

# The Social Life of Small Graphical Chat Spaces

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## ABSTRACT

This paper provides a unique quantitative analysis of the social dynamics of three chat rooms in the Microsoft V-Chat graphical chat system. Survey and behavioral data were used to study user experience and activity. 150 V-Chat participants completed a web-based survey, and data logs were collected from three V-Chat rooms over the course of 119 days. This data illustrates the usage patterns of graphical chat systems, and highlights the ways physical proxemics are translated into social interactions in online environments. V-Chat participants actively used gestures, avatars, and movement as part of their social interactions. Analyses of clustering patterns and movement data show that avatars were used to provide nonverbal cues similar to those found in face-to-face interactions. However, use of some graphical features, in particular gestures, declined as users became more experienced with the system. These findings have implications for the design and study of online interactive environments.

## Keywords

Avatars, computer mediated communication, empirical analysis, graphical chat, log file analysis, online community, proxemics, social cyberspace, social interfaces, and virtual community.

## INTRODUCTION

Text chats lack nonverbal cues that facilitate face-to-face conversations, such as gestures, physical distance, and direction of eye gaze. Graphical chats attempt to address these limitations by introducing surrogate representations for physical bodies and spaces [9, 7]. While a number of graphical chat systems have been created, little is known about the nature of social interaction in publicly accessible spaces [8, 10, 13].

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CHI '2000 The Hague, Amsterdam

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What do people do in graphical chat spaces? Do they cluster together in patterns approximating those seen in face-to-face interaction? How are the graphical features used in concert with textual modes of interaction? Broadly, we want to investigate whether these spaces are *sociopetal*, drawing people together into interaction, or *sociofugal*, driving them apart and away from interaction with one another [4]. To address these questions we report the results of survey research and analyses of more than three months of log files gathered from within three rooms (Lobby, Lodge, and Red Den) in the Microsoft V-Chat graphical chat system [14].

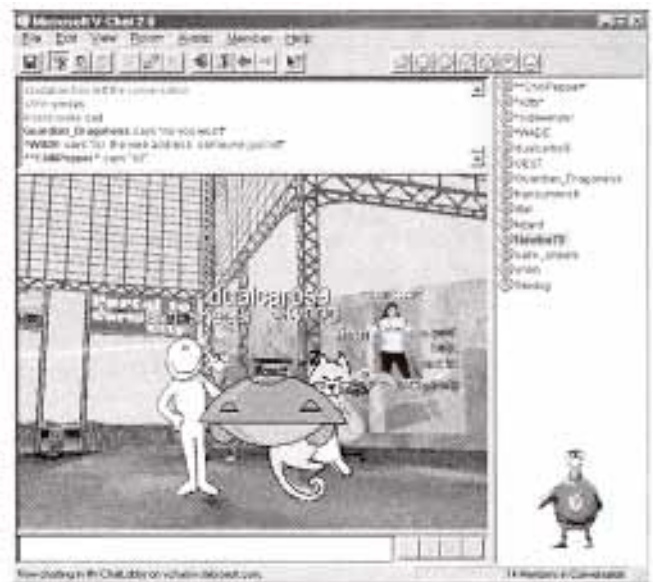


Figure 1. V-Chat interface includes a chat text box, chat history window, 3D space containing other avatars, room occupancy list, and an image of one's own avatar.

V-Chat clients connect to Internet Relay Chat (IRC) channels for communication transport. IRC is used to carry text chat as well as information about graphical events including avatar location and gestures. V-Chat provides a representation of each room as a 3D space, linked to a text chat window (Figure 1). Each space can contain up to 25

simultaneous Internet users. V-Chat allows users to puppet a graphical representation of themselves, an “avatar”, in the 3D space. All users within the same room can see each other’s messages (with the exception of “whispers” which are private point-to-point messages), irrespective of the distances between avatars. All avatars could also potentially see every other avatar depending on their line of sight. Traditional IRC users lack an avatar in the space, but appear in the user list and text box. People are able to select a standard avatar provided by the program, an avatar created by another user, or to create a custom avatar of their own. V-Chat avatars are represented by sprites, which have twenty frames, allowing them to communicate both direction of view in the 3D space and a series of gestures.

