EVOLUTION OF A VIRTUAL COMMUNITY: UNDERSTANDING DESIGN ISSUES THROUGH A LONGITUDINAL STUDY

Arvind Malhotra
Sanjay Gosain
Alexander Hars
Marshall School of Business
University of Southern California

Abstract

Although the potential impacts of virtual communities have been widely recognized in business and academia, little research has been done to provide guidelines for design of such communities and to improve the understanding of critical events and interaction patterns that arise during their evolution. This paper reports the results of two years of participative longitudinal study that led to the creation of a leading web site that has attracted more than 300,000 visitors since its inception. The patterns of interaction which led to growth and stabilization of the site are described, the impact of design choices are discussed, and typical events which occur during the gradual formation of community are analyzed. The site is dedicated to football at one of the major academic institutions in the United States. It consists of several interactive fora as well as over 50 pages pertaining to different aspects of the football program. The community was studied through initiation, adoption, and successive design changes. Issues and conflicts that arise in the course of life of a virtual community are traced. Among others, the study found that interactive fora entail a trade-off between "participation" and "signal-to-noise" ratio. Based on this study, implications for communities of practice found in organizational settings are developed.

Keywords: Virtual communities, longitudinal study, Internet, information systems design, evolutionary design, participative design, computer mediated communication.

"Virtual communities require an act of imagination to use and what must be imagined is the idea of the community itself" [Marc Smith 1992]

1. INTRODUCTION

Virtual communities have found wide recognition in business and academia. Several virtual communities based on identity derived from racial origin [NetNoir—http://www.netnoir.com/index.html], geographical location [Blacksburg Electronic Village—http://www.bev.net] and social issues [Public Electronic Network—http://pen.ci.santa-monica.ca.us], among others, have appeared in recent years. These communities eliminate geographical and social barriers to communication. Businesses are attempting to commercially exploit virtual communities by satisfying different user needs (Armstrong and Hagel 1996).

Despite all of this attention, there has been little research on the design of virtual communities. There is a large body of literature that investigates virtual community implementations. However, this literature focuses mainly on usage and adoption issues (Rafaeli and LaRose 1993; Schmitz et al. 1995). This study explores the evolution of a virtual community over a period of two years . One of the authors was the initiator of the web site that forms the nucleus of the virtual community and another was instrumental in its development and advancement. Although this endeavor did not start out as a research study, the authors recognized the research potential of the community-forming activities of which they had become a part. Therefore, documentation of the various events that transpired in the life of the community was begun. This paper is an effort to systematically analyze these events to provide design insights as well as directions for future research. In this paper, the pseudonym VirtuaLab will be used for the virtual community used as a background for the research (URL—http://www-scf.usc.edu/~malhotra/spirit_of_troy).

The paper is organized as follows: A discussion of the theoretical perspectives and related research is followed by a discussion of the methodology adopted for this study. Next, a description of key evolutionary phases of VirtuaLab is presented. In each phase, the major design choices and interaction patterns are discussed. Subsequently, repeatedly occurring, community-forming events are analyzed. Then the implications of key design choices, such as degree of interactivity, are evaluated.

2. VIRTUAL COMMUNITIES: THEORETICAL PERSPECTIVES

"Virtual communities" are communities formed through computer mediated communications (CMC) (Jones 1995). They can be defined as "incontrovertibly social spaces in which people still meet face-to-face, but under new definitions of both 'meet' and 'face'....Virtual communities are passage points for collections of common beliefs and practices that united people who were physically separated" (Stone 1991). These communities are created and maintained by people interacting with each other. "It is a process of creating commonalties through which individuality is constructed, interpreted and contained" (Phillips 1996).

Virtual communities may involve exchange of ideas and information between virtual strangers (Sproull and Keisler 1991) or between virtual friends (Reid 1991). Freedom of expression, lack of central control, many-to-many communications, and extensive volunteer effort are some of the characteristics of such communities (Rheingold 1993).

These virtual communities, which serve to satisfy the needs of the users based on commonalities, can be broadly categorized as communities of relationship, communities of interest, communities of transaction, and communities of fantasy (Armstrong and Hagel 1996). Interactions between participants in these virtual communities occurs just as it would occur in a physical space. Participants tend to refer to the virtual space as an architectural place and to the mode of interaction in that space as being social (Stone 1991). But interaction in virtual communities differs from that in real life in two ways in that it relies extensively on written language and participants interact without the benefit of extra-linguistic cues such as gender, identity, etc. (Hiltz and Turoff 1993).

Much research has been conducted on the lingual aspects of CMC and socio-cultural aspects of interaction in virtual communities (Herring 1996; Jones 1995). Other research studies have elaborated on incidents, events and impacts of virtual communities—such as the WELL (Rheingold 1993) and PEN (public electronic network; Schmitz et al. 1995). But very little work has been done on describing the information technology capability or functionality required to form, sustain, and advance such communities, especially using the World Wide Web and related technology. Another aspect that deserves the attention of researchers is the process of development of virtual

communities. This longitudinal study is a step in that direction. It describes the development of a virtual community —VirtuaLab—and the role that various technologies played in its evolution over time.

