Meme Tags and Community Mirrors: Moving from Conferences to Collaboration

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ABSTRACT

Meme Tags are part of a body of research on GroupWear: a wearable technology that supports people in the formative stages of cooperative work. Conference participants wear Meme Tags that allow them to electronically share memes—succinct ideas or opinions—with each other. Alongside of the person-to-person transactions, a server system collects information about the memetic exchanges and reflects it back to the conference-goers in *Community Mirrors*—large, public video displays that present real-time visualizations of the unfolding community dynamics. This paper presents results from a proof-of-concept trial of the Meme Tag technology undertaken at a MIT Media Laboratory conference.

Keywords

groupware, name tag, community, meme, collaboration, wearable computing, infrared communication, interaction design

INTRODUCTION

A new type of collaborative technology, called GroupWear, supports people in the formative stages of cooperative work. We are specifically interested in the conference-type setting, where people united by a common interest meet to share ideas, renew friendships, and forge new collaborations.

Our work is partly motivated by the irony that as CSCW researchers, we spend a lot of time at conferences, yet we have seen little use of CSCW ideas or technologies to help make this time more productive. This may be because time spent interacting with others at conferences is not considered cooperative work: conference interactions are somewhat evanescent, and a shared agenda is often not articulated. However, we believe that the groundwork for meaningful and enduring collaborations can be laid at such events, and that this can be encouraged with appropriate technology.

As a starting point for our research, we look to the wearable "paper and stick-pin" technology that is ubiquitous at every conference—the name tag. Judging by their popularity, name tags work very well as they are. Therefore, as we have developed our GroupWear Tags, we have been very careful not to break what was good about the name tag [2]. Our GroupWear Tags have two major capabilities that paper and stick-pin technology cannot support, however.

GroupWear Tags are about understanding relationships. While a normal name tag tells you something about its wearer, GroupWear tags can tell you something your relationship to the wearer. For example, the original GroupWear tags [1] offered two conversing people a simple measure of their agreement on a set of community-relevant issues. This type of relationship feedback can be an excellent "bootstrap" into a conversation for building a shared understanding with a new acquaintance.

GroupWear Tags are about understanding community. Our latest GroupWear tags, called Meme Tags (Figure 1), go further by helping people build a shared understanding of the whole conference community. In order for participants to build effective collaborations with others, they need to be able to understand the structure and dynamics of this community, and be able to locate themselves and others in it. People also need to be encouraged to more freely associate with a wider spectrum of individuals.

This paper presents a proof-of-concept trial of the Meme Tag technology undertaken at a conference at the MIT Media Laboratory. We start with an overview of the Meme Tag activity, a discussion of some of the design tradeoffs we had to make to support our goals, and some informal observations of the effectiveness of those choices. We then present a more focused analysis of some of the quantitative data we collected at this event, and what it suggests about redesigning part of the technology. We conclude with some plans for future

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work, including a detailed study of the impact of the Meme Tags on cooperative activity.

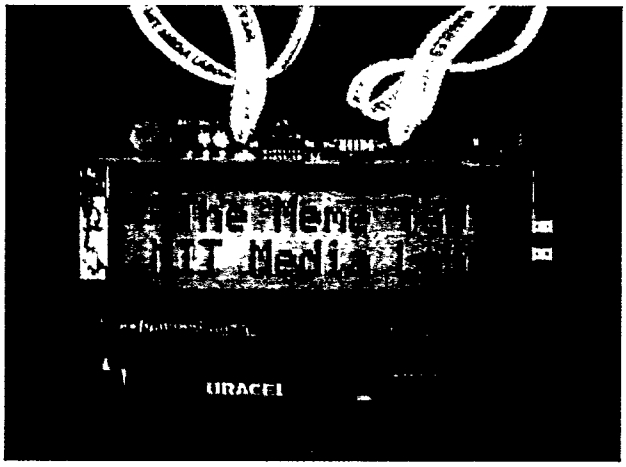

Figure 1: The Meme Tag. Worn around the neck, the Meme Tag includes a large, bright LCD screen, green and red pushbuttons (for accepting or deleting memes), a knob (not visible) for reviewing and choosing memes to offer, and a bidirectional infrared communications device.

THE MEME TAG EVENT

The Meme Tag event took place over a period of two days in October 1997. The event was designed to be a part of the MIT Media Lab's *Digital Life* (DL), *Things That Think* (TTT), and *News In the Future* (NIF) consortia sponsor meetings. Sponsors of the lab are invited to see work at the lab, visit with faculty and students, meet with other sponsors, and pursue collaborations. At the event, approximately 400 sponsors, faculty, and students congregated and were each given a Meme Tag, which also functioned as their name tag.

Richard Dawkins first introduced the term "meme" to suggest how ideas can spread and evolve through Darwinian selection [4]. In our use, a meme is an idea or opinion, expressed as a short piece text that spreads from person to person. The Meme Tag contains community-relevant memes that a participant has chosen.

