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# Lessons from LambdaMOO: A Social, Text-Based Virtual Environment

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## Abstract

The growing use of the Internet to provide a sense of personal connection and community is converging with the development of shared virtual spaces. In particular, the strong popularity of Multi-User Domains (MUDs), text-based networked virtual worlds, suggests the high premium many people place on social interactivity in their virtual environments. The project described in this paper was designed to broadly characterize what life in LambdaMOO—a classic, social, text-based MUD—is like for many of its members. A comprehensive, data-driven approach was used to explore topics including user and use characteristics, identity and gender role-play, sociality, and spatiality. A rich database of results was gathered. The findings demonstrate a striking and increasingly strong focus on social interaction, even at the expense of spatial navigation. Moreover, contrary to expectations, small, private, even exclusive social interactions were the rule, not the exception. In addition, provocative claims regarding the prevalence of identity and gender role-play were shown not to hold, at least for most people, in this classic social MUD. Finally, some intriguing results regarding the sense of place and space in a purely text-based virtual environment are presented. Taken together, these data shed light on robust psychological and social patterns observed in a large-scale, social virtual world. In doing so, they can help inform the discourse on, and design of, related systems in the future.

## I Introduction

As current interest in shared virtual environments demonstrates, the opportunity for social interaction can evoke a sense of immersion and engagement in virtual worlds that is quite apart from anything sensory/motor realism alone can provide. People are social animals, and without others to interact with, any “reality” can start to feel sterile, especially over time. Indeed, several recent attempts to define “presence” in virtual environments have included distinct factors related to environmental vividness and to social interactivity, respectively (Steuer, 1992; Heeter, 1992; Towell & Towell, 1997). It may not be too surprising, then, to find virtual environments converging with virtual communities as the requisite Internet technologies develop apace.

The popular phenomenon of social Multi-User Domains (MUDs) illustrates a kind of virtual environment in which extreme bandwidth limitations are balanced by a very high capability for social expressiveness and interactivity. MUDs, sometimes called “text-based networked virtual environments” (Towell & Towell, 1997), are typically represented to the user as a series of rooms that can be spatially navigated (usually via compass commands), although “tele-

porting” (immediate transport between nonadjacent rooms) is also possible. The rooms often have rich descriptions and may contain scripted, even interactive, objects (e.g., a clock that cries “cuckoo!” every hour on the hour, or an ASCII “Scrabble” game). Users represent themselves through character descriptions. Communication takes place in real time with everyone in a given room by default; special mechanisms for private and remote communication are also available. In brief, MUDs are shared, persistent, navigable text-based virtual environments in which user-created characters and scriptable objects can interact with one another in surprisingly rich and compelling ways (Curtis, 1992; Curtis & Nichols, 1993). These systems evolved from early text-based adventure games in the hopes of promoting a richer sense of place and sociality than conversational mechanisms (such as e-mail and chat rooms) alone can provide. A careful characterization of usage patterns and social affordances of these popular shared virtual worlds may reveal robust psychological and social patterns to help inform future discourse on—and design of—large social virtual environments.

MUDs now number in the hundreds, with tens of thousands of members worldwide. Most are still totally text based, although recent developments using VRML and other Web-based multimedia tools suggest that this may not be true for long. MUD types include fantasy/adventure role-playing games (e.g., *TrekMUSE*), research/education systems (e.g., *MediaMOO*), and purely social systems (e.g., *LambdaMOO*) (Cherny, 1995). “Social” MUDs have outgrown their adventure game roots to emerge as primary loci of open-ended social interaction and community on the Internet (see, for example, Rheingold (1993) and Turkle (1995)). This phenomenon has generated a great deal of media attention—as well as social science research—in which some popular yet provocative claims have emerged. For example, logging into the MUD for up to eighty hours a week (often called “MUD addiction”) is portrayed as a widespread phenomenon (Rheingold, 1993; Turkle, 1995). Identity and gender role-play with multiple characters (or “morphs”) has been described as the primary preoccupation of social MUDding, to the point of promoting a fragmentation of the psychological sense of self

(Allen, 1996; Dalaimo, 1995; Turkle, 1994, 1995). Others characterize social MUDs as “great good places,” informal public centers of sociality and community (Rheingold, 1993). Finally, it is commonly held that MUDs provide a strong sense of “place”; this is often attributed to use of the spatial metaphor, which permits navigation and exploration of the virtual world (Rheingold, 1993). The research reports in which such claims are made are often richly evocative and deeply insightful. However, assessing the generality of these claims is problematic, both because the research tends to be based solely on subjective methods and anecdotal evidence and because it generally involves only a small sample of participants, which was selected either without regard to representativeness or with the explicit intent to highlight diversity rather than to provide a sense of what may be common to the community as a whole.