3. STUDY METHODOLOGY

Virtual communities are dynamic systems that change constantly. This makes it hard to study them in a laboratory type setting. They show organic growth, evolving through different phases over time reflecting changes in the needs of people constituting the community, changes in the social setting, or changes in the support infrastructure. Any study dealing with design and evolution of a virtual community must, therefore, take its time-phased growth into account. This makes a longitudinal research approach the most favorable one. Longitudinal research entails (1) collection of data over two or more distinct time periods and (2) the subjects analyzed are the same or comparable from one period to next (Menard 1991).

Following the interpretive approach of ethnography (Geertz 1973; Harvey and Myers 1995), the various events that transpired in the life of the community as well as the CMC exchanges between the participants over a period of two years were documented. Ethnography is a widely used methodology in the study of the development of information systems (Hughes et al. 1992; Orlikowski and Robey 1991). It requires the ethnographer (researcher) to spend a significant time with the subjects of the study, immersing him/herself in the lives of the people he/she intends to study (Lewis 1985).

As a mode of analysis, principles of hermeneutics were relied upon to systematically analyze the events and communication exchanges that occurred during the evolution of the VirtuaLab community in order to provide design insights. Hermeneutics as a mode of analysis is concerned with interoperation of text or text-analogue data. It seeks to answer the question: What is the meaning of this text (Radnitzky 1970)? As Geertz (1983) states: "The hermeneutic circle … is as central to ethnographic interpretation, and thus to the penetration of people's modes of thought, as it is to literary, historical, philological, psychoanalytic, or biblical interpretation, or for that matter to the informational annotation of everyday experience we call common sense." Hermeneutic circle alludes to dialectic between the understanding of the text as a whole and the interpretation of its parts, where descriptions are guided by anticipated explanations (Gadamer 1976). The hermeneutic mode of analysis and the longitudinal approach complement each other as we seek to understand the context of the community and episodic sequences that stretch in time.

CMC exchanges are used as interpretable data. There are several research studies that have used CMC as ethnographic text from fora such as USENET, e-mail lists etc. (Aycock and Buchignani 1995; Ziv 1996). Analyzing the text garnered from electronic fora poses an ethical dilemma for researchers, i.e., maintaining the privacy of the data sources (participants). There are no specific guidelines for this, but a generally accepted norm is to avoid using participant's real names or any other information that would point to their real identity. In the analysis and presentation, an attempt was made to follow these norms to the extent possible. The quotes from message texts presented in this paper are for the purpose of illustration of specific phenomena.

In addition to the analysis of the CMC exchanges, quantitative analysis was conducted to assess the impact of the design features on the community. Log files created by the server on which the various fora of the community reside were periodically analyzed to study usage patterns. This measure was used to judge the extent to which the various fora met user needs. Successful fora attracted a growing number of participants over time while those that were not successful showed declining usage over time.

4. PHASES OF THE LAB'S EVOLUTION

VirtuaLab is dedicated to college football at one of the major academic institutions in United States. It consists of several interactive fora as well as over 50 pages pertaining to different aspects of the football program. The site averages about 300 hits per day and has a user base of approximately 2,000 (voluntarily) registered users. The user base not only includes students attending the academic institution and recent alumni, but also alumni from way back in the past:

> *"hi this old alumn, a member of [institution's] northern nevada alumni club at reno,nv is asking for the 1997 football schedule. by the way, i was a [Institution's] yellleader in 1946, before the enthusiastic addition to the squad of gorgeous ladies. we had just 5 men working up spirit to returning combat veterans of WW II(World War II.) this, to the uninitiated was back to the good old days of leather helmets on the gridiron and, you could tell a lineman by his toothless grin.the campus in the mid-40's was a different world. i have many fond memories. dusty '48"*

The site has grown in popularity since its inception in 1995 and has been rated the best of more than 100 sites for college football by Yahoo Internet Life in 1996 and named one of PC Computing's 1001 Best Web Sites. Figure 1 shows the main phases and events in the evolution of VirtuaLab.

4.1 Inception

Similar to many other communities growing on the Internet, VirtuaLab's inception was characterized by elements of chance. In the spring of 1995, one of the authors decided to explore new ways of providing an interface to the nascent Internet. At that time, it was not possible to anticipate both the social and technical evolution of VirtuaLab. The endeavor started out as a means of disseminating information related to the institution's football program to friends spread over the US. The information content was garnered from local media as well as the institution's student newspaper, making the web pages static in nature, with no interaction at all. Initially, the community consisted of a three-person core group.