Several weeks prior to the Meme Tag event, a web page was created to allow members of the Media Lab's extended community to submit memes. Approximately 400 memes were collected. A sample of approximately 200 of these were chosen and each Meme Tag was initialized with one random meme. We ensured that each of the 200 preselected memes was found on at least one tag. Table 1 presents a sampling of memes contributed both before and during the event.

Sample Memes
If brute force isn't working
you're not using enough of it
We learn best from experience...
preferably someone else's
Microsoft-Intel won't last long.
Net computers are the future!!
History convinces more people
than philosophy
The future is best seen through
peripheral vision -- N.N.
Keyboards as we know them
will disappear by the year 2010
Content is a commodity ...
context is value added
Do not read the "Good Times"
meme
Don't talk to me
Talk to my agent
This meme good for one free
dinner with Prof Michael Hawley
A witty saying...
proves nothing. -- Voltaire

Table 1: Sample Contributed Memes. Memes were restricted to 64 characters each.

Once participants received their Meme Tags, they were free to roam about the Media Lab and exchange memes with fellow participants. In Figure 2, Bob and Nancy meet and their Meme Tags activate, lighting their screens. Bob's tag presents a new meme to Nancy, while Nancy's tag simultaneously presents a fresh meme to Bob. For example, Nancy's tag might say

```
Fresh meme for Bob:
  Computing should be about
  insight, not numbers
```

while Bob's tag displays

```
Fresh meme for Nancy:
  Make money fast --
  pass this meme to your friends!
```

If Bob likes the meme shown on Nancy's tag, he can press the green button on his tag, causing the meme to be replicated onto his. Similarly, if Nancy wants the message Bob's tag has shown her, she can capture it onto her tag. After the exchange, the Meme Tags become idle and do not distract from their subsequent conversation.

Figure 2: Meme Exchange. "Bob" and "Nancy," two conference-goers at the Media Lab consortia meetings, exchange memes.

In addition to subscribing to memes from other people, participants were able to author their own memes at a kiosk and add them to their tags (Figure 3). When a participant wearing a tag approached the kiosk, the kiosk recognized that a Meme Tag was near, and greeted the participant by name. From the kiosk, participants could then add a meme to their badge. Approximately 300 memes were added to the original set of 200 during the event.

Figure 3: Kiosk Usage. A participant authors a new meme and adds it to his tag.

Around the event, large-screen displays presented visualizations of how the memes spread throughout the community (Figure 4). These displays formed a "Community Mirror," where in real-time participants saw which ideas were most popular and which ones were dying out, as well as information about group dynamics, such as the "cliquishness" of the gathering.

These Community Mirrors also gave participants a sense of knowing what other participants knew. This facilitated the formative stages of interaction by providing people with additional common reference points for conversation. Figure 5 shows four of the ten different visualizations offered by the Community Mirror; these visualizations cycled in rapid succession continuously throughout the event.

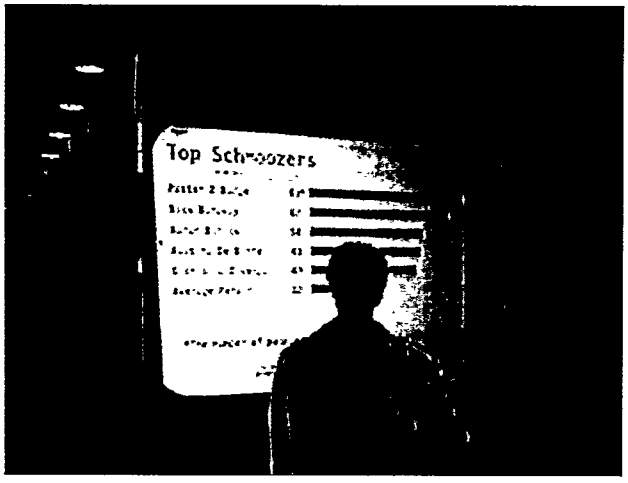

Figure 4: The Community Mirror. A large-screen display shows a series of visualizations based on real-time interaction data, reflecting a representation of social activity back to event participants.

The final piece of the Meme Tag System was the Meme Server Database (Figure 6). In addition to storing all of the meme text and meme subscription information, the server also stored basic demographic information on each participant: gender, affiliation (sponsor, faculty, student), and consortium (DL, TTT, NIF). This information was used for the Community Mirrors as well as for our post-event data analysis.

Each time participants met, their Meme Tags created a record indicating who met and what memes were exchanged (or rejected). During the participants' conversation, the Meme Tags also invisibly shared records of all other conversations they knew about—that is, not only conversations in which they were involved, but conversations they learned about "through the grapevine" from other tags. Thus, each Meme Tag collected a sample of the conversation records from throughout the entire community.

When a participant visited a kiosk, the kiosk downloaded the interaction records and sent them to the Meme Server Database. Because each participant's Meme Tag contained a representative sample of conversation records from the entire group, only a fraction of the participants needed to visit kiosks in order for the Meme Server to collect a substantial portion of all conversation records. This decentralized mechanism allowed the Meme Server to collect live community data from purely local interactions.