While V-Chat lacks object persistence, interactive objects, or user extensibility of the environment, it does implement many of the core features found in a broad range of graphical interaction tools. As such, an investigation of actual user behavior in V-Chat can shed significant light on the nature of social interaction in 3D virtual spaces.

Our investigation provides a longitudinal study of user behavior as well as analyses of user behaviors overall. These results lead back to central design and system management issues related to the development of 3D graphical environments for social interaction.

Our work follows the studies of physical social spaces pioneered by William H. Whyte [11, 12]. Whyte’s studies highlighted the ways people moved through and came to rest in parks and plazas and how social interactions, from the casual to the intense, were shaped by design choices and the structure of the space.

We examined user behavior focusing on three issues: 1) general usage patterns of the chat room participants, 2) use of 3D features of V-Chat, and 3) contrasts between text only users and users of the 3D features of V-Chat.

## METHODS

We address these issues by using both survey data and quantitative analyses of user behavior. While the survey data provides insight into the user’s subjective experience, quantitative analyses provide a more objective representation of chat behavior. Such quantitative analyses are distinct from ethnographic studies, which take the form of direct observation of participant behavior and activity in the virtual space. While ethnographic studies provide valuable information about the content and meaning of social relationships, they have significant limitations [1,7]. Direct observation is labor intensive, misses many forms of interaction and patterns that are difficult to observe from a first person view, is subject to the biases of the observer, and often lacks broad context or duration.

Quantitative analyses of log file data provide a useful complement to such ethnographic studies. Collected logs of

user activity can be used to produce a broad range of measures of the social structure and dynamics of interaction in the world. Combined with qualitative data, these measures can provide a broad backdrop for a multi-layered and complex picture of what really goes on in these graphical spaces. On their own, quantitative measures at least provide a possible basis for future comparison between varieties of graphical interaction systems.

For the present study we gathered data from three of the more popular V-Chat spaces, the “Lobby”, “Lodge”, and “Red Den”, using a logbot. The data we report was gathered from 10/22/98 at 12:38:38 PST until 1/16/99 at 17:47:07, a total of 119 days. The bot had no avatar in the space but did show up in the user list (as “LogBert”). A sign was placed in every room being logged announcing the data collection and pointing to documents that described the project. These rooms were selected because they were the most active of all the rooms available from the public Microsoft V-Chat servers. The system did not require users to enter the any of these rooms in order to access others. Nonetheless, the “Lobby” was listed as a default choice in the V-Chat user interface.

The bot received the same information as all of the V-Chat clients; it added a time stamp and wrote the data to a set of files. Private communication between users provided by the whisper command was invisible to the logs we collected. Logs contained the following information for each V-Chat event:

TIME, DATE, NAME, ACTION, ARGUMENTS, X, Y, Z, Rotation

These logs were analyzed to generate a series of reports and graphs that profiled users, user sessions, and avatars. Log files were aggregated on the basis of the events and other world states to produce a range of behavioral measures.

We found that the data files were fairly noisy. The logbot was often disconnected from the server, introducing data dropouts and skewing login counts when it automatically logged back into the spaces. We found that the data sent to clients was noisy. Many users appeared without login events. Position data was fairly low resolution, providing coordinates of avatars in motion only once per second. The pattern of jumpy motion in the data is an artifact and does not reflect the user’s experience of their own motion, but it does accurately reflect the way other user’s motion was presented. Additional issues raised by the nature of the data are discussed below.

Survey data were collected from a self-selected sample of 150 V-Chat users. Respondents were recruited from within the V-Chat rooms using signs placed in the space with URL’s pointing to the web-based survey. The survey asked for a broad range of information, including demographic background, V-Chat usage patterns, and ratings of

satisfaction with the V-Chat experience. These results offered a supplement to the log data.

## RESULTS

### General V-Chat Usage

35024 unique user names appeared in the three V-Chat rooms in the span of 119 days, averaging 5 chat sessions each. The average session length, the span of time beginning when the person arrived in a room and ending when the person left the room, was 6.6 minutes. 44% of the users logged in only once. Those who logged in more than once had an average of 8 sessions in the 119 days. Their session lengths averaged 6.4 minutes. 23.1% of the people were traditional IRC users, and 76.9% were V-Chat users.