In the research project to be described here, the aim was to characterize with some confidence robust aspects of life in *LambdaMOO* as commonly experienced by most, or at least many, members. We chose to study *LambdaMOO* because it is perhaps the oldest, largest, and best known of all social MUDs, and because much of what has been claimed about social MUDs in general has been based on *LambdaMOO* (or its immediate descendants) in particular. A hybrid, “convergent methodologies” approach was used, embracing subjective and objective, and qualitative and quantitative research methods, since each has its strengths as well as its weaknesses in social science research. The rationale for this approach (discussed in Schiano (1997)) is based on the assumption that while any single source of evidence may be incomplete, robust patterns emerging from multiple studies can be treated with greater confidence. Objective and quantitative approaches were applied where possible, but subjective reports were needed to contextualize these findings. Four broad categories of interest were addressed: users and use characteristics, identity and gender role-play, sociality and spatiality. In each category, in addition to characterizing common experience, an attempt was made to shed light on specific popular claims regarding social MUDding. A rich database of results was gathered, with initial results reported by Schiano and White (1998). This paper summarizes ma-

for previous findings in each of the categories and then provides new results from further analyses.

## 2 Method

### 2.1 Participants

All participants were active members of LambdaMOO, a social MUD created and maintained by Pavel Curtis of Xerox PARC since 1990, which is accessible from a widely publicized telnet address. See Curtis (1992) and Curtis and Nichols (1993) for the definitive papers on the system.

### 2.2 Procedures

The results reported in this paper are taken from a large, multiphase project. The data reported here were obtained primarily from 1994 to 1995, during which LambdaMOO was perhaps the largest and most sophisticated and well-known form of online community available. The results should be considered in that context. See Schiano (1997) and Schiano and White (1998) for further details.

**2.2.1 Online Survey.** All logins to LambdaMOO for one full week were met with an invitation to participate in an online research survey. Players could accept, decline or delay participation. Having accepted, the user's character entered a "survey room" for uninterrupted presentation of survey questions. Approximately thirty questions addressed four categories of interest: user and use characteristics, identity and gender role-play, sociality and spatiality. Numerical estimates, yes/no, forced-choice and open-ended responses were used. The estimated return rate was better than 1 in 10, with 585 participants responding to at least some questions, and 515 people completing the survey. 78% of respondents were male, 22% female; modal age was 19 to 21 years. The median reported hours of experience in character was between 10 and 100 hours (multiple choice alternatives included 0–10, 10–100, 100–500, 500–1,000, and 1,000+ hours). The complete text of survey questions is given by Schiano and White (1998) and can be provided upon request.

**2.2.2 Personal Interviews.** The online survey closed with a call for local residents to participate in a follow-up interview. Twelve volunteers (eight men and four women) participated in semi-structured, conversational discussions with the author on the four topics of interest. The goal was not simply to probe specific issues, but to do so in the context of having gained a rich sense of each interviewee's personal experience in LambdaMOO. Sessions lasted from one and one-half to two hours and included a final task in which participants were asked to draw their "mental map" of LambdaMOO. Ages ranged from 15 to 45 years (mean = 26 years), and the reported years of LambdaMOO experience ranged between one and five (mean = 19.5 months). Names were changed to protect privacy.

