principles that I did not implement, others that I misinterpreted in some subtle but important aspect, and those that were realised with great success.

However, the next chapter discusses Community Bar’s architectural details. The chapter discusses the low-level implementation requirements of the system and how those requirements were met through a centralised client-server architecture using the distributed

Model-View-Controller pattern. The client is constructed from modular component libraries. The majority of the chapter focuses on the implementation of extensibility through third-party groupware plugins – a requirement inherited from the Notification Collage (Rounding 2004).

## Chapter 4. Community Bar Architecture

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In this chapter<sup>7</sup>, I present the technical architecture underlying the Community Bar. The chapter unfolds by describing the technical requirements of the Community Bar, and how the architecture meets these requirements.

The first requirement is that the Community Bar must support distributed groups, where people use their own computers to broadcast and receive information about others. This means that the Community Bar must: have a distributed architecture, handle multiple processes across different computers, and transmit data between them. While many solutions are possible, we will see that CB implements a distributed Model-View-Controller pattern using a client/server architecture that relies on a shared dictionary server.

Community Bar needs to maintain a strong notion of three entities: of places, of people, and of media items. All three entities are potentially long-lived and each client requires information about these entities. Thus, CB's second requirement is to have persistent and distributed representations of places, people and items. We will see that CB uses the hierarchical key structure of the shared dictionary server to store and distribute the data model for each of these entities.

We previously saw that the CB client delivers content through Media Items. We also saw that places are holders for sets of these items, where people subscribe to places, which determine the Media Items that they see. Thus, the third requirement of CB is to provide a client that is a container for Media Item content by managing places and people. It must do this in both the data model and in the user interface.

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<sup>7</sup> Some of the material in this chapter has already appeared in McEwan et al (2006), Tee et al (2006b) and Young et al (2006).

Finally, the Community Bar is an open-ended system, where programmers are expected to create and/or tailor media items to fit the particular needs of their group. Thus the last requirement is that average programmers should be able to create media items without excessive training. By providing this facility, groups are able to extend and customise CB to fit their own interaction and collaborative needs. We will see that CB satisfies this requirement by offering a relatively simple way to share data, by an object-based programming metaphor, and by providing a development environment for rapidly prototyping ideas.

It is worth pointing out that these are all functional requirements, which are defined as those requirements specifying behaviours of the system that satisfy its intended uses. There were, of course, also non-functional requirements<sup>8</sup>, which are defined as requirements that are used to judge system operation. While not yet mentioned explicitly there were non-functional requirements for usability, reliability and performance throughout the development of CB. As the project was dependent on use of CB, most judgements of the non-functional requirements was through the constant feedback of the user community where unsatisfactory system operations were quickly identified and repaired to the point that they did not interfere with use of the system.

The following sections describe each of these four architectural requirements in more detail and how they were satisfied. I will also show examples of Media Items developed by other people after only minimal training.

## 4.1 Networking and distribution

As with all distributed systems, the first architectural requirement for Community Bar is to support distributed groups via networking and data sharing. Each groupware client must be able to share information with other clients, transmit changes, and respond to changes from

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<sup>8</sup> Functional and non-functional requirements can be read about in more depth at Wikipedia: [http://en.wikipedia.org/wiki/Functional\\_requirements](http://en.wikipedia.org/wiki/Functional_requirements) and [http://en.wikipedia.org/wiki/Non-Functional\\_Requirements](http://en.wikipedia.org/wiki/Non-Functional_Requirements)

others. This implies quite complex networking and data distribution requirements that could easily become a programming nightmare.

To manage this complexity, I built CB as a client/server architecture whose data distribution is based upon a distributed model-view-controller (dMVC) pattern combined with a notification engine (Greenberg and Roseman 1999). The basic ideas are:

- **Model:** the system maintains a persistent data store on a server that is accessible to all clients,
- **Controller:** the model is updated by distributed clients, usually as a result of user actions,
- **Views:** client interfaces will be updated to reflect the current state of the model.
- **Notifications:** the server will generate notifications to all distributed processes about additions, changes and deletions to that data.

To implement this pattern, CB uses GroupLab.Networking (Boyle 2005, Boyle and Greenberg 2005), a third generation publicly-available networking engine and toolkit developed within the Interactions Laboratory at the University of Calgary. It proved a good fit for the networking layer of Community Bar for several reasons. First, it provides a server with a persistent data store via a *shared dictionary*: a hierarchical key/value attribute list with an easy-to-use API for setting and retrieving distributed data. Second, the engine automatically updates clients via a publish/subscribe *notification system*, where clients subscribe to data by pattern-matching particular hierarchical branches and nodes of the shared dictionary. Thus the dMVC / notification pattern is easily implemented. Third, all low level networking details are hidden, as they are automatically managed by the GroupLab.Networking runtime architecture. Finally, it automatically marshals and stores data ranging from simple data types (e.g. strings and numerical types), complex data (e.g. structures, lists), and multimedia (e.g. binary data, images).

The persistent data store also assists with such issues as synchronisation of the clients and dealing with latecomers. A single, centralised repository of the shared data, coupled with notifications, means that all of the clients will be synchronised with each other as long

as each client refers to that centralised data. Clients that connect after a session has started, known as latecomers, are updated from the single data model held at the known centralised location.

Publish/subscribe notification servers allow clients to subscribe to data of interest. When a client publishes a change to the data, the server sends notifications to the subscribed clients. Figure 4.1 diagrams the centralised server with multiple clients, showing how, after a single client captures data (e.g. a new video frame of Anand taken by his web camera), the client publishes the data (e.g. a binary jpg-compressed image) (1), the server stores the binary data in the model under a key, and then notifies the subscribed clients (2).

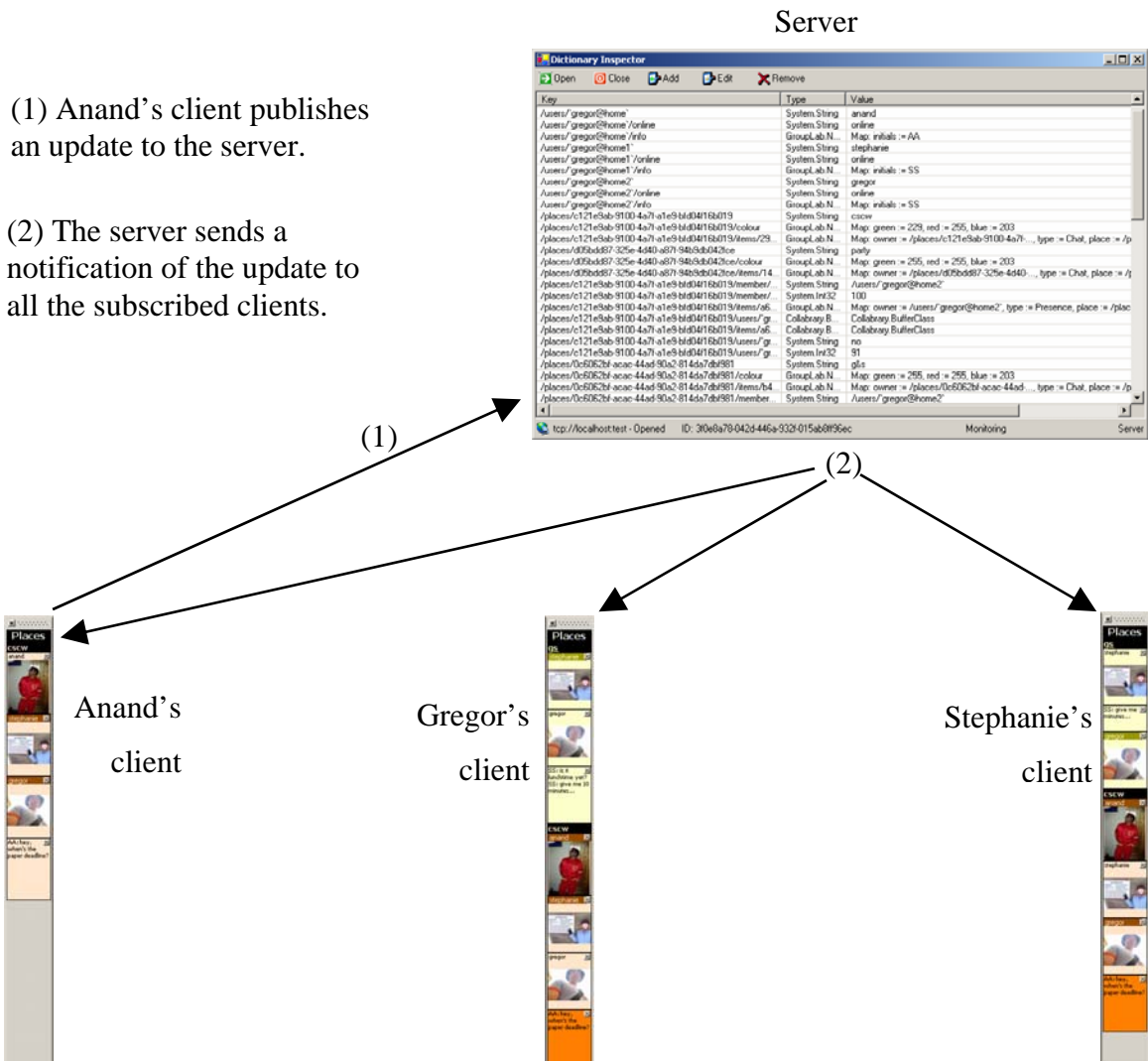


Figure 4.1: Server with three clients connected. The server view shows the listing of key-value pairs.

This section has described how the features of GroupLab.Networking enable the server and clients to interact together over a distributed architecture using dMVC, where the server, using the shared dictionary, provides facilities for sharing data between clients and maintaining synchronisation.. The next two subsections, 1.2 and 1.3, describe the details of how CB exploits the server (Model) and the client (View and Controller).

## 4.2 The Server (Data Model)

CB clients need to share data of three different types of entities, places, people and items. To illustrate how this is done, we will use the *Meeting Room* place illustrated in Figure 4.2 (screen capture on the right side), which is currently inhabited by two people and which displays two presence and one chat media item. Figure 4.2 also shows the (slightly stylized) corresponding data model held in the GroupLab.Networking shared dictionary server that defines the people, places and items in the *Meeting Room* place.



CB leverages the hierarchical nature of the shared dictionary by separating data into well-known branches of the data tree.

The top-level *users branch* stores data about a person, e.g., email, initials, online/offline state, and so on. Figure 4.2, for example, shows how information about its two people is stored in the model's users branch, where each person's subtree is defined by their unique email address. We see that a person's real name is indexed by this primary email key, while their initials are stored in the "info" subkey.

Next, the top-level *places branch* stores information about places created by a subgroup. It also contains a list of all members of the group, which in turn points back to particular people in the people branch. For example, the single place in Figure 4.2

<u>Key</u>	<u>Value</u>
<b>Users</b>	
/users/judy@mail	<b>Judy</b>
/users/judy@mail/info	initials = JO
/users/saul@mail	<b>Saul</b>
/users/saul@mail/info	initials = SG
<b>Places</b>	
/places/guid1/	<b>MeetingRoom</b>
places/guid1/member/guid2	/users/judy@mail
/places/guid1/member/guid3	/users/saul@mail
<b>Media items</b>	
/places/guid1/items/guid4/type	<b>Presence</b>
/places/guid1/items/guid4/owner	/users/judy@mail
/places/guid1/items/guid4/place	/places/guid1/
/places/guid1/items/guid4/picture	<picture data>
/places/guid1/items/guid5/type	<b>Presence</b>
/places/guid1/items/guid5/owner	/users/saul@mail
/places/guid1/items/guid5/place	/places/guid1/
/places/guid1/items/guid5/picture	<picture data>
/places/guid1/items/guid6/type	<b>Chat</b>
/places/guid1/items/guid6/owner	/users/judy@mail
/places/guid1/items/guid6/place	/places/guid1
/places/guid1/items/guid6/msg/	sender=Judy; initials=JO; message="Want..." sender=Saul; initials=SG; message="Sure..."

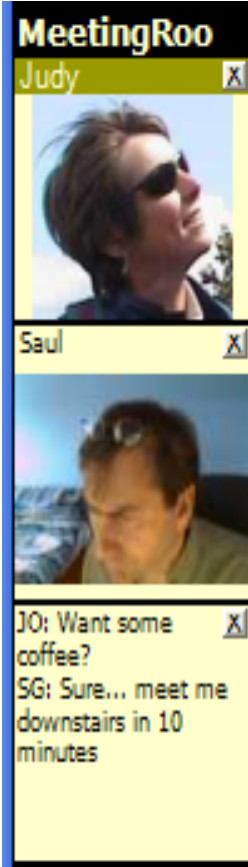


Figure 4.2: Sample client capture with server data keys and values.

(“MeetingRoom”) is identified by a Globally Unique ID (GUID), and contains information about its name and the primary index keys for the two people within it (“Saul” and “Judy”).

Finally, *media item branches* contain generic information common to all media items, as well as any local data particular to that media item type. As illustrated by the three media items in Figure 4.2, all items have a type, an owner (stored as the primary index of the person who created it), and the place it resides in (stored as an index to the places branch). Other data is specific to its function (e.g., the multimedia picture item, or the complex data structure comprising the actual text chat). Because items can only exist within a place, they are stored as sub-trees within a particular place branch. This can be seen in Figure 4.2, where the indexes of the media items are subkeys of the index of their place index, e.g. the primary index of the Chat item, “/places/guid1/items/guid6/” is a subkey of the MeetingRoom Place indexed by “/places/guid1”.

In this way, the clients are able to share data about places, people and items. Within the clients themselves, however, they have to interact with the raw data keys and values and translate them into the appropriate display in the UI. The next section describes how I implemented the client to manage this task.

## 4.3 The Client

The third requirement of CB is to provide a client which is a container for Media Item content. From a user interface perspective, this means allocating screen space for Media Item visual elements, making sure they are the right items for that client and in the right relationships to the visual representations of places. However, there is also a data management aspect that involves maintaining relationships between the data for places, people and items; e.g. places contain groups of items, people subscribe to places and people own items.

To achieve these goals, I have developed two code libraries: the *user interface library*, which provides the visual structure of the CB sidebar; and the *data model library*, which manages the data aspects of places, people and the generic parts of media items.

The CB client application links these libraries together by:

- querying the media items for display elements to place in the sidebar and tooltip grande;
- passing user commands from the user interface (issued by the user) to the data model library to send to the shared dictionary; and
- responding to the events from the data model library to appropriately update the user interface.

The next two subsections describe the User Interface Library and the Data Model Library and how the CB client uses them to provide a container for Media Items.

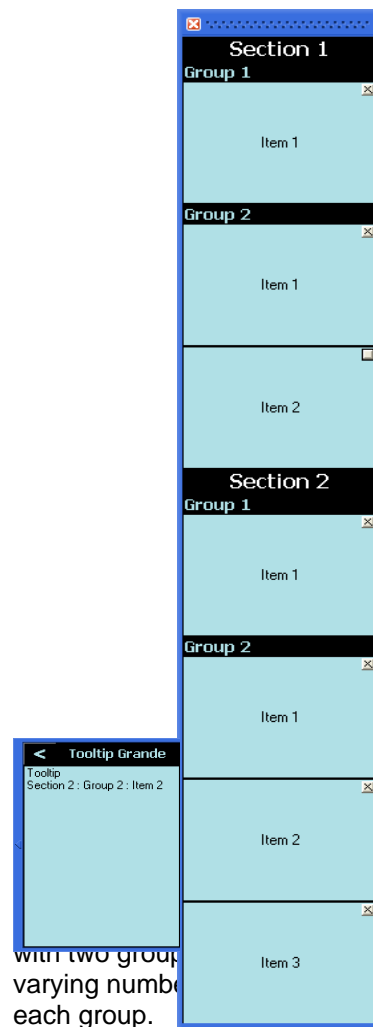
### **4.3.1 User Interface Library**

The UI library implements a generic sidebar interface, managing placement of controls and displaying the tooltip grande. The CB client uses the sidebar interface to display an individual's view of the current model.