Users were only identified by self-selected and non-persistent “handles” or user names. No email address, IP number or physical demographic data was available through the system. However, our survey data provides a picture of the basic demographic characteristics of the self-responding population. The average user was 29 years old, 72% male, and 28% female. 68% of all users had at least some college education. 45% of the users were single, 55% were not. Most of the users were from the United States or Canada (70%), and many of the remaining users were from Europe (17%).

An examination of the chat sessions shows that people tended to visit the rooms in the afternoon, from 2pm to 8pm, PST (or from 5pm to 11pm, EST) (Figure 2). While we were unable to determine the user’s local time, most users are from the United States so they fall within the range of PST to EST. Afternoon use peaked sharply on Thursday afternoons, and dropped on Saturday afternoons.

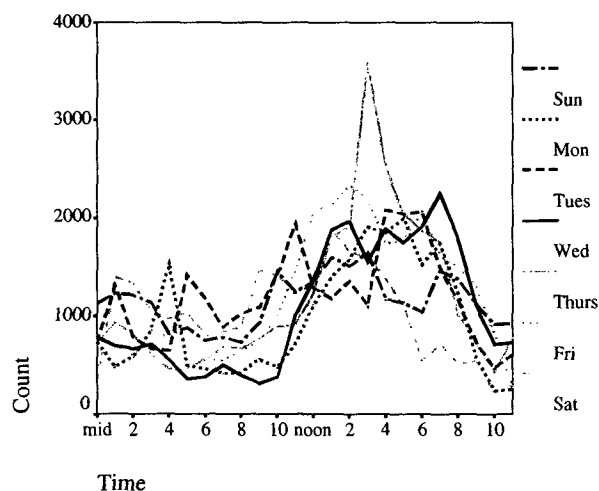


Figure 2. Count of chat sessions depending on time of day and day of week, Pacific Standard Time.

During each session, people posted an average of 3.4 messages. However, an unexpectedly large percentage of

the people, 61.3%, posted no messages, observing others without participation. Session lengths were much shorter when users did not post any messages (3.1 minutes) than when they posted at least one (8.4 minutes). When people did speak, their utterances were fairly short, averaging 23 characters, or approximately 5 words.

Conversational openings were the most common form of exchange; an analysis of a subset of the data shows that out of 31,529 messages posted, 23% had some form of greeting in the text (e.g., “hello, hiya, what’s up”) and 4% had some form of goodbye in the text (e.g., “bye, brb”). 14% of the messages included the names of one of the others in the room.

### Use of 3D V-Chat Features

Do people use the 3D features of graphical chats? If so, was that use sustained? It is important to consider the possibility that people might not use the 3D features at all, focusing for the most part on the text chat component of the program, or that people might use the 3D features initially for the sake of novelty, but use them less so as the novelty wore off. How were 3D features actually used as a component of social interactions? People might play with gestures and move around the 3D spaces without incorporating gestures and movement into their social interactions.

# sessions	# users	# gestures per minute	# positions per minute	% custom avatar
1	9165	0.57	5.9	21%
2 to 5	11105	0.53	5.2	25%
6 to 15	4548	0.37	4.6	41%
16 to 40	1517	0.35	3.3	62%
> 40	601	0.13	2.0	76%
Total	26936	0.49	5.2	31%

Table 1: Usage of 3D features by V-Chat users, broken down by user’s number of sessions in 119 days

V-Chat users reported using both the text windows to chat with others, and the 3D features of V-Chat. In the survey, 76% of the people reported paying equal attention to both the text window and the graphic window, 14% mostly paid attention to the text, and 10% mostly looked at the graphics. However such self-report data provided to the V-Chat providers tends to be biased by both sampling concerns (perhaps only avid V-Chat users bothered to answer the questionnaire) and demand characteristics, where the respondents felt compelled to report using the 3D features out of a desire to be good subjects. We examined the log data to determine whether people used the 3D features, and whether they were used as a part of social interactions.

The three most prominent 3D features are the customizability of the avatars, the avatar gestures, and the position and orientation of the avatars. The following sections of the paper examine each of these features.