4.2 Beginning of User Involvement

In the summer of 1995, several users of VirtuaLab attended the preseason football drills and began sending brief reports. This required one of the first design choices, which was critical to the formation of the community: Would the users be allowed to influence the content of the site? The founder of VirtuaLab added reports and other contributions provided they might be of at least some interest to some readers. These were the seeds of community. VirtuaLab's founder relied on his initial sense of community to make these decisions. As Internet publishing technology was not yet mature, the incorporation of users' e-mail led to significant and repetitive manual work. Each report was converted by the founder into HTML pages and placed at the web site.

4.3 Toward Interactivity

The formation of virtual communities entails interaction. "Community is created and maintained by people in interaction" (Phillips 1996). Interactivity at a philosophical level can be defined as "mtual and simultaneous activity on the part of both participants, usually working toward some goal, but not necessarily" (Brand 1987). Interactivity may be difficult to pin down objectively: "The common feeling is that interactivity, like news, is something you know when you see" (Rafaeli 1988).

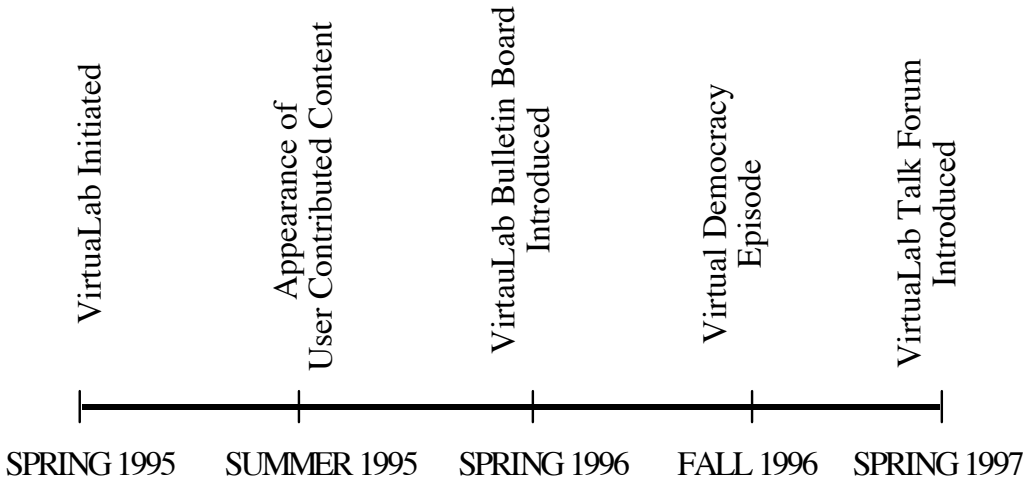

Figure 1. VirtuaLab Evolutionary Time

More specifically, in the context of this research, interactivity connotes an ability for the participants of the community to influence the information content of the community and thereby initiate exchanges that lead to enhancement and growth of the community.

User response to publishing their contributions was immediate. The number of visitors grew rapidly. Very soon users began to send electronic messages, asking for them to be placed on the site as well. These messages included opinions, questions, and requests. This led to a self-reinforcing effect: the increase in interactivity led to an increase in the size of the community that again led to an increase in interactivity. It was obvious that converting each message into hypertext would overwhelm the founders, considering that the start of the football season would see an exponential growth in volume of such messages.

At this point there were two options: scaling back the interactivity which would lead to a decrease in the size of the community or finding a different technological solution to increase interactivity. The second approach was chosen. Software was implemented that allowed messages stored in a mailbox to be converted into hypertext all at once. Further, the software created an index page with the message titles in a threaded form. This forum was christened Bulletin Board. The messages that were sent to the author's address were stored in a mailbox and the author would log on and run the software to convert the messages into hypertext. This meant messages had to wait for a while before the author would log in and run the program. Despite the drawback, the forum found large popularity, again significantly increasing the community.

During this period, the community began to form substructures. Regular users emerged. Some assumed ownership of specific tasks: one user scanned a wide variety of sources for football-related news and now has become part of the web site. Other users tested changes to the sites for compatibility with different web browsers and reported their results. Separation of roles is also visible in the events discussed in the next section.

At the end of this phase, the community clearly had been established. It had a clearly identified body, regular interactions, visible substructures, and shared a common goal and understanding.

4.4 Growth and Experimentation

In this phase, the mechanisms of interaction were further refined. The founders experimented with additional features and evaluated the interest they generated from the users. The introduction of the features, e.g., pages with one-line quotes, a quiz etc., was announced on the bulletin board and was also highlighted on the index page.

> *"This week onwards we will start a page called [VirtuaLab] SPEAK. It will include one line - quote from all contributors. What we (Authors) are looking for are soundbites about what you would like to see different with the football team. PLease send your contributions (restrict it to one line - 20 words or so) to: (authors' email)*
>
> *"We will collect them from Monday to Wednesday and post them on Wednesday evening or Thursday morning."*
>
> *"Thanx to you all of you who responded to the first quiz. By popular demand we present the Quiz #2. You can access it @ [URL]"*

Several fora were introduced over the growth period of the community. A majority of them found great success attracting increasing number of participants over time and still sustain their popularity. But at the same time, a small number of fora stagnated or declined in usage. The causes of success and failure of the fora in the sections to follow.