The basic units of the sidebar UI are *Sections*, *Groups*, *Items* and the *Tooltip Grande*. These are organised hierarchically; Sections contain Groups, which in turn contain Items. The library shows the Tooltip Grande when the user moves the mouse cursor over elements in the bar. Figure 4.3 shows an example of the sidebar UI without the Community Bar content. Within each of the two Sections shown in the figure there are two Groups, each of which display a number of items. The Tooltip Grande is displaying the complete hierarchy information about "Item 2", in this case that it is part of "Group 2" which is then within "Section 2".

The CB client makes use of this structure to display the elements of the client owner’s view. CB only creates one Section, headed “Places” in the CB client interface. Each of the owner’s subscribed places, along with all the media items within them, are displayed as sidebar Group elements. The sidebar Items are spaces for the media items to display their local tile view. The Tooltip Grande display area is used to display the media items’ transient views.

Commands from the user take five forms: creating and deleting places; subscribing and unsubscribing from places; creating and deleting media items; adjusting focus on media items; and, interaction with media items. The first three are passed on to the data model library, which then updates the server model data to reflect the command. Focus adjustments result in the client telling the media item of the change in available display space and asking for a new view. As for the last, the individual media items handle their own internal interactions.



### 4.3.2 Data Model Library

When designing and building the main Community Bar application, I was interested primarily in such questions as “Who owns this client?”, “Which places do they belong to?” and “Which items are in that place?” Rather than try to deal with these questions at the individual key/value pair level, and try to remember dependencies between them every time, I created the data model library. The data model library encapsulates all of the data dependencies between places, people and items in a Dynamic Linked Library (DLL).

Because a particular CB client uses the data model library, it manages data from the perspective of the client owner. The data model library acts as a controller, in the dMVC sense, by doing such things as subscribing and unsubscribing the owner to places and

creating and deleting places and items (in response to user commands). It acts as a dMVC view by watching the list of the owner's subscribed places for new items.

When the client owner creates a new media item, the data model library manages the interactions with the server model. The library creates a new branch for the media item in the server keys and enters generic information about the Media Item – type, owner and place (see Figure 4.2) – in that branch. The Media Item internals manage all other information in the item sub-branch (e.g. the picture data for Presence items and the chat messages for the Chat item).

The data model library handles client interactions with the server data model. In its roles as a dMVC view and controller it sends commands to the server data model and receives notifications from the server about changes to the data model. The commands originate from the user who also has to be informed of data model changes. The CB client uses the user interface library, described next, to gather user commands and show an up to date view of the data model.

The data model library uses events to inform the main client application of relevant changes to the server data model, and the client then updates the user interface. The exception to this process is the internals of the media items. As should be clear by now, media items are separate from the rest of the client and, apart from creation and deletion, the only interaction the client has with them is to ask for views to place in the user interface reserved spaces.

## **4.4 Media Items**

The final and most important requirement is that the Community Bar should be extensible by average programmers. We strongly believe that third party developers should be able to create media item plug-ins without excessive training and effort.

To satisfy this requirement, the CB main application has been designed as a groupware Sidebar Container that manages an ad hoc collection of media item plug-ins. At the same time, it manages People and Places, and provides networking and shared data

facilities. In contrast, the media items provide the actual awareness and interaction content. While CB provides a basic set of general use media items, its plug-in capabilities are meant to encourage third party developers to create more specific Media Items.

#### **4.4.1 The Plug-In**

Media item plug-ins are based upon an easy-to-learn development platform offering a relatively simple object-based programming metaphor, easy access to the distributed data model, and a development environment for rapid testing of ideas. The programmer creates and compiles media items as individual Dynamic Link Libraries (DLLs). CB then loads these DLLs dynamically at runtime; thus programmers do not need to access or recompile CB source. Most of the programming effort is on the custom functionality of individual media items, e.g., to implement a chat system and its interface. The only extra effort required is that programmers of these DLLs have to implement a simple pre-defined code interface that the CB sidebar requires to host the item. The interface specification is shown in Figure 4.4.

```

public interface IItem
{
    /// <summary>
    /// Initialise the item.
    /// </summary>
    /// <param name="sd"> The shared dictionary client instance for
    ///     storing all the shared data for this item. </param>
    /// <param name="path"> The unique key to identify this item in
    ///     the shared dictionary.</param>
    /// <param name="master"> True if this item instance is the
    ///     original one created.</param>
    /// <param name="currentUserKey"> The key of the current user
    ///     (the owner if master is true)</param>
    void StartItem(GroupLab.Networking.SharedDictionary sd,
                    string path,
                    bool master,
                    string currentUserKey);

    /// <summary>
    /// Stop the item running. Close down all running processes and
    ///     clean up the shared dictionary.
    /// </summary>
    void StopItem( );

    /// <summary>
    /// Return a display for the tile view of this item at a
    ///     particular focus.
    /// </summary>
    /// <param name="focus">Value in the range 1-100. Indicates user's
    ///     focus on the item.</param>
    /// <returns>A control that displays this item.</returns>
    System.Windows.Forms.Control GetTile(int focus);

    /// <summary>
    /// Return a display for the transient focus view of this item at
    ///     a particular awareness.
    /// </summary>
    /// <param name="size">The maximum size that the application
    ///     allows for this view.</param>
    /// <returns>A control that displays this item.</returns>
    System.Windows.Forms.Control GetTransientFocus(Size size);

    /// <summary>
    /// A handle for when the user wishes to separate this item from
    ///     the application.
    /// The result of calling this method should be a sparate form or
    ///     application that allows the user full interaction.
    /// </summary>
    void SeparateItem( );
}

```

Figure 4.4: The Media Item interface definition.

Perhaps the most important information given to the Media Item programmer is the handle to the shared dictionary (see the `StartItem` method in Figure 4.4). Unlike single user plug-ins, client groupware media items need to share data between their distributed counterparts. The dictionary, as in the main CB application, provides the model and

notifications for Media Items. This allows Media Items to distribute data between item instances (belonging to the owner or one of the user audience members), where the item acts as a view and controller following the dMVC pattern.

To facilitate this, programmers are provided, via a code interface, with a convenient handle to the Shared Dictionary server and hence the data model. They are also given a direct reference to this media item's branch in the dictionary, and direct references to the user branch of the item's owner and of the current user. Thus, programmers do not need to know or worry about the potentially complex hierarchical paths and data that are above these branches, i.e., they are exposed only to the primary data they would normally use and manipulate. Through this simplified data interface, the developers can easily add and distribute custom data so that all client media items display the appropriate contents for the tile view, the transient view, and the full view. However, advanced programmers can access the other data in the shared dictionary if needed, which may be useful for advanced features. For example, a programmer may iterate through the user's branch to list all connected people.

With this access to the shared data capabilities of the CB Model, media item developers have considerable flexibility in the presentation of the items. In some Media Items, e.g. the Chat item, the Tile, Transient and Separate views are seen the same way by all users. Most commonly however, the three views differ for the owner and the audience. For example, Figure 4.5 shows the six different views for a Presence item. While tiles are visually similar, only the owner of a tile can click on it to immediately update their video snapshot. The other views differ much more; the owner's view of the transient and full view provide control over their own appearance, while the audience's view provides opportunities to communicate with the owner. Potentially, a Media Item can provide even more views. For example, a simple game may have different views for each of the players and then another view for onlookers.



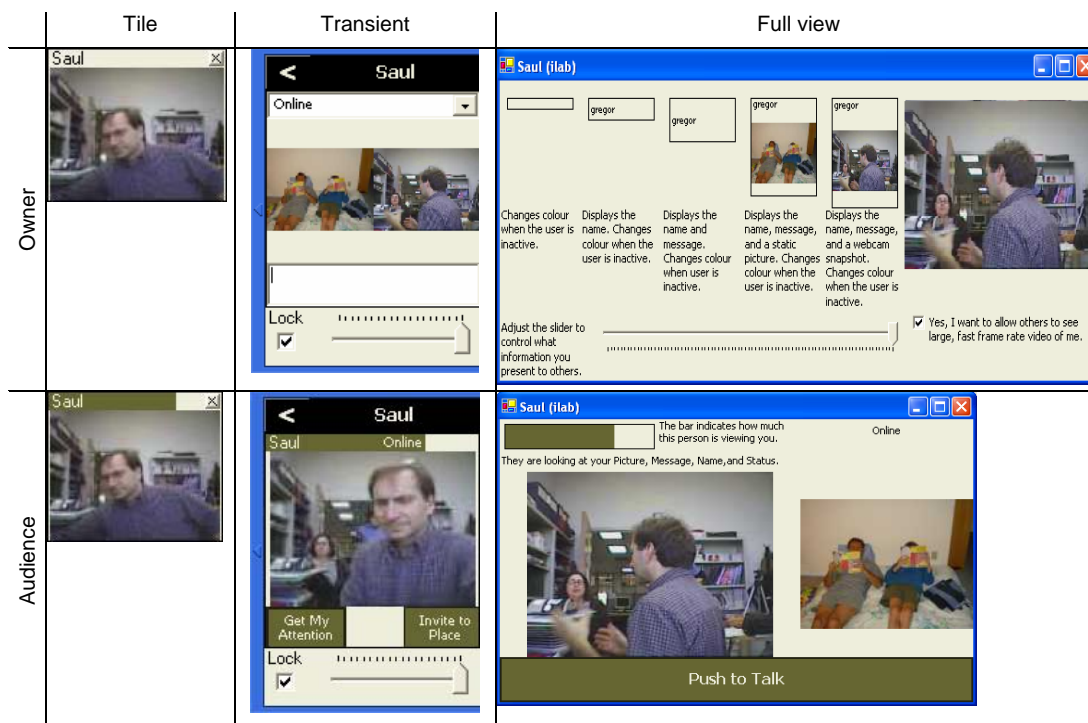


Figure 4.5: Six views of the Presence Item: Owner and Audience views of Tile, Tooltip Grande and Full view.

## 4.4.2 Media Item Development Support Tools

We have also created a development environment so that Items can be coded and debugged on a local machine, outside of the main CB application. The environment contains two primary components.

First, a *Media Item plug-in template* streamlines the programming and housekeeping process of creating media items. The template serves a convenience role as it incorporates many of the simple setup and housekeeping tasks that are common to most Media Items. It also has a teaching role as it demonstrates by example the necessary components of a media item and how they relate to each other.

Second, a *plug-in test interface* allows programmers to immediately test any plug-in code modifications by simulating a three-person groupware environment within a single window. As illustrated in Figure 4.6, the environment conveniently mirrors CB's interaction with a media item while allowing the use of standard debugging tools. For example, the Figure illustrates a photo viewer plug-in, where any user can post photos to

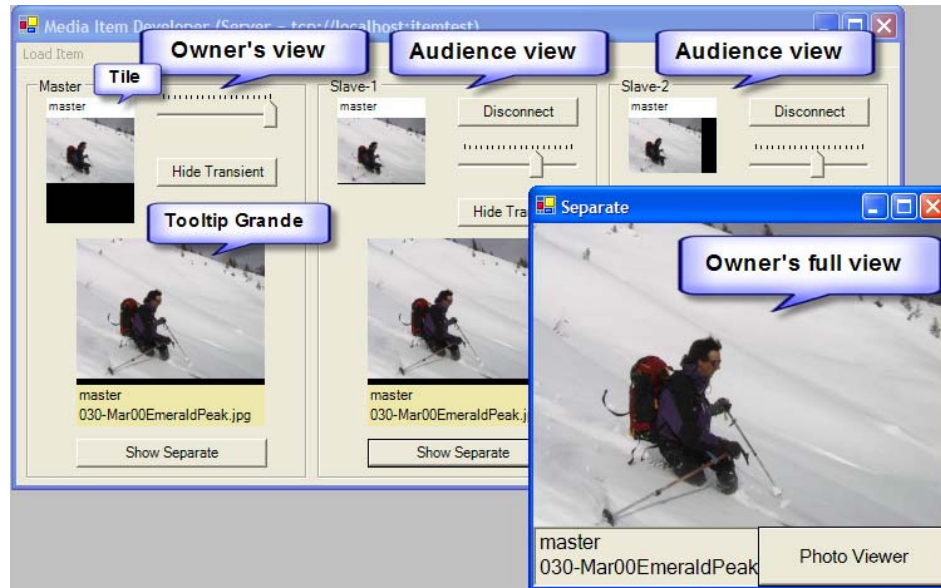


Figure 4.6: Media Item Test environment. Currently testing the Photo Item. the group. Programmers have the option of displaying, manipulating and testing the various owner and audience versions of this photo item’s tile, tooltip grande, and full view.

The simple mechanisms for creating Media Item plug-ins – an easy to use programming and data model, and a development environment – means that developers can focus on the creative and functional aspects of groupware component design rather than low level distributed systems details.

#### 4.4.3 Hello World Media Item Example

At this point the easiest way to explain the Media Item plug-ins is to step through a simple example. The example is not very sophisticated but serves to illustrate the implementation process. I will step through the process of creating a Media Item version of the classic “Hello World” program.

1. The first step is always design. I find that usually a few quick sketches of the (up to) six views are sufficient. In this case, there are only two views: the tile and the transient (shown in figure ??). When a user clicks the button in the transient, the tile displays the text: [name] “Hello!”, and the transient displays the text: [name] says, “Hello World!”

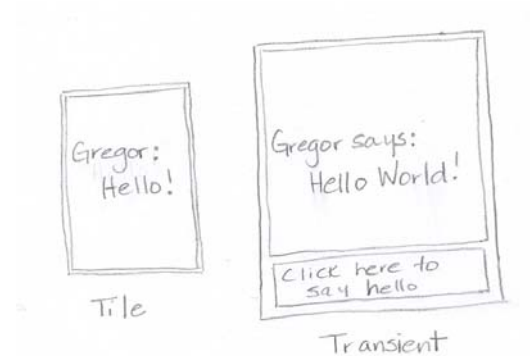


Figure 4.7: Hello World Example - Design Sketch

- Next, we have to work out the data that needs to be distributed. This is all the data that the media item needs to share with its other instances. For Hello World, all that needs to be shared is the name of the last person who clicked the button and said hello. This can be stored as a string value in a single shared dictionary key, shown in Figure 4.8.

Key	Value
[Media Item key]/HelloName	[user's name] (string)

Figure 4.8: Hello World Example - Shared Data

- Now to implement this design in code. Create a new windows library with method stubs for the `SideItem.IItem` interface shown in Figure 4.4. We will need to fill in the details for each of these methods.
- The first thing to do is to give a name to the Media Item. By default Community Bar will grab the class name of the Item, which looks pretty ugly. However, a class attribute can be declared to give the Item a nicer name. The class attribute goes at the top of the class definition as shown in Figure 4.9.

```
[SideItem.ItemName("Hello World")]
public class HelloWorldItem : SideItem.IItem
{
    ...
}
```

Figure 4.9: Hello World Example - ItemName Attribute

- Next, we want to start filling in the `StartItem` method as this is where all the necessary information is passed to the Media Item. For the Hello World example, there are three pieces of information we need: the link to the shared dictionary (`sd`), the key to the Media Item's area in the shared dictionary key structure (`path`), and the name of

the current user (accessed through `currentUserKey`). The name of the current user is not given directly, instead we have to retrieve it from the shared dictionary using the key reference we have been given. The variable initialisation and `StartItem` code should look like that shown in Figure 4.10.

```
public class HelloWorldItem : SideItem.IItem
{
    GroupLab.Networking.SharedDictionary sd;
    string itemPath;
    string userName;
    ...
    public void StartItem(GroupLab.Networking.SharedDictionary sd,
                          string path,
                          bool master,
                          string currentUserKey)
    {
        this.sd = sd;
        this.itemPath = path;
        this.userName = this.sd[currentUserKey] as string;
    }
    ...
}
```

Figure 4.10: Hello World Example - Starting the item.