**2.2.3 Logging Study.** At approximately one-minute intervals, 24 hours per day for approximately two weeks, publicly available status information on all characters and rooms in the system was logged and recorded. This data-logging procedure allowed precise characterization of "who was where when" over the entire system, including the time the user logged on, first-connect date (a measure of experience), character count (number of morphs owned by a given user), and the presenting gender of each character. To protect privacy, no data that identified specific users or the content of interactions were recorded. Two logging studies were performed nine months apart. This report will focus mainly on the second logging study, since it included the recording of idle times (when the user was logged in but inactive), and analyses could be performed on data from active characters only. However, patterns of results for both studies were very similar. In the second logging study, data on over 4,000 users—approximately 6,000 characters (not including "guests," characters constructed specifically for visitors to the system)—were taken during a total logging period of 348 hours (25,541 time-stamped samples). Data from users seen for less than ten samples were excluded, leaving a total of 3,122 users included in the analysis. Since several "genders" can be specified in LambdaMOO, gender was

coded in terms of the most commonly used, or modal, presenting gender (“MP gender”) of all characters of a given user. MP genders were coded into three groups: male-presenting (55%), female-presenting (34%), and other (11%). For ease of analysis and clarity of presentation, user experience level was divided into quartiles. Experience ranged from days to approximately five years; median experience was approximately four months.

**2.2.4 Additional Procedures.** Several additional procedures were used in this project, including participant-observer descriptive reports, email discussions, an online call for additional “mental maps” of LambdaMOO, close tracking of the experiences (and, with permission, some content logs) of two naive volunteers from initial logon through months of participation, and comparison surveys of comparably aged students at a local campus. Space constraints prohibit a discussion of all these efforts, but their results thus far converge well with the findings presented here.

### 3 Results and Discussion

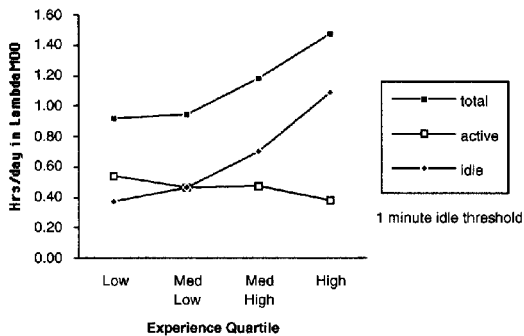
Results are presented in terms of the four categories of interest: users and use characteristics, identity and gender role-play, sociality and spatiality. All data in this project were analyzed for gender and experience effects and their interaction. In general, for conciseness, only statistically significant effects (i.e., at probability levels  $<0.05$ ) are reported here; failure to report a gender, experience, or interaction effect for any specified analysis implies nonsignificance. Experience effects are reported in terms of an omnibus test over all values of the variable; results of pairwise comparisons of means and other post-hoc analyses are available upon request. Results reported by Schiano and White (1998) are briefly summarized at the start of each section to provide context for further findings that are presented later in greater detail. New results for all categories except spatiality were obtained solely from further analyses of the logging data; those regarding spatiality came primarily from further analyses of survey response data.

#### 3.1 User and Use Characteristics

The initial analyses of survey responses showed that LambdaMOOers are mostly male (78%), fairly young (mostly college age) and have moderate experience programming and playing video games. In general, most claimed to be fairly new (in character on LambdaMOO for less than 100 hours), and they reported moderate experience with other online communities and fairly low experience with other MUDs. When respondents were asked to estimate the percentage of time spent in various kinds of activities while in LambdaMOO, social interaction clearly emerged as the primary activity overall (59%). Females reliably reported spending more of their time socializing than did males. Estimates of time spent socializing systematically increased with experience for both males and females, while estimates of time spent exploring the space showed a dramatic decrease. Interviewee reports were in strong agreement with these survey findings. Interviewees also emphasized a deep appreciation of written language, and of the surprising richness, flexibility, and creative potential of text when used in both conversational and descriptive modes.

The logging data provide direct measurements of time spent logged in to LambdaMOO. As Schiano and White (1998) previously reported, players were logged in for an average of 1.13 hrs./day or about 8 hrs./week. Despite highly publicized suggestions that MUDding for 80 hrs./week or more may not be uncommon (e.g., Rheingold, 1993; Turkle, 1995), results show that mean usage was actually substantially lower. Further analyses show that fewer than five percent of users were logged in for over twenty hours per week.

The time logged in is a very liberal estimate of MUD activity, since it does not take idle (inactive) time into account. In additional analyses, total time logged in was divided into active and idle samples. This is illustrated in Figure 1 across user experience levels, using an idle threshold of one minute (i.e., inactivity over one minute not including system lag). Overall, LambdaMOOers were active on the MUD less than one hour (mean = 0.47 hrs.) per day. Figure 1 indicates increasing idle time with experience. (Significant effects were found with idle thresholds of 1, 2, 15, and 60 minutes.

