SPARKS

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ABSTRACT
In this paper we introduce Sparks, an ambient social networking and communication facilitation interface. We developed the Sparks system as a physical alternative to existing connectedness mediator systems. While several systems are under investigation, they are limited by their confinement to the traditional display. We address this issue, in part, by collocating the visualization and the user within the physical environment of the scenario. We describe the specific aspects of the system that capitalize on both foreground and peripheral attention to facilitate communication throughout a conversation. We discuss our ongoing research where architectural surfaces are used to provide interactive layers of information related to elements present in the space, and conclude with a discussion of the benefits of the system in combining the immediacy of the physical environment with the dynamic data handling characteristics of a digital system.

Author Keywords
Social networking, ambient interface, interpersonal communication, augmented reality

ACM Classification
[**H.5.2**]: User Interfaces

INTRODUCTION
Light has long been a metaphor for guidance, and has literally provided guidance via lighthouses and beacons for centuries. It is thus a natural choice for creating an ambient interface designed to guide people. Sparks uses light to facilitate salient conversations by linking strangers with similar interests together in scenarios where the participants likely have many common interests, but little knowledge of those shared interest. Though there exist several varieties of systems for facilitating communication in related ways [2][3][4][5][6][7], they are either limited to a conventional workstation, or by the limits of the physical device itself, and are generally not designed to operate in the context of a real-time conversation. Therefore, we developed Sparks to explore lightweight environment augmentation within that context using ambient interface techniques. We have developed this system under the scenario that the user is an attendee at a business conference or party under conditions that preclude foreknowledge of the interests of other attendees.

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PREVIOUS WORK
Intro [7], the social matching software created by Mixed Grill and used in the annual Technology, Entertainment, and Design conference, shares a common goal with Sparks of augmenting social interaction within a short time period. It utilizes a keyword based GUI to connect attendees with similar interest, but is generally used in kiosks, completely outside of the context of the actual conversation.

Friendster [3] popularized web-based social networking using profiles and offline messaging. Users create a profile containing a set of interests, which allows other users to find and communicate with them, albeit via messages. Orkut [5] expands on this concept by adding online communities that foster public discussion.

The UbER-Badge [4] serves as a general platform for analysis and enhancement of group social interaction. Badges are self–contained devices worn around the neck capable of messaging, paging, location detection, and accumulation of the interest profile of the wearer. Similar systems [6] have been variously under consideration for some time.

Serendipity [2] is a system for cueing informal interaction using a combination of Bluetooth devices and a database of user profiles. It initiates interaction between people who may not know each other but share mutual interests.

ELEMENTS OF THE SPARKS SYSTEM
Before entering the Sparks environment, each user pre–selects a number of interests from a pool of keywords that cover a wide variety of areas. This selection represents the public face that the user wishes to present to others. Within the environment, Sparks projects the keywords in an aura around the user. The aura remains centered on the user everywhere within the environment, thus requiring no conscious interaction. By using the floor as a projection surface, Sparks prevents a user's own visualization from intruding on their visual field. In contrast to nametags, this system provides another layer of information overlaid in addition to what one can normally glean from the outward appearance of a person. The aura augments the visual cues people use to capture initial impressions about another individual. However, the aura alone is insufficient to create connections between people in a large group. To help guide distant users with similar interests together, the common descriptors on their respective auras are connected by illuminated paths. To help users locate others in the

conference space, the path's thickness modulates to indicate proximity of connected individuals. The thickness modulates the overall luminosity of the floor in the direction of the connected user. This change can be seen in the user's peripheral vision and serves as an ambient indicator. Furthermore, to differentiate between individuals the user has or has not previously met, the link changes color.

In addition to the dynamic path thickness and color, the orientation and density of the paths provide additional cues to help navigate the environment in different scenarios. For example, users can note that paths connect them to nearby users, and then use that connection as a conversational icebreaker. Alternatively, users can focus on and follow the paths originating from a keyword to a random group or individual. Users can also interact with the paths by sending pulses along them to signal others with a shared interest. The pulses act as a simple group paging system that allows one user to quickly form a group around a specific topic. To send a pulse, users simply tap the interest projected within their aura. When the pulse reaches the recipient, a glow appears on the corresponding word. This glow persists longer if many users show interest in the same topic and acts both as a message indicator and a gauge of interest, since the user is more likely to notice an interest that glows for a longer time.

When the system detects a group, a group pad automatically forms in between the individuals. The pad indicates an ongoing conversation, and also serves to kindle further conversation by displaying a stream of words and concepts related to the group's shared interests as a form of free association on those interests. When the group dissolves, the group pad slowly fades away, leaving a momentary trace of their presence at that location.

This trace is additionally retrievable during subsequent conversations using a passive nametag worn around the neck. This tool helps users remember group members from previous conversations. To access the information the user brings the tag to a horizontal position so that it can be used as a projection surface. Moving the tag clockwise and counterclockwise scrolls temporally through a group history. Raising and lowering the tag increases and decreases the level of detail projected on the tag.

