Iris

Informal workplace awareness with images and taglines

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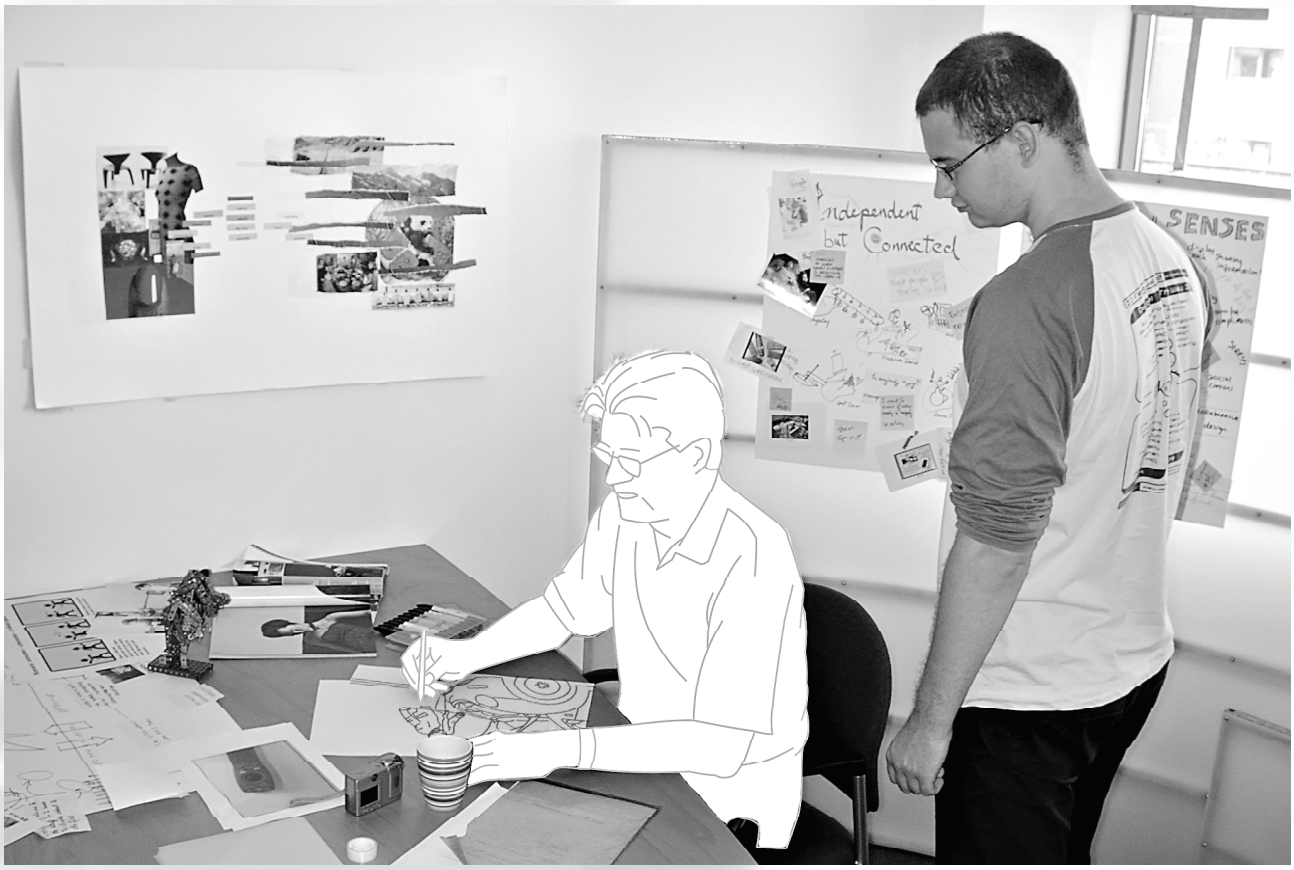
1 Introduction

Creative professionals are struggling these days. On the one hand, the computer enables them to create things they couldn't dream of before and to communicate in new ways. On the other hand, we lost a few things in the process as well. Because much of the creative work being done is made on computers, it often stays in there.

A shared overview of what's happening in the workspace, whether it is work, talk or people's presence, easily facilitates communication and other joint efforts. Unfortunately, the lack hereof by staying inside the computer, has led to creative professionals are missing some of the means for inspiration and learning opportunities. One might even argue that we are living together alone and should do away with shared workspaces altogether.



At first, the aim of this project was to explore if technology could make a difference in the workplace in terms of awareness. Literature from the field of Computer Supported Collaborative Work suggests so, but the apparent lack of detailed user studies and, with some exceptions, yielded either crude or passive systems in my opinion. Since we do most of our work on computers these days, I decided that the computer itself had to be used if we want to be able to gain a shared overview of what's going on in the workplace and of what people are working on. I personally believe this should be accomplished by binding people to one another and workspace using low threshold, open, pleasurable, free and ludic means.

In the process, I became somewhat frustrated with the lack of good examples, while I was running astray with the number of directions I could take this project to. At a certain moment my overzealousness with trying to use all the data I had gathered from people around me and from literature I had found caused the project to

come to a halt. Only when I started making choices, focusing on an interaction model by using metaphors and started building things, I was able to create something meaningful. This resulted in an addition to the awareness theme: I became interested in how people would interact socially with what I had created and even more so, to what end and what its implications would be.

For this purpose, I created a groupware environment, where people may interact with each other by using digital analogs of refrigerator magnets and sticky notes. The groupware environment, or Iris as I called it after the messenger of the gods in Greek mythology, is composed out of three components; a widget for use on the computer, a robot called Arthur and the Sticky Board. I tested this, by living and working with it, at the ID-StudioLab over a five-week period with 23 people. The ID-StudioLab is a research group composed of people designing as well as doing research on design, situated at the faculty of Industrial Design Engineering, Delft University of Technology. In this report I give an overview of the background of this project in Calm Technology, describe the Iris environment and report our experiences with its pleasurable interface.

2 Literature

As with most research, this project connects to multiple fields. It involves people (in a community), technology and design, therefore, I chose to look at the fields of sociology and interaction design and the field that tries to incorporate both of them, computer supported collaborative work. Within each of the fields I chose those elements I thought were applicable and which matched my own intuition.

2.1 Social Aspects

This project is about supporting creative people in their working environments, sharing interests, goals, expertise, location and timeframe. This may point out that this working environment houses a community, however, Lave and Wenger's [25] work on Communities of Practice (CoP) is more applicable and provides a few concrete characteristics. A Community of Practice has three characteristics: domain, community and practice.

1. The domain: a CoP's identity is defined by a shared domain of interest, requiring it's member's to have commitment and certain competences relevant to the domain. In the case of designers the domain is design and their competences are one or more relevant to design, like drawing or modeling.
2. The community: Within a CoP members engage themselves in joint activities and discussions, help each other and share information, helping to build relationships from which people can learn from each other. Within a design firm, the employees often work together on a daily basis, therefore seeing and speaking each other on a regular basis. They may participate in workshops, brainstorm sessions, help each other, engage in casual conversations at the coffee machine or go out at night together.
3. The practice: member's of CoPs share knowledge and resources, like experiences, stories, tools and ways of dealing with problems. A designer working on a presentation might ask a colleague how something works in Photoshop for example.

Communities of Practice were not invented in the twentieth century; they've been around for as long as humans. The difference is that they were properly described in the twentieth century. Communities of Practice can be either formal or informal and are formed for the purpose of doing things together and to learn from each other. Describing CoPs has been an important step in understanding learning in social groups revolving around a practice. Basically, two types of learning can be discerned: convergent learning inside the community and divergent learning towards the boundaries. The latter happens when there's a tension between the community's competences and individual experiences. Wenger states that these two aspects are necessary to form and maintain a CoP. These tensions may arise when new elements are added to the community, whether it is a new member, newly gained knowledge or a new object or artifact.

Brown and Duguid [4] note that the view of CoPs as a way of learning within organizational settings differs largely from previous methods. The classical, formalized view, or canonical as Brown and Duguid call it, separated learning from the practice. The problem with this is that it bypasses improvisation and the social aspects of learning. In practice people collaborate with one another by telling stories and thereby learn from each other. Brown and Duguid argue that this noncanonical practice is necessary as learning is social by nature, if it is to be successful within the workplace. Later on [3], both emphasize the role of artifacts in this

process. To them, an artifact has a center and a periphery, relevant to the practice. The center deals with the individual relationship a person has with the artifact, whereas those aspects available to anyone reside in the periphery. By using the border, where center and periphery meet, people are able engage themselves in social interactions. To a driver, for example, the engine sounds may be the center of attention, while for a passenger it is most likely in the periphery. A disturbance herein easily facilitates communication and collaboration. It's something both can easily relate to, it's socially present and to put it simply, gives something to talk about. It's noteworthy to point out that Brown and Duguid say their use of periphery is the same as Lave and Wenger's, although it's more closely related to the use described in Calm Technology. [22, 24]

2.2 Media Aspects

Although similarities exist, supporting communities is quite different from building a community. The main goal is to support an existing community by raising global awareness of the ambience, the participants and activities, in order to have a calming effect on people. This is a paradox; how is it possible to have a calming effect on people by adding more information, when people in general are suffering more and more from information overload? Within our own community, the ID-Studiolab [17], when people want to know something they have to explicitly ask a person; this is not necessarily bad, but continuously asking people might keep them from what they are doing. The ambience in the ID-Studiolab is not the easiest to start working in, because of the open space and people blurting out things; this should remain however, since this makes the environment fun, open and creative. Another paradox arises due to the fact that information overload happens mostly with the use of computers, while the tool to be developed will use computers in some way or another. A community-supporting tool might facilitate a gray area, thus creating a background hum. Just as people need a minimal sound level in order to sleep, this background hum of activity might be assuring to the members of the community and thus calming. Many researchers have tried and are still trying to tackle this subject and in the following paragraphs a number of them and their research will be mentioned.

Some work in CSCW focuses on supporting awareness in workspaces. The workspace may be the design firm's building(s) and the studios and offices therein. To understand this we must know what is meant by awareness in the context of workspaces and what the relevance is to the workspace. Essentially the workspace is the environment occupied by the community of practice in question. Awareness in CSCW research includes the ability of having a basic understanding and notion of who's around at a given moment, where they are and what activities and events are taking place. Being aware of what it is people are working on is also a part of awareness and is especially important in teamwork. To put it simply, awareness is the ability to maintain a connection to the environment, socially and physically. Learning is one of the key elements in research on Communities of Practice and deals mainly with the characteristic of community mentioned by Wenger. Supporting awareness in the workspace may thus be seen as a means of supporting Communities of Practice, but research on the latter is only sparingly mentioned in CSCW research on workspace awareness for some reason.

During early nineties, CSCW adopted research on supporting awareness in the working environment in addition to supporting collaborative efforts. Early research focused mainly on what type of technologies could be used for supporting workplace awareness. People at XeroxPARC and EuroParc pioneered the first steps in what became known as Computer Supported Collaborative Work. Both RAVE [10] and Portholes [6] show how

awareness of people within the workplace may be achieved. Experiments were conducted using chat, instant messaging, bulletin boards and so on, or even digital (immersive) environments were created consisting of two or more technologies. Later on, research on CSCW shifted more towards formalized approaches. In some cases this led to success en very successful products like chat and instant messaging. Other projects [2, 11, 12, 19, 21] probably took formalizations probably too far too be truly effective in my perspective. The problem lies in the restrictive nature, the amount of information and a general lack of focus towards the interaction. Attention shifted towards what media could be used and later still, towards how groupware, focusing on awareness, should be designed. The apparent success of both projects probably lies in the fact that they used relatively simple media and that they kept interaction very open. To a certain extent, Ubiquitous Computing [23] might help, as it offers some guidelines of how to deal with the computer. Ubiquitous Computing poses that by moving the focus away from the computer we can focus on the interactions and the tasks at hand, which in effect make computers as such blend better with our environments. The problem with this approach here is that computers won't go to the background anytime soon, as people use computers for doing their work during most of the day. A groupware system that tries to get the things out of their computers and into the environment should thus have a component on a user's computer then.

Building on Ubiquitous Computing, the Calm Technology [22, 24] approach doesn't shun computers altogether, but deals with the way information should be offered. The issues Weiser and Brown address, is that much interactive technology tries to absorb all of our attention all of the time. Weiser and Brown propose that, through filling the periphery, we're able to attune ourselves to our surroundings, without directing our attention to it. When changes occur within the periphery, we have the option to point our attention to it, or the center as they call it. This is the way people have been dealing with their natural surroundings for ages, but technology has to be designed to work like this in our perception. Without doing this we are at risk of overloading ourselves with information, demanding our attention. This might be accomplished by having different kinds of physical representations in the environment, but it also applies to interface design. We don't need to have all information being fully present all of the time since we're able to extrapolate information from smaller fragments; as the proverb goes, a word to the wise is sufficient. The first project documented to have used awareness in a peripheral sense is probably Natalie Jeremijenko's dangling string. [22] It's small, unobtrusive and playful and demonstrates how cognitively challenging information, in this case network traffic, can be broadcast to in a way that it's easy to deal with and ignore at the same time. Brown and Duguid [3] propose that being peripherally aware of the workspace and the people therein is essential to keep people interacting with one another.

Still, Calm Technology doesn't deal with center or what happens when the user chooses to focus on the interaction. User-experience, play and exploration are all part of this research and tend to occur in the center of attention. Slow Technology [13] tries people to focus on the technology in some cases in order to reflect on them. The goal is to help people to stay in touch with the state of technology by reflecting and thereby learning, in order to be able to transcend to higher levels of understanding. Learning is a slow process, hence the name. This cannot be achieved by adding complexity to systems or by bad design, but by making things playful to make people experiment and discover for themselves, instead of being forced. Especially in a workspace like the ID-StudioLab, people will, when using any new piece of technology, play and experiment with it and even try to thwart it. This process helps to explore a technology's possibilities and discover its purpose and meaning during that process. A long used resource for getting people to reflect on

what they perceive is ambiguity. [8] Artists have been using ambiguity for ages, by leaving things open for interpretation, thereby making their art intriguing, playful and challenging. Dadaism, shock-art and even the Mona Lisa smile have been making people wondering about purpose, context and relationships. This strongly contrasts usability, as usability follows the univocal approach based on intuitivism. While usability tries to use affordances in a way that complement each other, affordances in ambiguity often seem conflicting at first, getting people to reflect. Ambiguity is not limited to art, as pointed out by William Gaver [9] with his plea for ludic design and his Drift Table. Others have opted as well for setting aside usability, especially when it comes to aesthetics and exploring interactions. [16]

3 Road to supporting awareness

So if designers tend to participate within communities of practice, where the sharing of relevant resources is important and this tends to be hampered by the fact that it's difficult to get things out of their computers, what to do about it? First, let's take a look on how designers communicate with one another. When faced with a problem and seeking for help, designers tend to show what they're working on and tend to tell a story around what their showing. In other words, they tend to communicate on a more visual level. This approach has a low threshold and groupware in this context should reflect this. [20] This chapter describes the process followed to get from a basic idea of how awareness within a Community of Practice works and how this could be enhanced towards a feasible concept for a system. First a workshop was organized to gain insight in how people perceive and deal with awareness within the workplace. The results from the workshop and personal ideas were used as a basis for the creation of ideas. At first, most of the ideas didn't have much coherence in them. Only when I looked for inspiration in other places like ecosystems, I found the right inspiration for thinking up the right ideas leading to a feasible concept.

3.1 Workshop

In order what to focus on in this project an understanding of how people perceive awareness in their working environment was needed. Next to this, the needs and expectations needed to be found out. In order to do this a small workshop was organized around a fictional design bureau, in which the people recently found out that they weren't really communicating anymore and that they suffered from a general understanding of what people were working on. Another reason for the workshop was the fact that Mark Gross (back then head of the Design Machine Group at the University of Washington, nowadays at Carnegie Mellon) was visiting and it seemed like a good opportunity to share some interesting insights.