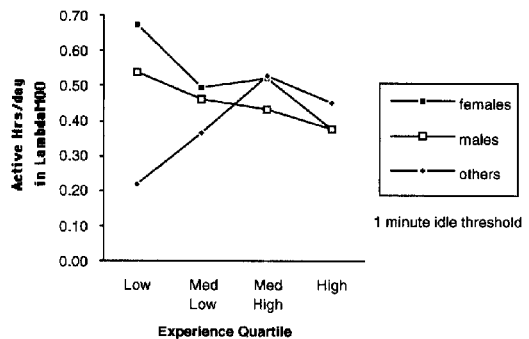


**Figure 1.** Mean active, idle, and total time (in hours/day) spent logged in to LambdaMOO by experience level.

Figure 1 shows the 1-minute idle threshold results.) This is consistent with common interviewee reports of “multitasking,” i.e., keeping a LambdaMOO window open on the computer screen while working or doing other things.

Figure 2 shows the results for active time by experience level and gender. No effect of experience was observed on active time, but a significant gender effect ( $F(2,3110) = 4.43, p < 0.01$ ) and an experience  $\times$  gender interaction ( $F(6,3110) = 3.91, p < 0.001$ ) were found, reflecting the fact that of the MP gender groups, “others” show a general increase in activity with experience, while “males” and “females” show a decrease ( $F(3,2784) = 9.90, p < 0.0001$ ). “Females” were active reliably more than “males” ( $F(1,2784) = 5.01, p < 0.01$ ). Additional analyses show that users overall tend to be idle more when alone than when with others and more when in private than in public rooms in LambdaMOO.

In summary, the new results are consistent with initial findings reported by Schiano and White (1998) and provide further information on usage patterns. While estimates of logged-in times of eighty hours per week have been used to suggest widespread “MUD addiction,” our results show actual mean usage was an order of magnitude lower. Many members do spend substantial time logged into LambdaMOO, but idle times can be considerable, especially when multitasking. Several interviewees did describe going through a “phase” of log-



**Figure 2.** Mean active time (in hours/day) spent logged in to LambdaMOO by experience level and MP gender.

ging in far more than usual for a limited period of time (e.g., during exam periods); this may correspond to the “enchantment” period described by Roberts, Smith, and Pollack (1996). However, the evidence shows that overall, the vast majority of LambdaMOOers are online far less than some popular reports have suggested.

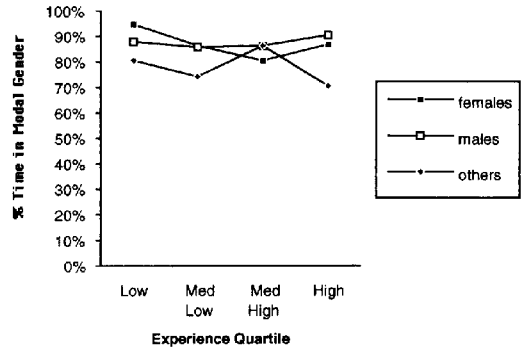
### 3.2 Identity and Gender Role-Play

Turkle (1994) described the social MUD as a “social laboratory for experimentation with the constructions and reconstructions of self that characterize post-modern life” where “there is no unitary voice” and the self is “multiplied without limit.” Experimentation with identity, and with gender in particular, is seen as widespread (Allen, 1996; Dalaimo, 1995). While this is an intriguing and popular view, the results of this project suggest it may not hold for most LambdaMOOers. As Schiano and White (1998) reported, slightly over half (51%) of survey respondents claimed to have only one online character; the vast majority of those using multiple characters (or “morphs”) report a total of two. Survey respondents rated the frequency of “role-playing [a] character (rather than ‘being yourself’)” as fairly low.