6. Before filling out the rest of the interface methods, we should add methods to deal with the shared data. We need to have a method to change the shared data, and we need to be able to detect and respond to changes in the shared data whether from this instance of the Item or from other instances. To respond to changes in the shared dictionary, we need to subscribe to a dictionary key. The shared dictionary will then activate a callback method whenever the data in that key changes. Figure 4.11 shows the three code portions needed: first, the method to change the shared data; second, the subscription code; and third, the callback method.

```

private void ChangeHelloName( )
{
    this.sd[this.itemPath+"/HelloName"] = this.userName;
}

public void StartItem(GroupLab.Networking.SharedDictionary sd,
                    string path,
                    bool master,
                    string currentUserKey)
{
    this.sd = sd;
    this.itemPath = path;
    this.userName = this.sd[currentUserKey] as string;

    // subscribe to [path]/HelloName
    this.helloNameSub = new GroupLab.Networking.Subscription();
    this.helloNameSub.BeginInit();
    this.helloNameSub.Dictionary = this.sd;
    this.helloNameSub.Pattern = this.itemPath + "/HelloName";
    this.helloNameSub.Notified +=
        new SubscriptionEventHandler(this.helloNameSub_Notified);
    this.helloNameSub.EndInit();
}

private void helloNameSub_Notified(object sender,
                                   SubscriptionEventArgs e)
{
    string helloName = e.Value as string;

    // update the tile

    // update the transient
}

```

Figure 4.11: Hello World Example - Changing and Subscribing to the shared data.

7. Now we can start implementing the tile and transient views. In this simple example the tile is just a label. All we have to do is initialise it, make sure it is updated at the right time and return it when it is requested in the `GetTile( )` method. The transient contains a label and a button, and the three steps are just the same: initialise, update, and return. The Item must also change the data when the transient's button is clicked. The code for these steps is shown in Figure 4.12.

```

public class HelloWorldItem : SideItem.IItem
{
    private Label tile;
    private Label transientLbl;
    private Button transientBtn;
    private Panel transient;

    public HelloWorldItem( )
    {
        this.tile = new Label( );

        // make the transient
        this.transientLbl = new Label( );
        this.transientLbl.Dock = DockStyle.Fill;
        this.transientBtn = new Button();
        this.transientBtn.Text = "Click to say Hello!";
        this.transientBtn.Click +=
            new System.EventHandler(transientBtn_Clicked);
        this.transientBtn.Dock = DockStyle.Bottom;
        this.transient = new Panel( );
        this.transient.Controls.Add(this.transientBtn);
        this.transient.Controls.Add(this.transientLbl);
    }

    private void transientBtn_Clicked(object sender, EventArgs e)
    {
        this.ChangeHelloName( );
    }
    ...
    private void helloNameSub_Notified(object sender,
                                        SubscriptionEventArgs e)
    {
        string helloName = e.Value as string;

        // update the tile
        this.tile.Text = helloName + ": \Hello!\\";

        // update the transient
        this.transientLbl.Text = helloName + " says \Hello World!\\";
    }

    System.Windows.Forms.Control GetTile(int focus)
    {
        return this.tile;
    }

    System.Windows.Forms.Control GetTransientFocus(Size size)
    {
        return this.transient;
    }
}

```

Figure 4.12: Hello World Example - Adding Tile and Transient Views

8. The final step is to compile the library to a .dll file and put it in the Community Bar items directory. When CB is started next the item's name, "Hello World" for our example, will appear in the Place Transient in the menu of items. Figure 4.13 shows screen captures of the final Hello World Media Item.



Figure 4.13: Hello World Example - Screen captures

The example above is trivial in its interaction capabilities. However, it demonstrates the principles of creating a groupware plug-in and in particular shows the mechanisms for sharing data between instances of Media Items. It can be easily seen that, by extending the tile and transient and implementing the separate, a Media Item developer is free to implement whatever interaction they would like. The next subsection demonstrates some of the possibilities by showing some example Media Items that were developed by third party programmers.

#### 4.4.4 Examples

Students in an undergraduate and graduate class were asked to develop media items. Training consisted of a single two hour tutorial describing the Community Bar interface and walking through an example of how to program a ‘hello world’ media item plug-in. Students had two weeks to develop and demonstrate their items. As we will see, their success validates the plug-in architecture as a groupware system that can be extended by average programmers.

The following figures illustrate the media items that the students created. In each case the different views are shown: some with six different views for master and slave versions of the tile, transient and separate views, and some with less as the master and slave versions are identical.


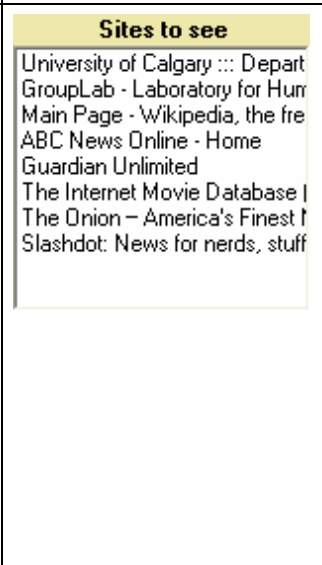
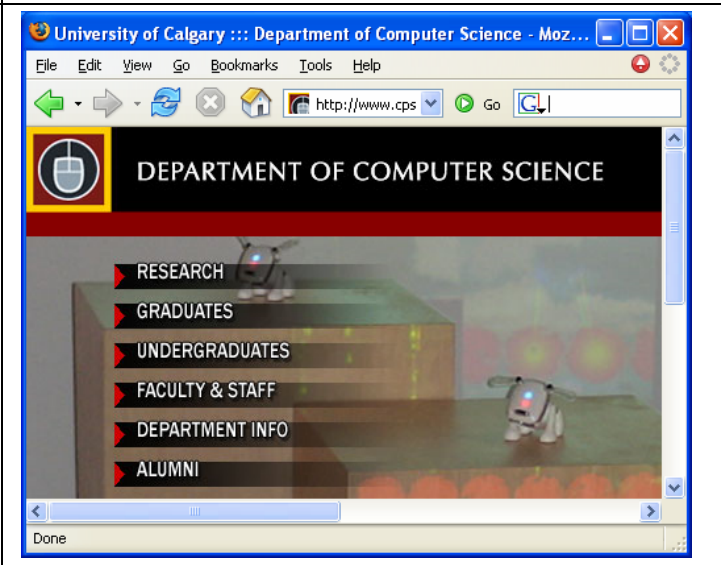
Tile	Transient	Full
		

Figure 4.14: Public Web Item (Stephanie Smale).

Figure 4.14 above shows the Public Web Item, an extension to CB’s stock web item. For this item, the owner and audience view and interact with the item in the same way. The media item allows any member of the Place to add web pages through drag’n’drop. The tile view shows the title of the last web page added, while the transient shows a list of all the web pages that the group has added. The full view loads any of the web pages in the list into the web browser for full interaction and viewing.

The Cambience Item, Figure 4.15, is an activity monitor. Successive frames of the


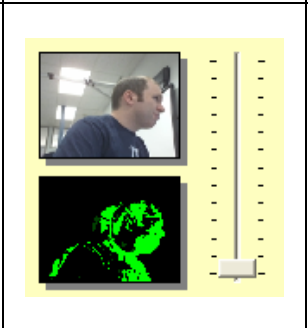
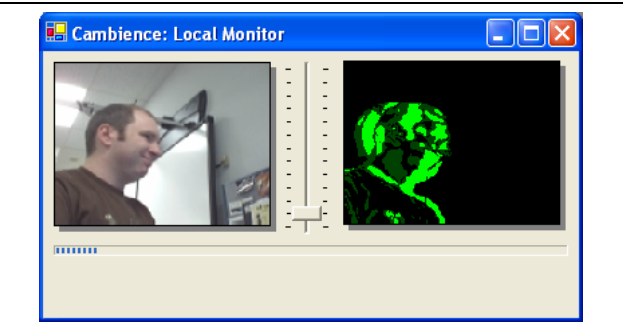
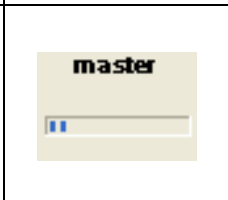
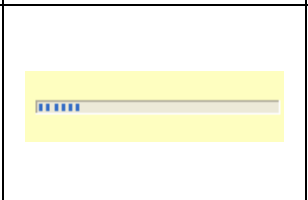
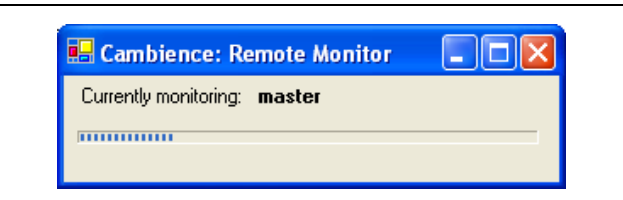
	Tile	Transient	Full
Owner			
Audience			

Figure 4.15: Cambience Item (Rob Diaz-Marino).



owner's web camera are compared through an image subtraction algorithm. The result is then reduced to a single value, which is displayed to the audience to give an indication of the owner's activity level without revealing details of the activity itself. The owner's transient and full views give information about the current web camera image and the image subtraction (in green). The owner can adjust a threshold value to control sensitivity of the activity detection. Audience members are only ever able to see the activity level.

The Video History Item in Figure 4.16 provides the group with capabilities to quickly and easily scan the history of a video camera. The technique used here is to take a single pixel slice of each video frame and then place all these slices together to form a new image. The new image shows the camera's history. In this item the tile shows the current camera capture. The transient shows the generated history image. Any Place member, owner or audience, is able to browse the history by dragging the mouse over the history image. As the mouse pointer moves over the slices, the image from that slice is shown in the tile view. In this way, the group can browse the history of the cameras they use. More details of this method and its application can be found in Nunes et al (2006).

The Photo Gallery Item in Figure 4.17 is an extension to the stock CB Photo Item in a similar theme to the Public Web Item. It allows the Place members to maintain a collection of photos within the item. Any Place member is able to drag'n'drop an image into the item. The tile view displays the last image, the transient adds the ability to browse the images through "Previous" and "Next" buttons, and the full view displays not only a larger image but also shows the whole collection with a fish-eye lens effect at the bottom, for browsing.



Figure 4.16: Video history Item (Michael Nunes).

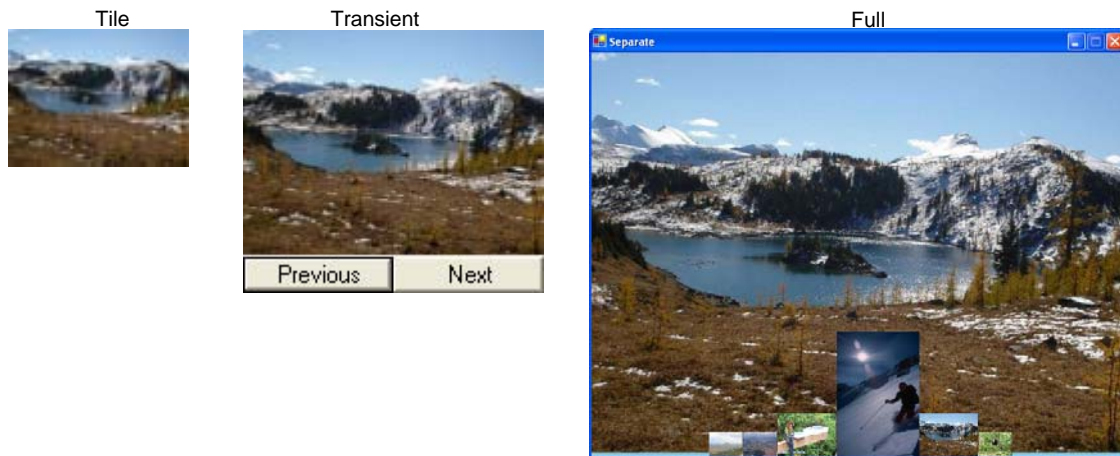


Figure 4.17: Photo Gallery (John McDonald)

The Blog Reader Item, shown in Figure 4.18, allows the group to monitor and browse a web log. The tile view shows a small preview of the latest blog entry. The transient view shows more of the text of the latest entry and has “<” and “>” buttons for browsing through the entries. The full view shows a list of all the entries in the top pane and the full text of the selected entry in the bottom pane.

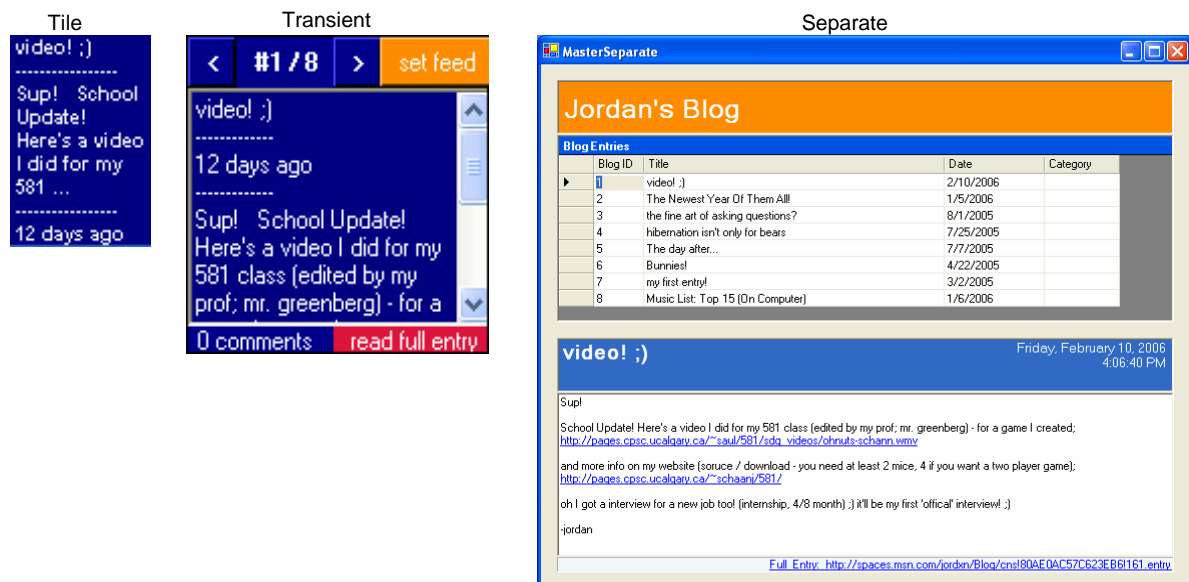


Figure 4.18: Blog Reader (Jordan Schaan)

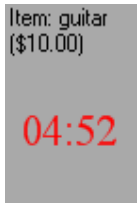


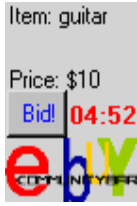
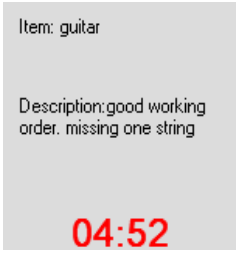
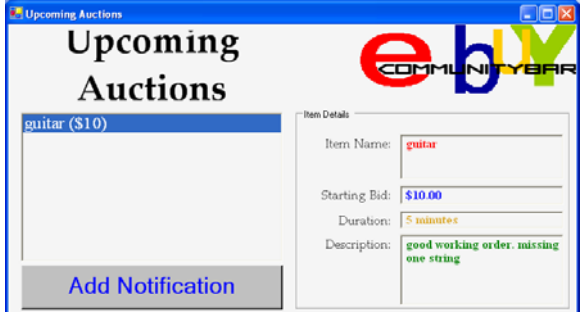
	Tile	Transient	Full
Owner			
Audience			

Figure 4.19: EBUY (Phil Serchuk)

Figure 4.19 shows the EBUY Item which allows the group to set up and participate in rapid real time auctions. The owner can set up an auction: specifying items, starting price, auction duration, and item descriptions. Audience members can bid on items as well as monitor the current auction and the auction queue. An audience member can also request to be notified when a particular item in the queue comes up for auction (the figure only shows one item in the auction queue but more can be added by the owner).