Participants from all over the faculty building were invited to participate, as well as some contacts from outside the faculty. The day started out with everyone introducing him- or herself, supported by three pictures. Although the project would be tried within the ID-StudioLab, it was decided that the workshop would focus on creative workplaces in general. Another advantage is that people tend to be more inhibited when discussing more personal issues. This does not imply however that people couldn't bring in examples from their own experiences. In order to get people to think about these issues in a more general way, a case of a non-existent design bureau and a small summary of its problems was presented.

The workshop was split into three phases and the participants were split up into four groups. Each phase was concluded with a presentation of each group, to relay results to all participants. Phase 1 was an assessment of which problems could be present at the design bureau as presented in the case by sticking post-its on a board and then clustering them into groups of problem-areas. During phase 2, people had to create posters

of an idealized situation or a dreamscape for either overcoming the problems found in phase 1, but without practical solutions. This phase was also concluded by presenting the posters, by telling what was created and why. The third phase was a step back, because people had to think about how their ideal situations could be realized now. People could comment on the posters by sticking things on them like post-its from the first phase, pictures from the introductions and new post-its. The participants were also asked to think of Calm Technology in their solutions by doing more with everyday things, but this didn't really work out, probably due to the fact that this field is too complicated to make it understandable in a short amount of time.

Roughly speaking, all of the problems and propositions could be categorized into six categories: ambience, locations, activities, communication, time and knowledge. It should be clear however, that these aren't independent variables, which means one cannot make an adjustment in one category without affecting at least one of the others. Each category is made up of a short summation of what participants thought up and a conclusion.

3.1.1 Problem assessment

Ambience	Locations	Activities
• Concentration is getting disturbed • Home is more pleasant to be • Competition between colleagues • Lack of team spirit • Bad lighting and acoustics • Lack of ambience	• People are spread among different rooms and locations • Team-isolation within rooms • Physical barriers, walls • No unity, due to different locations	• Not clear what people are working on • Different occupations, different activities • Too many people working on the same thing • Lack of focus among employees • Not being able to work due to technical breakdowns • Focus on being busy instead of what is being made • Limited visibility of processes and progress • Presentations

Communication	Time	Knowledge
• Awkward meetings and presentations • Limited perception of what people are doing • Different vocabularies among people • Changing colleagues and team members • Changing demands by the client • Different means of communication • Shyness of people • Different people, different styles of communication • People being absent • Asynchronous communication • People often don't know what they want • Lack of understanding • Decisions made outside formal meetings • Differing opinions • Influence of emotions • Lack of freedom in communication	• Postponing • Different processes require different timings • Mandatory meetings due to time-shortage • Lack of time • Waiting for input by a person • Missing appointments	• Where can you get what? • Who is doing what? • Presentations are not being stored • Lack of documentation • Keeping up with current levels of technology • Lack of ambient knowledge

Ambience

Generally speaking it seems that the ambience is often too empty. In this case ambience is a part of what Mark Weiser calls periphery; the ambience in this case is restricted to the working environment, whereas the periphery encompasses more than that. The ambience essentially provides a very basic, but necessary connection to the working environment.

Locations

Categorizing people into different locations by occupation seems to lead to people possibly feeling dislocated from their total working environment. The way people communicate and interact with each other is connected to how people are located. The question is if dislocation leads to miscommunication.

Activities

The main problem is that people don't like being disturbed from their activities or any other form of interruption, because the experience is almost always negative in nature; surprise for example is an exception to this. It's very difficult too see what people are working on, especially in the case of highly specialized people like engineers. Finding out almost always leads to disturbance. Disturbances inevitably lead to loss of concentration. Whether or not this is always as bad, is a bit unclear; with disturbances we can pick up things other than our occupational activities and stay in touch with everything.

Communication

Communication is the hart of the total system; failures in this area will surely lead to problems in all other areas. The way people communicate depends on factors like personality, occupation, ambience, knowledge, situation and many others. Problems in these factors might lead both miscommunication and lack of understanding, possibly leading to a downward spiral; lack of understanding leads to miscommunication and miscommunication leads to lack of understanding.

Time

Time is generally seen as an inhibitor instead of a facilitator; everyone deals with time differently, therefore people are never fully synchronous. This tends to lead to the general perception that we are often suffering from a lack of time.

Knowledge

The problem with knowledge is often not that it isn't present, but that it isn't in sight. This means people have to make an effort getting to know where it is before even getting it. This is partly caused due to the fact that people cannot know everything all of the time, not by themselves that is, since this would surely lead to information overload. Different persons are generally storing in multiple places and knowledge, which makes it difficult to find and access.

3.1.2 Propositions

Ambience	Locations	Activities
• Full sensory awareness • A space or ground where people leave equal marks, without having to think about leaving them, this especially for the specialists • Home-experience in working conditions • Control over ambient conditions • Thoughts, dreams, ideas automatically enrich the ambience	• Different areas for different purposes or activities • Possibility of extending activities into different areas and locations • Scalability between isolated and collaborative places • Smooth transitions between places	• Automated tracking of employees and their activities • Continuous flow of activities, due to lack of disturbance • Freedom of interaction with ambient information • Making activities and work visible • Scalability in level of sharing activities • Easy transitions between different types of activities • Dreaming at work! • Retreat, pressure relief at work

Communication	Time	Knowledge
• Gray area between formal and informal communication • Facilitating growth of understanding among people • Acceptance of different perspectives • Continuous stream of information of activities and ideas • Stream flows through all locations and areas • Visibility of activities might generate acceptance • Different means • No sensory deprivation	• Continuous flow of information • Leaving marks on in the ambience	• Capture and storage of ambience • Shared pool / flow of knowledge • Automated storage of activities / work • Pool / flow as reference library • Linking of expert tools to knowledge base

Ambience

The ambience needs to be filled, but not clogged up, with information about the people and their activities in it. It should take very little effort for people to leave their marks, but the marks themselves should be rich in nature. Marks can be made up from thoughts, dreams, ideas and snapshots of their activities. People will need to have some control over the ambience, either direct or indirect, to feel connected to their surroundings.

Locations

Other than the current situation where people are divided by project an occupation, people seem to want places differentiated by activities, like working, contemplating, recreating. This doesn't necessarily mean that the current situation should disappear. Another point is being made by the fact that people want to choose whether or not they want to share a space or be in isolation whenever they want. It seems that smooth transitions in people's perception between the locations are in order and perhaps that people can even create places for purposes of their own choice.

Activities

It's clear that people want activities to be more visible than they are now; they tend to feel that they're missing something. Apart from regular duties, people might want to be able to "float" between different types of activities, easily migrating from one activity to another, without the usual mental load. Activities range from informal to formal, free to obligatory. Freedom of choice in what people are doing supposedly leads to higher levels of motivation, as is the same in groups when people can easily migrate between different levels of participation. This strongly relates to Brown's plea for the non-canonical approach in supporting a community of practice, as this may help people in defining both the domain of interest and the practice that revolves around it.

Communication

A continuous presence of everyone's work might help to create more understanding among people and avoid ignorance. Hopefully, this breaches the downward spiral

as described above under problems. Even better, it might actually inspire others, either in their work or communication. One proposal for avoiding detachment was to use all the senses; this is particularly interesting since our senses other than our eyes are less prone to information overload. As mentioned above, people felt that changing team-members are a problem, whereas this is inherent to the nature of the community and may very well be a resource for learning. It should be noted that none of the participants managed to solve this problem.

Time

Time is a difficult aspect, because one cannot control this directly. The problem of time-shortage must be resolved by doing away with problems in other areas, thus effectively creating more time. Apart from using time for letting flow in information, time is also very useful for letting flow out information, in order to make sure the ambience doesn't get clogged up. It's interesting to see however, that the participants seem to need a common timeframe, perceived that is, but seem to be having difficulty coming up with solutions. This indicates, that this may be the most difficult point to tackle, probably having an effect of the synchronicity of the information flow.

Knowledge

It should be possible to store important parts of the information, which is flowing or floating around in the ambience. This is a bit like taking care of a plant. The plant represents a chunk of information; one can either choose to take care of the plant, i.e. store the information or one may let it whither in time, i.e. let the information vanish over time. The knowledge that is being stored, may be used to create some kind of shared pool of knowledge or even more practical, a reference library for example; a garden if you will. The knowledge may be used again in numerous activities, creating new knowledge. Knowledge is the key element to the domain; in sharing knowledge people give meaning to this.

3.1.3 Concluding

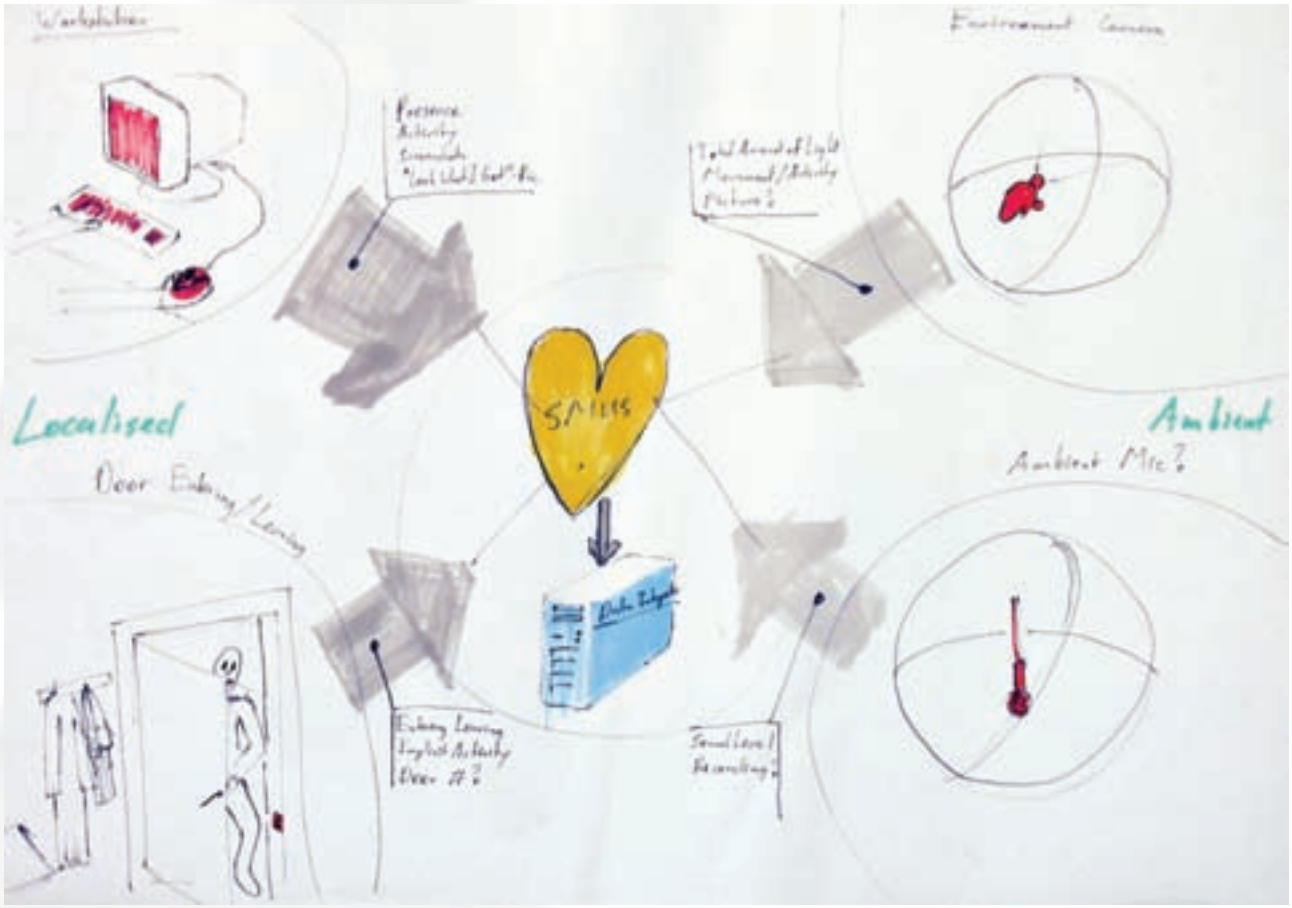
The workshop was very useful as a conformation of what the literature already suggested. Apart from conformation, some of the propositions helped in getting a focus in what direction this project should go; especially the part about linking locations to activities is interesting. It has become quite apparent how important time should be and how difficult it is to play with. It is a bit of a shame however, that people hardly told what the consequences were, both to them and the company. The main focus will be facilitating communication, which will be should be supported by aspects from other categories; especially the pool or the continuous flow should prove to be interesting. The approach however, should be done carefully, respecting people's privacy and preferences to communication and commitment, while enabling people with rich, open and free ways of communication.

3.2 Ideas

The first phase of this project was basically a search of what kind of relationships there could be between awareness, technology and people. The questions revolved around issues what encompasses awareness, how to measure/create it and what technology could be used for this. Initially the idea was that awareness would

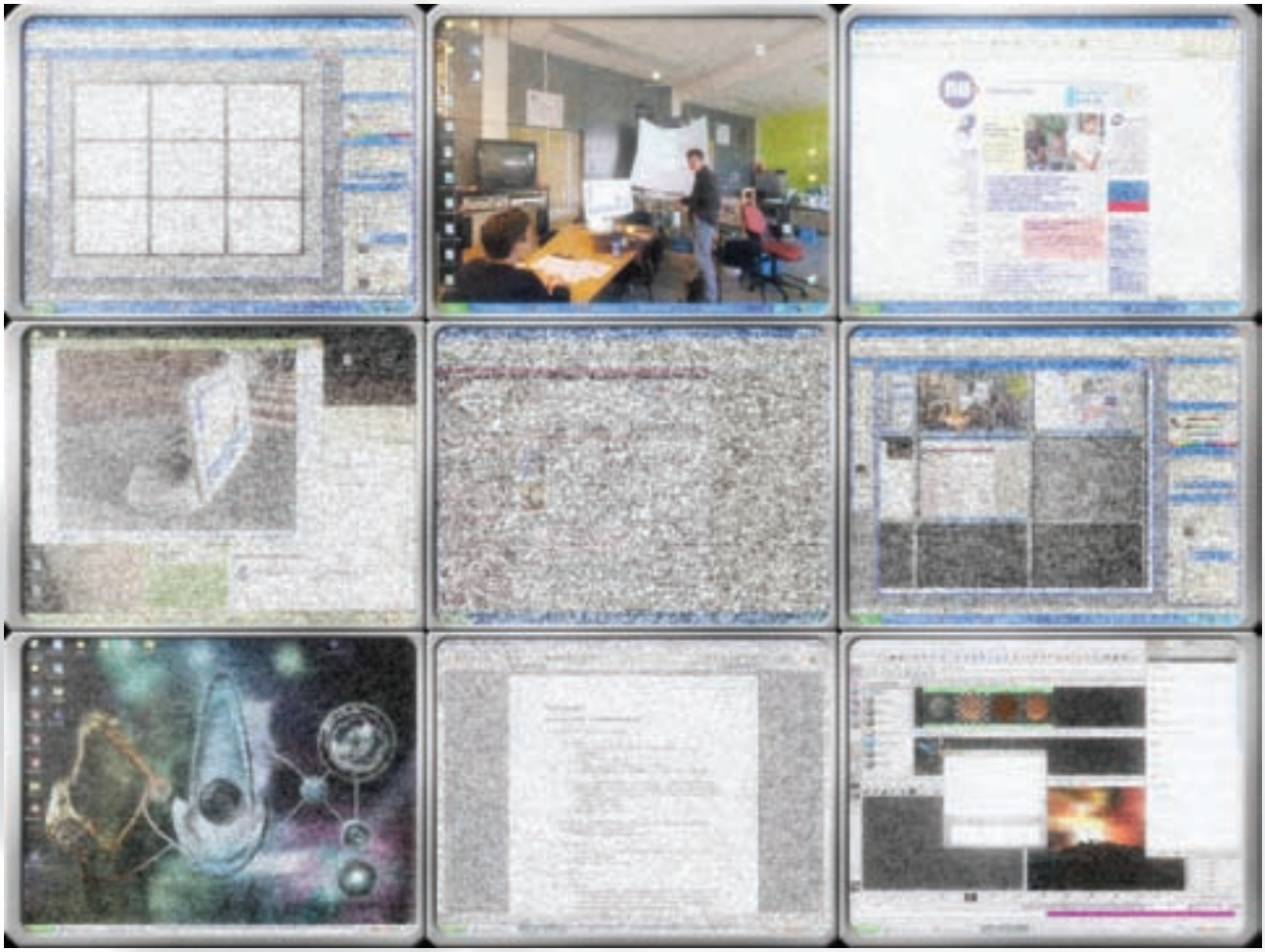
be passively measured by placing sensors in the workplace like infrared distance sensors at the doorways, microphones inside the workplace for measuring audio levels and cameras for detecting motion.