#### Avatars

People were able to either use one of 20 standard avatars provided by the V-Chat system, create one themselves, or use one created and made publicly available by another V-Chat user. A total of 1979 unique avatars were used, 99% of them custom made. V-Chat users wore a custom avatar for 45% of all the V-Chat sessions. Custom avatars ranged from simple, square photographs to complex cartoon-like characters. Overall, about 31% of the users wore a custom avatar at least once. According to the survey data, people reported using custom avatars to express their individuality (42%), stand out (24%), because they did not like the common avatars (23%) and for the challenge (11%). Two thirds of the people claimed they had avatars that represented their true gender.

Frequent users were much more likely than infrequent users to have used a custom avatar at least once (Table 1). People did not tend to change avatars during sessions. For 74% of all sessions, only one avatar was used. People used an average of 1.8 unique avatars, and each avatar was used for an average of 3.6 sessions.

#### Gestures

People were able to make their avatars perform one of seven gestures, representing angry, flirts, sad, shrugs, silly, smiles, and waves. As can be seen from Table 1, V-Chat users were on average using the avatar gestures .49 times per minute, or once every two minutes. Frequent users, or those who had visited the V-Chat rooms more than 15 times in 119 days, used fewer gestures: one every four to ten minutes. Given that the average session was less than 8 minutes, gestures do not appear to be a vital, sustained aspect of social interactions for the advanced users. As can be seen from Figure 3, the most common gestures were silly and waves, followed by flirts and smiles. It is important to note that when people make custom avatars, they can associate any image with the gesture buttons. The images they associate with the gestures are somewhat constrained, however, because the word appears in the chat window when the gesture button is clicked.

People may have used the silly gesture more frequently because there were three different randomly chosen sequences that represented silly, so silly provided a humorous surprise for both the user and the observer. Friendly and positive gestures (silly, smiles, waves, flirt) far outweigh (81%) conflictual or non-committal gestures (shrug, sad, angry).

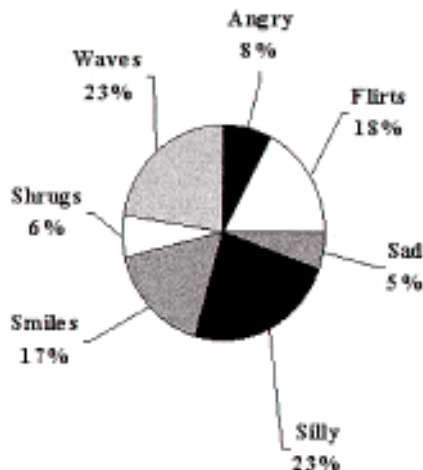


Figure 3: Breakdown of gestures used by V-chat users.

#### Positioning

Proxemics is the study of animal territoriality [4]. All animals, including humans, exhibit some form of territoriality. Some engage in direct physical contact with many others. Others, like humans, are predominantly non-contact species. Many people make an effort to ensure a certain space and distance is maintained around them.

Can the same proxemics be observed in graphical virtual environments as in physical spaces? That is, do people cluster together when interacting in graphical space much as they would in face-to-face interactions? Or is the graphical component ignored? How much do people orient to one another face-to-face? Do they maintain territorial buffers around themselves? If so, how does it compare in size to those seen in physical relationships?

An overhead perspective of the 3D graphical space provides a means for visualizing the proxemics of social interactions. We plotted the location of users as they moved through the V-Chat space (Figure 4). An arrow indicated the direction of each avatar's gaze. Reviewing these highlighted the movement of users into orientations that resembled conversation circles.

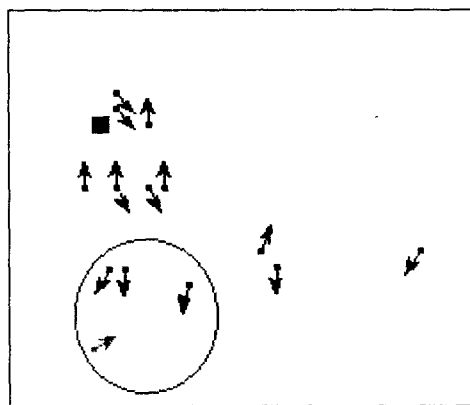


Figure 4. Top down view of the proximity and orientation of V-Chat users.