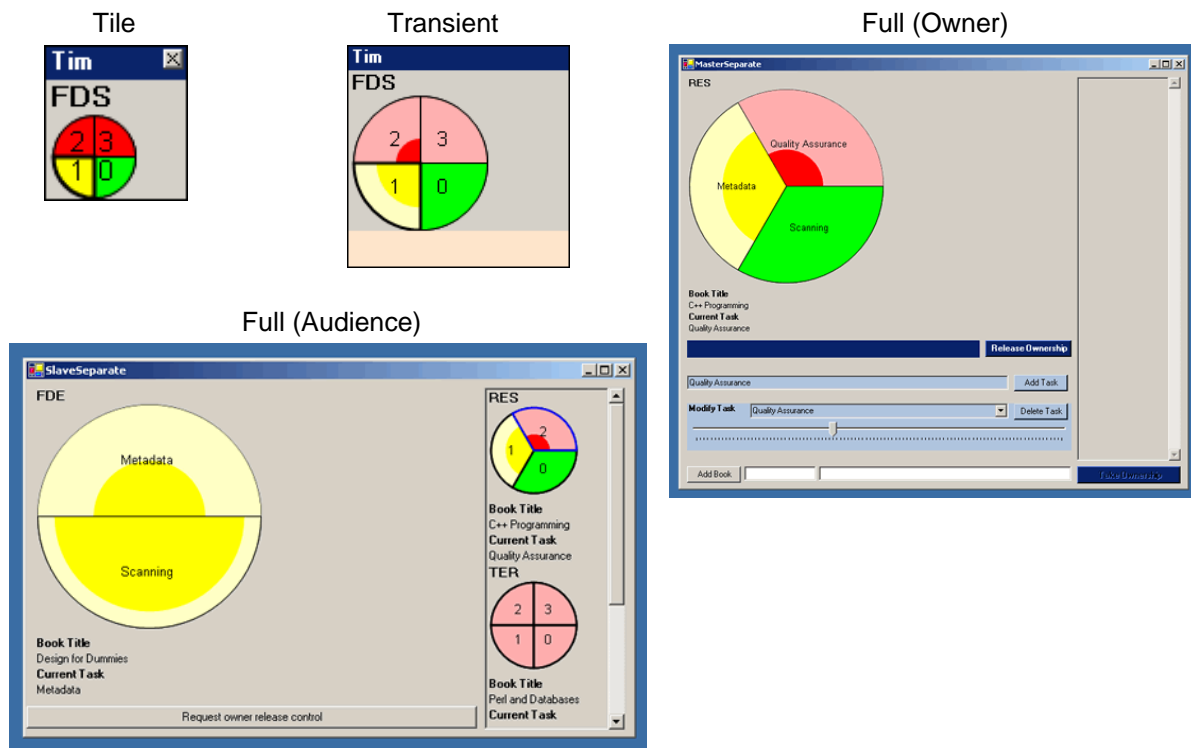


Figure 4.20: Digital Document Task Awareness (Tim Au Yeung)

The Digital Document Task Awareness Item (Figure 4.20) provides task assignment and task status awareness amongst a document digitizing team. As a team is digitizing a document, there are several tasks that they must perform. Each team member works by themselves on a task yet they need to be aware of which other tasks are being worked on and their level of completion. This media item provides awareness of the digitizing tasks. As shown in Figure 4.20, each document is represented by a circle. The circles are then divided up into sections, where each section represents a task. For example, in the owner full view in Figure 4.20, the RES document has three tasks associated with it: Quality Assurance, Metadata and Scanning. The amount of higher saturated colour in the task section indicates how much of the task has been done. The tile view displays only the number of tasks and the name of the document. The transient view provides more information on the completion state of the tasks. The full view then gives all of the information on the document tasks. The owner's full view allows updating the task state, while the audience members' full view allows them to request control of a document.

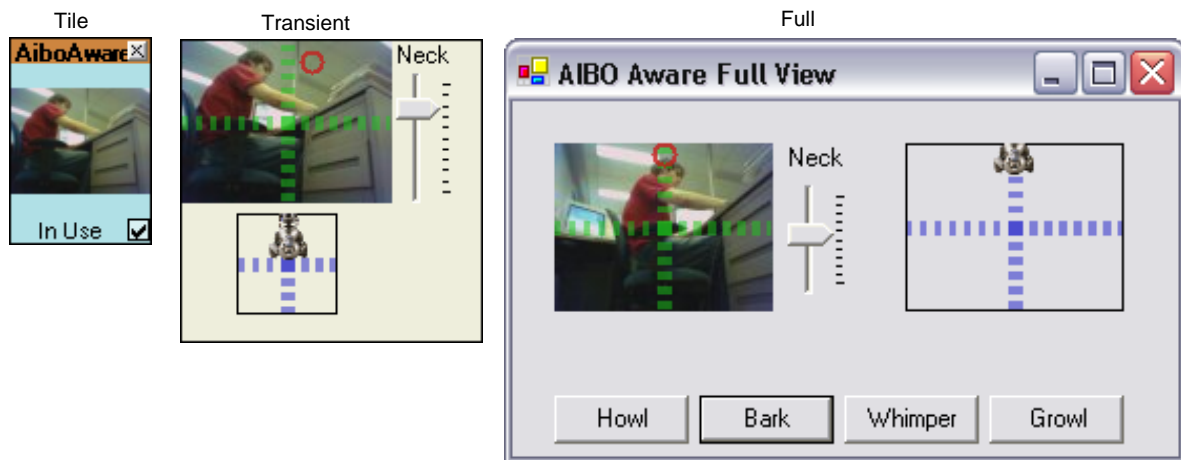


Figure 4.21: Aibo Awareness (Jim Young)

The AIBO Awareness Item, shown in Figure 4.21, allows group control of a mobile robot dog. Any member of the Place can control the robot at any time, providing a group presence in the physical environment. The tile view shows the image from the robot's camera and indicates if anyone else is currently controlling it. The transient view provides functions for controlling the movement of the robot and where it should look (the red circle on the camera image) as well as a slider for the tilt of its neck. The full view displays all of those controls plus buttons for the robot to make noises. Further details can be found in (Young et al, 2006).

The last example Media Item that I wish to show has been developed as the major implementation part of a M.Sc. project and as a result is a lot more advanced than the previous examples. The Screen Sharing Item (Figure 4.22), by Kimberly Tee (Tee et al 2006a, Tee et al 2006b), provides activity awareness by allowing people to share an image of their screen. The tile view shows a scaled down screen image, which, although small, still allows quick identification of at least the application being used. This rough idea of another's activity is enough to make the decision to investigate further and possibly start direct interaction.

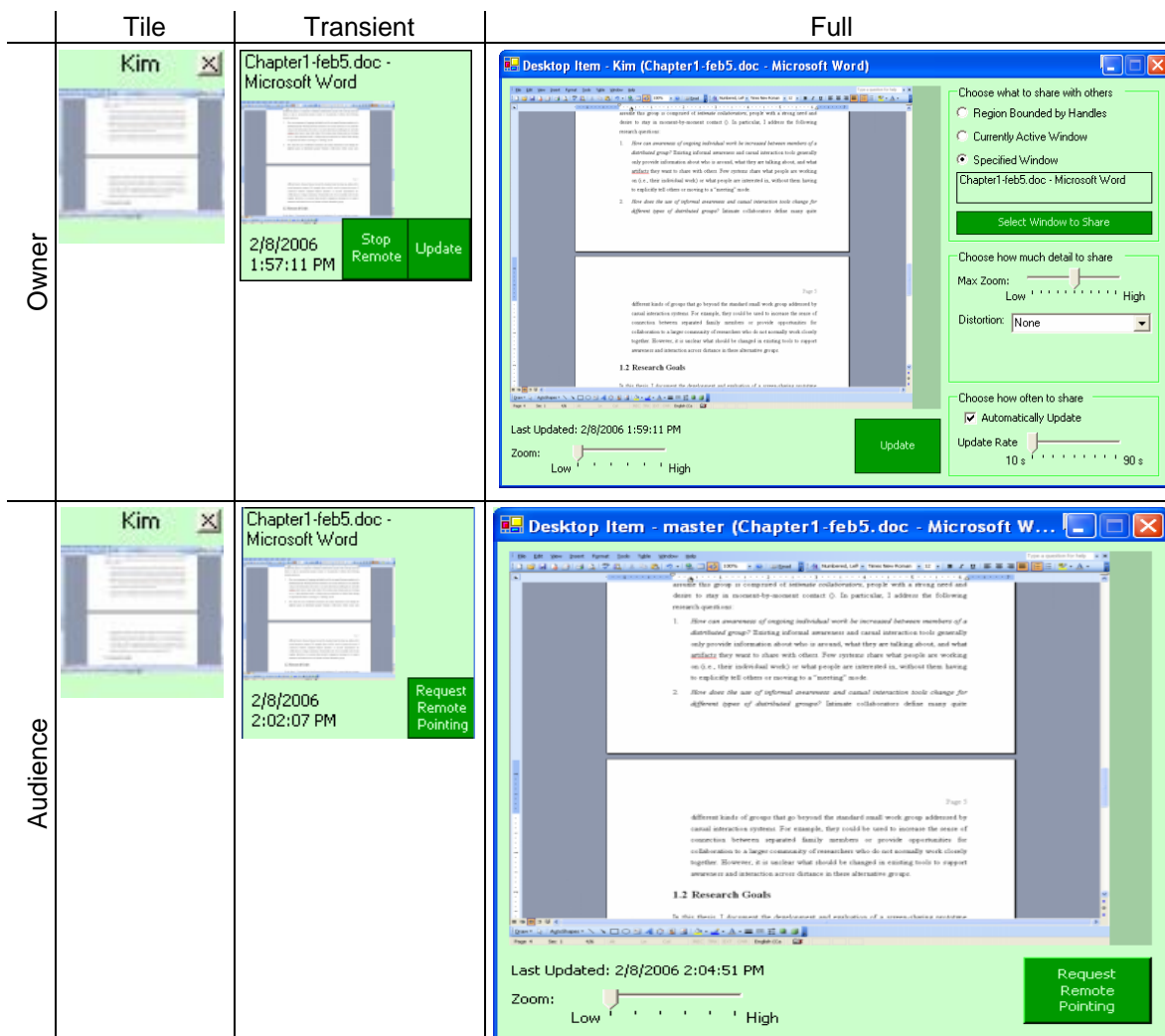


Figure 4.22: Screen Sharing Item (Kim Tee).

The audience for this item can use the transient and full views to see larger, more detailed views of the screen image. The full view for the audience provides facilities for panning and zooming to explore the image and to see in detail the owner's activities. There is also a button (Figure 4.22, audience transient bottom right, and audience full bottom right) that allows an audience member to request remote pointing. Pressing this button causes a dialog box to query the owner whether they want to enter into a remote pointing session with the audience member. If the owner accepts, the audience member is shown a large, real-time view of the owner's screen, and a telepointer appears on the owner's screen. A new CB Chat Item is created for them to converse. In this way, two people are

able to collaborate closely over work artefacts, having remote presence to point to the same things.

The owner's views of the item contain a large number of controls to allow them to control their presence (information presented about them) and their privacy. In the tile view they can see what they are showing to the audience and also perform manual updates on the screen snapshot (clicking on the image refreshes it). The transient view also allows manual updates and includes the "Stop Remote" button to stop any remote pointing session and to hide any sensitive information being displayed. The full view provides many other controls as well as a preview of what the audience can see in their full view. The owner's controls are as follows:

**Capture area.** The owner can specify a capture region bounded by movable handles on the screen, make the capture region always over the currently active window, or select a specific application window to be captured.

**Maximum Zoom.** The owner can set the maximum zoom level that audience members can use when viewing the screen capture. This will limit the zoom control on the audience full view.

**Distortion.** The owner is able to distort the image shown to the audience by specifying the type of distortion: blur, pixelise or negative of the image (similar to a photo negative). They can also set the level of distortion; for example, a low level of blur distortion can hide most details while still showing application type and even larger headings, while a very high distortion would only show the predominate colours on the screen.

**Image Refresh Updates.** The owner can select whether they want the image to be refreshed automatically, or only through their manual control. If automatic updates are selected then they can also select the frequency of the updates.

This example demonstrates that the Media Item framework allows more complex items to be built. By building on the simple Media Item framework, developers are able to add complex custom functionality to the Community Bar.

Other student created media items, not shown here due to space limitations, include:

- **LCD Display Item** (Nicolai Marquardt) lets a group send messages to a physical LCD display.
- **Scheduler** (Jeni Lynn Vito) is an event scheduler for a group's collective activities.
- **Mean Girls** (Alexandra Braginsky) lets teenage girls gossip around multimedia photos of friends.
- **Family Shopping List** (Liz Friesen) allows a family to collectively create a shopping list.
- **Dress Me up** (Tony Quach) supports collaborative multimedia fashion advice for an individual.

## 4.5 Conclusions

This chapter has described the four major architectural requirements of the Community Bar and how they have been implemented.

1. **Support distributed groups.** I have implemented this using a distributed Model-View-Controller pattern in a client-server architecture. The pattern and architecture are well supported by the Shared Dictionary library which was used to implement the networking for the Community Bar.
2. **Provide Places, People and Media Items.** The Shared Dictionary provides facilities for a server-side data store using hierarchical keys. I used the built in facilities to store and distribute the shared data of Places, People and Media Items as well as the relationships between them.
3. **Provide a UI container for Media Items.** I have developed a user interface library that simplifies the process of creating a sidebar user interface. The sidebar library is then used in Community Bar to hold Media Items in Places.



4. **Extensible groupware Media Items.** Users of Community Bar are provided with a Media Item template and a development environment, making it simple to implement new Media Items. In this way, each community is able to tailor the Community Bar to their own particular needs.

The next chapter reports on a field study that investigates how Community Bar is used. The results are used to reflect on the original design principles and on the implementation of those design principles.

## Chapter 5. Evaluation

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We<sup>9</sup> conducted an in-depth field study of a group's on-going use of Community Bar over several weeks. We use results obtained from this study to reflect upon not only interface issues, but on the matches and mis-matches that occurred between the theoretical usage behaviour predicted by our design principles versus the actual usage behaviours observed in the deployed implementation. As a critique, this reflection is an important iterative step in considering how CB should be redesigned, and serves as a cautionary tale of the difficulty of translating theoretical nuances into practice.