The period from fall 1996 to spring 1997 involved an exponential growth in the community user base and the number of hits that were recorded per day. This was accompanied by increasing contributions from users. Reports were received from different functions, for instance luncheons, practices, fundraisers, etc. To overcome the "public goods" paradox (Rafaeli and LaRose 1993), the content base was seeded by filing personal reports from these events. The users were very receptive toward these additions.

All along, requests were received from the users asking for a discussion forum that allowed the appearance of messages in real-time (as compared to the time delay in board postings). The lack of server accessibility prevented the forum from being implemented until a Windows NT server was procured in March 1997. A feature called VirtuaLab Talk was then initiated. This forum allows users to submit messages through a form on the web site and see the messages appended to the Talk page immediately. The differences between Talk and Bulletin Board are summarized in Table 1.

Table 1. Bulletin Board vs. Talk Forum

	Bulletin Board	Talk Forum
Submission	Through e-mail	Standard web form
Message Posting	Delayed	Instantaneous
Message Sequencing	Flexible—by subject, date or author	Fixed—by time

The response from the user community was rapid and very interesting. Talk resulted in an immediate and significant increase in the total number of contributions to VirtuaLab. Its appeal also resulted in the message volume for the Board to drop substantially (Figure 2). But a few weeks later, the messages began to trickle in again. Recently they seem to be returning to the same volume as before the appearance of the Talk forum.

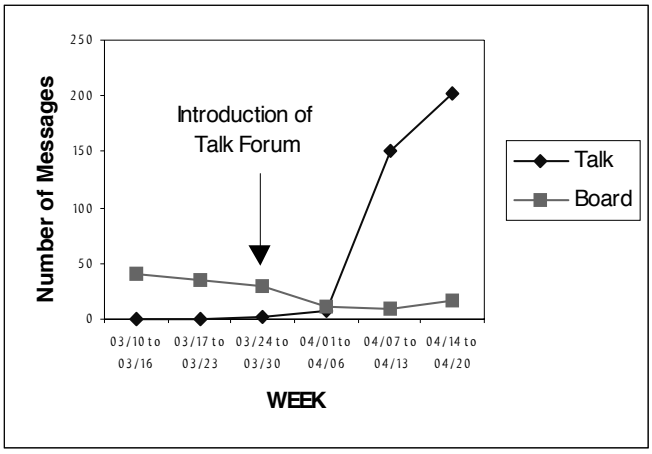

Figure 2. Impact of VirtuaLab Talk on Message Volume

Although users seemed to think that the two fora served the same purpose, they had mixed opinions on which forum to keep and which to phase out. The most problematic aspect of the talk forum was the lower signal to noise ratio.

Signal-to-noise ratio is a term adapted from signal processing in the field of electronics, where signals of very small amplitude cannot be separated from low-intensity noise in the system. "Signal" refers to useful information conveyed by some source of communications and "noise" to anything that is undesirable and ultimately ends up appearing in the load of the communications receiver (Miller 1979). Hence a low ratio implies that it is not worth paying attention to the medium in question. The term was adapted to CMC and applied to USENET newsgroups especially in the context of "flame wars." The term is used here in a similar context, where the signal refers to the number of useful CMC exchanges and noise to the number of messages that do not contain useful information content. With a growing number of messages, participants of the virtual community tend to be overwhelmed and find it difficult to glean or retain useful content—leading to what is commonly termed "Information Overload" in communication research (Cole et al. 1997; Valovic 1995).

VirtuaLab Talk participants were wary of the fact that it would allow anybody and everybody to post anything, thereby leading to a chaotic state. Those in favor of the Bulletin Board agreed that, although it lacked the real time posting feature ("immediacy"—as stated by one user), it had a higher signal to noise ratio. It received a reduced number of postings, but they were considered to be high quality and informative. The users felt that they could get what they needed in far less time by using the Bulletin Board.

The reason for the Board being perceived as a high signal to noise forum can be explained by its operational design. The users wanting to post messages on the Board had to compose an electronic mail message and send it to the site administrators. These messages were then converted into hypertext documents when the system administrators ran a software program to do so. This introduced a notion of administrative control that dissuaded people from sending inflammatory and trivial messages. Although the administrators never exercised such a screening control, the users always perceived such control. The time delay in posting and the necessity to compose a separate e-mail message also might have led the contributors to send well thought out and eloquently presented messages. This was in contrast to the Talk forum, where contributors used a standard form posted on the web site to write in their message

which was posted as soon they hit a submit button (as is the case with the Talk forum). Thus the "immediacy" enabled through the design of the Talk forum meant lower signal to noise ratio.