People were able to move their avatars with the use of either the keyboard or a mouse. While movement was continuous in the eyes of the user, changes in the avatar's position were only recorded once per second. As can be seen from Table 1, people had an average of 5.2 new positions every minute, indicating they spent about 8% of their time moving. As with the gestures, the rate of positioning is reduced for frequent users.

It is possible that people were moving simply to get from one end of the room to another, rather than to approach and look at the people with whom they are talking. To test whether or not people approached and looked at the people with whom they conversed, we needed to know who the target of their message was. We determined the target of a message by examining the content of the message for the name of the other users in the room. A subset of the log files from the main lobby from 12/15/1998 to 12/19/1998 was analyzed for the text content of the messages. In this period 1481 V-Chat users visited the lobby. For each person, there were an average of 20 other people co-present in the room. Messages were classified as being targeted or not targeted, depending on whether or not they contained the name of one of the other people in the room. A surprisingly large number of messages were targeted (13.8%).

For each person we calculated his or her average distance and orientation toward both targeted others and randomly selected others (selected from all of the people in the room at the time the targeted messages was produced). We calculated distances and angles of orientation using the position data provided by the logbot at the time of the message.

As can be seen from Figure 5, people were standing closer to their target than to a randomly selected other ( $t(497) = 6.57, p < .001$ ). Nonetheless avatars kept some distance from targeted others, suggesting the maintenance of personal territories.

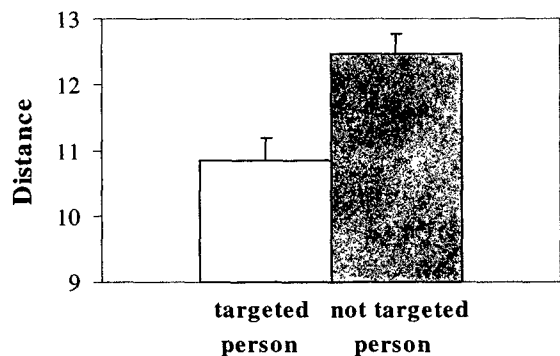


Figure 5: The average distance toward targeted persons and randomly selected non-targeted persons. Distances were measured adopting a map view of the V-Chat room using a 40 X 40 grid. People were standing

closer to the people they were talking to. Note error bars represent standard errors.

Orientation toward others was calculated as the difference in angle between the vector defined by the line between the first person and second person, and the vector of the first person's gaze. As such, if a person was looking directly at another, the angle of orientation would be 0°, if the person were looking sideways relative to the other, the angle would be 90°, and if the person were looking in the opposite direction, the angle would be 180°. An examination of histograms of angle of orientation shows that people were generally not looking at randomly selected others, but rather sideways relative to randomly selected others (see Figure 6). Few people had their back turned to randomly selected others. However, people were prone towards looking toward the targets of their messages.

Randomly Selected Other Targeted Other

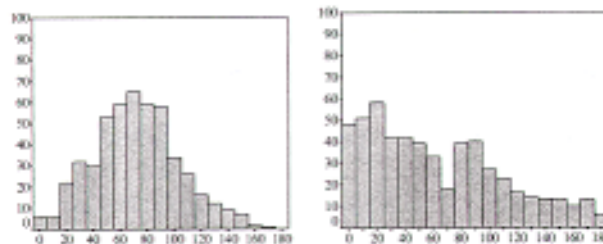


Figure 6: Histograms of people's angle of orientation relative to a randomly selected other, or relative to the target of a message. A person looking directly at another would have an angle of 0°, a person looking directly away from another would have an angle of 180°.

On average, people were more oriented toward targeted others than non targeted others ( $M_s = 63^\circ$  and  $72^\circ$ , respectively,  $t(496) = 4.17, p < .001$ ).

Just as people tended to be looking more toward a targeted other than a randomly selected other, targets were more prone to look back than were randomly selected others ( $M_s = 68^\circ$  and  $75^\circ$ ,  $t(496) = 3.05, p < .005$ ).

In addition to testing whether people approached and looked at others in the 3D space, we wanted to test whether people moved their avatars during the course of their conversations, or only before and after their conversations. In other words, did people interleave chat messages and avatar movements? To measure the interleaving of chat and avatar movement we counted the frequency with which people moved their avatars in between any two messages. We found that on average, people moved their avatars in between 46% of their messages. Perhaps more importantly, the number of messages posted in a session did not affect this proportion. People moved in between messages as much for long conversations as short conversations.