### 5.1 Field Study of CB in Practice

Unlike task-oriented productivity tools, Community Bar is intended to support ongoing collaborative social practices as they occur in the everyday world. Consequently, we felt it appropriate to evaluate CB's efficacy through a field study investigating how people used CB while continuing with their normal practices. Yet we recognized that CB's use by a group would evolve over time, where it would be adopted into the group's everyday social practices and their cultural norms. We were more interested in examining how the group used CB after this period of adoption, so that we could see how their social practices had stabilized. This suggests that a longitudinal field study was needed. The catch is that the logistics of seeding a new group with CB and monitoring them for (say) many months until CB was adopted was onerous. Instead, we decided to study the creators of CB and their

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<sup>9</sup> This material in this chapter originally appeared in a report produced by Natalia Romero, Saul Greenberg and I (Romero et al, 2006). The work was apportioned as follows: Natalia and I made modifications to CB code to prepare it for the study; Natalia conducted the primary interviews while I did smaller followup interviews later; Natalia analysed the bulk of the data to produce graphs and figures and I did some work in extracting quotes; I wrote the majority of the content in the report; and Saul did some heavy editing and revision of the report as well as performing some vital analysis of the results to arrive at the conclusions presented here. Hence the use of "we" rather than "I" in this chapter.

colleagues - a group that already had been using CB and its predecessor (NC) for a long period of time.

While examining this group introduces some biases (this group is likely more favourable to CB), we stress that the group is still worthy of study for several reasons:

- Members had used CB and its predecessor for several years.
- Current members included people working on quite different projects and who were uninvolved in the actual CB research.
- Group membership has changed over years as people came and went, and thus went beyond the original core group that had vested interests in it.
- All were experienced with casual interaction theory and systems prior to the study, and were thus better able to reflect on their practices.
- The principle investigator of this field study, Natalia Romero, was *not* part of this group: her involvement with them was for the express purposes of setting up and conducting the field study.

## 5.2 Participants

The group we observed consisted of fifteen study participants. All had real world work and social relationships with each other. Eleven were current members of a research laboratory at a university (one Professor and ten graduate students), all who periodically saw each other face to face over the course of the work week. Five of the ten graduate students were supervised by the Professor. Three of the remaining four were former graduate students of this Professor: two had left within the last year and now worked in private industry, while the other was now a student at a different university. The final participant was a researcher at another university; this person had a weak academic relationship with this group. Thus fourteen people knew each other very well, while the fifteenth had only met part of the group a few times. Finally, before the start of the study, ten of the fifteen were using CB as a group on a regular basis; four had used it a few times, while one was a new user.

## 5.3 Method

We collected and analysed activity logs of CB usage, people's subjective diary entries, and performed a series of interviews.

***Duration.*** We monitored all CB interactions between our fifteen study participants for a period of three weeks.

***Logging.*** For the duration of the study CB was instrumented to log all actions both on shared data, such as chat messages and web pages posted, and on personal clients, such as raising full views. This data was then processed and interpreted to obtain information on how CB was actually used.

***Diary.*** A special diary entry media item was created. At any time, CB users could enter stories and reflections about their on-going experiences, which were logged by the system. The diary also prompted people when they did certain CB actions, and when they were affected by other people's actions. The diary item was based on the chat item and the interface was much the same, with the exception of messages not being shared with the rest of the group. Table 1 shows all questions that could be displayed by the diary item, along with the events that prompted their appearance. Most questions had multiple phrasings (included in Table 1), and these were randomly selected each time the event occurred. It was made clear to study participants that they did not have to answer every question.

***Interviews.*** After the study period, nine participants were interviewed about their experiences with CB. The others were either unavailable at the time, disqualified from interviews because they were too close to the research, or the interview data was discarded due to poor recordings. All interviews were audio recorded. Interview responses were matched with the logging data and diary item entries to give insight into intentions and experiences as well as the direct actions. The interviews were semi-structured and open-ended. A set of seed questions, shown in Table 2, guided the interview. Participants were encouraged to answer at length, often through follow-up questions. The interviews were typically about 30-45 minutes long.

Question	Event
<ul style="list-style-type: none"> <li>• Are you too distracted by CB at the moment? Why? How do you deal this distraction?</li> <li>• Has something interesting happened in CB in the last hour? What? How relevant was it for you?</li> <li>• Any specific experience with CB that you want to report now? What?</li> <li>• Any problems with CB at the moment? If so, what was the problem?</li> <li>• Are you consciously using the camera to communicate something?</li> <li>• Do you feel annoyed by something in particular related to CB?</li> <li>• What's the best thing in CB right now? Why?</li> <li>• What's the worst thing in CB right now? Why?</li> <li>• What has been the most useful experience when using CB today? Why?</li> <li>• What has been the most annoying experience when using CB today? Why?</li> <li>• What has been the most uncomfortable experience when using CB today? Why?</li> <li>• Name two things that you want to change in CB now? Why?</li> <li>• Name two things that you have successfully achieved using CB today? Why?</li> </ul>	The Diary item has not asked any questions for 30 minutes.
<ul style="list-style-type: none"> <li>• Why have you changed your nimbus to {value}?</li> <li>• Why do you want people to see you differently? What are you trying to communicate?</li> </ul>	User changed their nimbus setting.
<ul style="list-style-type: none"> <li>• Why have you {opened/closed} the separate window of item {item_name}?</li> <li>• What are you seeking in {item_name} larger screen?</li> </ul>	User opens the Full View of an item.
<ul style="list-style-type: none"> <li>• What do you want to communicate with the new {item_name} item?</li> </ul>	User creates a new item.
<ul style="list-style-type: none"> <li>• Have you noticed any new information in CB? Is it relevant to you?</li> </ul>	Someone else creates a new item.
<ul style="list-style-type: none"> <li>• Why have you removed information you have posted earlier?</li> </ul>	User deletes an item that they posted.
<ul style="list-style-type: none"> <li>• Why have you removed information posted by {user_name}? How do you feel by deleting others' information?</li> </ul>	User deletes an item posted by someone else.
<ul style="list-style-type: none"> <li>• Are you missing information earlier posted in CB by you? Does it affect you?</li> </ul>	Someone else deletes an item that the user posted.
<ul style="list-style-type: none"> <li>• Are you missing information earlier posted in CB by others? Does it affect you?</li> </ul>	Someone else deletes an item that someone else posted.
<ul style="list-style-type: none"> <li>• Why have changed focus of place {place_name} to {value}?</li> <li>• Why have you changed the size of the items in {place_name} place?</li> </ul>	User changes a Place's Focus.

<ul style="list-style-type: none"> <li>• Why have you changed the locked option of your item {item_name} to {value}?</li> <li>• Why have you {locked/unlocked} the size of the item {item_name}?</li> </ul>	User locks or unlocks an item.
<ul style="list-style-type: none"> <li>• Why have you changed the focus of {item_name} to {value}?</li> <li>• Why have you changed the size of {item_name}?</li> </ul>	User changes an item's Focus.
<ul style="list-style-type: none"> <li>• Why have you changed the focus of {user_name} to {value}?</li> <li>• Why have you changed the size of {user_name}?</li> <li>• What are you trying to communicate to {user_name} by changing the size?</li> </ul>	User changes their Focus on someone else's Presence item.
<ul style="list-style-type: none"> <li>• Have you noticed that {user_name} has changed your focus to {value}?</li> <li>• Have you noticed that {user_name} has changed the way they see you? What does this mean to you?</li> </ul>	Someone else changes their Focus on the user's Presence item (visible in the user's view of the other person's Presence item).
<ul style="list-style-type: none"> <li>• Why have you changed your status to {status}?</li> <li>• What are you trying to communicate by changing your status to {status}?</li> </ul>	User changes their status in their Presence item (Online, Away, etc.)
<ul style="list-style-type: none"> <li>• Have you noticed that {user_name} has changed their status to {status}?</li> <li>• Have you noticed that {user_name} has changed their status to {status}? How does it affect you?</li> </ul>	Someone else changes their status.
<ul style="list-style-type: none"> <li>• Why have you changed your picture?</li> <li>• What are you trying to communicate by changing your picture?</li> </ul>	User changes their static picture in their Presence item.
<ul style="list-style-type: none"> <li>• Have you noticed that {user_name} has changed their picture?</li> <li>• Have you noticed that {user_name} has changed their picture? How does it affect you? Does it have a specific meaning for you?</li> </ul>	Someone else changes their static picture.
<ul style="list-style-type: none"> <li>• Why have you changed your message?</li> <li>• What are you trying to communicate by changing your message?</li> </ul>	User changes their message in their Presence item.
<ul style="list-style-type: none"> <li>• Have you noticed that {user_name} has changed their message?</li> <li>• Have you noticed that {user_name} has changed their message? How does this affect you? Does it have a specific meaning for you?</li> </ul>	Someone else changes their message.
<ul style="list-style-type: none"> <li>• Why have you buzz {user_name}? Have you got any reaction?</li> <li>• Did you manage to get {user_name}'s attention? How do you feel using the buzz option?</li> </ul>	User "buzzes" someone else using the "Get my attention" feature in the Presence item.

<ul style="list-style-type: none"> <li>• Have you noticed that {user_name} is trying to get your attention?</li> <li>• What does it mean for you that {user_name} is trying to get your attention? How does it affect you? How are you going to react?</li> </ul>	<p>Someone else “buzzes” the user using the “Get my attention” feature in the Presence item.</p>
<ul style="list-style-type: none"> <li>• Why have you invited {user_name} to {place_name} place? Have you got any reaction?</li> <li>• Did {user_name} respond to your invitation? How do you feel using the invitation option?</li> </ul>	<p>User invites someone else to a Place using the “Invite to Place” feature.</p>
<ul style="list-style-type: none"> <li>• Why did you respond to that activity?</li> </ul>	<p>User RSVPs in the Activity item (deprecated)</p>
<ul style="list-style-type: none"> <li>• Have you noticed that {user_name} has responded to an activity?</li> <li>• Have you noticed that {user_name} has responded to an activity? How does this affect you?</li> </ul>	<p>Someone else RSVPs in an Activity item (deprecated)</p>

Table 1: Diary item questions and the events that prompt them.

**Communication and Information**

- When thinking of CB as a communication tool, how will you describe it in terms of its channels and features? What does it offer to you? What is missing?
- When thinking of CB as an awareness information source, how will you describe it in terms of information update, relevance, reliability and history? What does it offer to you? What is missing?

**Use of several places?**

Yes: Why? When, for what purpose? Did you get expected response? Did you have to use invitations? What were the benefits? What were the costs?

No: Why? What should be different? Were you aware of other places? Is because of the type of community or system limitations?

**Peripheral display**

How would you rate the relationships between:

- Space used versus provided awareness
- Unwanted distraction versus wanted distraction (please refer to the new added features awareness bar & buzz item)
  - Distracting features? Distracting behaviors of you/others
  - Attracting features? Attractive behaviors of you/others

**Time-history information**

- How will you describe the awareness information that CB offers in terms of permanency?
- Which items do you feel could provide better awareness if they had history and time information?

**Nimbus**

- Is the concept clear? Does it make sense? Is it useful?
- Was natural to set how much other can see of you?
- When did you use it? For what purpose? Successful/failure?
- Is the interaction clear? Was the control intuitive, flexible?

**Focus**

- Is the concept clear? Does it make sense? Is it useful?
- Was natural to personalized what you see of others?
- When did you use it? For what purpose? Successful/failure?
- Is the interaction clear? Was the control intuitive, flexible?

**Awareness by changes in information content**

- CB provides a set of controls to manage what is displayed in your bar and in others, was that a good tool for you to express and receive awareness?
- How does CB rate in terms of getting the expected response when varying/adding information?
- How does CB rate in terms of paying attention to changes and increasing your awareness?



**User perception/feelings**

For each situation, answer the questions and choose positive and negative feelings associated with the situation (you can provide other feelings as well)

<b>Situation</b>	<b>Positive Feelings</b>	<b>Negative Feelings</b>
Times <b>you wanted to reach</b> someone but it failed <ul style="list-style-type: none"> <li>• How often?</li> <li>• Why did that happen?</li> <li>• How did you fix it?</li> </ul>	<ul style="list-style-type: none"> <li>• Understanding</li> <li>• Looking for other ways</li> </ul>	<ul style="list-style-type: none"> <li>• Frustration</li> <li>• Insisting</li> <li>• Requesting explanation</li> </ul>
Times <b>someone wanted to reach you</b> and you noticed but you did not respond <ul style="list-style-type: none"> <li>• How often?</li> <li>• Why did that happen?</li> <li>• How did you/other fix it?</li> </ul>	<ul style="list-style-type: none"> <li>• Freedom to not respond</li> </ul>	<ul style="list-style-type: none"> <li>• Annoyed</li> <li>• Obligated to respond</li> </ul>
You/other sent a <b>general or addressed</b> message <ul style="list-style-type: none"> <li>• What are your rules about this?</li> <li>• Do you think your rules are common rules?</li> </ul>	<ul style="list-style-type: none"> <li>• Comfortable</li> <li>• Practical</li> <li>• Group benefit</li> </ul>	<ul style="list-style-type: none"> <li>• Irrelevant (disturbed)</li> </ul>
<b>Benefits/Costs</b> of being connected	<ul style="list-style-type: none"> <li>• Group bonding</li> <li>• Interpersonal/group interaction</li> <li>• Reachable</li> <li>• Sharing personal info</li> </ul>	<ul style="list-style-type: none"> <li>• Interruption</li> <li>• Distraction</li> <li>• Vulnerable</li> <li>• Overwhelming</li> </ul>
<b>Benefits/Costs</b> of not being connected	<ul style="list-style-type: none"> <li>• Isolation</li> <li>• Hard to reach people</li> <li>• Hard to be reachable</li> <li>• Miss group activities</li> </ul>	<ul style="list-style-type: none"> <li>• Control</li> <li>• Selectivity</li> <li>• Personal/direct contact</li> </ul>

**Rules**

- Did you feel that the community used common rules (group conventions) when using CB? Could you give an example? How did those rules emerge: explicitly, implicitly?
- Did you adopt particular ways (rituals) to express your availability to others? What information did you use? How?
- Was it easily understood? Was it accepted? Did you get what expected?
- Did you recognize others' rituals?

**Assumptions**

- Could you assess other's reachability based on information in CB?
- Could others assess your reachability based on information you expressed in CB?
- Did your assumptions match what others intended to express about their privacy?
- Did your expectations match others' reactions to the information you presented?

**Collaboration/Group effort**

- Did you see collaboration when being reached or when reaching someone? Did you see group efforts to display correct/relevant information and group efforts to attend and understand what is being displayed?
- Was the group effort minimized by all the information displayed?
- Do you think that collaboration/group effort is a key to the success of CB? Why?

<ul style="list-style-type: none"> <li>• Could you elaborate on the following statement: <ul style="list-style-type: none"> <li>○ “An awareness system should be restrictive enough to ensure that each individual of the community provides an equal amount of effort so the whole community benefits from each member.”</li> <li>○ “An awareness system should provide the proper tools to support individuals to use their social practices to coordinate their personal and group interests so everyone can benefit from it”.</li> </ul> </li> </ul>
<p><b>Satisfaction</b></p> <ul style="list-style-type: none"> <li>• What was the best and the worst of CB for you? (could be an experience, a feature of CB, etc.)</li> <li>• Any other comments?</li> </ul>

Table 2: Interview seed questions.

## 5.4 Results

We continuously collected 21 days of activity logs. For analysis, we divided each day into four equal parts: morning, afternoon, evening and night. Each of these was then divided into two three hour blocks: morning is 6am-9am, afternoon is 3pm-6pm and so on. Data for three time periods (shown as the gaps in the x-axis in Figure 5.1) was lost due to server problems. Thus a total of 145 time blocks were recorded, representing a total of 435 hours of CB activity.

## 5.5 Login Activity

Figure 2 graphs the number of people logged onto CB during each block over the whole study period. Of the 145 blocks, only ten were ‘empty’, i.e., no one was logged onto the system. Not surprisingly, most of these were during the night (midnight to 9am). For the remaining times, login activity varied in somewhat predictable ways, as revealed by the patterns in the figure. The busiest times were on weekdays, between 9am--6pm. On average, three people were logged in at any one time but during the busy blocks the average rose to six. Peak attendance, up to 10 people, tended to coalesce around the middle of the day.