At this stage, the community has sufficiently stabilized; design decisions still affect but do not change the community. It was decided to leave both the fora in action as they seemed to meet different needs of the users. Having moderated (perceived in this case) as well as unmoderated fora is a way to foster communication without stifling free and creative expression.

In this phase, another interesting control available for experimentation was the appearance of the institution's official athletics web site. Table 2 compares the features of VirtuaLab to the official website. The focus and interactivity features were explicitly designed while control was based on situational factors. Feedback from users who frequented both sites formed the basis for these comparisons. The official site follows the traditional media model—disseminating information gathered by dedicated information providers to its consumer base. The VirtuaLab model, on the other hand, uses an intermediary model that aims to bring together information providers and consumers in non-dedicated roles. The aim is to provide the infrastructure to allow rich interactions to be supported. There is little in the way of designed use or constraints in the VirtuaLab—in fact the design has been largely influenced by user feedback over time.

Table 2. VirtualLab vs. Official Web Site

Feature	VirtuaLab	Official Site	Implications
• Focus	Dedicated to major sports at one school	Covers all sports at 10+ schools	Greater shared understanding (+) Affiliation – Identity formation (+) Higher relevance for users (+) Smaller potential user base (-)
• Interactivity	Users providers too	Users as consumers	More participation (+) Higher perceived user control (+) Reliance on public goods phenomena (-) Lower signal to noise probability (-)
• Control	No restrictive parameters placed on possible content	Restricted content–official approval	Greater diversity of views expressed (+) More interest generated (+) Lower signal to noise probability (-)

4.5 Evidence Of Community: User Needs and Socialization

The inhabitants of this virtual community have a shared understanding of the real world. Even though many of them have not met each other in person, they relate to the same events, places, and artifacts in the real world. They share a common identity, having been affiliated with the same institution.

> *"Amen, really great work. This is the best Internet site I have EVER seen. The fact that it's* ***subject is something so near my heart*** *makes it just a perfect place to be."*

The VirtuaLab helps provide integration and identity to the community it supports. The process of communication serves to further transmit and consolidate shared beliefs and values. It also satisfies a variety of needs for the members, ranging from the purely goal-oriented, utilizing social network and knowledge capital

> *"If anybody has one or two extra tickets to the [rival] game that they would like to sell, please let me know"*

> *"We all appreciate your hard work and dedication, even if we don't sent messages often. Thanks again from old alums who get their primary [institution] news through the [VirtuaLab] page"*

to the experiential

> *"The fact that it's subject is something so near my heart makes it just a perfect place to be"*

The VirtuaLab also supports traditional media needs as an organizer

> "*Thank you very very much for giving [fans] a CLEAN forum to debate amongst fellow [fans]...*"

and as a mobilizer for action

> *" I ask of you, SHOW UP & YELL YOUR LUNGS OFF THESE NEXT TWO GAMES!!!"*

The VirtuaLab community has evolved distinct behavioral dynamics in response to its needs and the avenues presented by the available infrastructure. For instance, note the strong urgings (and in part contradictory) exhortations to be positive and rational. The underlying needs are to lower cognitive dissonance and have solidarity of viewpoints.

> *"I never, in my wildest dreams, thought that writing a few bits on the option would create such a plethora of insightful comments and opinions.... I have a lot of respect for the things that are said on this board, when they are intelligent, thoughtful, and POSITIVE. Emphasis on positive. Keep up the good work, everyone. Maybe we should all do the coaching for [Institution] next year, from our computers."*

The messages on the VirtuaLab naturally tend to organize in streams according to themes. The next section presents one such stream, which illustrates a virtual democratic process being enacted.

5. CRITICAL EPISODES

5.1 From Communication to Action

This episode demonstrates how an electronic community transforms itself from a largely self-centered entity to an entity that actively exerts influence on its environment. It exemplifies the process of building institutions and collaborative structures toward achieving definite ends. One of the cases encountered was a campaign for retaining the football coach despite the team's poor performance during the season. Initially some users started the dynamics by asking for change.

> *"Look, I am not, do I pretend to be a football coach and do not have all the answers but I do know that as long as we continue to have the same coaching staff as we presently have, nothing will change"*

The socialization process through the board led to other postings on this subject. These initial posts typically demonstrated more emotion.

> *"The solution is real simple: [Coach] must go. I shudder to think what awaits us next week."*

In response to these posts, there were others that were more thoughtful

> *"Hey people...firing [Coach] now would be not only irrational but also unfair! ....Let [Coach] get another strong class in and see what he does next year."*

and some that were more introspective

> *"It's sad to lose...but many of the postings I've read are pathetic...calling the players and the coaches 'losers,' demanding that the coaches be fired, etc....I think the fans who do this are totally clueless."*

Ultimately, there was more support, evident from the number of postings, for retaining the coach. One of the users then agreed to be a conduit for conveying these feelings to the president of the institution.