These results suggest that people do appear to be using their avatars to do more than move from one end of the room to the other. They use their avatars to stand closer to people to



whom they are talking, they look towards people to whom they are talking, and they frequently reposition their avatars during the course of their conversations.

Overall, V-Chat users appear to be using the 3D features of the program to reproduce the social conventions of physical proxemics.

People continued to use the 3D features over time, however the rate of gesture and positioning declined for frequent users. The reduction in the use of gestures and movement suggests that some initial use was due to the novelty, which then wore off. All users were prone to change their avatar on average once per session, and frequent users were more likely to have used a custom avatar at least once.

### Contrasting Text-Only and Graphical Users

Some indication of the impact of the 3D features on social interactions is provided by the survey data. When asked in an open-ended question what they liked best about V-Chat, a full 20% of users said they liked making and seeing avatars the most. Only 4% liked gestures the most, and only 6% mentioned the ability to move around. People generally thought that V-Chat was a good place to make friends and meet people of the opposite sex. However, the survey data does not provide an objective indication of the impact that the 3D features had on people's interactions.

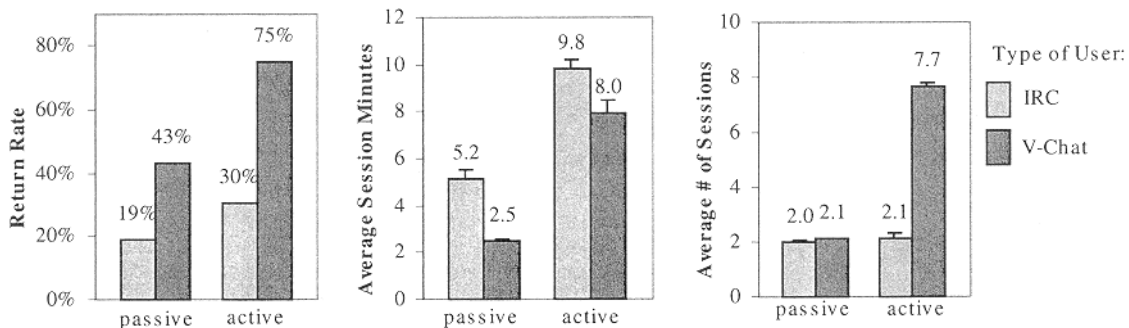


Figure 7; Rate of returns, average session length, and average # of sessions, depending on type of user and participation level.

One n

only systems is the differential rate of return, length of stay and number of sessions. An important further contrast is that between active participants, who spoke at least once, and passive participants, who never spoke at all.

As mentioned earlier, a surprising number of people merely observe the space, visiting without ever saying anything (61.3%).

As can be seen from Figure 7, V-Chat users were much more likely to return to the space than conventional IRC users, especially if they actively participated in the conversation. A logistic regression with the interaction entered as a cross-product term shows that the main effects

of participation level and type of user are significant ( $\beta = 1.22, p < .0001$ , and  $\beta = 1.70, p < .0001$ , respectively).

Although V-Chat users were more likely to return to the V-Chat space than IRC users, they did not spend more time on each session (Figure 7). For active chatters, V-Chat users spent 1.9 minutes less per session than IRC users. This difference is significant,  $t(19298) = 3.03, p, .001$ .

Although V-Chat users spent slightly less time online per session than IRC users, they tended to return to the space more frequently. Over the period studied, V-Chat users frequented the space many more times than did IRC users ( $t(34199) = 19.67, p < .001$ ), especially if they were active participants (the type of user by participation level interaction is significant,  $t(34198) = 14.10, p < .001$ ). See Figure 8.

A comparison of traditional IRC users and V-Chat users indicates that V-Chat users were more likely to return to the V-Chat space than IRC users, and visited the space a greater number of times than the V-Chat users. However, the average duration of the V-Chat users sessions was almost two minutes less than that of the IRC users. It can be argued that return rates, number of sessions, and duration of sessions provide an indirect measure of quality of social interaction. However, IRC users may not be returning to the V-Chat space for reasons other than that of the quality

ce. For example, they may simply feel like outsiders when they realize that many of the other users have bodies while they do not, and thus feel less inclined to return. Another possible measure of quality of social interaction might be provided by *quantity* of social interaction.