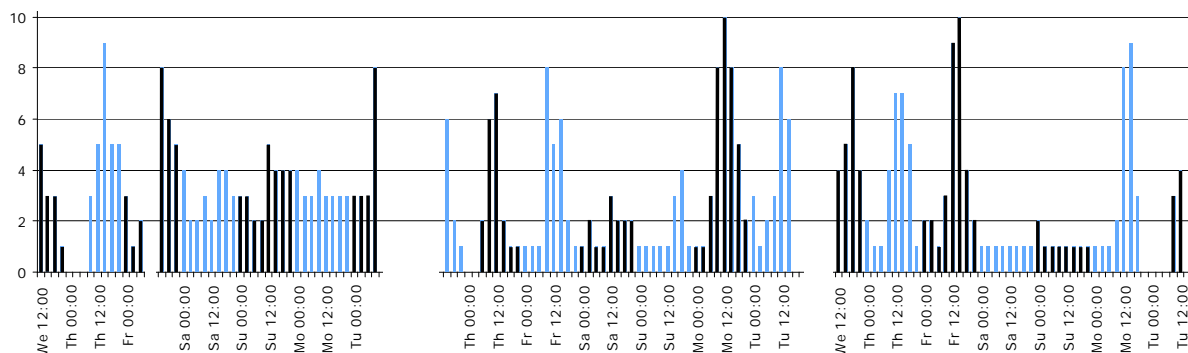


Figure 5.1: Number of people logged on over the study period. Days in alternating colors, blanks on the X-axis indicate missing data.

The figure also reveals that login activity was not restricted to work hours, as there are still concentrations of people in the evening blocks (6pm-9pm and 9pm-12am). Interestingly, we found that the membership of the daytime group is different from the evening group. To illustrate this, Figure 5.2 shows one example day where there is a clear change of members (labelled A – J) logged onto the system between afternoon and evening. In this particular case, there is a transitional time overlap, and one member remained throughout the day. This general pattern repeated itself most days.

Further analysis comparing people's actual CB activities in the daytime *vs.* evening 'groups' revealed differences in the content of their interactions. Data collected from chat item content and diary item responses indicates that the daytime group interacted less and that activity tended to be work focussed. In contrast, the evening group typically had more direct interactions that were more playful and socially focused.

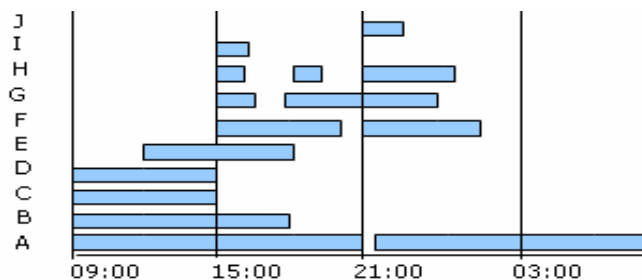


Figure 5.2: Membership change (note 15:00-18:00 period).

## 5.6 Analysis: Theory vs. Practice

The primary purpose of our evaluation was to investigate how the theoretical principles used in the design of Community Bar (described in full in Chapter 2) played out in practice. Our analysis below is structured around each principle.

### 5.6.1 Awareness information should be always visible at the periphery.

Our study data indicates that CB's design largely matched this principle, where people's primary use of CB was for awareness. Most (7 out of 9) of the participants explicitly stated that their primary motivation for using CB was gaining awareness to contact others.

From an interface perspective, most participants indicated that the benefit of the awareness information was worth the screen space that they had to sacrifice. Only three participants complained of space issues in a single screen situation (over 75% of participants had a dual monitor setup). A typical response:

*"I think in general, the amount of space that it uses for the information it gives off is quite balanced ... it's definitely useful for the size that it is."*

CB's design tries to trade off peripheral vs foreground awareness through visibility and screen real estate. One person commented on this when comparing CB to its Notification Collage (NC) predecessor (Greenberg and Rounding, 2001, Rounding, 2004). She said that NC, which displayed larger notification on a full-screen, led to more interactions:

*"Even though I like that CB takes up less space, I probably interacted with [NC] more and used it more when it ... took up a whole monitor ... I would post more things and I would use more things other than the videos."*

People also adjusted the focus (the size) of each tile to reflect their ongoing interest in its information as awareness:

*"[I make the tile bigger] so I can see new messages when they arrive"*

*"[I make the tile smaller] because there is nothing in it now – I will open it up big again if it turns bright blue [which indicates new information]"*

Distraction can occur either because the interface itself is problematic, or because information content changes so quickly that it demands their attention. To check this, the diary routinely asked “Are you too distracted by CB at the moment?” In all cases respondents said that (excepting the diary queries themselves) they were not distracted, largely because group activity only placed modest demands for their attention:

*“No, as ... there is little direct activity other than the video i.e., I am 'up to date'.”*

*“I only check every once in a while if something new is going on and it rarely is. It would be different if people were more active on the CB.”*

An item’s salience may provide useful awareness information to one person, and distraction to another. For example, when a new message is posted to a Chat item, the tile subtly notifies people of this change by increasing its colour saturation. Interview responses to the utility of this fell into three categories:

**Distracted:** *“Sometimes it’s too distracting, especially if there’s a conversation going on that I’m not interested in.”*

**Unaware:** *“I would say it wasn’t distracting enough if anything because it was really hard for me to tell when people were talking to me.”*

**Involved:** *“I will notice when the text items change and I’ll go and look and see if it’s a conversation that, you know, I want to participate in and if it’s not I’ll just go back to what I’m doing.”*

The *distracted* response was given by people who felt compelled to look at the changed chat item but who were often uninterested or uninvolved in conversations. The *unaware* response was from people who were also uninterested in most of the conversations but, in contrast to the distracted group, had learned to ignore the notifications but then felt left out if the conversation turned to something that they should have seen. The final *involved* response was for people who felt directly involved in the conversation. These results suggest a peripheral awareness display cannot satisfy all people at all times, for the balance between useful awareness and distraction is heavily subjective and determined by context.

### 5.6.2 Allow lightweight transitions from awareness to interaction.

Participants responded extremely favourably to this aspect of CB's design, as typified in the following quotes about the chat item:

*"I do use the [tooltip] a lot to chat because it's convenient. Mostly for short conversations though, if it looks to be a long conversation then I'll open the separate."*

*"[I use the chat full view] as an easy way to type as well as view conversation. Also, to see if the other person is still typing."*

All of the interviewed participants said that the chat item views reflected their desired interaction extremely well. People used the tooltip to see a bit more of the conversation while giving them the ability to send quick messages. They used the separate view for extended interaction and to view the entire conversation.

However, while the overall design principle was praised, people said that some media items did not implement the design principle well. In particular, if a tooltip grande offered only slightly more information and controls than the tile, people did not bother with it. An example is the Presence item: while the tooltip grande video is larger and updated slightly more frequently, it really shows little more than its tile counterpart (see figures in Chapter 3). A quote concerning the Presence item typifies the majority of responses:

*"I don't think I actually use the [Presence] tooltip ... I think all I ever do is expand the tooltip to get at the arrow to open up into the bigger [Full] view where I can then adjust to turn on my video."*

In spite of this design problem with some of the media items, we were told that bypassing the tooltip was not a big deal as it was very quick and easy to open the separate view.

In summary, compelling media items are those that make full use of their three views, each showing personally significant new information detail leading to progressively richer interactions.

### 5.6.3 Support small groups of intimate collaborators

From comments received, our study participants were easily divided into two groups: the Professor and the students he was currently supervising (six participants); and everyone else (nine participants). The Professor and his students often worked together closely and interacted with each other often. These people used CB more often for communication. While everyone else also interacted frequently (outside of CB), they had less work ties to the first group. These different relationships came out in the interview comments: the first group was the “core group” and the others who were “peripheral members”. As we will see, this led to a divide in how CB was considered.

Core group members consistently talked about the sense of belonging to the community that CB gave them. One participant talked about times when he was unable to use CB from home due to network problems:

*“I really lose out, mostly on this feeling of being connected, that I am still part of the group, especially if I’m working at home because there’s a problem... there’s no-one else around and it’s very isolating.”*

In contrast, peripheral members often reported that they felt like outsiders, and that most of the explicit communication on CB did not involve them. As one member said:

*“As it happens right now I’m not working that closely with anybody in [the main CB location] ... so if it were a time when I was working more closely with people I could see where it would have been more useful.”*

Another, who was collocated with the core group but not part of it, summarized why she felt left out:

*“I think most of the conversations are just [the Professor participant] wanting something from his students and I don’t really care.”*

These different types of responses correspond to the distraction categories in subsection 5.6.1 – the “involved” group were all core group members, while the “distracted” and “unaware” groups consisted of the peripheral members.

However, all people, whether core or peripheral, expressed sentiments on how useful CB was for maintaining an idea of what was going on with the rest of the group.

We have little insight into those who did not use CB at all but one of the study participants who worked with other groups commented on how useful CB would be in those other groups:

*“Do I think that it could be useful? Yes. Do I think that [my own groups] would use it? No. I’m sort of split between two groups which are theoretically doing the same stuff but are not very cohesive ... I think that there needs to be some social cohesion and I think that there needs to be some work cohesion”*

In summary, CB works best for small coherent groups of intimate collaborators. It works less well for participants who are peripheral members. If people are not part of a cohesive group, they do not see CB as a panacea for bringing it together.

#### **5.6.4 Provide rich information sources and communication channels.**

As mentioned before, the most common (7 of 9 interviewees) motivation for using CB was the video awareness. Typical comments included:

*“For me being able to communicate with my colleagues using a tool that is so rich as the CB is very valuable.”*

*“The thing that I like the best is just being able to see video of what everybody’s up to ... because it’s just useful to have a sense of who’s in their office and who’s on the phone ... it just gives you a better sense of what’s going on.”*

Yet the richness provided by the video turned out to be a mixed blessing. Video awareness overshadowed other types of awareness information, e.g., static pictures were considered much less useful. Participants reported that they often neglected other these lesser forms of presence information. One participant, who used video throughout the study, said:

*“So the awareness information it gives me [when people are using video] is fairly reliable because I can see when they’re around. Whereas if they just have a standard static image it provides me much less awareness. ... I don’t really notice the away bar ... so really I rely heavily on the video. So I really like the fact that lots of people do use the video.”*

There were only two interviewees who did not have webcams during the study, though one of these people started using a webcam towards the end of the study period.



Both of these people said they felt somewhat left out. One said that people without cameras were like “*second class citizens.*” The relationship between video and this feeling of inclusion is emphasised by one person who started using video in the middle of the study period after he bought a camera:

*“There were benefits, in that, you know, people talked to me more ... because they knew I was there.”*

Video presence awareness also caused some frustration because it did not quite give people the capabilities of a true collocated situation. Sometimes people would try to contact someone through CB because they could see that person on the video, but they could not attract their attention. The following anecdote captures this frustration:

*“I almost get this impression that [Participant] will only look at the CB every so often, like maybe every 15 minutes or something. I have this impression that he [doesn't notice] when things change on it. It's more of he looks at it every now and then to see if something's happened. ... Often there's a long delay when I post a question to him and when he actually finally responds ... it bugs me sometimes and I guess I'd like to know why ... and I don't get that information.”*

In summary, CB's richer information and communication channels proved useful for awareness and interaction, but users were still very aware of the difference from real world interaction. This is good motivation to make CB's media items even richer.

### **5.6.5 Provide centres (locales).**

During the study period, all participants primarily used a single place. Three other places were created, but they were used infrequently and by few people, and were not long-lived. Two of the three only had two people each and the third had five people at its peak. The first two only lasted a period of hours, while the third lasted roughly 3 days. As investigators, we were somewhat surprised by this as we observed many instances where another place would have been warranted, e.g., when a conversation topic diverged or when a subset of the group was working closely together for an extended period of time. However, none of these events resulted in new places being created.

When asked why they did not create new places, participants responded in very similar ways, saying that they were not needed in the existing community social structure:

*“In CB you can make multiple places but I’ve not yet really come across a situation where I need to. Mostly I think because the people who are using CB that I know are all from the same kind of culture, they’re all from the lab here ... If I’m on the Community Bar, basically what I’m saying I take as public anyways so I see no real reason to go to another [Place]. I may open up another chat item to keep the conversations separate ... There’s always this feeling of not wanting to exclude people, particularly in a community that is so close and has a rich culture like we do.”*

When asked about the situations under which they would use different places, most participants hypothesised that they would use different places if they were also involved in distinctly different groups that did not know each other.

We questioned the small group of people involved in the “Games” place, the longest lived and largest of the secondary Places. Its creator said:

*“I started using it to discuss things that weren’t really relevant to all of [the people in the main place]. So, things like games. A lot of people who are in [the main place] don’t talk about it, they don’t really care about it, they’re not part of that group.”*

In summary, while CB’s Places were originally conceived as a way to have groups create many different locales, sites and means, this did not reflect how they were used. Instead, the study group saw a single Place as containing all community members and their activities. Thus our study group was too cohesive to make much use of multiple places. For multiple Places to be useful, we suspect there needs to be separate, distinct communities. Instead, we saw that the group used media items within a Place to implicitly create *mini-locals* used by group subsets. That is, people would post things to the Place that only a few people would be interested in, and let them make their own choices as to what was worth viewing.

### **5.6.6 Provide a way to relate locales to one another.**

As mentioned in the previous section, this group used only one primary place. Indeed, people who did create the other places did so because its purpose was quite distinctive from

the primary place. Yet even in this limited use of multiple Places, people expressed an interface issue as revealed in this quote:

*“In the Game place, there were the same people as in [the main] place so I had the same camera picture twice [for each person] and it was just totally cluttered ... so I didn’t like it that much.”*

Another limitation is that Places were hard to bootstrap because people in the primary place did not receive notification of when a new place was created, i.e., new places became ‘by explicit invitation only’. Even if they accidentally discovered a new place by its listing on a popup menu, they could not find out anything about it unless they entered it. This was something they were very hesitant to do uninvited, regardless of their curiosity:

*“I noticed them but I didn’t go into them because I wasn’t sure who they were and so I wasn’t sure if I was invited. Like I was curious about the games place but it was like, oh well, I don’t know who set it up and I don’t really know what it’s for, so I’m not going to join.”*

As mentioned, people did create ‘mini-locales’ within a Place. Yet there was no explicit way to relate these together except by semantic content. For example, a person may create a mini-locale by posting a web page and starting a chat about its contents, but the items that contained these could be scattered around the sidebar.

Thus CB’s design did not satisfy this principle. Places appeared to define distinctive communities, with little need to show the relationships between them. While people exploited media items to create mini-locales, they had no way to cluster related items together, e.g., by spatial positioning or grouping mechanisms. This clearly needs to be addressed in future versions.

### **5.6.7 Allow individual views.**

The few participants who made use of more than one place were able to easily discern the different contexts across their viewset and direct communication appropriately. Apart from the problem of repeated presence tiles described previously, people appeared comfortable with the idea of multiple places.

People were also comfortable with their individual views within a place, i.e., they all knew that item display was entirely local, while the information within them was shared. That is, each person had their own idiosyncratic view of the order of items on the sidebar, the size of items, the individual focus settings, that the raising of tooltip grandes and full views was entirely local, and that the owner of an item could see owner-specific information and controls.

Many participants' comments indicated that they wanted a greater level of control over their individual views than CB currently provides. Some people asked for specific features such as to be able to move media items within the sidebar so they could place the most important information at the top. More generally we received comments like:

*“If I could have a place where it has all the individuals where I only want to maintain a slight amount of awareness, and a place where it has a lot of awareness.”*

This comment reflects not only a stronger need for personal view control, but that part of this desire stems from people wanting to group things into mini-locales of varying interests to them.