This information would be on a central point and relayed to all kinds of awareness "actuators" like peripheral displays, applications on peripheral displays or all kinds of physical representations. One of the problems with this approach was that it didn't take in to account the differences in locatedness of people from the ID-StudioLab. The ID-StudioLab is essentially split up into two locations. The lower floor consists of a large studio, housing up to sixteen people, and a number of smaller studios meant for presentations, meetings, workshops and prototype building. The upper floor is a hallway made up from small offices housing one to three people. Practically, it would be next to undoable to supply every single office with this sensor equipment, more importantly it would probably be rather pointless as well.



This led to the first differentiation: peripheral access versus private access to the system. Private access would be very important to a system aiming on supporting awareness. First of all, it is in the private space most people do their work nowadays, mainly because people tend to do most of their work on their computers. Secondly, the private space is more or less equal throughout the different types of locatedness. This led to some of the first programming experiments, where people could share information. By using Macromedia Director and the Shockwave Multiuser Server the first working prototypes were built. At first it was very simple information like mouse locations and the number of keystrokes, which would then be visualized. On a technical level this was very useful, but it was decided that the visualizations and the information they would represent

were too abstract for people to relate to. For the second step added sharing of content to the prototypes. The idea behind this was very simple; if most of people's work is on their screens, why not share the entire screen as well? The TRI-setup [15], developed by Ianus Keller, would be transformed into a large array of TV screens. Each of the screens would randomly show the screens of users as if everyone was a channel. Depending on how high a person's activity level was, measured by counting keystrokes, a channel would reveal a person's screen more clearly and show less static. If someone would want to point other's attention to something, he or she would be able to show their screen in full temporarily.



While this idea is probably too much, hardly sophisticated or particularly useful, it revealed the second differentiation: active versus passive creation of awareness. Calm Technology, which aims for the periphery, tends to focus on relaying all kinds of activity information or the state of the environment and the objects therein. If people are to have a general sense of what people are working on, user created content should be a part of this awareness. Monitoring screens could perhaps do this, but this doesn't convey any meaning and moreover, people's computer screens are too personal, because they don't just show work, they also show e-mail and other personal information.

At this stage the project started to become too focused on the virtual side of things. There wasn't any connection to physical really, except apart from using the TRI as a peripheral display. There wasn't any way

to share any physical material like drawings, objects or just people. To do this, there would have to be at least one central point where people could present their physical things. A sort of carrousel was thought up where people could present whatever they wanted to a camera and then leave it there. The carrousel would rotate the objects depending on measured activity levels. The camera would also be active, making it a kind of curious robot.

3.3 Concept

This was the point where things started to come together. To illustrate the system to be developed, a number of metaphors were thought up: a spider's web, a pond, a group of islands and a fish tank. All of these can be seen as ecosystems. Things get caught in here, like leaves falling into the water, bugs getting trapped or even a castle being put into a fish tank. Without caretaking, all of these environments would get clogged up; otherwise everything added would have to fade away over time. To summarize, an ecosystem is active with things entering and leaving, while its inhabitants live in it.

In the system the elements being added would be images. The images might be parts of people's work or pictures showing events, like a picture of a piece of pie, meaning that someone's celebrating his or her birthday. This is a big step up from a previous idea, where there were a fixed number of events represented by icons. The limited set of icons could never provide in all the events or notifications people would think up. Also, categorizing events and awareness isn't a goal of this research. For physical objects like printed

material, objects or even people the robot would be used. It was decided that the public walkway between the 2nd and 3rd floor would be used for the robot's location. Its appearance was changed to accommodate its location, which was behind glass in order to protect it. Making it active behind glass meant that it had to move behind the glass. The solution came from another robot, called Hektor. [14] Hektor is essentially a spray can attached to two wires, capable of painting large vertical surfaces. The robot, which was later named Arthur, would move behind the glass and would be equipped with a camera. The camera would detect motion and track it by rotating. When detecting prolonged motion, the camera would take a picture and send it to the system. People would be able to leave the things they had shown on a border on the outside of the glass as well; this feature was dropped later on. A small application for people to use on their workstation would be developed. It would show all the people using the application, a visualization of activity levels, provide a means of sharing images and measure activity levels by counting keystrokes. The TRI-setup would be used to collect all the images that had been shared and create a dynamic collage of them. The dynamics would be based on measured activity levels. People would be able to reorganize and clean the collage if they wanted to. These three elements would be connected to one another by using the Shockwave Multiuser Server.

For example, if Elif, one of the members of the ID-StudioLab, had her birthday and wanted to announce that she brought cake she could do that by using the application on her desktop. In this case she could take an image of a piece of pie from Google image search, add some text to it, take a picture of it and send it to everybody. Hereby inviting everyone seeing it to have cake at 11 AM.

If Ianus, another member, would want to show off his interview in the "Integraal" (a university published magazine), he could use Arthur to do this. By taking the magazine to the robot and presenting it, he'd be able to share it to the community, presumably with the intent of people commenting it or getting people to read the article.

4 Iris detailed

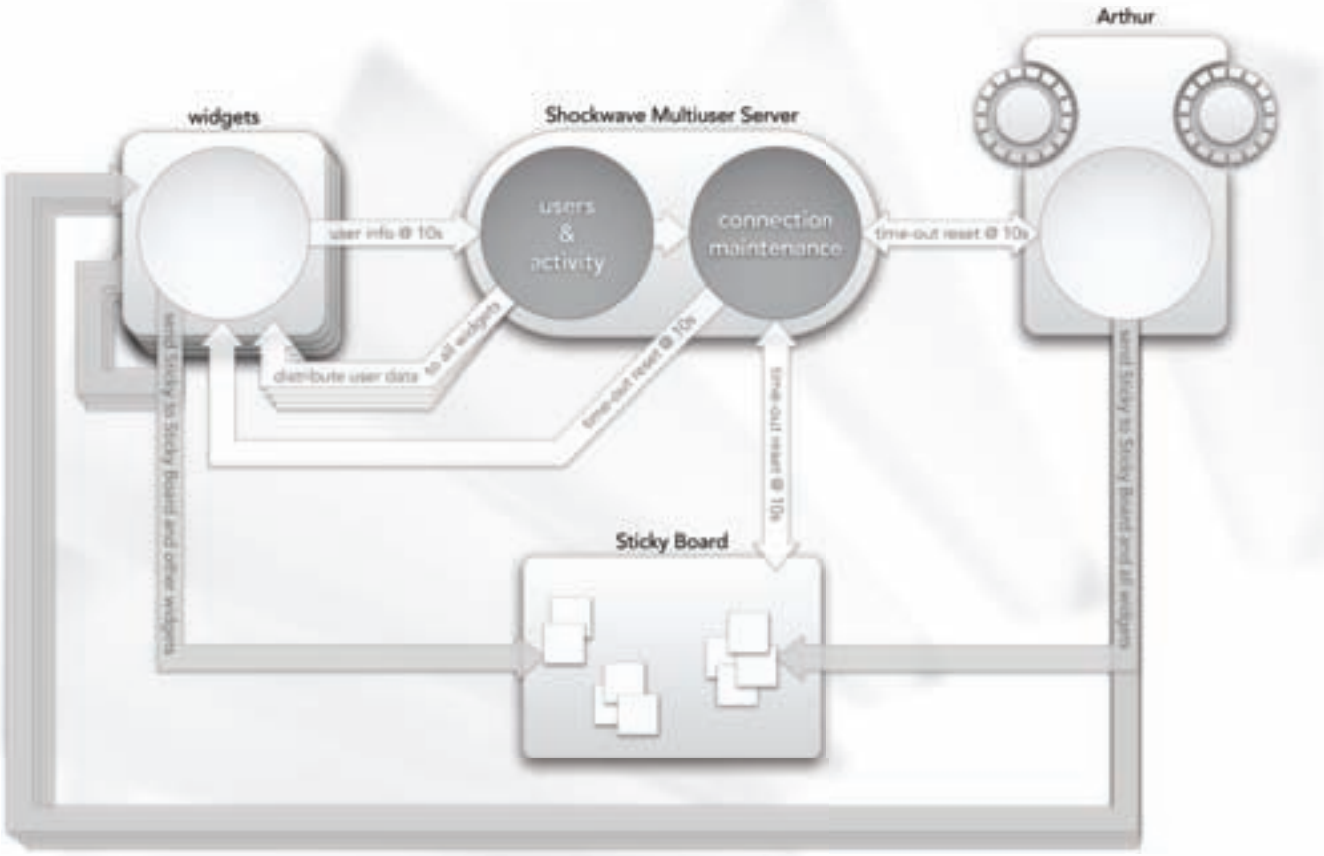
This chapter describes the development and workings of the prototype system proposed in the previous chapter. The system was named Iris, but not until its development was nearing completion. The choice for the name was twofold. In ancient mythology, Iris was messenger of the gods to men, which seemed appropriate to a communication system. The name of the system, which mainly deals with visual communication, also has a relation to the eye, as the iris is a part of the human eye. One might even argue that the shapes of the activity visualizations within the widget (described later on) even resemble an iris.

4.1 Basic Layout

Iris was developed using a client-server model, consisting of four components.

1. A widget on everyone's computer for monitoring activity and for simple visual interaction between other users and the Sticky Board
2. The Sticky Board, a shared whiteboard, meant for large displays.
3. Arthur, a robot built from Lego Mindstorms, for playful interaction and taking pictures of physical objects.
4. Finally a server for managing network messaging and keeping track of activity levels.

There are two types of communication in Iris: active and passive communication. The main reason for the passive communication is to check and maintain connections between clients (the widgets, the Sticky Board and Arthur) and the server. For example, when a connection time-out occurs within one of the clients, i.e. no data has been received for some time, it automatically tries to reconnect to the server. If a time-out occurs on the server side for one of the widgets, it will disconnect the widget and update the user data accordingly. The active communication present in Iris deals only with posting to the Sticky Board. As the diagram below shows, most of work dealing with communications deals with the widget and the server.



From early on I decided to use Macromedia Director for the system. This seemed to be a logical approach, as Director is well suited for creating multimedia content in relative short amounts of time and supports networking out of the box by using the (unfortunately no longer supported) Shockwave Multiuser Server, which uses the classic client-server model. Any shortcomings in terms of functionality I hoped to fill in by using Director's extensibility, called Xtras. Director does proper job at facilitating interaction designers with the tools they need to create basic interactive prototypes. However things become more difficult if the prototype needs to go beyond presentation purposes. When it comes to interacting outside of it's own environment, Director needs to make use of Xtras. Most of the time, Macromedia's own Xtras are adequate, however most of these are not well documented. Most of the Xtras used deal with storing and retrieving variables, importing, exporting and translating files, both text and images.

4.2 Sticky Board

The shared collage was at first meant to be a dynamic collage of all images shared and provide something of a historical overview. The idea was to make the collage interactive as well, making it possible for people to rearrange the collage. Due to time-constraints and technical difficulties, I decided that the collage would be static, focusing on its aesthetics instead. In order to make it able for people to relate to the images, it was decided that they would be accompanied by the name of the person sharing them. To enhance this further, the option to add a comment or tagline would be added as well. Taking inspiration from the ID-StudioLab members board and perhaps even the movie Memento, the image, the user's name and the tagline were combined in what resembled a Polaroid™ photo.

The collage of Polaroid photos was at first a pile of, where newer ones would cover the old ones. The problem was that this gave the collage a cluttered and illegible appearance. Therefore, with every post added, the collage was made to blur slightly, adding depth to the collage as the old posts were covered by what looks like a fine mist. This is not to say that the collage was kept entirely static; before sharing, the post has to be positioned on the collage, as if it were a sticky note. The posts were therefore named Stickies and the collage the Sticky Board. Because Arthur is a robot and therefore has no sense of context, it would "choose" a random location at the border.

Since the Sticky Board was put on the TRI-setup, which is used for other tasks as well, the collage was used as a desktop background, instead of putting it on top of everything else. Although, this tends to make it less visible, putting the Sticky Board on top of everything else would probably lead to people removing it entirely from the display.

4.3 The widget

Instead of providing users with a communications portal like a website or an application showing all of the information being created, I decided that a small client application showing only snippets was more adequate. Small applications providing a limited amount of functionality are often called widgets. The main reason for this is simple; if the application takes up a large amount of screen estate, it will get in the way of the rest of what's on the screen, i.e. people's work. This forces people to shift their attention fully to the application or not at all, whereas a small application may reside in the corner of the eye, making it easier for people to shift their attention either towards or away from the application. The widget was the primary focus, in terms of interaction as well as aesthetics. For the latter, Adobe Photoshop and Adobe Illustrator proved to be more than adequate with an exception or two.

After some experimenting, I decided that the pixel dimensions would measure 160 X 160 pixels in its normal state. Its normal state would show a kind of filmstrip of a few of the last images that had been shared, an overview of users connected, a visualization of activity levels over time as well as provide some means of control. The control would enable users to change the visualization and provide a means of access to the shared collage. The first stage of the design was a bit like a TV screen where users could adjust its functionality with the buttons below the screen. It was quickly decided that having a TV screen was a bad analogy in the

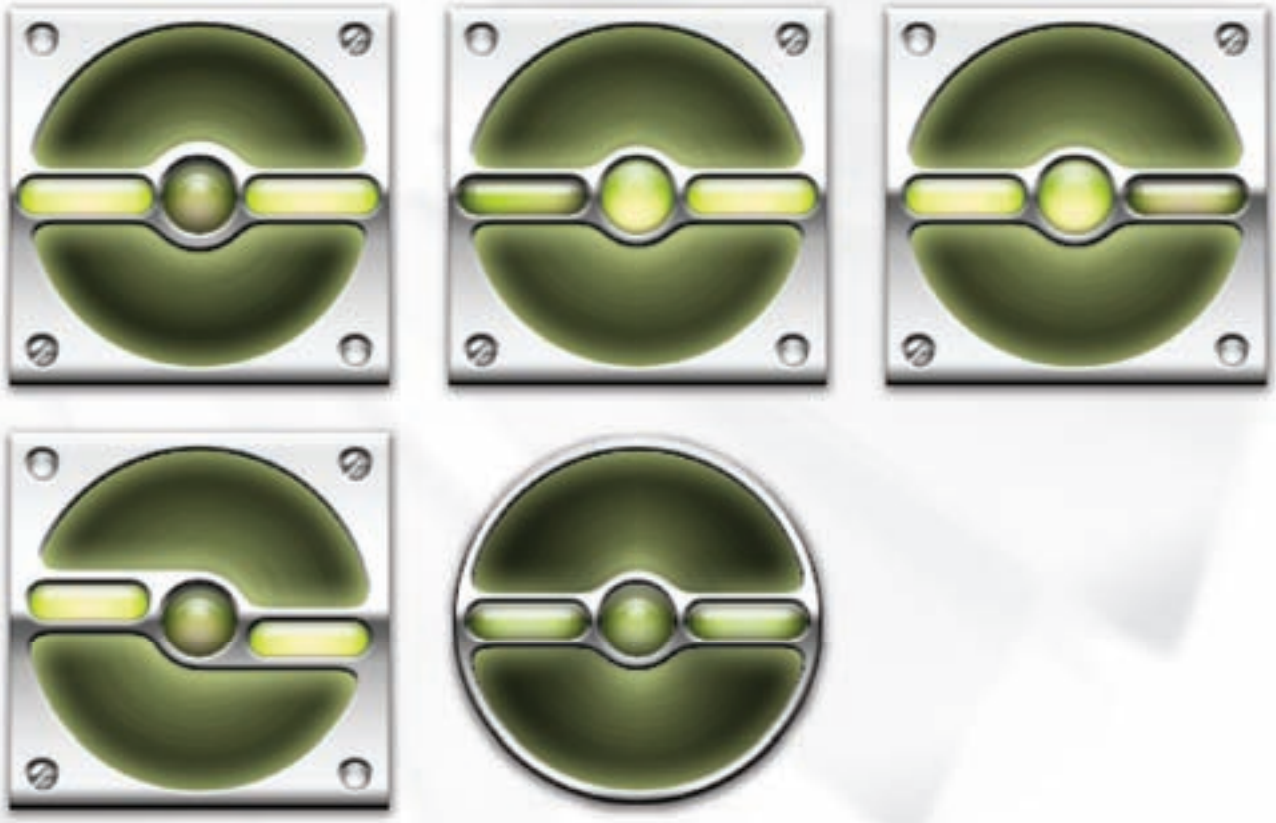
first place; why use a screen when people already have a computer screen to look at all day long?