An examination of the number of messages per minute indicates that active IRC users tend to speak more than active V-Chat users (Table 2). (We focused on active V-Chat users because use of 3D features will not affect the quality of social interactions for people who only observe the space.)

Type of User	Messages per Minute	
	Mean	SD
IRC	3.37	8.12
V-Chat	0.78	1.41

Table 2: Means and standard deviations for messages posted, broken down by type of user. Only active users were included in the calculations

These results suggest that IRC users have a greater quantity of social interaction than V-Chat users. However, we were interested in whether the use of the 3D features directly affected the quantity of social interactions. As can be seen from Table 3, V-Chat people who used the 3D features at a greater rate posted more messages per minute. The rate of movement and the rate of avatar changes had the most substantial correlation with messages posted per minute.

Thus, while IRC users tend to exhibit more chat behaviors overall, V-Chat users who use the 3D features at a greater rate show higher levels of chat behaviors as well. However, given that these data are correlational in nature, we cannot make strong causal inferences. The use of 3D features may be increasing the quantity of messages, however the quantity of messages may in some way be increasing the usage of 3D features, or some third variable, such as general activity level, may be causing increases in both.

We argued that positioning would enhance social interactions because it allows people to indicate the direction of their attention. If V-Chat users are using eye gaze and distance to indicate the direction of their messages, then they should need to address the target of their message by name less frequently than standard IRC users. As predicted, we found that while 14% of all messages from V-Chat users were targeted by including the name of someone in the chat room in the message, 26% of all messages from IRC users were targeted with the name of someone in the chat room. A logistic regression indicates this difference is significant ( $b = .79, p < .001$ ).

Use of 3D features	Messages per Minute
Gestures per minute	<b>0.22</b>
Positions per minute	<b>0.50</b>
Avatars per minute	<b>0.51</b>

Table 3: Correlations between use of 3D features and the messages posted for active V-Chat users. Correlation coefficients vary from -1 to 1, the greater the magnitude of the value the greater the correlation. All correlations are significant at the  $p < .005$  level.

We also argued that avatars would enhance social interactions because people would be able to communicate information about themselves more effectively if they were able to represent themselves visually. Users reported feeling that they stood out more and were able to express themselves better if they had a custom avatar. If people are standing out more and expressing a richer presence if they have a custom avatar, then people should be looking at them more than if they do not have a custom avatar.

An examination of Figure 8 illustrates that randomly selected others were more likely to be looking at a person if he or she was wearing a custom avatar than if he or she was wearing a standard avatar. A within-subjects analysis shows the difference in others' orientation is highly significant ( $t(727) = 7.99, p < .001$ ). That the same person receives more attention when he or she is wearing a custom avatar than when he or she is wearing a standard avatar suggests that the use of custom avatars significantly impacts the quality of people's social interactions.

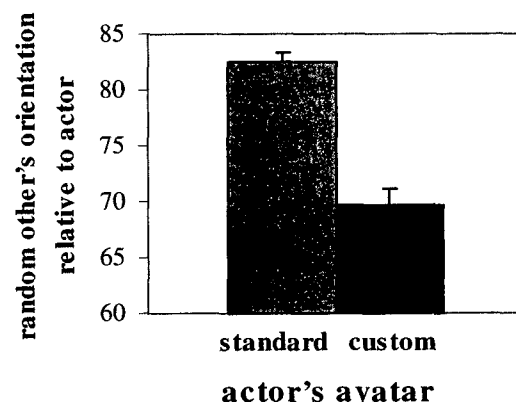


Figure 8: The average relative orientation of randomly selected others toward an actor, depending on whether the actor was wearing a custom avatar or a standard avatar.