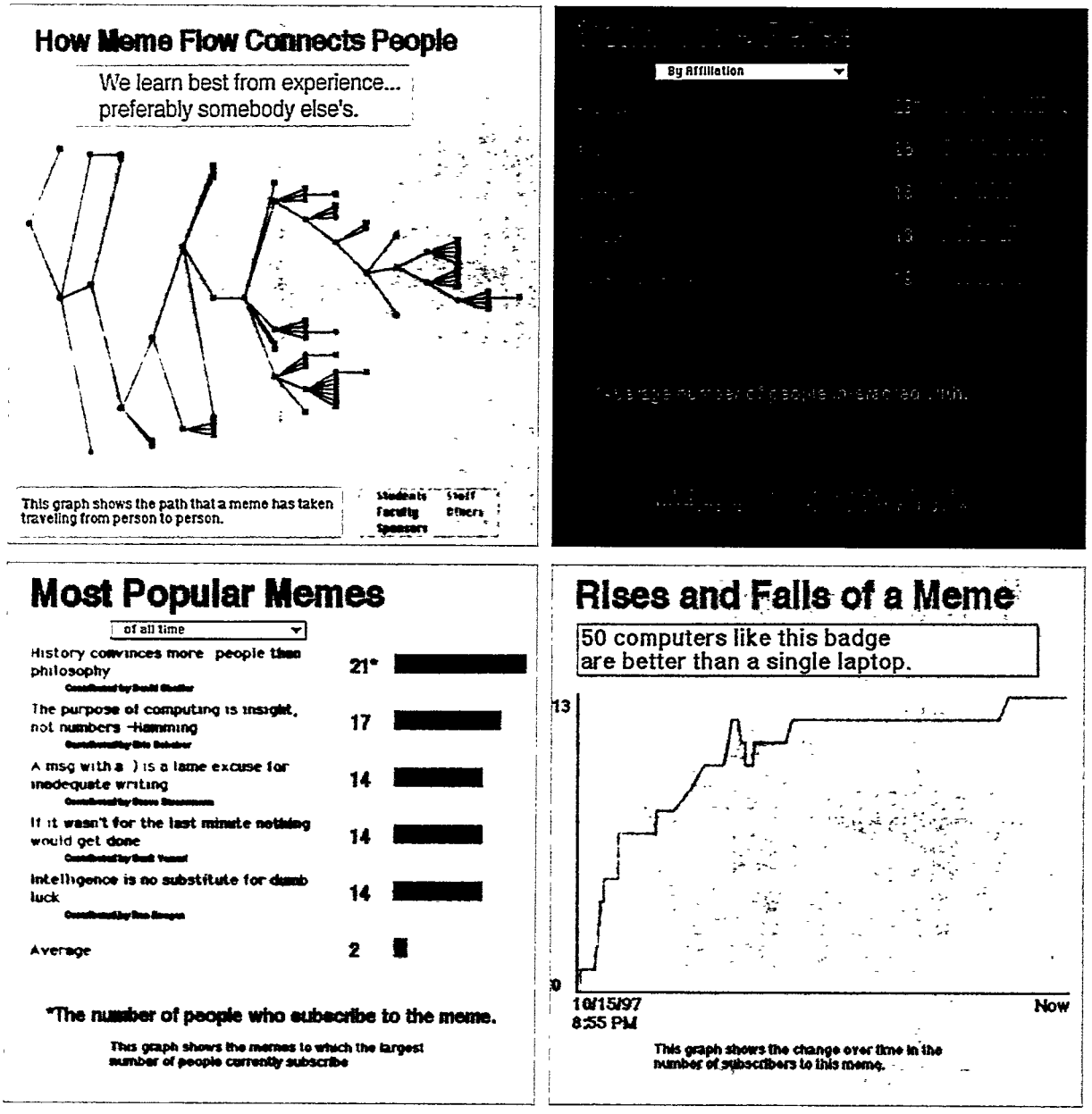

Figure 5: Four Examples of Community Mirror Visualizations.