During the second phase I did some experimenting with the layout and the overall appearance. The main viewing area would be more like a scrying pool or a crystal ball. It even incorporated the ID-StudioLab logo for a viewing area. Still, it was the same thing as in the first phase, only with differing appearances.

In the third phase, the experimenting took a different path. The role of a display was questioned, as the buttons itself could perhaps serve as displays, having no displays in the basic state of the widget at all. If the shared images and activity levels were to be visualized, questions of how these could be mixed led to the conclusion that this could not be done in one display. Also there needed to be some hierarchy in the appearance of the different controls, relating to their functionality, with an emphasis on the button for adding

images to the collage. Out of these, the second was chosen for further design. The coloring was only used to differentiate between the different objects. The final coloring was ended at the end.

At this point, I did a short study for further refinement, balancing all the different elements. The center button would create the images for sharing, whereas the buttons next to it would relate to the displays above and below it. The small buttons were to provide the more trivial functions like quitting, minimizing, settings and help. In this stage, it was discovered that Director MX 2004 supported masking, so it wasn't necessary to use square displays anymore. However in contrast to the circular Photoshop version below, it turned out that Director only supported 1-bit masking, so a fully round widget would look too jaggedly. Out of these I chose the third layout.



For the final step, some polishing was done. Director's masking option was used to round the corners giving the widget an overall softer appearance, making it resemble a gadget. Finally, the reflective gradient was toned down as if it was made from a softer material.

In its final stage the widget received its definitive appearance. I made the center button to resemble an aperture, transforming the widget into a magnifying glass. The upper display shows a visualization of activity levels as well as the names of everyone connected. The lower display shows a circular filmstrip of the six last images sent to the Sticky Board. The button right to the aperture brings the user to the Sticky Board for viewing purposes. The button to the right changes the timescale of the visualization. The small buttons in the corners are for quitting, minimizing, going to the help webpage and changing connection settings, like the server and the username. The right frame is what became the magnifying glass for taking the picture; zooming was chosen in favor of a selection window to crop the image.

Most of the work however, went into tuning the interaction. Grabbing and dragging the elements could cycle through the elements in the two displays. I added animations to give more of an aesthetic appeal. The activity visualizations and the zooming functionality were therefore both animated. Linear interpolations between one scale and another scale proved to be rather clunky. Therefore iterative functions were used to give a more "fluid" effect to the animations. This applies to the activity visualizations, scaling the images in the bottom and especially the zooming actions during framing.

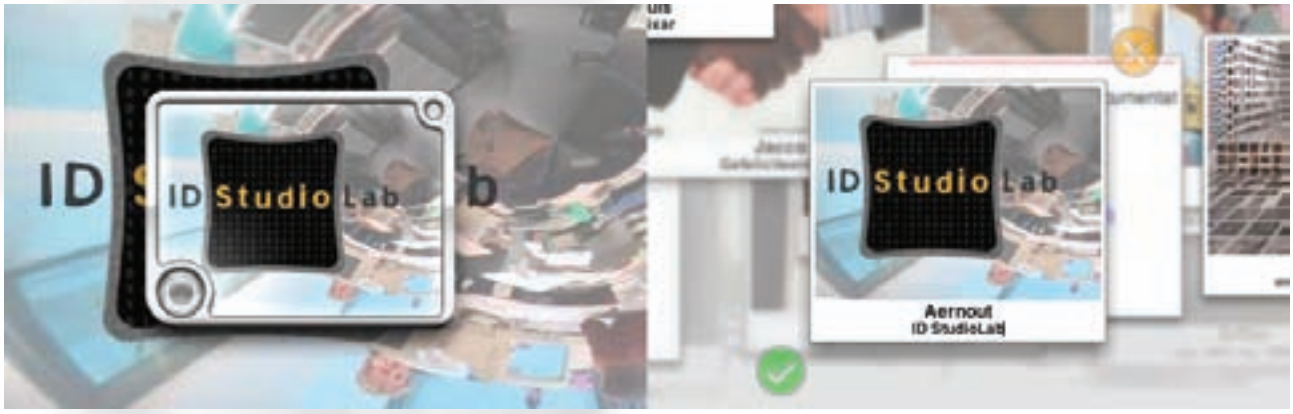
I also used the layout for the picture framing for a login window. When the user runs the widget for the first time, he or she sees the login window. By clicking on the field where saying "put your name here", the user may enter the name others will see. The server address was kept locked for the time being. Clicking the big blue button, takes the widget to its normal state. This doesn't show itself anymore, except when the user desires.

The visualization runs in four modes, one is dynamic and the other three are static. The visualization of the current activity is animated and will show more yellow as activity is higher. The static visualizations show the activity over time, the last hour (in steps of two minutes), the last day (actually last 15 hours) and the last week. Their respective color can be different, depending whether activity has been below or above average, ranging from bright yellow to red.

Holding the mouse over the upper half circle will display the names of the people currently present. It will only fit twelve names at a time. However, one may grab these names by clicking on them and cycle through them by dragging either left or right. If there are less than twelve names, the names will be repeated throughout the cycle like in the picture.

Holding the mouse over the lower display, will turn it yellow and display who sent the picture and, if present, the comment with it. Here it is possible to grab the pictures as well as rotate them by dragging left or right. By dragging up or down the user can pull the picture under the mouse towards him- or herself for a more detailed look. If one wishes to see even more detail, the user may press the blue button to the right of the aperture, displaying the number of new photos since last time checked and go to the shared collage.

Pressing the center button takes the widget to the framing mode. The framing mode works like a magnifying glass. By dragging the widget, the user may frame anything he or she wants, provided it's on the screen. Pressing the "A" and "Z" keys on the user's keyboard will respectively zoom in and out. Updating occurs by pressing the spacebar. Closing the aperture closes the magnifying glass and opens the shared collage with the Sticky attached to the mouse. After clicking the mouse, the Sticky no longer moves and a message may be typed underneath the picture. When done, the post may be confirmed by clicking the green button or cancel using the orange button.

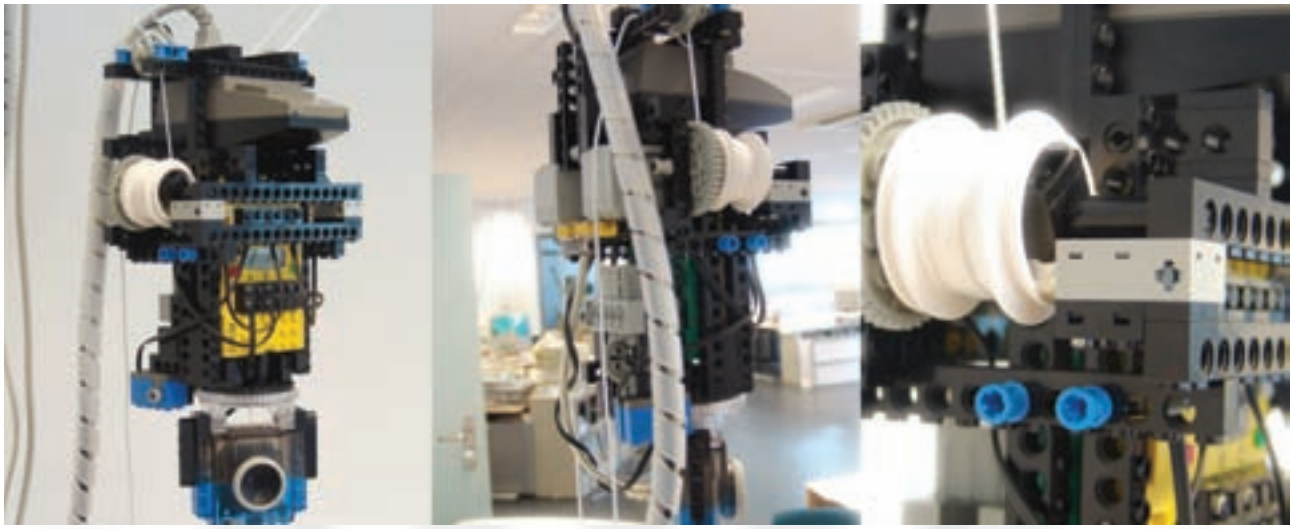


In order to get the screen content into Director, I used screencapturing. Both Windows and OS X support screencapturing out of the box, however access to the screenbuffer from Director can't be accomplished without the use of Xtra(s). On Windows, the ScrnXtra was used, which has direct access to the screenbuffer. On OS X an extra step was used, by using the ShellXtra, which can send commands from Director to a (hidden) UNIX shell. On both systems the screendumps are sent to the clipboard, to be pasted into Director again. Pasting is not without problems though, as pure white gets automatically cropped by Director.

When it comes to optimizing an application, Director starts showing its shortcomings. Unfortunately, Director is somewhat of a resource hog. This is especially the case with Mac OS X, where it uses up all the system's unused CPU-cycles, making the computer a drag to use. There is a workaround for this, but it tends to slowdown the application, depending on how aggressive the throttling is. The client therefore uses different levels of throttling with different types of activation. There's also a difference between computers running Windows and OS X; whether or not this is due to the difference in processor architecture, the operating system or a combination of both is unknown.

4.4 Arthur

While not the most important aspect of the system, Arthur was intended to add some physicality to the system and allowing for some playful interaction. I built Arthur from Lego (Mindstorms), mainly because it was available and because it makes it relatively easy to make alterations, due to its modular nature. Its interactivity was to driven by Macromedia Director, like all other parts of the system in order to make it connect to the Shockwave Multiuser Server.



Arthur has four main components, an RCX (the computer for connecting the sensors), a rotating camera and two motorized cable winders. If Arthur was to move both horizontally, its weight proved to be a problem. For Hektor, this wasn't an issue, as the weight mainly consists of a spray can. In order to solve this, bottles filled with water were added to Arthur to serve as counterweights. At first the counterweights hung at both sides of Arthur's ceiling suspension. Later on, the counterweight was centered to make the whole construction more stable. Arthur uses three sensors to measure its position. Each of the two cable winders used a sensor to measure the amount of wire used. These two measurements were then used to calculate the horizontal and vertical position. The third sensor was used to measure the rotation of the camera.

For interactivity, I gave Arthur two means of input. It uses the combined activity levels of the users to for its own physical activity; Arthur tends to move around more often as activity levels become higher. The second part was the camera. I used the camera both for taking pictures as well as detecting movement. The movement detection was realized by using difference imaging. In difference imaging, two images are necessary, a reference image and the measured image to compare to the reference image. The resulting difference image may then be used to find hotspots were the difference is largest in order to get a focal point in motion. In order to compensate for different lighting situations and camera angels, the reference image

can be made to adjust (slowly) to the current one. This technique is also used in video game interfaces like Sony's EyeToy.

By holding something in front of Arthur, one may put it onto the Sticky Board and share it with the community. When Arthur detects enough motion, it will show it's view mirrored with a white progressbar. Now to make a post, you have to keep moving in front of Arthur; the progressbar will shrink and after 5 seconds of consecutive motion, Arthur will show the current picture. To update the picture, just keep on moving. When you're done, hold still for a second and Arthur will create a sticky for you with the last shown picture and add a random comment.

Later on, a few issues with camera motion detection had to be resolved. As the lighting conditions tended to become worse later in the day, the camera feed started having increased noise levels. The noise then had a tremendous impact in the difference imaging, mistaking noise for motion. This resulted in an annoying amount of posts during nighttime. To compensate, I gave Arthur a standby mode, which would spring into action after closing ours and during the weekend. In the morning, Arthur would come back to life again.

4.5 Server

The widget, the Sticky Board and Arthur are all clients, which had to be connected to a central server. The server was configured to manage the connections made by the clients as well as handle the network traffic. The first issue that had to be resolved was that the Shockwave Multiuser Server was made for mainly small data packets across multiple clients. In theory, the SMUS should be able to handle messages of about 4MB, but in practice this seems to be unreliable and slow as well. As it was needed to send images up to 1024x768 pixels, a workaround was needed to send these in a compressed form.

By default the server uses time-outs to clean up idle or improperly disconnected clients. This helps maintain quality, but requires clients to keep sending data in intervals shorter than the set time-out. On the other side, clients don't come with a network time-out by default. This means that it a client is to reconnect itself after the connection was lost, the server must send messages at regular intervals to reset a custom-written time-out on the client-side. Thankfully, the SMUS supports "server-side scripting", which makes this easier to accomplish and without the use of other clients. Unfortunately, both the scripting and testing on the server-side is to say the least archaic, due to the lack of a scripting environment or run-time mode.

Another positive aspect of "server-side scripting" is the ability to store data on the server for later retrieval. In this it was used to store data of the past activity levels, which was used in the different timescales of the activity visualizations. In retrospect, it should have been used to log the clients' usage as well, instead of doing this client-side, as it was a hassle retrieving them from all the participants of the trial. It's remarkable however, that the SMUS, of which development seized a number of years ago, is actually better in storing variables than Director's FileIO Xtra is; it can read and write, without the need of explicitly converting strings into variables or visa versa.