## CONCLUSIONS and DISCUSSION

Log file analysis of user behavior can illustrate the dynamics and structure of social cyberspaces. These spaces are novel environments for interaction that host familiar social norms and processes. The present research shows that people use the 3D features of graphical chat, however use of such 3D features tends to be reduced among frequent users. Spatial management of interaction occurs in a manner very similar to that in physical interactions, suggesting that proximity and orientation information are valuable additions to network interaction media. People tended to be standing near and looking toward those with whom they spoke. At the same time they maintained some personal space. A comparison of V-Chat users to IRC users showed that V-Chat users were more likely to return to the V-Chat space, returned more frequently, but did not stay as

long. Traditional IRC users posted many more messages than V-Chat users. However, among V-Chat users, the use of 3D features correlated positively with the quantity of messages posted. V-Chat users tended to have fewer targeted messages than traditional IRC users, suggesting that avatar positioning provided a nonverbal indication of attention similar to that found in face-to-face interactions. An examination of avatar usage indicates that people used about two distinct avatars across their sessions, that frequent users were more likely to have used custom avatars, and that when people used custom avatars, others were more likely to be looking at them.

The present research has several limitations. Many of the findings presented here are correlational. Further experimental studies that allow for tighter control of user conditions are necessary to draw any causal conclusions. The possibility that different people used the same names in different sessions is a very real one, as is the possibility that individuals used multiple user names in the same or different sessions. The invisibility of private interactions in the form of whispers resolved an ethical concern in the research but reduced our ability to gauge the volume of interaction and reduced the indicators of interaction ties between users. The present research compares traditional IRC users to V-Chat users, however the IRC users studied were those present in the V-Chat space. It would have been better to compare V-Chat users to IRC users who did not interact with V-Chat users. Future work should focus on contrasts between various graphical systems to explore the ways design decisions effect social interaction.

Despite these limitations, the present research does suggest that people use the 3D features of V-Chat and that the use of such features enhances social interactions. While 43% of the people who visited the V-Chat spaces did so only once, this rate is not out of line with the retention rates of many online systems. In addition, although frequent users were less likely to use some of the 3D features, even expert users continued to make use of proximity and orientation features to enhance their interactions in the space. V-Chat users did post significantly fewer messages than traditional IRC users, which may indicate that they found proxemics modes of communication sufficient to convey their intent to one another. Graphical representations, therefore, are used and may enhance social interaction in online spaces in many ways.

This research suggested important directions for future work. Producing the data set and analysis tools used in creating this research highlighted another important concept: many of the issues we were concerned with are of interest and value to the end user while in the midst of

interaction. We came to think of this work and the data we generated as a form of a "social accounting" system. This system could track the number of sessions users have had in each space and how often they interacted with others. Future work will explore the effects of presenting such data in the user interfaces of such spaces in real time. We believe that social accounting data will add an important layer of context and history to online interaction environments that will improve their capacity to generate social cohesion.

#### ACKNOWLEDGMENTS

We thank Elizabeth Reid Steere and the Microsoft Research Virtual Worlds Group for their support of this research.

#### REFERENCES

1. Becker, Barbara and Gloria Mark, Social Conventions in Collaborative Virtual Environments, *Proceedings of Collaborative Virtual Environments 1998 (CVE'98)*, Manchester, UK, 17-19th June 1998.
2. Erickson, Thomas, et al. Social translucent systems: Social proxies, persistent conversation, and the design of babble. CHI 99.
3. Goffman, Erving *Relations in Public*
4. Hall, Edward Twitchell, 1990 *The Hidden Dimension*, New York: Anchor Books
5. Hill, Will and James D. Hollan. History Enriched Data Objects: Prototypes and Policy Issues, *The Information Society*, Volume 10, pp. 139-145.
6. Hill, Will and Loren Terveen, "Using Frequency-of-mention in public conversations for social filtering", unpublished manuscript. 1996.  
<http://weblab.research.att.com/phoaks.cscw96.ps>
7. Jeffrey, Phillip *Personal Space in a Virtual Community*, CHI 98, pp.347-348.
8. The Palace. <http://www.thepalace.com>
9. Viegas, Fernanda and Judith Donath, *Chat Circles*, Proceedings of CHI 99.
10. Virtual Places. <http://www.vplaces.net>
11. Whyte, William H. 1971 *The Social Life of Small Urban Spaces*, New York: Anchor Books
12. Whyte, William H., 1971 *City: Rediscovering the Center*, New York: Anchor Books
13. WorldsChat. <http://www.worlds.net>
14. Microsoft V-Chat. <http://vchat.microsoft.com>