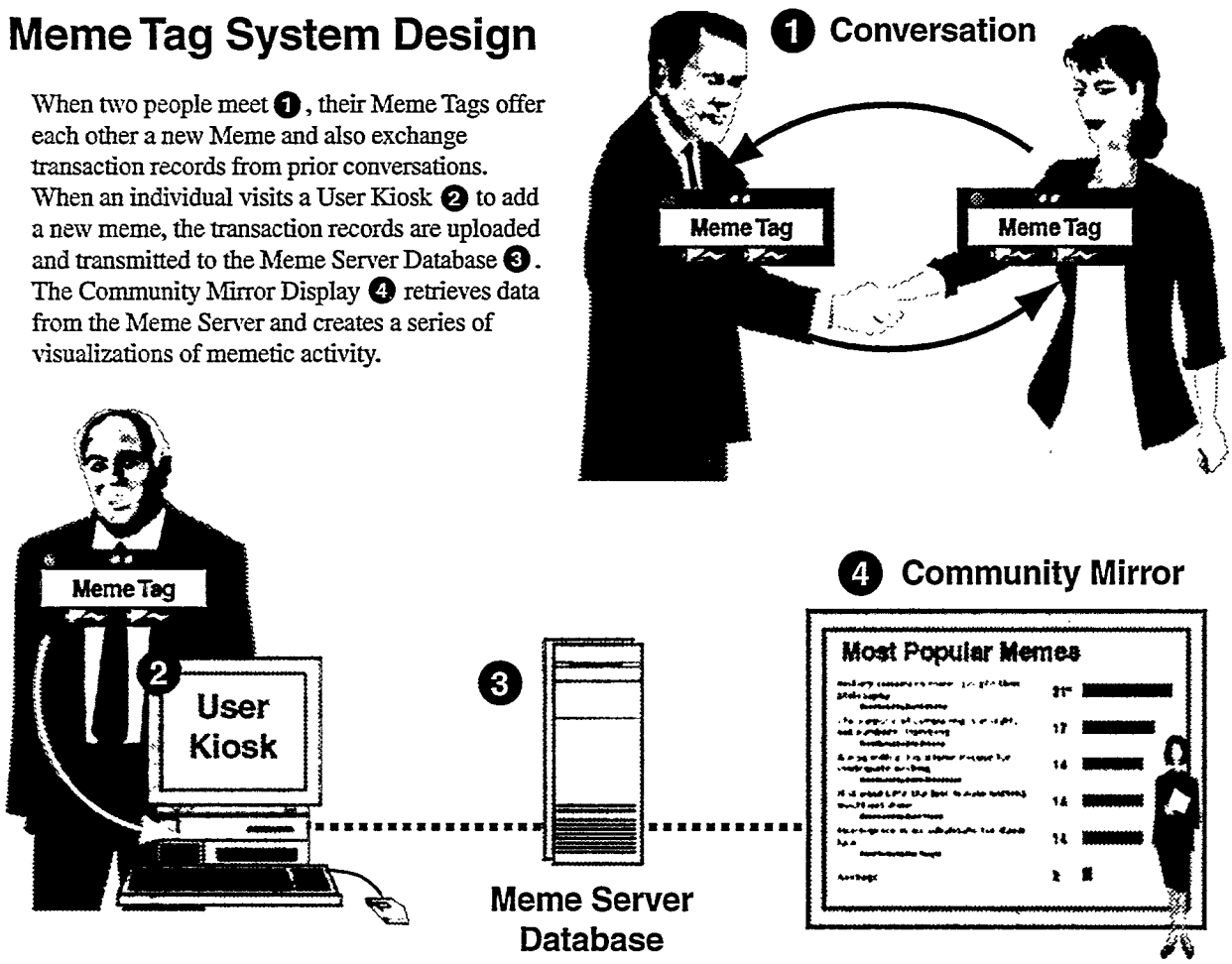

Figure 6: Meme Tag System Design.

RELATED RESEARCH

Our original GroupWear tags, called Thinking Tags, helped two conference participants build a shared understanding by showing them a measure of their agreement on some community-relevant issues [1]. At a Thinking Tag event, participants programmed their tags with answers to several multiple-choice questions. When two participants met, their tags flashed a green light for each question they agreed upon and a red light for each question they answered differently.

Unlike the design of the Meme Tag activity, Thinking Tag content had to be determined in advance of the event—there was no way for participants to add new issues as the event progressed. Also, the Thinking Tags did not have any support for visualizations of community activity like the Meme Tags' Community Mirrors.

Our GroupWear research continues the emerging CSCW trend toward support for the more informal, unstructured, and unplanned aspects of the collaborative process [10, 13]. Also, like the Xerox PARC work on Collab and LiveBoard, our research aims to augment face-to-face work [16, 7]. We have worked hard to weave the GroupWear tags into the social fabric of a normal conference, heeding Moran, et al's warning that the tools should not "inhibit or distort" people's natural collaborative activities [12]. To this end, we have insured "alignment" between GroupWear mechanics and normal group dynamics: when two people face each other at normal conversational distance, their tags interact; also, tag output is designed to be easily comprehensible within the time and space constraints of regular social interactions.

Unlike other research on face-to-face CSCW, GroupWear attempts to augment the collaborative work that goes on before collaborative work is formally acknowledged—before any project meetings have taken place, a team has been established, or a shared vision has been articulated. GroupWear technology is designed to help participants at a conference find like-minded individuals, and begin conversations that can lay the groundwork for further collaboration. Although people spend a lot of time engaged in this type of face-to-face activity, we know of no other technology designed to support it.