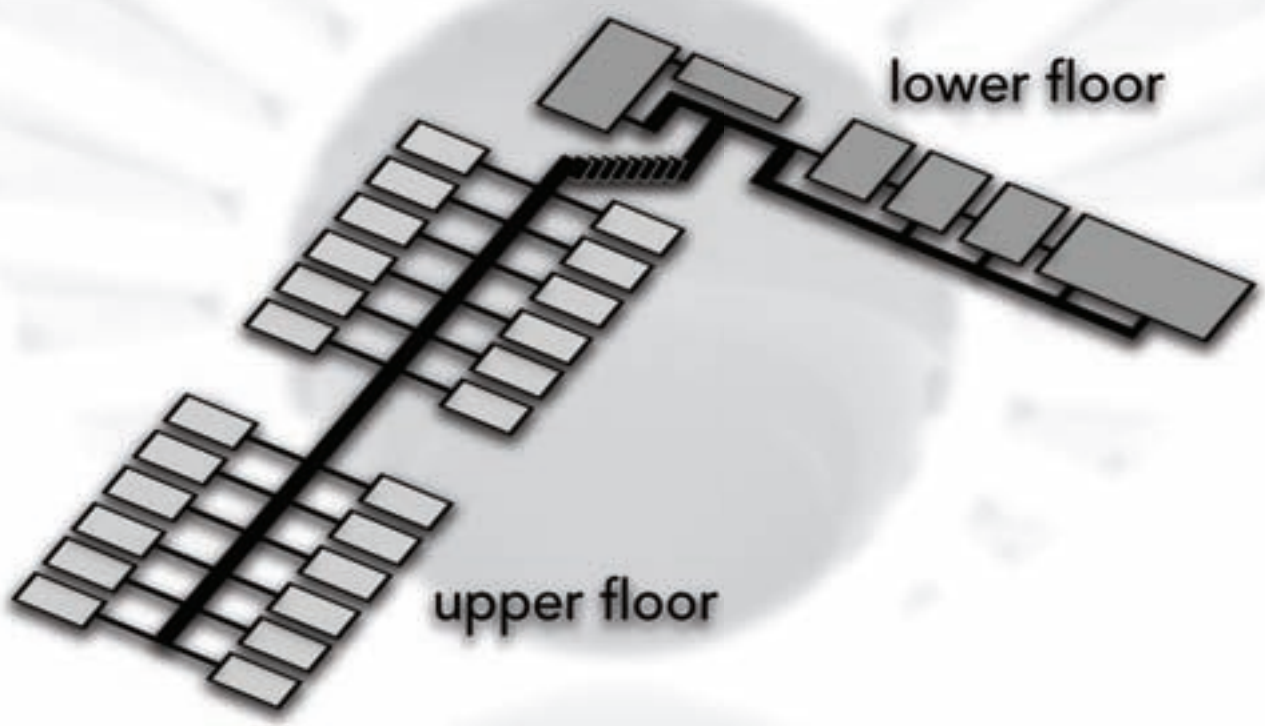
5 Trial and error in practice

In this chapter I describe the process followed in researching the topics discussed earlier. This research attempts to answer questions dealing with awareness in the workplace through a trial using Iris, which was executed within our own workspace, the ID-StudioLab. The trial was accompanied by using two questionnaires, usage logs, snapshots of the Sticky Board and interviews with the participants. A combination of these helped me to gain insight in the process of adopting a new technology by a community as well as the inner workings of the community itself and which role Iris played in this.

5.1 The ID-StudioLab

The ID-StudioLab is a multidisciplinary group of people consisting of research, teaching and support staff. The work being done focuses on design and research, with emphases on aesthetics, design techniques and experience. The ID-StudioLab is very much a Community of Practice.

Essentially the workspace is divided into two main locations. The heart of the first location is a studio, housing up to 16 people. In this space I used the TRI-setup serving as a large display for the Sticky Board. Around are a few smaller studios, meant for workshops, prototype building, meetings and presentations. The last room houses two people doing supportive work. The second part is located one floor up and consists of a hallway split in two halves, of which the furthest part is one of the quietest parts of the building. On either side of the corridor there are offices, housing one to three people. I put up Arthur in the public walkway to attract the attention of passers-by. The walkway is between both floors, with Arthur hanging behind a glass wall in order to protect it from vandalism and theft.



5.2 Research Question

Can the goals of Calm Technology and other relevant aspects of the found literature effectively implemented in supporting awareness within a Community of Practice? If so, how does this affect the community and which effects in terms of awareness, commitment and bonding can be observed. The goal here is not testing the usability of Iris, but to see for which purpose(s) people would use Iris, how they would experience it and what effects it would have on the users and the community they reside in.

In order to answer this question, Iris was tried. Before participants could use Iris, they were given a questionnaire (see Appendix II) for them to fill out in order to measure their attitudes towards the community. This questionnaire was handed out again after the trial so the two could be compared to one another, following a pretest/posttest design. During the trial, the use of the widgets was logged, logging activity levels and posts. However, an irreparable bug in the activity measurements caused the results of the activity logs to be discarded. There were two manipulations during the trial: I posted at least once a day and half of the participants were give the assignment to do the same in order to keep Iris "alive". The state of the Sticky Board was saved every 15 minutes if a post was made during that time. These snapshots of the Sticky Board were used to determine how people had communicated and to find out if any themes could be discerned. Also, the snapshots were used as guidance in semi-structured interviews I did at the end of the trial after participants had filled in the second questionnaire. I asked them what they could tell about Iris, how they had experienced it and what they felt the added value of Iris was. For the analysis of the questionnaires statistics were used, on a per question basis as well as well as per subject. There were three subjects: awareness, commitment and bonding. Each question was assigned to one of the three subjects and the (average) scores weighted. Furthermore, the scores were compared to the number of posts participants made and to whether or not participants resided in the studios.

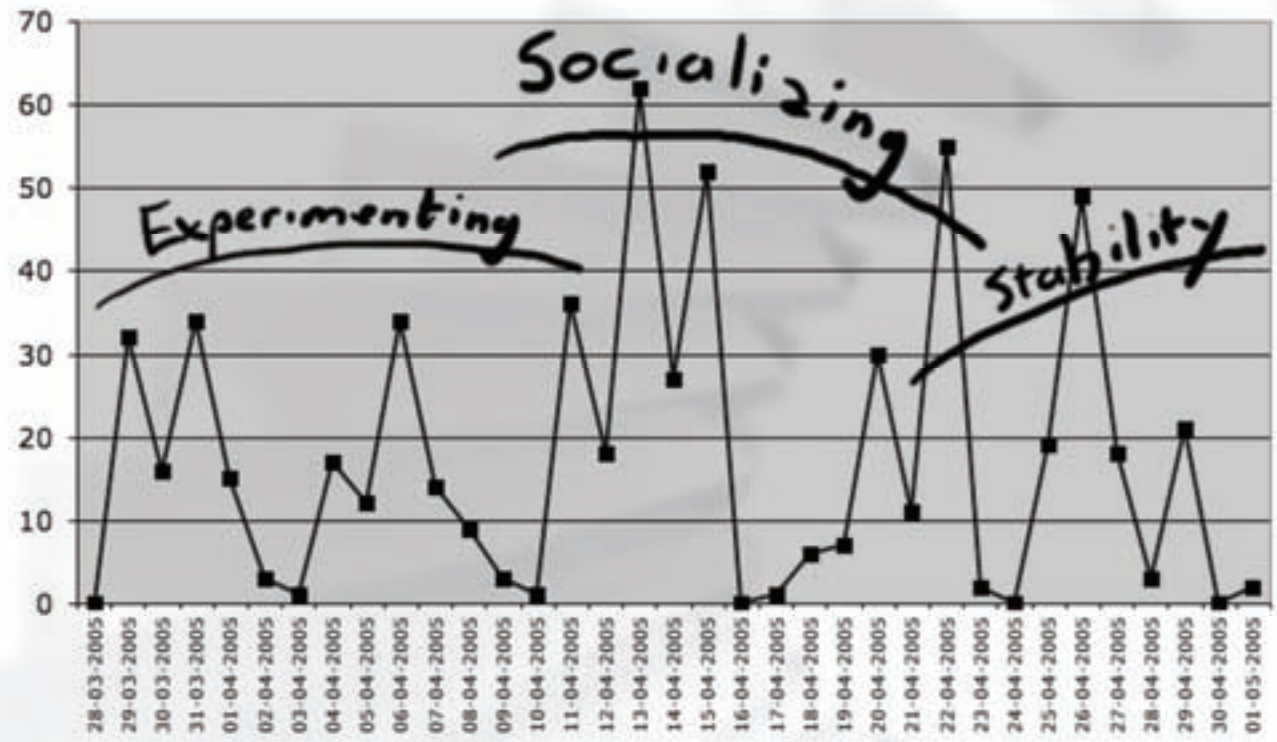
For analysis, the research question was split up into a number of sub-questions, with the intent of finding out in which areas Iris would have the most significant impact.

	Questionnaires	Logs	Interviews
How do participants use Iris? Do participants keep Iris running How often do they actively use it and do they find Iris to be enjoyable?	▬	▬	▬
Can participants report a change in their social awareness level? If so, how strongly and often?	▬		▬
To what extent can participants recall events generated by the experiment, i.e. having a real increase in awareness?			▬
Have participants gotten reactions on their using Iris, i.e. experienced an increase in awareness towards themselves? If so, how often?			▬
Can an increase in participants' commitment towards and bonding with the community and its people be observed?	▬	▬	▬
What do people report as negative side effects of using Iris and is not about usability?			▬
What is the influence of having assignments? How well do participants live up to the assignments; does this have a correlation to the above?	▬	▬	

5.3 Results

Over the entire period a potpourri of subjects and interactions was observed. Participants were experimenting, exploring the limits of Iris, teasing and provoking, making announcements and asking for help or information. They tried to show things from their work, occupations and interests, but mainly dealt with play, humor, greetings, the weather, spare-time, things happening in the workspace and pleasing images in general.

Iris evolving over time

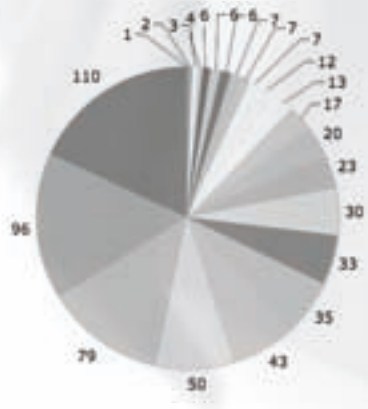


The first week mostly showed many lose postings without follow-ups, which some described as noise. A general lack of tone and little interactions between users was observed; there were hardly any follow-ups on posted sticky notes and attempts to communicate around a (work-related) theme failed to attract follow-ups. There were two exceptions; an aesthetic attempt to create a Droste-effect and the creation of a single picture composed of multiple sticky notes. One person, who was continuously showing his affection for a certain celebrity, also raised the noise-factor to many participants. However, he stopped using Iris altogether after two weeks, mainly due to the fact that people were showing their annoyance with it, both using Iris and in face-to-face talk.

The first themes and interactions were seen in the second week. Greetings in the morning and goodbyes in the afternoon were getting responses. A few people attempted to create a weblog about interesting or funny websites and about gadgets. Web-addresses were often entered in the comment-field. These posts almost never received follow-ups and, with some exception to the gadgets, didn't generate any talk within the workspace.

After two weeks people were trying to socialize Iris. At one time, when I had shaved my head during the weekend and minutes after I had entered the large studio on the lower floor, the first comment had been posted. As a tease, someone created a sticky note, showing the upper half of a celebrity's head, asking whom it was. This resulted in a spree joined by four people, creating a joint quiz of "guess the bald head". Although only people from the large studio joined in, people from other locations commented on it during ad-hoc conversations and lunch. Two days later, a yawning kitten on the Sticky Board, resulted in another spree. Perhaps because spring had started, the Sticky Board was filled with pictures of all kinds of (young) animals. Remarkably someone commented on the fact that two other participants had obfuscated their names on Iris in such a way that she could no longer relate them to anyone; she was quite annoyed by this. The last day of the week was the first sunny day of the year, with people commenting on the weather. One person, who is researching products and sounds, commented by showing songs from her music library, having to do with the sun. Others reacted in the same manner.

During week four and five, the last two weeks of this trial, themes and topics were stabilizing. People started reacting on a more personal level and we're specifically looking for subjects that would interest others. A core group of four people were setting the tone, repeatedly reacting to one another, often dealing with small talk, like when someone had changed his screen name to a Japanese version. We observed people showing off specific gadgets, Lego and their new nicknames for iTunes music sharing. Also two were discussing their homework for a statistics course they were doing together.



Of all posted sticky notes created during the experiment, logs show that four people, including one of the authors, are responsible for half of posted sticky notes and eight people were responsible for three quarters of postings. Out of these eight people, three were situated on the upper floor and one from the lower floor only worked for two days a week at the ID-StudioLab. The other three days, he worked at home and used Iris, despite the effort required to connect to the university network. The people belonging to the group responsible for setting the tone on Iris were all part of the top eight posting people as well.

In the months after the trial, Iris was kept operational. The people from the core group and one or two others kept using Iris. They mostly went on as they had done before, mirroring the tone from the last two weeks. At one time, one of the women was fed up with the men always "talking" about gadgets, toys and other "boy-stuff". She suggested to one of the other women to talk about shopping, clothes and shoes. However, as soon as I had made a comment on that, one of the other men immediately told me to stay with the women for the rest of the day. A few weeks later a posting spree, like it happened with the bald heads, occurred again. This time it started with someone posting a Sticky of himself with a black bar painted over his face, depicting himself as a criminal. At first, everyone did the same thing, but soon afterwards, all kinds of celebrities and iconic figures everyone could relate to received the same treatment. Not having had enough, people continued on the theme the following day.

Participants' reactions

When I asked people what they thought about Iris I received mostly positive reactions. Most found Iris to be aesthetically pleasing and fun to use as well as having had a pleasant experience in communicating with each other. Three of the participants were negative. One had expected Iris to be used for sharing more work-related content, whereas another found it to be too cognitively challenging. The last participant found the idea of communicating to be apprehensive, because she feels we're doing far too much with computers today.

Some commented on the fact that it was a new way in communicating with one another. Most described it as play, fun and humor. Especially the people, who posted more, said they and others used it for teasing, provoking and finding the limits. One participant noted: "As long as it was witty, it was okay". However, a few pointed out that this sometimes annoyed them, because it sometimes led to pointless noise. Especially posting a sticky note over one that had been made moments earlier was reported to be irritating. On the other hand, what was noise to some, was fun and engaging to others.

Initially some tried to show work-related material, but noted that they couldn't "fit" it inside a small picture and a tagline. Many also commented that they couldn't understand most work-related sticky notes. This was also shown by the fact that these almost never received follow-ups. Some opted either for the option of adding more text than a single tagline or the option of adding hyperlinks to the sticky notes. People who had thought this through, however, noted the possibility that this might lead to everyone adding hyperlinks, causing the Sticky Board to be nothing more than a visual collection of hyperlinks, without the interactions

between people.

When asked what the added value of Iris was, all remarked that it was mainly social. The activity-visualizations had nothing to with this though, only having used them, checking if activity was rated high if large numbers of posts had been made. Five reported to use Iris often as a means to escape from work for a moment. They said they toyed with the basic widget, rotating the list of names and rotating and scaling the array of photos, but mainly checking up on what had been posted and creating sticky notes of their own. Especially the people who posted often liked the ability to have a little chitchat and some compared the tone of the Sticky Board to "bartalk". Although some checked the list of names to see who was present, they noted that this had only little meaning to them; it didn't tell whether someone was at his or her desk.

Participants were able to recollect five to ten names, when asked who had been participating in the experiment. They noted that this was mainly because of the posts that had been made, or as one participant remarked: "If you post, you exist". It's interesting to note that only participants on the upper floor, who have offices, experienced Iris as bonding. They liked the fact that things happening in the large studio, which is often regarded as the heart of the ID-StudioLab, found their way to their personal workspace, even if they had been more passive users. Some noted that they were annoyed when they couldn't relate sticky notes to a person, due to people using nicknames, meaningless to some. One person remarked that this influenced the quality of interactions on the Sticky Board in a negative way. This emphasizes the social function of Iris within the community.

Although some used Iris just to show a single nice looking image, most created their sticky notes with the intent of getting reactions, checking if someone had posted a follow-up during the first few moments after posting. While not disappointed when they hadn't received any reactions, whether it was using Iris or face-to-face, all mentioned they appreciated it when they had. Within the large studio, people often used the sticky notes as triggers for short face-to-face conversations. But also people reported commenting on people's posts as they ran into each other in the hallway or during lunch. One participant, who had started a discussion about shopping and shoes, in reaction to "the boys" always talking about gadgets, told she continued talking about it face-to face at the end of the day.