> *"We owe him the opportunity to follow through what he had started when he came back. So I request you all (those of you who are in favor of keeping [Coach]) to send me a letter addressed to President {Name] email@address I will collect all of them and personally deliver it to President's [Name] office tommorow evening. PLease come out in numbers to express your support for [Coach]"*

The episodes present evidence that, over time, the socialization process in electronic communities can lead to the democratic exchange of views and consensus building. The VirtuaLab is an infrastructure designed for an intended use, but the actual structural outcomes are determined by actual use and, over time, certain routines emerge.

5.2 Defending Community Boundaries

Besides mobilizing the political network capital of the community, as evident in the above episode, members also came together to defend the boundaries of their community. On occasion when users perceived to be outsiders (like a rival school's fans) posted inflammatory messages, community members came together to intensively flame the transgressor. The message below is one in a series of 39 messages posted in a span of three days to ward off one such intruder. The mix of caustic humor and hint at mobilizing administrative action is typical of the contents of these messages.

> *Steve, I guess you aren't getting the message. I know you [rival school people] are a little, uh, slow, so I'll try to keep the words short. PLEASE LEAVE. We don't want you here. We don't want you to "further the rivalry." We don't want you to provide great insight about your football "team." We don't even want you to be nice to us. We just want you to leave. If [the systems administrator] wanted to, he could track down your IP number and we could really make your life hell. The board is intended for [institution's] fans to trade information and opinions about [institution].*

In the face of this sustained onslaught from the community, the instigator opted to stop. This episode and the one described in the preceding section highlight how virtual community members reach common understandings, form communal bonds, and construct collective identities through communicative action (Habermas 1984).

5.3 Perception of Control

One of the problems in the talk forum was the unanimous perception that it had a much higher ratio of non-informative content than Bulletin Board. The signal to noise ratio was an ailment of Talk. It was decided to duplicate the perceived administrative control of the Board by posting a message stating that previous nuisance contributors to Talk would be blocked from posting.

> Posted by sysadmin on April 08, 1997 at 16:01:13:
> *I can assure that we have gotten rid of the pests buzzing around this forum. Didnt want to do it but have resorted to IP blocking for Bruce O'K and Dub guy. Anyone else wants to get blocked go ahead make our day.*

This had a remarkable effect on the type of postings, but for a few weeks only. The signal to noise ratio went up dramatically. Users in general hailed this move and felt that things would get much better from then on. Unfortunately, a few weeks later, new nuisance contributors appeared. Besides, there was nothing that could be done to stop contributors from sending follow-ups that had no useful or informative value. For instance, there were follow-ups that contained a large previously posted message on the bottom of which the new contributor would write one line saying that he or she agreed with the above opinions.

From this experiment, an understanding was gained of the design features that go along with the interactive many-to-many fora and their impact on communication. It was decided to leave both the fora in action as they seemed to meet different needs of the users. Having moderated (perceived, in this case) as well as unmoderated fora is a way to foster communication without stifling free and creative expression.

6. MATCHING NEEDS TO FEATURES

Table 3 presents a concise summary of the observed match between users' needs and design features that were created in the two years of experiments in the VirtuaLab. Critical mass theory (Markus 1987) suggests that achieving high levels of participation in communities of interest requires heterogeneity of resources. To achieve this, an infrastruture was created that supports users with varying interactive capabilities and needs.

It has to be noted that high levels of participation come at the expense of signal- to-noise ratio (Figure 3). From the experience gained with the Talk forum, it became apparent that there are negative sides to efforts to increase participation. The Talk forum allows members of the community to make contributions without appropriate reflection. The perceived lack of control also encourages inflammatory contributions. There is a need to convey perceived administrative control while retaining freedom of expression and diversity of viewpoints when designing interactive fora.

Figure 3 shows the mapping of Talk and Bulletin Board on two dimensions. Ideally, a forum would exist that allows high levels of participation while maintaining information richness. In the next phase of this research, an investigation of the impact of design features like password restrictions to access and contribute, contribution guidelines, and community feedback on participation and signal-to-noise ratio is planned.