Analysis of the Sparks Design

Unlike traditional GUI social networking systems, Sparks strongly couples the system and its interface to its environment, which is intentionally chosen to be conducive to natural social interaction. By removing the barrier of the traditional keyboard and screen, we hope to reduce the learning curve and encourage direct interaction. Additionally the system can communicate to the user through ambient peripheral channels in the common case where the user is not paying direct attention to the visualization. More specifically, the lines form paths that can be easily followed using peripheral attention, while the auras require no more foreground attention than common nametags would. This also reduces the penalty for having a system that operates continuously in real time, since users can easily ignore the output of the system if they so choose. Lastly, the components of the system that the user carries are inactive and therefore less obtrusive by nature than active systems tend to be.

Figure 1. Sparks system in use in the testing environment.

The peripherally focused bias of the system design was intentionally chosen to coincide with the focus of Sparks, which is not to promote relationships, but to kindle communication. To this end, the group pad attempts to keep existing conversations alive by providing a ready pool of ideas that are relevant to the interests of the group. The real time operation of the system also allows the user to concurrently influence the system and react to the influence of others upon the system as changes take place, making it more instantaneous in nature, like conversations themselves.

PRELIMINARY USER OBSERVATIONS

To better understand Sparks, we introduced mockups of several components of the system to novice users and requested feedback and impressions. From these informal user studies and observations we observed usage characteristics such as natural "personal" distancing during conversation and the frequency with which the aura was used. Consequently, we based the size of our auras on the observed distance between two subjects. We must note that the auras were underused until the concept of the keywords was further explained. However, in actual usage, this would be mitigated by the presence of the connections and the similarities between the user–defined profile and aura. We were also able to refine the concept of the tag as a group history record and as a tool to remember names and recollect discussions. These informal user studies reaffirmed our initial concepts and refined many aspects of the system.

IMPLEMENTATION

A camera tracks the individuals present in the space from above. The vision tracking system implements the Lucas-Kanade [1] method of calculating optical flow to accurately follow a multitude of points on moving individuals over an extended period of time. In the experimental system, the vision tracking does not recognize users. Therefore, a system administrator needs to assign a tag to every person in the space upon initialization. A running average is also used to ensure that the effects of noise on the system are minimal.

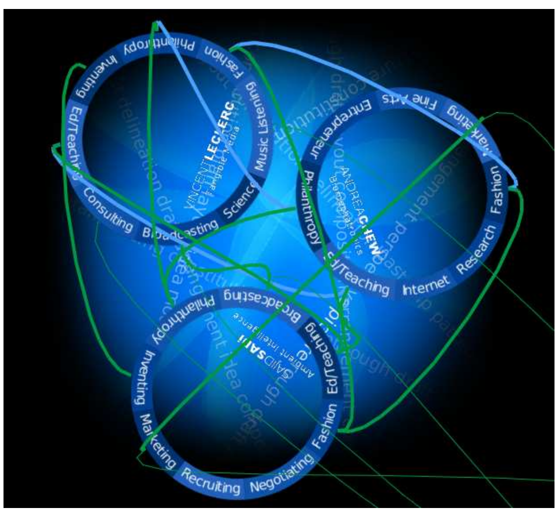

Figure 2. Group pad forms under several persons in a conversation for some time.

The visualization system communicates via TCP/IP to the vision system to receive the coordinates of the users. To allow the user to turn around within their aura, the system only uses the position gleaned from the vision system. Once the system senses that the user is moving in a particular direction, it automatically rotates the aura to keep the name pointed along the motion vector to ensure that the information visible to individuals the user may approach. It also compensates for a variety of visual nonlinearities such as the perceived thickness of strokes and relative brightness values.

In managing the group formation and dissolutions, the implicit meanings and common consequences of such actions are also considered. Since approaching a group once it forms suggests an implicit action of joining that group, the system allows latecomers to join groups freely. However, the departure of a member often signals a change in topic as well, and is thus recorded separately for use in the tag display.

CONCLUSIONS

We believe that our interface offers several advantages and distinctions over conventional GUI–based social networking and connection augmentation systems:

Persistent mediation. Traditional icebreakers take time to initiate, and require a third party mediator. The aura provides concise information in a continuously accessible format, and allows control over the information that is used in initiating conversations.

Physicality. The followable paths and gesture/motion sensing controls strongly couple digital information to the physical environment.

Real time interaction. The goals of seeking out relevant conversation and actually communicating with others can be achieved concurrently.

Minimal need for foreground attention. The unobtrusive nature of the display provides a subtle level of information about the individuals in the periphery of the user and can easily provide details upon inspection.

Focus on sparking conversations. The focus of the system is not in building user communities but rather in augmenting the natural interaction that takes place in conversational groups.

FUTURE WORK

As it stands, our design incorporates a simple messaging feature. It does not approach the complexity of popular offline social networking systems, which rely on message passing as the primary means of communication. Since such communication constitutes the bulk of activity on these systems, it is an area that we would like to investigate further within the framework of our ambient interface. Additionally our system currently requires the user to enter keywords through a traditional GUI interface, and many venues of investigation remain for editing these preferences within the environment itself. We also hope to employ an artificial intelligence based system for more relevant selection of unifying concepts for the group pad. Our limited user studies show that the system can be useful in augmenting real time conversation. In the future we envision the system being integrated into various spaces and acting in lieu of conventional interfaces to allow people to communicate and connect more efficiently.

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