Three remarked that when they had gone home early or been away for a day, they were surprised how many posts had been made. One of the participants, who comes in early and leaves early, said: "I always noticed how much always happened in the hour after I left. Sometimes I saw it (the Sticky Board) had completely changed and I thought, wow, a lot has happened". They and others would have like the ability to back into time because of this.

I asked what Iris was and surprisingly everyone regarded the widget on his or her computer screens as Iris, not the entire system. The presence of the Sticky Board on the TRI-setup was mostly not observed, but this may have to do with the fact that it is used for other applications as well, like presentations and music. Arthur was regarded as a mixed bag. As a utility, most people saw Arthur as being flawed, mainly because of its awkward interface and its location. A few people, especially those who mentioned Arthur as being a participant, thought Arthur did have an added value. They appreciated how Arthur reacted to them and allowed for physical play and told Arthur gave Iris a presence outside of the computer. Most would walk by

one or twice a day, reminding them of Iris' presence in the community and triggering interest in the processes happening there.

Questionnaires

The data gathered from the two questionnaires didn't reveal much (see Appendix III). When comparing the questionnaire from the pretest to the one from the posttest, two questions and two topics revealed a significant increase. At a 95% single tailed confidence interval, participants noted that they used the mailinglist more often. Although the hypothesis that the use of Iris would reflect positively on other media as well was not rejected, this wasn't one of the main issues of the questionnaire. More interesting is that participants reported that they liked to share more of what they were working on, being significant at a 90% single tailed confidence interval. The hypothesis that the use of Iris would reflect positively on the topics wasn't rejected for bonding and commitment. At a 90% confidence interval, both increased significantly.

After factoring in the number of posts in comparing the two questionnaires, the results were somewhat different. Only one question and one topic revealed significant differences in means. It seems that the more participants posted, the more they feel they know about the presence of people (who are neither in their vicinity, nor from their section); this being significant at a 95% confidence interval. Of the topics only commitment revealed a significant increase at a 90% confidence interval.

Anticipating that the biggest changes would be observed from participants located outside the studios, the questionnaires were compared factored by location. Two groups for location were used: inside the studios or located elsewhere. Although the test might seem to produce more significant results, many of these actually revealed a drop, causing hypotheses to be rejected for questions 9b, 10b and 10c. Showing a significant increase at a 95% confidence interval, participants from outside the studios reported they experienced a larger increase in their feeling of missing out on events. This reveals the flaw in this particular question. One might argue that, perhaps they weren't aware of the fact they were missing out on events before the trial, but since the hypothesis was for the positive effect, it has to be rejected as well. The only real significant positive change was that participants from outside the studios have experienced more increase in knowing what's happening due to the mailinglist. The difference in locatedness didn't reveal a correlation in the number of posts participants made.

The assignments did not have an effect on the questionnaire, as factoring the questionnaire from the pretest by having or not having assignments revealed significant differences in five questions and one topic. This shouldn't be there since the assignments were given out randomly. Drawing any conclusions from comparing the two questionnaires factored by having or not having an assignment would therefore be pointless. The assignments didn't have an effect on the number of postings either, as no significant correlations were found. It should be noted however, that some participants with an assignment failed to live up to it. The effect of the assignments can therefore be considered to be negligible.

5.4 Discussion

I feel Iris and the trial have been a success. I had expected more communication on what people we're working on. I can contribute this to the fact that the majority of the work people are doing at the ID-StudioLab is not

purely visual, in contrast to a designers' daily work. However, I think the low level of work-related postings is mainly due to the fact that creative people tend to be playful and the fact that Iris facilitates this so easily.

Without making Iris playful, simple and restricting it, conversations most likely wouldn't have been so personal. A more formal approach would probably have led to people not committing to Iris by setting on a tone, resulting in much less communication and not having the wealth of information we have now. Other than hyperlinking and an ability to go back in time, participants didn't feel they we're missing anything. In fact, I believe that had I added more functionality and sacrificed some of it's minimalism, like adding personal messaging for example, Iris would be competing with instant messaging and people wouldn't have been able to address a purpose to Iris. While one could easily compare Iris to instant messaging, the fact that messages were public and visually oriented made for different types of conversation.

Apart for the part where it seemed that participants experienced an increase in liking to share, the results from the questionnaire and the statistics are mostly trivial or lacking. I did somewhat expect this, as this research is experimental and attempts to find out what awareness actually is and what purpose it has within Communities of Practice. I have not been able to find any examples in available literature with clear operationalizations on this subject, neither for qualitative research, nor for quantitative. It may very well be that the questionnaire was lacking due to the fact that I have very little experience in doing quantitative research, failing to ask the right questions in tackling the subject. This is especially the case in the weighted topics, which were made arbitrarily.

I was able to make the widget stand out, by setting it apart from other things happening on the screen, aesthetically and in terms of size. This probably contributed to the fact that when talking about Iris, people we're actually talking about the widget. By being small, the widget doesn't interfere with what people are doing. Almost none minimized Iris during use and kept it in a corner of their screen the entire time. Those that did minimize it were all Microsoft Windows users; Mac OS X users probably found having it open no problem due to OS X's Exposé window management functionality. It's remarkable to see how popular the use of widgets has become, since the introduction of the Dashboard under Mac OS X 10.4. [1]

Some of Iris's aspects need some work however. The activity visualizations, while pleasing to the eye, could probably be discarded. The fact that the Sticky Board was on display wasn't noted by most. For this to work it probably needs a dedicated display, which doesn't interfere with other functions like serving as a jukebox as well as some interactivity. This conflict didn't come as a surprise, but since it was the most appropriate display available, we decided to use it anyway. Arthur needs to be less awkward to work effectively for most, only few were able to deal with its quirks. Also, a better location would be preferable. Iris was built as an open system and is still a work in progress. Derivations are likely to be made, as well as new types of input, like camera phones for example.

6 Coming full circle

6.1 Concluding

Iris allowed people to explore new ways of communicating, finding form and purpose in the process. While Iris didn't allow for work-related discussions, people found a way to interact with one another. One third of participants committed themselves to Iris and the purpose it served within the community. The tone was set by only a sixth of participants, having others follow. Out of a need of informal social interactions, after experimenting the first two weeks, they used Iris for teasing and provoking reactions, socializing the workplace.

Especially for participants on the upper floor, who were not surrounded by a large group of people, Iris had a bonding effect and gave them a feeling of presence of the people surrounding them. This is not to say that Iris served no purpose in the large studio on the lower floor. Setting visual triggers often sparked people's curiosity and appealed to their playful nature, providing a means to engage in face-to-face conversations at their desks or in the hallway. Iris helped people to find common interests in each other, whether it is play, gadgets or shopping.

By knowing what interests others in the workspace we can easily interact with one another and engage ourselves in conversations and discussions. In informal and casual conversations we can freely associate further. We can relate this to the work we're doing and hereby learn from each other. For this to arise we need something to talk about in the first place. Iris helped to give the handles needed to spark people's curiosity and imagination. Without form, though, this wouldn't have happened either, requiring a few people committing themselves, inspiring others to follow.

Results from other studies, incorporating groupware focusing on peripheral awareness and using lightweight and unobtrusive interfaces seem to provide similar results. As with Iris, users of Portholes [6] were able to recollect events and reported feelings of social bonding. The fact that Portholes has an emphasis, similar to Iris, may contribute to the similarity in results. From AROMA [18] we may conclude that (abstract) visualizations may actually serve a purpose in supporting peripheral awareness. Although, AROMA's visualizations weren't perfect, they sparked far more interest that Iris' visualizations. However, we feel that abstract visualizations will be overshadowed by the dominant nature of the visual triggers and should therefore be omitted.

I feel that I returned something to workplace that has been lost since the introduction of the computer. Although not the creative work we initially aimed for, we found out we were able to provide people with a toolset that has been successful in creating a pleasurable experience and providing a means of sharing the handles people need to engage themselves in informal and casual interactions. People need to have a shared overview of these interactions if they are to connect and bond to one another. I also believe these interactions are necessary when a community wants to be able to commit itself to a common cause and become more than just the sum of its members. I believe Iris may be improved further with these aspects in mind. Should the Sticky Board support more interaction like hyperlinking, rearranging of the Stickies and perhaps even multiple collages, people would be able to differentiate between work and fun and point others more easily to what interests them, especially if the Sticky Board would be published and updated as a website or weblog as well.

6.2 Side notes

Iris shows that media can play a important role in supporting Communities of Practice. Online communities also thrive very well on media like it is the case with Flickr. [7] The richness of media can help people tell stories, which serve a role in finding a common ground in each other. This sharing is essential in creating, defining and redefining culture, which needs a common ground in order to work. Most media used are visual stills, which makes sense since computers are so visually oriented, which require very little effort to create and tend to take up little bandwidth. However, increases in available bandwidth, the availability of easier, cheaper and more fun tools have led to people creating other media as well. The increasing popularity of Podcasting shows that audio and video may have profound effects on sharing culture. People are imitating each other, basing what they create on the works of others, communicating and learning from one another. This is exactly how culture works and people can do it on a global scale these days.

Unfortunately, publishing companies and copyright watchdogs, which need to make money from the media created by the artists, are now waging a war over intellectual property and copyright. The ability to make (almost) perfect copies of various kinds of media due to their digital nature led publishers to resort to means of copy protection, mainly due to an increase in file-sharing for the sole purpose of copying music without paying for it. While some companies use a somewhat lenient form, others use ways that restrict users in such a way, that only the media's intended use is possible and even worse crippled some people's computers as an unwanted side-effect. The consequence of this is that users can no longer build upon the works of others if this becomes a common practice, which I think would be a shame.

If all popular media would be protected by copy protection, creativity tools would be rendered useless, unless they would able to circumvent it, which in turn is illegal in some countries. For example, capturing the screen in OS X 10.4 is impossible using the regular way while running the DVD Player application. Presumably, this is meant to protect the property belonging to the movie studios, meaning that a user can't use a picture from a movie for doing a mockup for example. Although Iris' widget uses screencapturing to get its content, this issue did fortunately not hamper it, as it "communicates" more directly to the operating system.

On the other hand, some artists and interest groups like Creative Commons [5], recognize this need for culture remixing. The digital era means that artists can publish their works without the need of publishing companies and can add licenses to their works, allowing for different derivative work, commercial or not.

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Appendices

Appendix I - References

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Appendix II - Questionnaire

Q1) Whether people are present or not, I… *awareness, 2*

rarely know about						often know about	
1	2	3	4	5	6	7	people located near me
1	2	3	4	5	6	7	people from my section
1	2	3	4	5	6	7	other people

Q2) Being aware of other people's presence is important to me *bonding, 3*

I disagree fully						I agree fully
1	2	3	4	5	6	7

Q3) About what people are generally working on, I know… *awareness, 3*

very little from						very much from	
1	2	3	4	5	6	7	people located near me
1	2	3	4	5	6	7	people from my section
1	2	3	4	5	6	7	other people

Q4) Knowing what other people from the ID StudioLab are working on is important to me *bonding, 3*

I disagree fully						I agree fully
1	2	3	4	5	6	7

Q5) I like to share what I'm working on with my fellow members *commitment, 2*

I disagree fully						I agree fully
1	2	3	4	5	6	7

Q6) Getting feedback when I have something interesting to share is important to me *bonding, 2*

I agree fully						I disagree
1	2	3	4	5	6	7

Q7 I find it easy to share interesting things with my fellow members *commitment, 1*

I disagree fully						I agree fully
1	2	3	4	5	6	7

Q8) I feel I miss out on interesting events happening at the ID StudioLab *awareness, 2*

never						often
1	2	3	4	5	6	7

Q9) I know what's happening within the ID StudioLab, … *awareness, 2*

rarely due to						often due to	
1	2	3	4	5	6	7	talking to people
1	2	3	4	5	6	7	the weekopening
1	2	3	4	5	6	7	the mailinglist
1	2	3	4	5	6	7	the internal website

Q10) When I have something interesting to share, I do it… *commitment, 1*

rarely by						often by	
1	2	3	4	5	6	7	telling / showing people
1	2	3	4	5	6	7	using the mailinglist
1	2	3	4	5	6	7	using the internal website

Q11) The ID StudioLab is a community *bonding, 3*

I disagree fully						I agree fully
1	2	3	4	5	6	7

Awareness	2/9 * (Q1.1 + Q1.2 + Q1.3) / 3 + 3/9 * (Q3.1 + Q3.2 + Q3.3) / 3 + 2/9 * (8 – Q8) + 2/9 * (Q9.1 + Q9.2 + Q9.3) / 3
Bonding	3/10 * Q2 + 3/10 * Q4 + 2/10 * (8 – Q6) + 3/10 * Q11
Commitment	2/4 * Q5 + 1/4 * Q7 + 1/4 * (Q10.1 + Q10.2 + Q10.3) / 3

Oneway ANOVA: Questionnaire factored by Time

Descriptives

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
1a	before	23	5.87	1.180	.246	5.36	6.38	3	7
	after	23	5.91	1.041	.217	5.46	6.36	3	7
	Total	46	5.89	1.100	.162	5.56	6.22	3	7
1b	before	23	4.17	1.557	.325	3.50	4.85	1	7
	after	23	4.61	1.234	.257	4.08	5.14	2	7
	Total	46	4.39	1.406	.207	3.97	4.81	1	7
1c	before	23	2.39	1.158	.241	1.89	2.89	1	5
	after	23	2.96	1.296	.270	2.40	3.52	1	5
	Total	46	2.67	1.248	.184	2.30	3.04	1	5
2	before	23	5.04	1.261	.263	4.50	5.59	2	7
	after	23	5.48	.790	.165	5.14	5.82	3	7
	Total	46	5.26	1.063	.157	4.95	5.58	2	7
3a	before	23	4.74	1.322	.276	4.17	5.31	2	7
	after	23	5.17	.984	.205	4.75	5.60	3	7
	Total	46	4.96	1.173	.173	4.61	5.30	2	7
3b	before	23	4.57	1.674	.349	3.84	5.29	1	7
	after	23	4.91	1.411	.294	4.30	5.52	1	7
	Total	46	4.74	1.541	.227	4.28	5.20	1	7
3c	before	23	2.83	1.267	.264	2.28	3.37	1	6
	after	23	2.91	.996	.208	2.48	3.34	1	5
	Total	46	2.87	1.128	.166	2.53	3.20	1	6
4	before	23	5.70	.926	.193	5.30	6.10	3	7
	after	23	5.78	.951	.198	5.37	6.19	4	7
	Total	46	5.74	.929	.137	5.46	6.02	3	7
5	before	23	5.48	.846	.176	5.11	5.84	4	7
	after	23	5.96	.976	.204	5.53	6.38	3	7
	Total	46	5.72	.935	.138	5.44	6.00	3	7
6	before	23	3.83	2.059	.429	2.94	4.72	1	7
	after	23	3.04	1.821	.380	2.26	3.83	1	7
	Total	46	3.43	1.962	.289	2.85	4.02	1	7
7	before	23	4.83	1.230	.257	4.29	5.36	3	6
	after	23	5.04	1.147	.239	4.55	5.54	3	7
	Total	46	4.93	1.181	.174	4.58	5.29	3	7
8	before	23	3.65	1.799	.375	2.87	4.43	1	7
	after	23	3.61	1.948	.406	2.77	4.45	1	7
	Total	46	3.63	1.854	.273	3.08	4.18	1	7
9a	before	23	5.96	1.107	.231	5.48	6.44	2	7
	after	23	6.00	.603	.126	5.74	6.26	5	7
	Total	46	5.98	.882	.130	5.72	6.24	2	7
9b	before	23	4.61	1.725	.360	3.86	5.35	1	7
	after	23	4.26	1.738	.362	3.51	5.01	1	6
	Total	46	4.43	1.721	.254	3.92	4.95	1	7
9c	before	23	4.09	2.043	.426	3.20	4.97	1	7
	after	23	4.61	1.373	.286	4.01	5.20	2	7
	Total	46	4.35	1.741	.257	3.83	4.86	1	7
9d	before	23	2.78	1.858	.387	1.98	3.59	1	7
	after	23	3.57	1.647	.343	2.85	4.28	1	6
	Total	46	3.17	1.780	.262	2.65	3.70	1	7
10a	before	23	6.00	.674	.141	5.71	6.29	5	7
	after	23	6.17	.778	.162	5.84	6.51	4	7
	Total	46	6.09	.725	.107	5.87	6.30	4	7
10b	before	23	2.22	1.413	.295	1.61	2.83	1	7
	after	23	3.13	1.576	.329	2.45	3.81	1	6
	Total	46	2.67	1.550	.229	2.21	3.13	1	7
10c	before	23	2.52	1.855	.387	1.72	3.32	1	7
	after	23	2.65	1.584	.330	1.97	3.34	1	6
	Total	46	2.59	1.707	.252	2.08	3.09	1	7
11	before	23	5.26	1.322	.276	4.69	5.83	3	7
	after	23	5.57	.945	.197	5.16	5.97	3	7
	Total	46	5.41	1.147	.169	5.07	5.75	3	7
awareness	before	23	4.2037	.83080	.17323	3.8444	4.5630	1.93	5.81
	after	23	4.4428	.81852	.17067	4.0889	4.7968	2.52	5.93
	Total	46	4.3233	.82438	.12155	4.0785	4.5681	1.93	5.93
bonding	before	23	5.1225	.72965	.15214	4.8070	5.4381	3.82	6.73
	after	23	5.4901	.54802	.11427	5.2531	5.7271	4.55	6.27
	Total	46	5.3063	.66456	.09798	5.1090	5.5037	3.82	6.73
commitment	before	23	4.8406	.74912	.15620	4.5166	5.1645	3.58	6.50
	after	23	5.2355	.77551	.16171	4.9001	5.5709	3.58	6.75
	Total	46	5.0380	.77990	.11499	4.8064	5.2696	3.58	6.75