### **5.6.8 Allow people to manage and stay aware of their evolving interactions over time.**

Study participants placed themselves into two distinct groups; the first much larger group wanted only information from CB about “right now”, while the other smaller group wanted more long term history information.

The “right now” group did not think that time information would help them gain any further awareness, or felt that the extra information that they would get would not be of any use to them.

*“There’s not much history but the things I use it for I wouldn’t necessarily want history ... to know if someone’s there, to know if they’re busy or on the phone.”*

Yet this reaction was item specific: members of this group still asked for timestamps to be added to Chat messages:

*“That would be nice, if it had a time stamp on messages cause I’ll see a conversation when I log on ... and I don’t really know when so I don’t know if I can add ... like if it was six hours ago I’m not going to jump in but if it was five minutes ago I might”*

The minority, time-based group felt that historical information could help them to predict useful future events:

*“If I look to see if [Participant]’s around and see he’s not, I have no idea of when he left which could be a good indicator of when he’s probably coming back.”*

They also wanted presence information to be augmented with known future events:

*“I can’t get any sort of long term prediction because I only get a small snapshot. Like maybe if CB videos were augmented with a calendar of when the person had appointments that day I could know they’re available right now, they don’t look like their busy, but they have a meeting in 10 minutes.”*

Another interesting pattern occurs when participants were away from their desk for a while. When they came back they were unable to assess whether they should respond to new information.

*“There were times when there was a message in there... like I didn’t know when the person had said it so I didn’t know if it was relevant to reply.”*

The long-term awareness group also suggested interest in long-term information about other users’ rhythms (Begole et al, 2002), because this would help them predict future behaviour.

In summary, while people’s reactions varied, several uses of an evolving interaction emerged: to see if lingering items are still relevant, to review past activities, and to help form predictions of future activities so that they can manage their interaction more effectively.

### **5.6.9 Provide methods for controlling focus.**

Focus controls were primarily used to increase awareness of video images in the Presence tile, where people would set it at their maximum size. To explain, when there are too many items to fit in the sidebar, CB automatically reduces the size of all existing items to make

room for the new one. Yet people wanted video items at full size. One user expressed the frustration like this:

*“I don’t have the time to go in and adjust people’s focus all the time... I have tried in the past but then all of a sudden I’ll have too many items on my bar and then CB will re-adjust everybody’s focus and then it’s like, why did I bother in the first place?”*

Another problem is that CB did not increase the size of tiles when room became available:

*“You know, lots of people log in and it makes everybody smaller then some of them leave and so people are sort of arbitrarily sized so there were certain people I would go back and make them bigger so that I could actually see them.”*

*“I’m just getting rid of white space so that everyone will fit - I actually wish that CB would do this for me but it doesn’t.”*

Sometimes, however, people used the focus to reduce the size of items that were less interesting, e.g., people’s photos down to names, or empty chats. Overall, they used this strategy to make the awareness information on the sidebar more viewable ‘at a glance’, i.e., a quick glance at it would let them concentrate on the items of most personal interest.

People also used focus to mute items that had already been read such as a web page. *“[I shrunk it] because I read the contents and didn’t need to see the whole thing anymore until it changed.”* This behaviour suggests that users had a clear preference for seeing constantly changing dynamic information on the sidebar, rather than static information that had already been seen.

Obviously, CB’s focus control is flawed. People should use it to adjust awareness needs rather than fight the constraints imposed by automatic resizing. This should be changed. For example, people could indicate that video should always be as large as possible. Automatic resizing should reuse empty space when the bar is less busy. User settings should be stored so the system remembers preferences. Grouping, as mentioned previously, could be used to place and shrink less interesting items.

In summary, focus control in real life is a matter of glancing around and attending to things as desired. This is reasonably emulated in the tooltip grande and full view. However,

the explicit focus control in the tile view, while valuable, is too awkward and too much work.

#### **5.6.10 Provide methods for controlling nimbus.**

People with a webcam typically left their Presence nimbus at its maximum, i.e., to show video. Those who did not own a webcam changed the nimbus to a static picture instead of a test pattern (in hindsight, this should have been done automatically by CB).

People used reciprocity as the reason for keeping their nimbus setting at the richest level possible. Of the nine participants that talked about video use in the interviews, five said that not showing video would be unfair for the people who were showing video. There were two reasons for this. First, video was perceived as so much richer and more useful than the other presence information (as already discussed in subsection 5.6.4) and users wanted to provide others with good presence information. The second reason was a function of the community's social practices. One user's comment summed up the general feeling in the group:

*“The social environment was such that it would be weird if you [reduced nimbus]... People may ask questions like why.”*

One home telecommuter would adjust his nimbus when he left the home office, as he was concerned that other family members using the room would be caught on camera. However, he always readjusted the nimbus back to full on his return.

Even when people did not use the nimbus control, they still believed this power was important. Indeed, some people did not join CB because they did not feel comfortable being on camera all the time. Some were concerned over being caught on camera at embarrassing moments. Some telecommuters didn't think that the camera was appropriate for their home environment.

CB's nimbus control was also too discrete: either video was transmitted, or not. People wanted finer control, where video could be transmitted but at reduced fidelity (Neustaedter 2003). One of our interviewees described his problem and solution:

*“When I’m at the university I basically don’t care what people see of me because I’m in a public place ... but when I go home I’m very conscious of what people see of me because I’m not constrained like I am at work, you know to be dressed appropriately [and] there’s other people at home that don’t like cameras ... I don’t actually change my nimbus though when I’m at home, it stays at full I’m pretty sure because I still like to present people with a video as oppose to the picture because I don’t feel the pictures provide much information, so what I instead do is take my camera and I adjust the focus ... so I’m blurred in the background.”*

We also saw people pointing the camera at the keyboard or mouse, affording privacy while still providing some awareness information to others. Even when neither of these techniques was used, all participants made sure that their camera was directed so as not to capture visitors or people just passing by.

In summary, CB provides explicit but limited control over nimbus. People worked around this by implementing their own fine-grain adjustments of video nimbus by changing their environment rather than using CB’s less than perfect controls.

## **5.7 Discussion**

Because there are overlaps in the above principles and study results, we will structure our study implications within the four themes presented in Chapter 2.

### **5.7.1 Multiple social worlds through public locales.**

While we know that multiple places are theoretically sound and have proven useful in another casual interaction system (Fitzpatrick et al, 1998), CB Places were used very little. As mentioned, a CB Place seemed to define a community rather than a public locale. Instead, people tended to use collections of CB media items as implicit locales; this led to disparities between the levels of awareness people wanted on the items defining these locales.

The Locales Framework (Fitzpatrick, 2003) strongly features the concepts of *centre* and *peripheries*. The peripheries of our study’s social world became very apparent during our interviews. People felt on the periphery for a variety of reasons: not having a webcam



when most others did; not being collocated with the majority of the group; and not being part of the “core” group consisting of the Professor and his students. Those on the periphery were unable to adequately express their distance from the centre to others and the system did not support their different needs within the space.

Clearly, CB has to be redesigned. Perhaps these mini-locales can be created in place, with items easily grouped and its nimbus easily adjusted. In this way, those at the centre can have greater awareness and opportunities for interaction. Those at the periphery can still acquire passing information about the core group’s activities, and move towards the centre as desired by readjusting their focus (see the last part of this section).

### **5.7.2 Ad hoc groups.**

As previously mentioned, CB Places did not encourage ad hoc groups. Even when a new Place was created, it was not used that much and it was not long lived. This could be partly explained through interface issues, e.g., that people were not notified when a place was created, and that they were reluctant to enter a place unless explicitly invited.

However, a more likely interpretation is that ad hoc groups *were* created, but outside the explicit structure offered by the Community Bar. Just as people created their own implicit locales through media items within a place, they also formed implicit ad hoc groups as a function of their awareness and CB activities. This was evident by the way chat items were used. Typically, only subgroups partook in discussions in chat items, and different chat items were often created (or taken over) for different purposes and people. Similarly, different sub-groups were interested in different things at different times: this likely led to some of the differences in how people interpreted some media item awareness information as useful *vs.* as clutter and distracting. People seemed comfortable – even those who were ‘on the periphery’ – of doing all this ad hoc group formation within the context of the larger CB community.

Implementing the CB changes mentioned previously could also help how people who are part of a larger community form and dissolve ad hoc groups within it. Rather than

create an explicit structure for ad hoc groups, the easy creation and use of a mini-locale may be all that is needed to define it.

### **5.7.3 Lightweight transitions from peripheral awareness to foreground interaction.**

The design of peripheral awareness with transition to foreground interaction is borrowed from the *quick drill-down and escape* design principle in the Sideshow system (Cadiz et al, 2002). The success of the Sideshow deployment trial indicated that this design principle should work, and this is what we saw in CB. No one mentioned problems with the drill-down awareness-to-interaction-transition design, suggesting it is a natural way to move between the two.

Our usage data and interview results indicate that the primary use of CB is as a peripheral awareness tool that promotes feelings of belonging to the group. Our data also shows that it is the Chat item's full view that is used most often. CB succeeds because awareness can be easily transformed into intensive, full-focus collaborative interaction. Of course, CB could do much better in supporting rich interaction, e.g., by offering high quality Voice over IP, and better groupware interaction tools.

### **5.7.4 Focus/nimbus control of centre/periphery relationships and awareness.**

The study uncovered many centre/periphery issues. Of most concern, it revealed that people on the periphery of the core group were inadequately supported. They were unhappy about the notifications they received, as these were usually about communications more relevant to people near the group centre. Their concerns indicate that CB's focus and nimbus controls are not sufficient for peripheral group members.

The central issue seems to be that, despite our efforts to do away with the rooms metaphor, CB Places are still too much like rooms. We feel strongly, after seeing these results, that CB has to provide more *transitory zones* if it is to be effective. Leveraging

the idea of implicit locales, these zones could be constructed as mini-places that allow some of the interaction within it to “leak” out into the surrounding area. Perhaps the idea of focus and nimbus controls for centre/periphery relationships is the wrong approach. Instead, people need lightweight, natural and flexible control over how they move between the centre and the periphery. Awareness is adjusted as a consequence.

### **5.7.5 Final words.**

While we have been somewhat critical of CB throughout this discussion, it is important to remember that CB is fundamentally useful. Our group has voluntarily used CB for over two years. CB’s design also evolved in this period in response to the feedback received from dedicated and enthusiastic users. The problems reported here provide yet another way for us to reflect on how we can move CB’s design forward.

## **5.8 Conclusion**

The basic repeating pattern throughout our results was that the theoretical principles are valid. When people could use CB’s design features in a way that matched the principles, we received very positive feedback. When CB’s design – in spite of good intentions – was a mismatch to this theory, our study participants would point out that we were missing such support, and would often find workarounds to implement this support ‘outside’ the system’s structure.

Perhaps the most interesting result here was the misinterpretation of how social worlds would arise out of CB. The assumption when designing CB was that different Places were enough for division of social worlds, but the study has shown that there is a need for two levels of social world to be supported: firstly, “community” social worlds that are distinct from each other and correspond to CB’s Places; and secondly, smaller mini-locals within the community that are not supported in CB.

The next chapter concludes this thesis with a summary and some indications of future directions for this research.



## **Chapter 6. Conclusion and Future Work**

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At the start of this thesis, in Chapter 1, I began with the proposition that existing informal awareness and casual interaction tools, while demonstrating the benefits of some design points, are impoverished when considered in the context of a rich sociological concept of community. To address this, I have derived design principles from a comprehensive sociological theory (Chapter 2). I have described the interface implementation of the Community Bar that arose from these design principles (Chapter 3). I have also described the Community Bar architecture to support the interface implementation (Chapter 4). Once the implementation was mature and stable, I, in conjunction with some colleagues, performed an extended field study that allowed us to reflect on both the implementation and the sociologically based design principles (Chapter 5).

In this chapter I will discuss some future research directions that could be taken with this research and conclude by revisiting the original goals of this thesis.

### **6.1 Future Work**

There is always room for more research and Community Bar has raised many interesting questions about informal awareness and casual interaction within communities. The following are a few points of interest that warrant further investigation.

#### **6.1.1 Time and Locales**

User feedback and study results have both suggested some simple interface changes. Time stamps on chat messages, for example, were implemented in a version released soon after the study, and they have markedly improved the experience of using the chat item. Another relatively simple fix was to make CB media items expand to use up available blank space if

they had previously been shrunk automatically when space ran out. This feature is not currently available but is implemented for the next release of CB.

These small features just touch the surface of two larger issues: time awareness and supporting mini-locales. Time stamps are a small step in the direction of greater time awareness. Automatically re-expanding media items is part of respecting people's view preferences, which will help with managing mini-locales.

- **Time Awareness.** Although the study results show that some users did not care about time awareness, there were a significant number of people who did. Information that could be included about other Place members includes time of last activity, average activity patterns, this day's activity patterns, and other information for interpreting routines and rhythms (Begole et al 2002). Tang et al (2003) presented a study about the kinds of information necessary to explore histories of multimedia interactions, and these could be incorporated into CB to increase a user's time awareness. Adding these types of features would also increase support for asynchronous interaction in CB; currently a frustrating experience for users who travel to or live in different time zones.
- **Supporting mini-locales.** One of the major results of the study was the discovery that people formed ad hoc subgroups within Places. We called these mini-locales. That people were able to do this is encouraging. It suggests that CB supported (even by accident) the group's behaviour. However, there were also many issues reported about managing views onto this interaction: peripheral members received too much information; people were frustrated when CB changed their carefully constructed views; and not being able to reorganise items. In response to these issues I have implemented the automatic re-expansion of media items to the user's preferred size and capabilities for moving media items in the sidebar. It is possible that these two features are only treating the symptoms of a deeper problem, however, and they don't address the problems faced by peripheral members. I would like to see how the group uses these new features and what problems arise.

### **6.1.2 Further Evaluation**

The results of the study need to be confirmed against other types of user communities. An initial interview has already been conducted with members of a commercial development team who are using CB. The results, though very preliminary at this stage, are positive. It seems that, although the team's situation is somewhat different (e.g. no remote users, very few webcams), their use of CB is very similar. I would like to confirm this result through more in depth studies and by looking at other groups.

In addition to confirming that groups interact in similar ways at a high level, I believe there would be a lot of interesting material in the differences between groups in different contexts. Even the very preliminary interviews with a second group (the commercial development team mentioned earlier), there are some interesting differences noted. For example, they use the Screen Sharing Media Item a lot more than the primary study group in Chapter 5. Maybe this arises from the type of work they are doing, their shortage of webcams, or some other factor that not yet noticed.

### **6.1.3 Other Contexts**

In the longer term, the principles of CB could be extended to other types of interface such as semi-public displays or mobile devices. The current architecture supports relatively simple implementation of new interfaces for CB and this could be leveraged to support other devices.

For example, the Notification Collage (Greenberg and Rounding 2001, Rounding 2004) was very well suited for large displays. A Notification Collage-like interface could be built for CB to be displayed in a community's public spaces to support people that are not next to their personal desktop computers all the time but remain within a certain area. For more far-ranging mobile communities, perhaps a mobile device interface could be better suited.

## 6.2 Thesis Contributions Revisited

The four steps described in this thesis – principles from theory, design and implementation from the principles, extensible groupware plugins, and evaluation – have led to three primary contributions.