GroupWear Community Mirrors support a type of "social group awareness," another strong theme in CSCW research. Dourish and Bellotti's definition of awareness [6] is "the understanding of the activity of the others, which provides a context of your own activity." Community Mirrors do this by letting participants view their own social activity in the context of community dynamics

(for instance, "The average person has met fifteen people, but I've spoken with only six"). We also extend the definition of awareness to include understanding of the knowledge and beliefs of others, in order to provide context for one's own knowledge and beliefs. Community Mirrors let participants examine the beliefs of others by allowing them to see statistics such as a particular meme's current popularity within the community.

Community Mirrors offer viewers knowledge of other people's knowledge (specifically, knowledge of the collective beliefs of a community), allowing them to serve as a partial solution to the "Mutual Knowledge Problem." Krauss and Fussell characterize this problem as the work communicating parties must do in "constructing their common cognitive environment—that is, ascertaining and representing the information that they and the other participants can (and will) assume to be known to all." [11]

Because Community Mirrors are displayed in full public view, and people can assume that most people have seen them, they reflect a gathering's common cognitive environment, in terms of a set of shared beliefs, and shared knowledge of these shared beliefs. This knowledge, shared by the community about the community, can then be a powerful resource for individual conversation. By locating themselves within this space, participants in a conversation can begin to build a more personal shared understanding that can lead to continued collaboration.

The Community Mirrors feed back visualizations of community dynamics in real-time to a co-present community. Real-time community visualizations have been previously explored for on-line communities [5]. Also, sociologists engaged in Social Network Analysis have produced many interesting representations of real-world community activity [15]. However, their representations were not available for the real-time consumption of their subject community.

DESIGN DECISIONS

During the design of the Meme Tag event, the object was to ensure that the activity and technology facilitated meaningful interaction between participants that could lead to further collaboration. All of the following design decisions follow from this purpose.

Tag Design

How many memes per tag

Though there were over 300 memes circulating during the event, the Meme Tags were restricted to hold a maximum of seven memes. This was not a technical restriction, since there was enough free memory in the Meme Tags to hold many more memes. Rather, we wanted participants to have a sense that the space on their Meme Tag was precious. By restricting the number of memes, people needed to be selective in accepting memes. (Participants could delete memes to make room for new ones they found more interesting.) Furthermore, by restricting space on the tags, we hoped to find interesting global trends in meme popularity.

Initializing tags with memes

In order to bootstrap the event, each tag was initialized with one meme. By seeding participants' tags with memes, people could start exchanging memes immediately without having to go to a kiosk to enter a new meme. However, it was extremely important that people feel a bond with their tags [2], which could be lessened by the presence of random content. Nevertheless, without a substantial pool of memes in circulation from the beginning, the activity might not have been able to get started. As a compromise, tags were initialized with exactly one random meme.

As another way to bootstrap the event, we placed large posters with Meme Tags attached to them. These special "Poster Tags" had several memes in them. Participants could walk up to the poster and receive a meme from the poster tag. In this way, people could easily seed their tags with memes of their own choosing before joining the social activity.

Meme Exchanges

Identity

As part of the design of the Meme Tag, two tags within infrared communications range start an exchange by displaying a greeting that included the name of the conversation partner. This was important because in a group of more than two people, it made clear which two Meme Tags were interacting by creating a visible connection between conversation partners.

Which Meme to Offer

After the greeting, each tag selected a meme to offer the other. We considered different methods for the Meme Tag to computationally determine which would be the best meme to offer in an exchange. Proposals included using a collaborative filtering algorithm to determine which among a given set of memes would be most relevant. After some debate, we concluded that meme selection would appear fairly arbitrary regardless of the method, since the interface could not reveal the selection process. The final design attempted to present persons with a meme from their conversation partner's tag that they had not seen before. As such, the choice of meme was based on both participants' history: one had subscribed to the meme, and the other had not yet encountered it.

In trial runs, some users wanted to evangelize a specific meme or carefully choose a particular meme for a colleague. So, a feature was added that would allow a user to offer a specific meme: by turning the knob on the tag to a specific meme, that meme would be offered in the subsequent exchange.

Double Interactions

To ensure that when a pair of tags finished an exchange, they did not start another one immediately, a feature was added that prevented a tag from initiating an exchange with the same tag twice in a row. However, in early user interface tests, people sometimes wanted to initiate a second session with the same person. The design was modified to allow people to reset their tags by

pressing the red button. Though this overloaded the red button to mean both "delete a meme" and "reset the tag," the added feature proved valuable to power users.

Design of the Community Mirrors

Showing the whole meme

The purpose of the Community Mirrors was to convey a variety of information about the event in real time to event participants. Included within these displays were the actual text of the memes. In the initial design, the entire text of the meme was not displayed. We reasoned that if people had seen a meme on a Community Mirror before they encountered it from a fellow participant, the meme might be less intriguing and their reaction to it would be muted. However, participants found the displays confusing without the entire text of the meme. Therefore, we reversed this decision in favor of showing the entire meme in the Community Mirror and kiosks.