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
1a	Between Groups	.022	1	.022	.018	.895
	Within Groups	54.435	44	1.237		
	Total	54.457	45			
1b	Between Groups	2.174	1	2.174	1.102	.300
	Within Groups	86.783	44	1.972		
	Total	88.957	45			
1c	Between Groups	3.674	1	3.674	2.433	.126
	Within Groups	66.435	44	1.510		
	Total	70.109	45			
2	Between Groups	2.174	1	2.174	1.964	.168
	Within Groups	48.696	44	1.107		
	Total	50.870	45			
3a	Between Groups	2.174	1	2.174	1.601	.212
	Within Groups	59.739	44	1.358		
	Total	61.913	45			
3b	Between Groups	1.391	1	1.391	.580	.450
	Within Groups	105.478	44	2.397		
	Total	106.870	45			
3c	Between Groups	.087	1	.087	.067	.797
	Within Groups	57.130	44	1.298		
	Total	57.217	45			
4	Between Groups	.087	1	.087	.099	.755
	Within Groups	38.783	44	.881		
	Total	38.870	45			
5	Between Groups	2.630	1	2.630	3.154	.083
	Within Groups	36.696	44	.834		
	Total	39.326	45			
6	Between Groups	7.043	1	7.043	1.864	.179
	Within Groups	166.261	44	3.779		
	Total	173.304	45			
7	Between Groups	.543	1	.543	.384	.539
	Within Groups	62.261	44	1.415		
	Total	62.804	45			
8	Between Groups	.022	1	.022	.006	.938
	Within Groups	154.696	44	3.516		
	Total	154.717	45			
9a	Between Groups	.022	1	.022	.027	.869
	Within Groups	34.957	44	.794		
	Total	34.978	45			
9b	Between Groups	1.391	1	1.391	.464	.499
	Within Groups	131.913	44	2.998		
	Total	133.304	45			
9c	Between Groups	3.130	1	3.130	1.033	.315
	Within Groups	133.304	44	3.030		
	Total	136.435	45			
9d	Between Groups	7.043	1	7.043	2.286	.138
	Within Groups	135.565	44	3.081		
	Total	142.609	45			
10a	Between Groups	.348	1	.348	.657	.422
	Within Groups	23.304	44	.530		
	Total	23.652	45			
10b	Between Groups	9.587	1	9.587	4.282	.044
	Within Groups	98.522	44	2.239		
	Total	108.109	45			
10c	Between Groups	.196	1	.196	.066	.799
	Within Groups	130.957	44	2.976		
	Total	131.152	45			
11	Between Groups	1.065	1	1.065	.807	.374
	Within Groups	58.087	44	1.320		
	Total	59.152	45			
awareness	Between Groups	.658	1	.658	.967	.331
	Within Groups	29.924	44	.680		
	Total	30.582	45			
bonding	Between Groups	1.554	1	1.554	3.732	.060
	Within Groups	18.320	44	.416		
	Total	19.874	45			
commitment	Between Groups	1.794	1	1.794	3.086	.086
	Within Groups	25.577	44	.581		
	Total	27.371	45			

General Linear Model: Questionnaire factored by Posts & Time (covariates)

Tests of Between-Subjects Effects

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1a	.126(a)	2	6.312E-02	.050	.951
	1b	3.860(b)	2	1.930	.975	.385
	1c	12.531(c)	2	6.265	4.679	.015
	2	2.190(b)	2	1.095	.967	.388
	3a	2.224(d)	2	1.112	.801	.456
	3b	3.971(e)	2	1.985	.830	.443
	3c	1.849(f)	2	.925	.718	.493
	4	.230(g)	2	.115	.128	.880
	5	3.583(h)	2	1.792	2.155	.128
	6	7.048(i)	2	3.524	.911	.410
	7	5.007(j)	2	2.504	1.863	.168
	8	.584(k)	2	.292	.081	.922
	9a	2.523E-02(l)	2	1.261E-02	.016	.985
	9b	2.887(m)	2	1.443	.476	.625
	9c	4.651(n)	2	2.326	.759	.474
	9d	10.111(o)	2	5.055	1.641	.206
	10a	.395(p)	2	.197	.365	.697
	10b	9.765(q)	2	4.882	2.135	.131
	10c	7.962(r)	2	3.981	1.390	.260
	11	3.490(s)	2	1.745	1.348	.270
	awareness	.890(t)	2	.445	.645	.530
	bonding	1.672(u)	2	.836	1.974	.151
	commitment	3.222(v)	2	1.611	2.869	.068
Intercept	1a	792.391	1	792.391	627.142	.000
	1b	400.696	1	400.696	202.475	.000
	1c	131.522	1	131.522	98.223	.000
	2	585.043	1	585.043	516.780	.000
	3a	516.565	1	516.565	372.131	.000
	3b	479.348	1	479.348	200.312	.000
	3c	183.696	1	183.696	142.662	.000
	4	746.130	1	746.130	830.320	.000
	5	690.261	1	690.261	830.405	.000
	6	336.696	1	336.696	87.082	.000
	7	535.696	1	535.696	398.547	.000
	8	306.783	1	306.783	85.586	.000
	9a	816.043	1	816.043	1003.915	.000
	9b	488.522	1	488.522	161.071	.000
	9c	384.174	1	384.174	125.353	.000
	9d	178.087	1	178.087	57.795	.000
	10a	828.000	1	828.000	1530.852	.000
	10b	113.087	1	113.087	49.446	.000
	10c	146.261	1	146.261	51.053	.000
	11	636.565	1	636.565	491.759	.000
	awareness	406.436	1	406.436	588.601	.000
	bonding	603.527	1	603.527	1425.749	.000
	commitment	538.918	1	538.918	959.618	.000
Posts (covariate)	1a	.104	1	.104	.083	.775
	1b	1.686	1	1.686	.852	.361
	1c	8.857	1	8.857	6.615	.014
	2	1.565E-02	1	1.565E-02	.014	.907
	3a	4.960E-02	1	4.960E-02	.036	.851
	3b	2.579	1	2.579	1.078	.305
	3c	1.762	1	1.762	1.369	.248
	4	.143	1	.143	.159	.692
	5	.953	1	.953	1.146	.290
	6	4.963E-03	1	4.963E-03	.001	.972
	7	4.464	1	4.464	3.321	.075
	8	.562	1	.562	.157	.694
	9a	3.490E-03	1	3.490E-03	.004	.948
	9b	1.496	1	1.496	.493	.486
	9c	1.521	1	1.521	.496	.485
	9d	3.067	1	3.067	.995	.324
	10a	4.671E-02	1	4.671E-02	.086	.770
	10b	.178	1	.178	.078	.782
	10c	7.766	1	7.766	2.711	.107
	11	2.425	1	2.425	1.873	.178
	awareness	.232	1	.232	.337	.565
	bonding	.118	1	.118	.278	.601
	commitment	1.429	1	1.429	2.544	.118

Time (covariate)	1a	2.019E-03	1	2.019E-03	.002	.968
	1b	.324	1	.324	.164	.688
	1c	3.810E-03	1	3.810E-03	.003	.958
	2	1.410	1	1.410	1.245	.271
	3a	1.290	1	1.290	.930	.340
	3b	2.456E-02	1	2.456E-02	.010	.920
	3c	.201	1	.201	.156	.695
	4	.202	1	.202	.225	.638
	5	.747	1	.747	.899	.348
	6	5.258	1	5.258	1.360	.250
	7	.236	1	.236	.176	.677
	8	.271	1	.271	.076	.785
	9a	2.448E-02	1	2.448E-02	.030	.863
	9b	.129	1	.129	.042	.838
	9c	4.638	1	4.638	1.513	.225
	9d	1.778	1	1.778	.577	.452
	10a	.378	1	.378	.700	.408
	10b	8.145	1	8.145	3.561	.066
	10c	1.192	1	1.192	.416	.522
	11	3.260E-03	1	3.260E-03	.003	.960
	awareness	.190	1	.190	.274	.603
	bonding	.773	1	.773	1.825	.184
	commitment	.259	1	.259	.461	.501
Error	1a	54.330	43	1.263		
	1b	85.096	43	1.979		
	1c	57.578	43	1.339		
	2	48.680	43	1.132		
	3a	59.690	43	1.388		
	3b	102.899	43	2.393		
	3c	55.368	43	1.288		
	4	38.640	43	.899		
	5	35.743	43	.831		
	6	166.256	43	3.866		
	7	57.797	43	1.344		
	8	154.133	43	3.584		
	9a	34.953	43	.813		
	9b	130.417	43	3.033		
	9c	131.784	43	3.065		
	9d	132.498	43	3.081		
	10a	23.258	43	.541		
	10b	98.344	43	2.287		
	10c	123.191	43	2.865		
	11	55.662	43	1.294		
	awareness	29.692	43	.691		
	bonding	18.202	43	.423		
	commitment	24.149	43	.562		
Total	1a	1651.000	46			
	1b	976.000	46			
	1c	399.000	46			
	2	1324.000	46			
	3a	1192.000	46			
	3b	1140.000	46			
	3c	436.000	46			
	4	1554.000	46			
	5	1543.000	46			
	6	716.000	46			
	7	1183.000	46			
	8	761.000	46			
	9a	1679.000	46			
	9b	1038.000	46			
	9c	1006.000	46			
	9d	606.000	46			
	10a	1728.000	46			
	10b	437.000	46			
	10c	439.000	46			
	11	1407.000	46			
	awareness	890.352	46			
	bonding	1315.099	46			
	commitment	1194.938	46			

Corrected Total	1a	54.457	45			
	1b	88.957	45			
	1c	70.109	45			
	2	50.870	45			
	3a	61.913	45			
	3b	106.870	45			
	3c	57.217	45			
	4	38.870	45			
	5	39.326	45			
	6	173.304	45			
	7	62.804	45			
	8	154.717	45			
	9a	34.978	45			
	9b	133.304	45			
	9c	136.435	45			
	9d	142.609	45			
	10a	23.652	45			
	10b	108.109	45			
	10c	131.152	45			
	11	59.152	45			
	awareness	30.582	45			
	bonding	19.874	45			
	commitment	27.371	45			

a R Squared = .002 (Adjusted R Squared = -.044)
b R Squared = .043 (Adjusted R Squared = -.001)
c R Squared = .179 (Adjusted R Squared = .141)
d R Squared = .036 (Adjusted R Squared = -.009)
e R Squared = .037 (Adjusted R Squared = -.008)
f R Squared = .032 (Adjusted R Squared = -.013)
g R Squared = .006 (Adjusted R Squared = -.040)
h R Squared = .091 (Adjusted R Squared = .049)
i R Squared = .041 (Adjusted R Squared = -.004)
j R Squared = .080 (Adjusted R Squared = .037)
k R Squared = .004 (Adjusted R Squared = -.043)
l R Squared = .001 (Adjusted R Squared = -.046)
m R Squared = .022 (Adjusted R Squared = -.024)
n R Squared = .034 (Adjusted R Squared = -.011)
o R Squared = .071 (Adjusted R Squared = .028)
p R Squared = .017 (Adjusted R Squared = -.029)
q R Squared = .090 (Adjusted R Squared = .048)
r R Squared = .061 (Adjusted R Squared = .017)
s R Squared = .059 (Adjusted R Squared = .015)
t R Squared = .029 (Adjusted R Squared = -.016)
u R Squared = .084 (Adjusted R Squared = .042)
v R Squared = .118 (Adjusted R Squared = .077)

General Linear Model: Questionnaire factored by Location (fixed) & Time (covariate)

Descriptive Statistics

	Outside Studios	Mean	Std. Deviation	N
1a	no	5.92	1.164	26
	yes	5.85	1.040	20
	Total	5.89	1.100	46
1b	no	4.08	1.521	26
	yes	4.80	1.152	20
	Total	4.39	1.406	46
1c	no	2.54	1.363	26
	yes	2.85	1.089	20
	Total	2.67	1.248	46
2	no	5.04	1.183	26
	yes	5.55	.826	20
	Total	5.26	1.063	46
3a	no	5.12	.993	26
	yes	4.75	1.372	20
	Total	4.96	1.173	46
3b	no	4.35	1.648	26
	yes	5.25	1.251	20
	Total	4.74	1.541	46
3c	no	2.73	1.313	26
	yes	3.05	.826	20
	Total	2.87	1.128	46
4	no	5.81	.981	26
	yes	5.65	.875	20
	Total	5.74	.929	46
5	no	5.85	.732	26
	yes	5.55	1.146	20
	Total	5.72	.935	46
6	no	3.65	1.979	26
	yes	3.15	1.954	20
	Total	3.43	1.962	46
7	no	4.92	1.230	26
	yes	4.95	1.146	20
	Total	4.93	1.181	46
8	no	3.04	1.685	26
	yes	4.40	1.818	20
	Total	3.63	1.854	46
9a	no	6.00	1.020	26
	yes	5.95	.686	20
	Total	5.98	.882	46
9b	no	5.04	1.248	26
	yes	3.65	1.954	20
	Total	4.43	1.721	46
9c	no	3.88	1.774	26
	yes	4.95	1.538	20
	Total	4.35	1.741	46
9d	no	3.38	1.899	26
	yes	2.90	1.619	20
	Total	3.17	1.780	46
10a	no	6.27	.604	26
	yes	5.85	.813	20
	Total	6.09	.725	46
10b	no	2.88	1.774	26
	yes	2.40	1.188	20
	Total	2.67	1.550	46
10c	no	3.15	1.994	26
	yes	1.85	.813	20
	Total	2.59	1.707	46
11	no	5.58	1.027	26
	yes	5.20	1.281	20
	Total	5.41	1.147	46
awareness	no	4.4031	.94857	26
	yes	4.2194	.63685	20
	Total	4.3233	.82438	46
bonding	no	5.2692	.61576	26
	yes	5.3545	.73672	20
	Total	5.3063	.66456	46
commitment	no	5.1795	.78482	26
	yes	4.8542	.75310	20
	Total	5.0380	.77990	46