**1. Design Principles.** My first contribution is to derive a series of design principles from a comprehensive sociologically based framework, supported by a generalised model of awareness and previous research in informal awareness and casual interaction specifically. While I do not claim that individual principles are new, their combined effect gives new insights into the design of systems, as discussed in Chapter 2. These combined principles indicate support for multiple public locales, ad hoc groups, lightweight transitions from awareness to interaction, and focus/nimbus controls for membership and awareness.

**2. Community Bar.** However, I recognize that these principles are high-level and very general, and do not immediately translate into a particular design. Consequently, my second contribution is to demonstrate how these principles can be applied to generate a novel design of groupware supporting informal awareness and casual interaction: the Community Bar. Of course, even good principles do not necessarily guarantee good design; this is why CB design details are augmented by six years of observation and feedback: four years from its Notification Collage predecessor, and two years of CB use (this includes a pilot study that tracked details of user interactions within CB).

**3. Groupware Plugins and CB Architecture.** Any single piece of groupware cannot hope to incorporate all the functionality required by everyone. Extensible customisation of groupware through Media Items (McEwan et al, 2006), was a major contribution of the earlier Notification Collage work (Rounding, 2004). I extended and published this work as part of CB. The architectural design also demonstrates a modular design using the distributed Model-View-Controller pattern, leaving an easy path for future CB client interfaces to be created.



**4. Evaluation.** My fourth contribution is an evaluation of Community Bar in practice, and through that an evaluation of the original design principles. The evaluation stems from a field study of a group of people using CB over an extended period of time where we observed the group practices and interviewed them afterwards. Their activities and responses informed reflection upon the design principles and CB's success at implementing them. The importance of this contribution is in further exploration of how to implement the design principles. The study results, and reflection on them, elaborate on the strengths and weaknesses of my interpretation of the principles in design and implementation.

I have also contributed a system that has been successful in supporting informal awareness and casual interaction for a community in actual use. I hope that the system and the research results here will support other communities in the future.

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## **Appendix A. Co-Author Permissions**

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UNIVERSITY OF  
CALGARY

July 25, 2006

Eindhoven University of Technology  
Den Dolech 2  
5612 AZ Eindhoven  
The Netherlands

I, Natalia Romero, give Gregor McEwan permission to use co-authored work from our technical report (to be submitted for conference publication later), "A Field Study of Community Bar: (Mis)-matches between Theory and Practice" for Chapter 5 of his thesis and to have this work microfilmed.

Sincerely,

Natalia Romero

A handwritten signature in black ink, appearing to read "Natalia Romero", written over a light blue circular stamp.



UNIVERSITY OF  
CALGARY

July 31, 2006

SMART Technologies  
1207 – 11 Avenue SW, Suite 300  
Calgary, Alberta  
T3C 0M5  
CANADA

I, Michael Boyle, give Gregor McEwan permission to use co-authored work from our paper, "Groupware Plug-ins: A Case Study of Extending Collaboration Functionality through Media Items," for Chapter 4 of his thesis and to have this work microfilmed.

Sincerely,

A handwritten signature in cursive script that reads "Michael Boyle".

Michael Boyle





UNIVERSITY OF  
CALGARY

July 31, 2006

SMART Technologies  
1207 – 11 Avenue SW, Suite 300  
Calgary, Alberta  
T3C 0M5  
CANADA

I, Michael Rounding, give Gregor McEwan permission to use co-authored work from our paper, "Groupware Plug-ins: A Case Study of Extending Collaboration Functionality through Media Items" for Chapter 4 of his thesis and to have this work microfilmed.

Sincerely,

A handwritten signature in black ink, appearing to read "Michael Rounding".

Michael Rounding



UNIVERSITY OF  
CALGARY

July 31, 2006

University of Calgary  
2500 University Drive NW  
Calgary, Alberta  
T2N 1N4

I, Ehud Sharlin, give Gregor McEwan permission to use co-authored work from our technical report, "Moving a Media Space into the Real World through Group-Robot Interaction" for Chapter 4 of his thesis and to have this work microfilmed.

Sincerely,

  
Ehud Sharlin



UNIVERSITY OF  
CALGARY

July 25, 2006

University of Calgary  
2500 University Drive NW  
Calgary, Alberta  
T2N 1N4

I, James Young, give Gregor McEwan permission to use co-authored work from our technical report, "Moving a Media Space into the Real World through Group-Robot Interaction" for Chapter 4 of his thesis and to have this work microfilmed.

Sincerely,

A handwritten signature in black ink, appearing to read "James Young".

James Young



UNIVERSITY OF  
CALGARY

July 31, 2006

University of Calgary  
2500 University Drive NW  
Calgary, Alberta  
T2N 1N4

I, Saul Greenberg, give Gregor McEwan permission to use co-authored work, listed below, for Chapters 2, 3, 4, 5, and 6 of his thesis and to have this work microfilmed.

Papers:

- "Groupware Plug-ins: A Case Study of Extending Collaboration Functionality through Media Items",
- "Supporting Social Worlds with the Community Bar"

Workshop papers:

- "Community Bar: Designing for Awareness and Interaction"
- "Community Bar Places for Collaboration"

Technical reports:

- "A Field Study of Community Bar: (Mis)-matches between Theory and Practice"
- "Moving a Media Space into the Real World through Group-Robot Interaction"

Videos:

- "Shared Desktop Media Item: the Video"
- "Community Bar (The Video)"

Sincerely,

A handwritten signature in black ink, appearing to be "Saul Greenberg".

Saul Greenberg



UNIVERSITY OF  
CALGARY

July 29, 2006

Department of Computer Science  
University of Calgary  
2500 University Drive NW  
Calgary, Alberta  
T2N 1N4  
CANADA

I, Kimberly Tee, give Gregor McEwan permission to use co-authored work from our video, "Shared Desktop Media Item: the Video" for Chapter 4 of his thesis and to have this work microfilmed.

Sincerely,

A handwritten signature in cursive script that reads "Kimberly Tee".

Kimberly Tee



UNIVERSITY OF  
CALGARY

July 31, 2006

Department of Computer Science  
University of Saskatchewan  
110 Science Pl.  
Saskatoon, Saskatchewan  
S7N 5C9  
CANADA

I, Carl Gutwin, give Gregor McEwan permission to use co-authored work from our video, "Shared Desktop Media Item: the Video" for Chapter 4 of his thesis and to have this work microfilmed.

Sincerely,

A handwritten signature in cursive script that reads "Carl Gutwin".

Carl Gutwin

## **Appendix B. Ethics Application**

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UNIVERSITY OF  
CALGARY

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**CERTIFICATION OF INSTITUTIONAL ETHICS REVIEW**

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This is to certify that the Conjoint Faculties Research Ethics Board at the University of Calgary has examined the following research proposal and found the proposed research involving human subjects to be in accordance with University of Calgary Guidelines and the Tri-Council Policy Statement on "*Ethical Conduct in Research Using Human Subjects*". This form and accompanying letter constitute the Certification of Institutional Ethics Review.

File no: **4162**  
Applicant(s): **Kimberly E. Tee**  
Gregor McEwan  
Department: **Computer Science**  
Project Title: **Exploratory Study of Community Bar**  
Sponsor (if applicable):

**Restrictions:**

**This Certification is subject to the following conditions:**

1. Approval is granted only for the project and purposes described in the application.
2. Any modifications to the authorized protocol must be submitted to the Chair, Conjoint Faculties Research Ethics Board for approval.
3. A progress report must be submitted 12 months from the date of this Certification, and should provide the expected completion date for the project.
4. Written notification must be sent to the Board when the project is complete or terminated.

\_\_\_\_\_  
**Janice Dickin, Ph.D, LLB,**  
**Chair**  
**Conjoint Faculties Research Ethics Board**

2004/11/08

**Date:**

**Distribution:** (1) Applicant, (2) Supervisor (if applicable), (3) Chair, Department/Faculty Research Ethics Committee, (4) Sponsor, (5) Conjoint Faculties Research Ethics Board (6) Research Services.



30 August, 2005

**To:** The Chair, CFREB  
c/o Mrs. Patricia Evans,  
Room 602 Earth Sciences

**From:** Kimberly Tee, Gregor McEwan, and Saul Greenberg

**Re: Modifications to Approved Protocol:** Exploratory Study of Community Bar (File No. 4162)

With regards to the research proposal titled "Exploratory Study of Community Bar" (file no. 4162). We have completed the first pass of the study described in the previously approved ethics application. However, we would like to continue this study through a second round. While the ethics concerns and the study protocols remain very similar to that described in the original application, there are a few minor changes that require your attention.

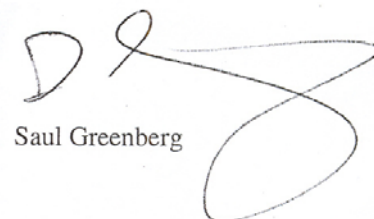
Detailed below is a list of the changes we would like to make to the original Application for Ethics Review form.

- **Section 1.** Addition of co-investigator Natalia Romero, a PhD student from the Eindhoven University of Technology, Netherlands, who will be here in the Department of Computer Science as a visiting researcher for four months, October, 2005 – January, 2006.
- **Section 3.2.** Addition of Community Bar use by people located in other sites aside from our laboratory and participants homes. Examples include different research laboratories and work settings.
- **Section 3.6.** The completion date is now August 2006.
- **Section 4.** In the previous form, investigators participated as full members of the various electronic Community Bar communities. In this stage, investigators may also act as outside observers as well, monitoring but not necessarily interacting as community members.
- **Questionnaires.** While study details may change in minor details (e.g. the particular questions asked in the interview and on the questionnaire), the style, substance, and structure will remain essentially unaltered from those attached to the original. We are not submitting new questionnaires as the original samples still apply.
- **Consent and other forms.** These forms will only be modified to reflect the addition of the new investigator and modified study protocols mentioned above.

Sincerely,

  
Kimberly Tee

  
Gregor McEwan

  
Saul Greenberg

Department of Computer Science  
University of Calgary



UNIVERSITY OF  
CALGARY

MEMO

Conjoint Faculties Research Ethics Board (CFREB)  
Research Services Office  
Main Floor, Energy Resources Research Building  
Research Park  
Telephone: (403) 220-3782  
Fax: (403) 289-0693  
Email: plevans@ucalgary.ca

**To:** Kimberly Tee and Gregor MacEwan  
Department of Computer Science

**Date:** September 6, 2005

**From:** Dr. Janice P. Dickin, Chair  
Conjoint Faculties Research Ethics Board

**Re:** Approval of Modification for: Exploratory Study of Community Bar  
Original Approval Date: 08 November 2004  
File No: 4162

The Certificate of Institutional Ethics Review issued on 08 November 2004 continues in force and extends to the modifications as set out in your memo dated 30 August 2005. Your requests to: include Natalia Romero (PhD student from the Eindhoven University of Technology, Netherlands) as a co-investigator for the project; add to the study Community Bar use by people located in sites other than the researchers' laboratory and participants' homes, such as different research laboratories and work settings; extend your completion date to August 2006; and have investigators act as outside observers, and not necessarily as full members, of the Community Bar communities are approved, as described.

You should attach a copy of the documentation you provided in order to request the modification, together with a copy of this memorandum, to the original Certification in your files.

Sincerely,

Janice Dickin, Ph.D., LL.B., Professor  
Faculty of Communication and Culture  
Chair, Conjoint Faculties Research Ethics Board

**Cc:** Faculty/Department Chair  
Supervisor: Dr. S. Greenberg



UNIVERSITY OF  
CALGARY

Kimberly Tee, Gregor McEwan & Natalia Romero  
Department of Computer Science  
University of Calgary  
2500 University Drive  
Calgary, AB, CANADA T2N 1N4

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## Invitation to Participate: Using an Informal Awareness and Casual Interaction Tool

### What is Involved?

We are looking for people to participate in a study exploring how distance-separated people use an informal awareness and casual interaction tool. Participants will be asked to use an informal awareness and casual interaction tool during two observational periods of two weeks (total one month). Participants' groups and interactions over the tool will be monitored and data will be collected about them. Interviews or questionnaires may be distributed during and after the observational period.

Participation in this study will not put participants at any risk or harm and is strictly voluntary.

### Interested in Participating?

If you are interested in participating, or if you would like more information, please contact us:

Kimberly Tee  
Gregor McEwan  
Natalia Romero

(403) 210-9501  
(403) 210-9501  
(403) 210-9501

[tee@cpsc.ucalgary.ca](mailto:tee@cpsc.ucalgary.ca)  
[mcewan@cpsc.ucalgary.ca](mailto:mcewan@cpsc.ucalgary.ca)  
[n.a.romero@tuc.nl](mailto:n.a.romero@tuc.nl)



UNIVERSITY OF  
CALGARY

Kimberly Tee, Gregor McEwan, & Natalia Romero  
Department of Computer Science  
University of Calgary  
2500 University Drive  
Calgary, AB, CANADA T2N 1N4

## Consent Form for Participants

**Research Project:** Exploratory study of Community Bar

**Investigators:** Kimberly Tee, Gregor McEwan, and Natalia Romero  
**Supervisor:** Saul Greenberg

This consent form, a copy of which has been given to you, is only part of the process of informed consent. It should give you the basic idea of what the research is about and what your participation will involve. If you would like more detail about something mentioned here, or information not included here, you should feel free to ask. Please take the time to read this carefully and to understand any accompanying information.

### Description of Research Project:

The purpose of this study is to explore how people use an informal awareness and casual interaction tool, Community Bar. We will ask you to use Community Bar during two observational periods of two weeks (total one month). To get used to the system, we will ask you to try to use it as much as possible during this time, e.g., by having it on permanent display. Your group and your interactions over Community Bar will be monitored and data will be collected about them. Also, an evaluator may join Community Bar from time to time or as a permanent Community Bar member. Interviews or questionnaires may be distributed during and after the observational period.

Participation in this study will not put you at any risk or harm and is strictly voluntary. You choose to participate by using Community Bar. You may choose to withdraw from the study at any time by simply not using the system any more. Any data collected to your withdrawal will still be available to the investigators for analysis. Electronic data will be stored in a secure manner, such as in a computer secured with a password. Hardcopies of data will be stored in a locked cabinet/room with restricted access. Data will be kept for a minimum of three years. On disposal, electronic data will be erased and hardcopies will be shredded.

Personally identifiable information will only be used in papers or presentations with your explicit permission. If we wish to use any personally identifiable information, we will contact you with the particulars of the information we wish to use, and you may decide whether or not you give us the permission to use it. If you choose at this time not to give us permission to use personally identifiable information we collect in papers or presentations, please indicate so below by checking the box:

- I do not give the investigators permission to use personally identifiable information in papers and presentations.



# UNIVERSITY OF CALGARY

Your signature on this form indicates that you have understood to your satisfaction the information regarding participation in the research project and agree to participate as a subject. In no way does this waive your legal rights nor release the investigators, sponsors, or involved institutions from their legal and professional responsibilities. You are free to withdraw from the study at any time. Your continued participation should be as informed as your initial consent, so you should feel free to ask for clarification or new information throughout your participation.

At the conclusion of the study and its analysis, we will post any resulting papers that we have written about them. You can view these by asking the investigator or by accessing the website: <http://groupiab.cpsc.ucalgary.ca/papers/index.html>

If you have further questions concerning matters related to this research, please contact:

Kimberly Tee	(403) 210-9501	tee@cpsc.ucalgary.ca
Gregor McEwan	(403) 210-9501	mcewan@cpsc.ucalgary.ca
Natalia Romero	(403) 210-9501	n.a.romero@tue.nl

If you have any questions or issues concerning this project that are not related to the specifics of the research, you may also contact the Research Services Office at (403) 220-3782 and ask for Mrs. Patricia Evans.

---

Participant's Signature

Date

---

Investigator and/or Delegate's Signature

Date

---

Witness' Signature

Date

A copy of this consent form has been given to you to keep for your records and reference.