RESULTS

The focus of this pilot study was on getting the technology working, not on collecting detailed data on its use and impact. However, the data that the Meme Tags themselves collected tells us something about the success of the project. During the course of the event, the 400 participants collectively hit their green buttons to subscribe to a meme approximately 2000 times. Also, during the event, 147 different people took the time to go to a kiosk and author, on average, two new memes each. This data paints a picture of a gathering that was fairly engaged with the Meme Tag activity.

Unfortunately, due to a software bug, the Meme Tags relayed only about 45% of the transaction data to the server, where a transaction consisted of a meme offer between two people, a meme acceptance, or a meme deletion. Although we were disappointed with this outcome, we eventually came to regard the data glass as half full, rather than half empty. The networking algorithm we designed for the Meme Tags was complex, and this was our first opportunity to test it with a large group of people over an extended period of time. Furthermore, we could find no reason to believe there was any selection bias in the data that was captured. Therefore, we believe the Community Mirrors—and our further analysis here—were based on a representative sampling of the data.

In addition to the above quantitative data, we have a collection of informal observations and anecdotes relating to the impact of the Meme Tags.

Compellingness of a Meme Tag Personal Greeting

When one of the conference speakers concluded his speech and walked up the aisle to the exit, he purposefully shielded his tag with his hand. It seemed clear that this was to avoid the potentially awkward situation of his tag "striking up" an unwanted interaction with a member of the audience. Many people told us they found the Meme Tag introduction protocol—where a Meme Tag on a person you are facing lights up with a salutation that includes your name—extremely engaging, almost to the point of distraction. One person said that if they walked past someone and their tags inadvertently started to interact, it was hard to resist stopping and talking when he saw his name lit up on the other person's tag.

Of course, it is highly ironic that finding one's name on someone else's name tag is compelling. Conventional wisdom would say that this is the last thing anyone needs to see on someone else's name tag, since we all know our own names. There is something more important happening here. Part of the salutation's significance is that it demonstrates to Meme Tag viewers that what they are seeing has been created just for them. It hints at fulfillment of the childhood fantasy world that is totally constructed for one's own viewing pleasure.

More importantly, the Meme Tag personal salutation seemed to have the power to create what Goffman called a "focused interaction" between two people, which involves "individuals who extend one another a special type of mutual activity that can exclude others who are present in the situation" [9]. In fact, we designed the Meme Tag software to ensure that one Meme Tag would seek out a single other one, and exclude other tags in the vicinity. We did not want one person's tag starting an interaction with several others' tags at once, leading to multiple meme offers and subsequent confusion about which meme might be accepted by pressing the green button.

Goffman describes an elaborate human protocol for negotiating focused interactions, that includes such rituals as third party introductions of two people who have something in common. In some ways, the Meme Tags enacted this protocol by choosing two people in a group and lighting up their tags with memetic content drawn from one and personalized for the other. Whether this is too much power to give to a name tag is worthy of further consideration.

Technology as Fashion

Before anyone could use the Meme Tags to help form collaborations, we saw that they had to overcome a conceptual hurdle. Some people had a hard time dealing with the fact that although they were the ones wearing this small computer, its LCD screen was designed primarily to be viewed by other people. In fact, several Media Lab members demonstrated difficulty with this concept: in a brainstorming session on possible Meme Tag uses, they repeatedly suggested applications, such as using them as pagers, for which they were not well suited. Of course, Meme Tags are unusual in the world of technology, where pagers, PDAs, and cell phones that we carry are designed to be looked at primarily by us.

Over time, however, as participants looked at the tags of the others, they seemed to get more comfortable with the idea that their tag was meant for others to view. In fact, this is a communicative model with which we are all familiar: namely, fashion. Fashion is about wearing things that communicate something about us to others [3]. In some ways, the Meme Tag is another type of wearable display like a neck-tie, a piece of jewelry, or a

T-shirt with text on it. Of course, the Meme Tag has the special ability to change its appearance depending on who is viewing it. We believe people will become increasingly comfortable with this model of "interpersonalizable" hi-tech fashion.

Testimonials

We got a lot of feedback like the following part of an e-mail from one participant, who wrote asking if he could keep his tag after we asked sponsors to return them: "In all of the conferences that I have attended and produced, the meme tag is the most unique and high-tech solution to a low tech-problem: getting random people to connect and converse with each other." Other people also told us the Meme Tags helped them have meaningful interactions with others that they otherwise might not have.

We have little hard data on the impact of the Community Mirrors. We know that many people stood around and watched the displays as the visualizations streamed past. One faculty member reported talking to a sponsor who kept glancing over at the display. At one point, the sponsor suddenly stood up, pulled out a camera, and took a picture of the Community Mirror. He told the faculty member that one of his memes had made it to the "Most Popular Memes" list, and that he wanted to be able to show this to his friends at home. A much more thorough study of the impact of the Community Mirrors will be undertaken in a future study.