Table 3. Matching User Needs and Design Features

User Needs	Design Features to Support Needs
Affiliation needs	Organize for a specific and relevant context
Uncertainty reduction	Stable interface features; information about planned changes and contributors
Information needs	News features; grapevine
Experiential (flow) needs	Heterogeneity of forums and features (Markus 1987)
Interactivity	Bulletin board, VirtuaLab Talk features
Dynamic experience	Provide stimuli through agenda-setting messages, quizzes etc.
Perceived administrative control	Sustain illusion of monitoring content to restrict undesired material; feedback on important issues
Conflict reduction	Do not post immediately to bulletin board forum—allow cool-off time; weeding of offensive material; manage by consensus
Knowledge creation	Channel for expert opinions to be highlighted; reflections on past
Information dissemination	Avenues to channel information from different sources; regular updates
Highlight issues	Threaded discussions

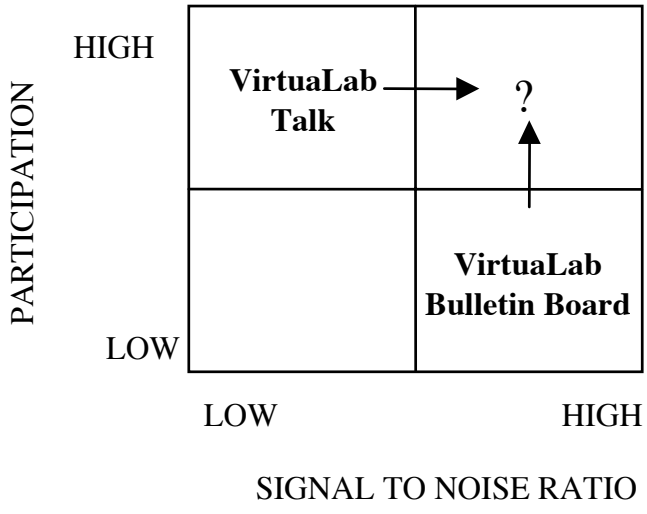

Figure 3. Participation vs. Signal-to-Noise Tradeoff

7. IMPLICATIONS FOR CORPORATE COMMUNITIES

The world is moving toward a post-industrial society (Bell 1976) with information as its defining characterization. There are two emerging paradigms in organizational competitiveness: organizations compete either by developing a specialized bundle of capability (knowledge) or through faster response. In both of these paradigms, communication between people in the organization is paramount. The experiments with VirtuaLab provide some important implications for developing corporate communities for knowledge creation and sharing.

- A community must be focused on a context shared by its members. As an example, in a business context, this may imply building fora around department units if a critical mass can be achieved.

- Firms are mostly organized along rigidly defined roles. The experiments presented here suggest that allowing community members to self-select into their desired roles (such as information providers, facilitators, action agents, interpreters, leaders, etc.) is more fruitful. Also, users should be able to morph into new roles as and when they desire.

- This research suggests that intranets to discuss organizational issues can be extended through a number of design features:
  - multiple forms of interaction
  - stimulating issues to provoke ideas
  - reflection on the past and retention of archives
  - introducing competitive elements

Ethnographic studies of workplace practices indicate differences between formal work descriptions and the way people actually work. Brown and Duguid (1991) emphasize the need to reassess work, learning, and innovation in the context of actual communities and actual practices in order to reconceive and redesign organizations. The study presented here points toward ways in which non-canonical communities in the midst of organizations may be studied in order to reconceive organizations as communities of communities to harness their innovative energy.

8. FUTURE RESEARCH

Considering the growing application of intranets to foster internal communication, it would be appropriate to confirm the research findings in a corporate setting. More specifically, as suggested by Kling (1996), there is a need for research to examine the interaction between social design/organization of electronic fora and group life in workplaces and communities. The advent of telecommuting also creates the need to understand membership in such communities and its impact on work collaboration (Lund 1996).

In terms of communities of relationships, a specific issue that we intend to address in future research is the way in which technology could be leveraged to establish fora that have high participation as well as high signal-to-noise ratio. In order to do this, we intend to make Talk readable to all but writable only through password protection.

The fora studied in this paper are of the asynchronous-CMC genre. We would like to extend our study to synchronous real-time CMC—chat rooms. By running both types of fora simultaneously, it should be possible to determine the specific needs of the community participants that each of these address.

Methodologically, the observations made in this paper were based on the authors' interpretation of user exchanges. It would be useful to use different methodologies such as user surveys to triangulate and validate the research findings.

9. REFERENCES

Armstrong, A., and Hagel III, J. "The Real Value of On-line Communities," *Harvard Business Review* (74:3), May-June 1996, pp. 134-141.

Aycock, A., and Buchignani, N. "The E-Mail Murders: Reflections on 'Dead' Letters," in *CyberSociety: Computer-Mediated Communication and Community*, S. G. Jones (ed.), Sage Publications, Thousand Oaks, CA, 1995.

Bell, D. *The Coming of Post-Industrial Society: A Venture in Social Forecasting*, Basic Books, New York, 1976.

Brand, S. *The Media Lab*, Viking Penguin, New York, 1987.

Brown, J. H., and Duguid, P. "Organizational Learning and Communities-of-Practice: Toward a Unified View of Working, Learning and Innovation," *Organization Science* (2:1), February 1991, pp. 40-57.

Cole, D. N.; Hammond, T. P.; and McCool, S. F. "Information Quantity and Communication Effectiveness: Low-Impact Messages on Wilderness Trailside Bulletin Boards," *Leisure Sciences* (19:1), 1997, pp. 59-72.