Tests of Between-Subjects Effects

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1a	8.211E-02(a)	2	4.105E-02	.032	.968
	1b	8.084(b)	2	4.042	2.149	.129
	1c	4.771(c)	2	2.386	1.570	.220
	2	5.132(d)	2	2.566	2.412	.102
	3a	3.683(e)	2	1.842	1.360	.268
	3b	10.626(f)	2	5.313	2.374	.105
	3c	1.239(g)	2	.619	.476	.625
	4	.368(h)	2	.184	.206	.815
	5	3.622(i)	2	1.811	2.181	.125
	6	9.913(j)	2	4.957	1.304	.282
	7	.552(h)	2	.276	.191	.827
	8	20.978(k)	2	10.489	3.372	.044
	9a	5.000E-02(l)	2	2.500E-02	.031	.970
	9b	23.184(m)	2	11.592	4.526	.016
	9c	15.961(n)	2	7.981	2.849	.069
	9d	9.698(c)	2	4.849	1.569	.220
	10a	2.335(o)	2	1.167	2.355	.107
	10b	12.242(p)	2	6.121	2.745	.075
	10c	19.413(q)	2	9.707	3.735	.032
	11	2.671(r)	2	1.336	1.017	.370
	awareness	1.039(s)	2	.520	.756	.476
	bonding	1.636(t)	2	.818	1.929	.158
	commitment	2.990(u)	2	1.495	2.637	.083
Intercept	1a	784.318	1	784.318	620.249	.000
	1b	406.285	1	406.285	216.023	.000
	1c	132.619	1	132.619	87.279	.000
	2	587.723	1	587.723	552.545	.000
	3a	506.996	1	506.996	374.392	.000
	3b	487.587	1	487.587	217.846	.000
	3c	184.813	1	184.813	141.965	.000
	4	737.060	1	737.060	823.178	.000
	5	679.522	1	679.522	818.376	.000
	6	328.098	1	328.098	86.346	.000
	7	531.486	1	531.486	367.115	.000
	8	319.120	1	319.120	102.603	.000
	9a	808.157	1	808.157	994.917	.000
	9b	465.485	1	465.485	181.764	.000
	9c	393.938	1	393.938	140.607	.000
	9d	172.571	1	172.571	55.831	.000
	10a	813.432	1	813.432	1640.787	.000
	10b	108.943	1	108.943	48.865	.000
	10c	135.392	1	135.392	52.102	.000
	11	625.220	1	625.220	475.992	.000
	awareness	400.655	1	400.655	583.155	.000
	bonding	599.650	1	599.650	1413.840	.000
	commitment	529.621	1	529.621	934.079	.000
Time (covariate)	1a	2.174E-02	1	2.174E-02	.017	.896
	1b	2.174	1	2.174	1.156	.288
	1c	3.674	1	3.674	2.418	.127
	2	2.174	1	2.174	2.044	.160
	3a	2.174	1	2.174	1.605	.212
	3b	1.391	1	1.391	.622	.435
	3c	8.696E-02	1	8.696E-02	.067	.797
	4	8.696E-02	1	8.696E-02	.097	.757
	5	2.630	1	2.630	3.168	.082
	6	7.043	1	7.043	1.854	.180
	7	.543	1	.543	.375	.543
	8	2.174E-02	1	2.174E-02	.007	.934
	9a	2.174E-02	1	2.174E-02	.027	.871
	9b	1.391	1	1.391	.543	.465
	9c	3.130	1	3.130	1.117	.296
	9d	7.043	1	7.043	2.279	.138
	10a	.348	1	.348	.702	.407
	10b	9.587	1	9.587	4.300	.044
	10c	.196	1	.196	.075	.785
	11	1.065	1	1.065	.811	.373
	awareness	.658	1	.658	.957	.333
	bonding	1.554	1	1.554	3.664	.062
	commitment	1.794	1	1.794	3.163	.082

Outside Studios (factor)	1a	6.037E-02	1	6.037E-02	.048	.828
	1b	5.910	1	5.910	3.143	.083
	1c	1.097	1	1.097	.722	.400
	2	2.958	1	2.958	2.781	.103
	3a	1.509	1	1.509	1.114	.297
	3b	9.235	1	9.235	4.126	.048
	3c	1.152	1	1.152	.885	.352
	4	.281	1	.281	.314	.578
	5	.991	1	.991	1.194	.281
	6	2.870	1	2.870	.755	.390
	7	8.194E-03	1	8.194E-03	.006	.940
	8	20.956	1	20.956	6.738	.013
	9a	2.826E-02	1	2.826E-02	.035	.853
	9b	21.793	1	21.793	8.510	.006
	9c	12.831	1	12.831	4.580	.038
	9d	2.655	1	2.655	.859	.359
	10a	1.987	1	1.987	4.008	.052
	10b	2.655	1	2.655	1.191	.281
	10c	19.218	1	19.218	7.395	.009
	11	1.606	1	1.606	1.223	.275
	awareness	.381	1	.381	.555	.460
	bonding	8.228E-02	1	8.228E-02	.194	.662
	commitment	1.196	1	1.196	2.110	.154
Error	1a	54.374	43	1.265		
	1b	80.872	43	1.881		
	1c	65.338	43	1.519		
	2	45.738	43	1.064		
	3a	58.230	43	1.354		
	3b	96.243	43	2.238		
	3c	55.978	43	1.302		
	4	38.502	43	.895		
	5	35.704	43	.830		
	6	163.391	43	3.800		
	7	62.253	43	1.448		
	8	133.740	43	3.110		
	9a	34.928	43	.812		
	9b	110.120	43	2.561		
	9c	120.473	43	2.802		
	9d	132.910	43	3.091		
	10a	21.318	43	.496		
	10b	95.867	43	2.229		
	10c	111.739	43	2.599		
	11	56.481	43	1.314		
	awareness	29.543	43	.687		
	bonding	18.238	43	.424		
	commitment	24.381	43	.567		
Total	1a	1651.000	46			
	1b	976.000	46			
	1c	399.000	46			
	2	1324.000	46			
	3a	1192.000	46			
	3b	1140.000	46			
	3c	436.000	46			
	4	1554.000	46			
	5	1543.000	46			
	6	716.000	46			
	7	1183.000	46			
	8	761.000	46			
	9a	1679.000	46			
	9b	1038.000	46			
	9c	1006.000	46			
	9d	606.000	46			
	10a	1728.000	46			
	10b	437.000	46			
	10c	439.000	46			
	11	1407.000	46			
	awareness	890.352	46			
	bonding	1315.099	46			
	commitment	1194.938	46			

Corrected Total	1a	54.457	45			
	1b	88.957	45			
	1c	70.109	45			
	2	50.870	45			
	3a	61.913	45			
	3b	106.870	45			
	3c	57.217	45			
	4	38.870	45			
	5	39.326	45			
	6	173.304	45			
	7	62.804	45			
	8	154.717	45			
	9a	34.978	45			
	9b	133.304	45			
	9c	136.435	45			
	9d	142.609	45			
	10a	23.652	45			
	10b	108.109	45			
	10c	131.152	45			
	11	59.152	45			
	awareness	30.582	45			
	bonding	19.874	45			
	commitment	27.371	45			

a R Squared = .002 (Adjusted R Squared = -.045)
b R Squared = .091 (Adjusted R Squared = .049)
c R Squared = .068 (Adjusted R Squared = .025)
d R Squared = .101 (Adjusted R Squared = .059)
e R Squared = .059 (Adjusted R Squared = .016)
f R Squared = .099 (Adjusted R Squared = .058)
g R Squared = .022 (Adjusted R Squared = -.024)
h R Squared = .009 (Adjusted R Squared = -.037)
i R Squared = .092 (Adjusted R Squared = .050)
j R Squared = .057 (Adjusted R Squared = .013)
k R Squared = .136 (Adjusted R Squared = .095)
l R Squared = .001 (Adjusted R Squared = -.045)
m R Squared = .174 (Adjusted R Squared = .135)
n R Squared = .117 (Adjusted R Squared = .076)
o R Squared = .099 (Adjusted R Squared = .057)
p R Squared = .113 (Adjusted R Squared = .072)
q R Squared = .148 (Adjusted R Squared = .108)
r R Squared = .045 (Adjusted R Squared = .001)
s R Squared = .034 (Adjusted R Squared = -.011)
t R Squared = .082 (Adjusted R Squared = .040)
u R Squared = .109 (Adjusted R Squared = .068)

Oneway ANOVA: Posts factored by assignment

Descriptives

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
no	10	15.60	24.441	7.729	-1.88	33.08	0	79
yes	13	26.31	25.847	7.169	10.69	41.93	2	96
Total	23	21.65	25.263	5.268	10.73	32.58	0	96

ANOVA

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	648.048	1	648.048	1.016	.325
Within Groups	13393.169	21	637.770		
Total	14041.217	22			

Oneway ANOVA: Posts factored by location

Descriptives

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
no	13	24.85	30.759	8.531	6.26	43.43	1	96
yes	10	17.50	16.270	5.145	5.86	29.14	0	50
Total	23	21.65	25.263	5.268	10.73	32.58	0	96

ANOVA

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	305.025	1	305.025	.466	.502
Within Groups	13736.192	21	654.104		
Total	14041.217	22			

T-Test: Questionnaire (pretest) grouped by assignment

Group Statistics

	assignment	N	Mean	Std. Deviation	Std. Error Mean
1a	no	10	6.20	1.229	.389
	yes	13	5.62	1.121	.311
1b	no	10	4.70	1.567	.496
	yes	13	3.77	1.481	.411
1c	no	10	2.60	1.174	.371
	yes	13	2.23	1.166	.323
2	no	10	4.50	1.716	.543
	yes	13	5.46	.519	.144
3a	no	10	5.40	.966	.306
	yes	13	4.23	1.363	.378
3b	no	10	4.50	1.434	.453
	yes	13	4.62	1.895	.525
3c	no	10	2.90	1.101	.348
	yes	13	2.77	1.423	.395
4	no	10	5.60	.699	.221
	yes	13	5.77	1.092	.303
5	no	10	5.50	.972	.307
	yes	13	5.46	.776	.215
6	no	10	3.60	1.713	.542
	yes	13	4.00	2.345	.650
7	no	10	4.60	1.350	.427
	yes	13	5.00	1.155	.320
8	no	10	2.60	1.350	.427
	yes	13	4.46	1.713	.475
9a	no	10	6.60	.516	.163
	yes	13	5.46	1.198	.332
9b	no	10	5.50	.850	.269
	yes	13	3.92	1.935	.537
9c	no	10	4.80	1.619	.512
	yes	13	3.54	2.222	.616
9d	no	10	2.70	2.312	.731
	yes	13	2.85	1.519	.421
10a	no	10	6.20	.789	.249
	yes	13	5.85	.555	.154
10b	no	10	2.90	1.792	.567
	yes	13	1.69	.751	.208
10c	no	10	2.90	2.331	.737
	yes	13	2.23	1.423	.395
11	no	10	5.10	1.524	.482
	yes	13	5.38	1.193	.331
awareness	no	10	4.7111	.69680	.22035
	yes	13	3.8134	.72228	.20032
bonding	no	10	4.9455	.67787	.21436
	yes	13	5.2587	.76498	.21217
commitment	no	10	4.9000	.93112	.29444
	yes	13	4.7949	.61106	.16948

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	Upper
1a	Equal variances assumed	.015	.905	1.189	21	.248	.58	.492	-.438	1.607
	Equal variances not assumed			1.175	18.514	.255	.58	.498	-.459	1.628
1b	Equal variances assumed	.108	.746	1.457	21	.160	.93	.639	-.397	2.259
	Equal variances not assumed			1.446	18.916	.164	.93	.644	-.417	2.278

1c	Equal variances assumed	.300	.589	.751	21	.461	.37	.492	-.654	1.392
	Equal variances not assumed			.750	19.443	.462	.37	.492	-.659	1.398
2	Equal variances assumed	13.987	.001	-1.921	21	.068	-.96	.500	-2.002	.079
	Equal variances not assumed			-1.713	10.272	.117	-.96	.561	-2.208	.285
3a	Equal variances assumed	1.781	.196	2.299	21	.032	1.17	.509	.111	2.227
	Equal variances not assumed			2.405	20.903	.026	1.17	.486	.158	2.180
3b	Equal variances assumed	1.958	.176	-.160	21	.874	-.12	.720	-1.613	1.382
	Equal variances not assumed			-.166	21.000	.870	-.12	.694	-1.559	1.328
3c	Equal variances assumed	.220	.644	.240	21	.813	.13	.545	-1.002	1.263
	Equal variances not assumed			.248	20.993	.806	.13	.526	-.964	1.225
4	Equal variances assumed	.542	.470	-.426	21	.674	-.17	.397	-.995	.656
	Equal variances not assumed			-.451	20.454	.657	-.17	.375	-.950	.612
5	Equal variances assumed	.690	.415	.106	21	.917	.04	.364	-.719	.796
	Equal variances not assumed			.103	16.941	.920	.04	.375	-.753	.830
6	Equal variances assumed	5.400	.030	-.453	21	.655	-.40	.882	-2.235	1.435
	Equal variances not assumed			-.473	20.969	.641	-.40	.846	-2.160	1.360
7	Equal variances assumed	1.315	.264	-.766	21	.452	-.40	.522	-1.487	.687
	Equal variances not assumed			-.750	17.762	.463	-.40	.534	-1.522	.722
8	Equal variances assumed	1.791	.195	-2.823	21	.010	-1.86	.660	-3.233	-.490
	Equal variances not assumed			-2.914	20.972	.008	-1.86	.639	-3.190	-.533
9a	Equal variances assumed	1.714	.205	2.799	21	.011	1.14	.407	.293	1.984
	Equal variances not assumed			3.074	17.160	.007	1.14	.370	.358	1.919
9b	Equal variances assumed	8.722	.008	2.396	21	.026	1.58	.658	.208	2.946
	Equal variances not assumed			2.628	17.321	.017	1.58	.600	.312	2.841
9c	Equal variances assumed	2.896	.104	1.510	21	.146	1.26	.835	-.476	2.999
	Equal variances not assumed			1.575	20.966	.130	1.26	.801	-.405	2.928
9d	Equal variances assumed	1.108	.304	-.183	21	.857	-.15	.799	-1.808	1.516
	Equal variances not assumed			-.173	14.751	.865	-.15	.844	-1.947	1.655
10a	Equal variances assumed	2.299	.144	1.265	21	.220	.35	.280	-.228	.936
	Equal variances not assumed			1.207	15.470	.245	.35	.293	-.269	.977
10b	Equal variances assumed	3.489	.076	2.203	21	.039	1.21	.548	.068	2.348
	Equal variances not assumed			2.000	11.440	.070	1.21	.604	-.115	2.530
10c	Equal variances assumed	2.572	.124	.852	21	.404	.67	.785	-.964	2.302
	Equal variances not assumed			.800	14.036	.437	.67	.836	-1.124	2.462

11	Equal variances assumed	1.459	.240	-.503	21	.620	-.28	.566	-1.461	.892
	Equal variances not assumed			-.487	16.701	.633	-.28	.585	-1.520	.950
awareness	Equal variances assumed	.155	.698	3.000	21	.007	.8977	.29926	.27537	1.52007
	Equal variances not assumed			3.015	19.854	.007	.8977	.29780	.27623	1.51921
bonding	Equal variances assumed	.284	.599	-1.022	21	.318	-.3133	.30660	-.95090	.32432
	Equal variances not assumed			-1.039	20.509	.311	-.3133	.30160	-.94142	.31485
commitment	Equal variances assumed	.714	.408	.327	21	.747	.1051	.32170	-.56387	.77413
	Equal variances not assumed			.309	14.738	.761	.1051	.33974	-.62012	.83038