Everyone interviewed reported having only one primary character, although their descriptions tend to sug-

gest somewhat idealized or fanciful versions of one's view of oneself (Curtis, 1992; Roberts et al., 1996). Secondary characters appear to serve more often as short-term, special-purpose tools or costumes rather than true alternate identities, and they are often employed for comedic effect. Most interviewees said that they primarily "act as themselves" or "speak in their own voice" rather than play roles. Only one interviewee reported experimenting with a primary character of the opposite gender, and he experienced increasing difficulty in maintaining this ruse as he became close friends with female LambdaMOOers. Several interviewees reported that experience in LambdaMOO brought an awareness of social pressures to maintain the authenticity and accountability afforded by a single primary identity. As one person put it, "pseudonymity is not anonymity." This is supported by recent findings by Roberts et al. (1996), and is consistent with the sociologist Goffman's (1959) view that stability of self-presentation is an essential requirement for long-term social group cohesion in "real" life. Interviewees further suggested that in LambdaMOO, as in real-life communities, a concern for reputation exerts great control over behavior. Surprisingly, this interaction between identity and sociality has been largely ignored by previous MUD researchers (e.g., Allen, 1996; Dalaimo, 1995; Turkle, 1995), who have tended to focus instead on the personal and psychological significance of "acting out" risky, taboo, or otherwise difficult behaviors such as gender-swapping or other forms of sexual experimentation. (Schiano and White (1998) provide a more detailed discussion of these and related identity issues.)

The logging data provide information on the frequency of identity and gender change that occurred during the observation period. As previously reported, only 22% of LambdaMOOers ever "morphed" (or changed identity) over the entire two-week period. Those who did used a total of three characters on average. (This may be inflated by such practices as varying the formatting of a character's name, which the system considers as creating new morphs (Schiano & White, 1998).) Most of their time (81%) was spent in a single "main" character. Similar patterns of results were found in both logging studies.

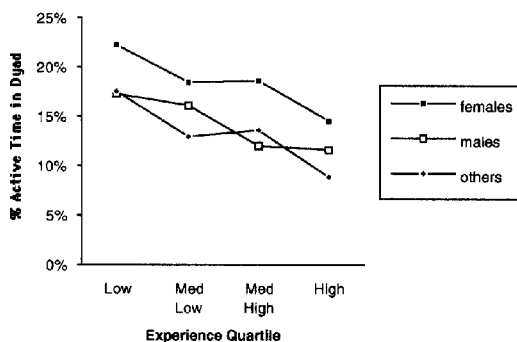


**Figure 3.** Mean percentage of morphers who ever changed MP gender during the observation period, by experience level and MP gender.

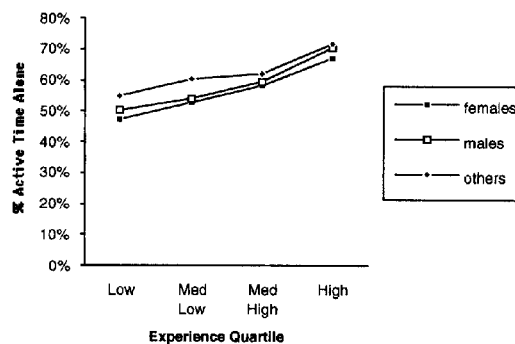
Additional analyses were performed on active time samples from the second logging study. Morphers (users who changed identities) were found to behave rather differently than nonmorphers on a number of measures. Overall, morphers spent more time online than nonmorphers (mean active hrs./day for nonmorphers = 0.34; for morphers = 0.86;  $F(1,3114) = 267.95, p < 0.0001$ ); spent less time alone (nonmorphers = 60.58%, morphers = 49.51%;  $F(1,3102) = 66.46, p < 0.0001$ ), and tended to be in the presence of more companions (mean simultaneously active nonmorphers = 1.37; morphers = 1.84;  $F(1,3102) = 50.12, p < 0.0001$ ).

Of those who morphed, 37% (8% of the total population) ever changed gender during the observation period; of these, many may have specified a gender for the first time in creating a character. (The default gender is "neutral" ("other").) On average, those who did change genders were found to spend 86% of their time in their main, or modal, gender. These data are shown in Figure 3 by experience level and gender. A significant gender effect ( $F(2,247) = 8.15, p < 0.001$ ) and a gender  $\times$  experience interaction ( $F(6,247) = 2.80, p = 0.01$ ) were found in these data.