Gadamer, H. G. *Philosophical Hermeneutics*, University of California Press, Berkeley, 1976.

Geertz, C. *The Interpretation of Cultures*, Basic Books, New York, 1973.

Geertz, C. "From the Native's Point of View: On the Nature of Anthropological Understanding," in *Local Knowledge*, C. Geertz (ed.), Basic Books, New York, 1983.

Habermas J. *The Theory of Communicative Action*, translated by Thomas McCarthy, Beacon Press, Boston, 1984.

Harvey, L., and Myers, M. D. "Scholarship and Practice: The Contribution of Ethnographic Research Methods to Bridging the Gap," *Information Technology & People* (8:3), 1995, pp. 13-27.

Herring, S. C. *Computer-Mediated Communication: Linguistic, Social and Cross-Cultural Perspectives*, John Benjamins, Philadelphia, 1996.

Hiltz, S. R., and Turoff, M. *The Network Nation: Human Communication via Computer*, MIT Press, Cambride, MA, 1993.

Hughes, J. A.; Randall, D.; and Shapiro, D. "Faltering from Ethnography to Design," in *CSCW '92: Proceedings of the 1992 ACM Conference on Computer-Supported Cooperative Work: Sharing Perspectives*, ACM Press, New York, 1992, pp. 115-123.

Jones, S. G. *Cybersociety: Computer-Mediated Communication and Community*, Sage Publications, Thousand Oaks, CA, 1995.

Lewis, I. M. *Social Anthropology in Perspective*, Cambridge University Press, Cambridge, England, 1985.

Kling, R. "Synergies and Competition Between Life in Cyberspace and Face-to-Face Communities," *Social Science Computer Review* (14:1), Spring 1996, pp. 50-54.

Lund, A. M. "New Forms of Collaboration for NII Usability," *Social Science Computer Review* (14:1), Spring 1996, pp. 27-29.

Markus, M. L. "Toward a "Critical Mass" Theory of Interactive Media: Universal Access, Common Interdependence and Diffusion," *Communication Research* (14), 1987, pp. 491-511.

Menard, S. *Longitudinal Research*, Sage Publications, Newbury Park, CA, 1991.

Miller, G. M. *Handbook of Electronic Communication*, Prentice-Hill, Inc., Englewood Cliffs, NJ, 1979.

Orlikowski, W. J., and Robey, D. "Information Technology and the Structuring of Organizations," *Information Systems Research* (2), 1991, pp. 143-169.

Phillips, D. J. "Defending the Boundaries: Identifying and Countering Threats in a Usenet Group," *The Information Society* (12), 1996, pp. 39-62.

Radnitzky, G. *Contemporary Schools of Metascience*, Scandinavian University Books, Goteborg, Sweden, 1970.

Rafaeli, S. "Interactivity: From New Media to Communication," in *Advancing Communication Science: Merging Mas and Interpersonal Processes*, R. P. Hawkins, J. M. Weisman, and S. Pingree (eds.), Sage Annual Reviews of Communication Research, Sage Publications, Newbury Park, Ca, 1988.

Rafaeli, S., and LaRose, R. J. "Electronic Bulletin Boards and 'Public Goods' Explanations of Collaborative Mass Media," *Communication Research* (20:2), April 1993, pp. 277-297.

Reid, E. *Electropolis: Communication and Community on Internet Relay Chat*, unpublished bachelor's honors thesis, Department of History, University of Melbourne, Australia, 1991.

Rheingold, H. *The Virtual Community: Homesteading on the Electronic Frontier*, Addison-Wesley, Reading, MA, 1993.

Rheingold, H. *The Virtual Community: Finding Connection in a Computerized World*, Secker & Warburg, London, 1994.

Schmitz, J.; Rogers E. M.; Phillips K.; and Paschal, D. "The Public Electronic Network [PEN] and the Homeless in Santa Monica," *Journal of Applied Communication Research* (23), 1995, pp. 26-43.

Smith, M. *Voices from the WELL: The Logic of Virtual Commons*, unpublished master's thesis, Department of Sociology, University of California, Los Angeles, 1992.

Sproull, L., and Keisler, S. *Connections: New Ways of Working in the Networked Organization*, MIT Press, Cambridge, MA, 1991.

Stone, A. R. "Will the Real Body Please Stand Up? Boundary Stories About Virtual Cultures," in *Cyberspace*, M. Benedikt (ed.), Frank Cass & Company, Ltd., London, 1991.

Valovic, T. "Quality of Information – Part II," *Telecommunications* (29:2), February 1995, p. 8.

Ziv, O. "Writing to Work: How Using E-Mail Can Reflect Technological and Organizational Change," in *Computer-Mediated Communication: Linguistics, Social and Cross-Cultural Perspectives*, S. C. Herring (ed.), John Benjamins Publishing Company, Philadelphia, 1996.