A NEXT GENERATION OF COMMUNITY MIRRORS

Designing the original Community Mirrors turned out to be a bootstrapping problem. Part of the reason for building the Meme Tags in the first place was that people—including ourselves—do not have good intuitions about community dynamics. Therefore, we were in the position of building visualizations for a data set that we could barely imagine. We relied on our intuitions and on relevant research [13] to come up with the first set of visualizations. Now, however, having run a large-scale event and collected a set of interaction data, we can propose a set of views based on interesting patterns in the data. The following sections sketch the content of some of these views, without presenting the specifics of the visualizations.

Insularity

During our work on GroupWear, one of the complaints we have heard is that organizations will go to great lengths to bring a diverse set of people together, only to see them interact with the small subset of people that they see every day. This pattern of behavior was evident in our Meme Tag data (Figure 7). The graph shows the amount of face-to-face interactions that occurred between members of the same group (i.e., sponsors, faculty, and students). Each group's data is displayed as the ratio between the number of interactions that occurred and the number that would occur if people were mixing randomly (i.e., without bias toward interacting with particular groups). Therefore, the line at 100% represents what the values would be if there were no insular bias. As one can see, sponsors have the smallest tendency toward insularity, while students have the largest—they are twice as likely to interact with another student as they would be if they mixed randomly.

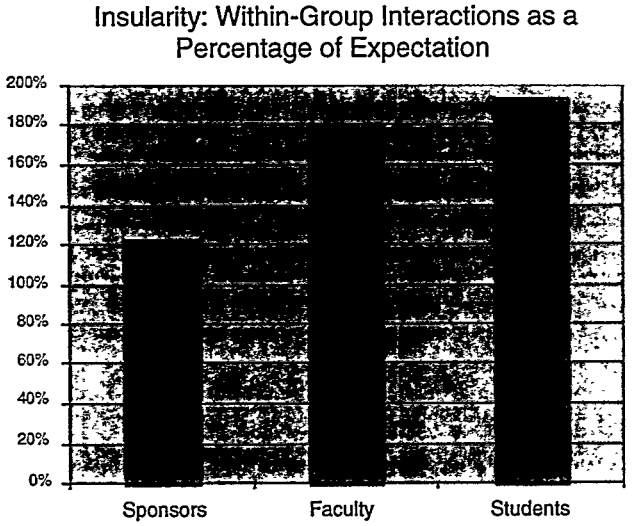

Figure 7: Insularity Between Groups.

Since insularity can have a negative impact on the initiation of useful new collaborations, we would like to highlight it in future GroupWear Community Mirrors. Of course, we are not trying to interfere with the Constitution's guaranteed right to freedom of association. There are times when people may want to be insular. However, research suggests that group behavior like insularity can occur despite the wishes of individual group members [14]. This could occur if people had a slight personal preference toward insularity, and no sense of how their actions were contributing to an undesirable trend. A Community Mirror could make this trend visible, helping people link their own choices to this otherwise invisible macro behavior. Furthermore, because of the public nature of the Community Mirror, insular groups will also be able to see that other people can see their behavior. This is in contrast to the perceived invisibility of individual interactions in a group situation. These two factors could contribute to a shift in an individual's perceived trade-off between insular and non-insular behavior. This matter will be taken up in future GroupWear research.

A word about statistical significance: The insularity bias is statistically significant, with $p<0.01$. However, it is important to keep in mind that these graphs are not meant to provide an after-the-fact, statistically significant sociological analyses of the event. Rather, they are leading us to design new visualizations whose significance will be rightfully determined by the participants who will be able to discuss them as they unfold in real-time at a future Meme Tag event.

Communities of Believers

Communities are partially constituted by the set of beliefs they hold in common [8]. Sub-groups within a community will share some beliefs, but divide on others. Identifying these "belief communities" at a conference

gathering, and locating oneself and others within them, could be helpful for identifying potential collaborators, establishing common ground, and creating a sense of group identity.

By putting the memes into thematic categories, we were able to analyze various Media Lab groups' predisposition to subscribe to certain types of memes. This analysis is somewhat costly to include in the Community Mirror because it would require human attention during the progress of an event. For memes that were added during an event, someone—either the meme author or someone behind the scenes—would have to categorize them.

Many of the disparities between different groups' subscription rates to different types of memes were telling. For example, Figure 8 shows that *Digital Life* sponsors had a larger percentage of subscriptions than *Things That Think* sponsors to memes that sounded a cautionary note about technology (e.g., "New does not equal good. More does not equal better"). This is in keeping with the Digital Life Consortium's focus on looking at technology in a broader, human context, and not just liking it for its own sake. Both groups had roughly equal percentage of subscriptions to memes with explicit technical content, however, showing that Digital Life sponsors are certainly not technophobes. A Community Mirror that paired such graphs showing disparity and commonality between groups could be very powerful tool to help establish a shared sense of individual consortia identities in the context of a larger Media Lab identity. Once again, this shared understanding would be very useful starting point for collaborations.

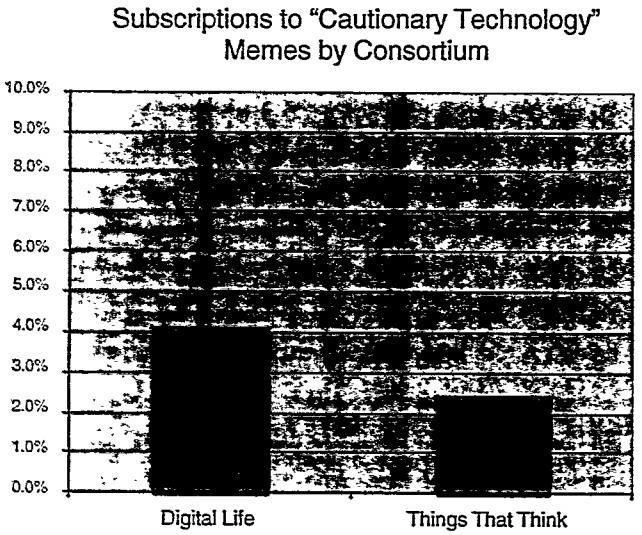

Figure 8: Cautionary Technology Subscriptions by Percentage of Total.

The variance in popularity of "Self-Referential" memes among different Media Lab groups was also revealing. These were memes that were explicitly about memes, or about the meme tag activity. Some examples were "This is not a Meme" and "Make money fast. Pass this meme to your friends." Figure 9 shows that sponsors found these memes less appealing than faculty, who in turn found them less interesting than students. This data supports the stereotype that sponsors prefer ideas that are about the real world, whereas academics are more interested in ideas about ideas and students appear to be the most invested in this kind of metaphysical contemplation. By presenting such a graph at a future event, we would hope people would think about these patterns and their relationships to them.

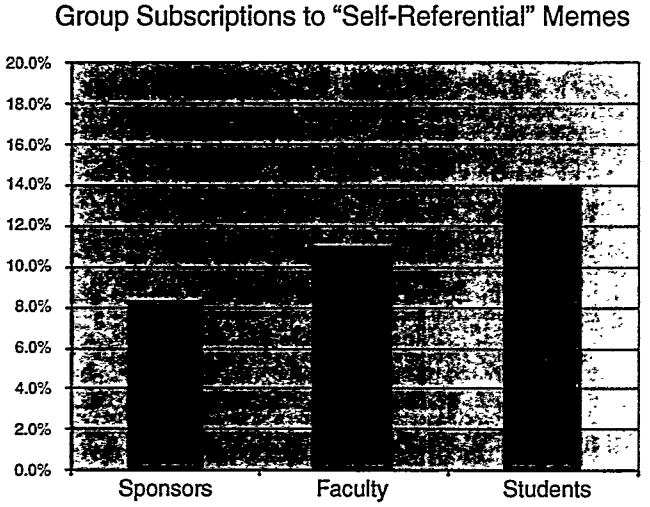

Figure 9: Group Subscriptions to Self-Referential Memes by Percentage of All Group Subscriptions.

Not all visualizations would perpetuate stereotypes. For example, although one might predict some gender differences in terms of memetic taste, the data does not support it. Categories such as "attempt at humor," "techie," "self-referential," "cautionary about technology"—any category we looked at—showed no significant gender-based preferences. Even if they had, however, what would it mean? We believe very strongly that the community in which these visualizations are embedded should determine their meaning. The real-time nature of these visualization is important because it keeps them within the "hermaneutic circle" of those participating in the event: they get to decide the significance of what they see, and whether it should impact their behavior.

CONCLUSION

Our informal observations suggest that the proof-of-concept trial of the Meme Tags was successful. People enthusiastically used the tags through both days of the event, and even through dinner on the first night. The Kiosks were in fairly constant use through both days, with people lining up to author memes that they hoped would reach the "big board" (the Community Mirror). Several people told us that the Meme Tags helped them feel comfortable about approaching people they otherwise would not have. Finally, although we asked for the tags back, many people asked to keep them as conversational props to explain the event to their colleagues.

We also found some flaws in the activity. Probably the most significant was people's seeming lack of attachment to the memes in their tags. Often, we saw that people did not really know what memes they owned. Also, the data showed that no memes really reached a "mass audience"—the maximum number of people that subscribed to any one meme was about forty (we cannot determine this exactly due to the previously mentioned data loss).

Rigorous study of the hypotheses discussed in this paper were beyond of the scope of our initial study. However, now that we have the technology operating and have seen its potential power, we are applying what we learned to the design of a more methodical study. While we will not vary the technology greatly, we are interested experimenting with a different context. We would like to see how the Meme Tags work at a more narrowly focused intellectual gathering, such as a small academic conference. We believe such an environment might offer a more focused meme pool, and result in stronger bonds between memes and participants. This should provide us with the opportunity to further test the impact of the Meme Tags and Community Mirrors on the early stages of collaborative activity.

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