In summary, while identity exploration is a complex topic, the pattern of initial results and those presented here converge to suggest that deep exploration of mul-



**Figure 4.** Mean percentage of active time spent in a dyad by experience level and MP gender.



**Figure 5.** Mean percentage of active time spent alone by experience level and MP gender.

tiple identities is not the primary preoccupation of most LambdaMOOers. Still, some people do play with identity more than most others, and these may form a special subgroup of the population. Of course, in a group containing many adolescents under little social constraint, failing to find some evidence of identity and gender play might be more surprising than finding it. The strong predominance of the single primary character converges well with reports of social pressures constraining identity over the long term. Radical experimentation with multiple roles is inconsistent with true sociality and community; over the long term, the price of intimacy may be authenticity.

### 3.3 Sociality

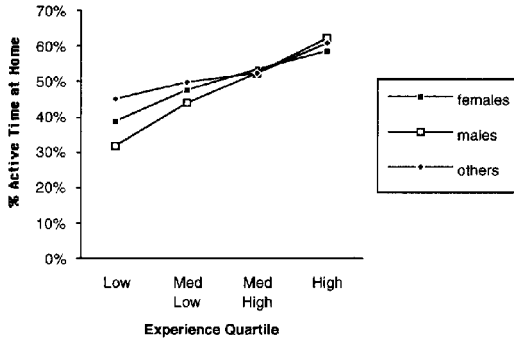
Rheingold (1993) viewed the social MUD as a kind of “great good place,” a familiar public alternative to the home and workplace or school, of which the British local pub is a classic example. The sociologist Oldenburg (1991) argued that such places play a crucial role in promoting social cohesion in real-life communities. Schiano and White (1998) reported that while sociality was given as the primary purpose for MUDding by both survey respondents and interviewees (and contrary to the view of the MUD as typically composed of fairly large groups in public spaces), initial analyses of the logging data showed that social groups tend to be small,

often consisting of only two characters, and that most time is spent in private. These patterns are further explored in the following analyses.

Overall, LambdaMOOers spent a substantial proportion of their time (mean = 16%) in dyads, i.e., in the presence of one simultaneously active companion. These data are shown in Figure 4 by experience level and gender. A robust decrease in dyads was found with increasing experience ( $F(3,3098) = 15.47, p < 0.0001$ ), together with a strong gender effect ( $F(2,3098) = 22.36, p < 0.0001$ ). “Females” spent more time in dyads than did “males” ( $F(1,2781) = 38.13, p < 0.0001$ ); results for “males” and “others” did not differ. Further analyses showed that 66% of dyads were composed of differing genders; “male” and “female” dyads were most common by far. A significant effect of gender on same-gender pairings ( $F(2,2244) = 99.82, p < 0.0001$ ) was found, which is not too surprising given the demographics. “Males” were much more likely to have a same-gendered partner than “females” ( $F(1,2035) = 138.68, p < 0.001$ ).

Interestingly, despite the strong reported focus on sociality, users were alone (the single active occupant of a room) over half (mean = 58%) of their time in LambdaMOO. As seen in Figure 5, the data show a robust increase in alone time with experience ( $F(3,3098) = 36.22, p < 0.0001$ ). Moreover, a significant gender effect ( $F(2,3098) = 5.33, p < 0.01$ ) was observed;





**Figure 6.** Mean percentage of active time spent at home by experience level and MP gender.

“males” tended to be alone slightly but significantly more than “females” ( $F(1,2781) = 4.05, p < 0.05$ ). As previously reported, interviews with experienced players provide a means for reconciling this apparent discrepancy. More experienced MUDders are more likely to know and to use remote communication mechanisms that do not require being present in the same room with one’s interlocutor (e.g., “remote channels,” “paging” commands, and MOO mail). In fact, while home alone, an experienced MUDder can monitor multiple remote conversations (or do something completely different) while still remaining accessible to friends in disparate parts of the MUD who might want to make contact.

**3.4.2 Private and Public Places.** In MUDs, one’s location has strong social implications. The logging data show that users spent considerable time in their own private rooms, or “homes.” Home-ownership was nearly universal among LambdaMOO members (mean = 99%) in the second logging study (up from 78% in the first study, suggesting an increasing general tendency to build a home immediately upon joining the MUD). Shared home-ownership was negligible.

Overall, LambdaMOOers spent slightly less than half (49%) of their active time at home. These data are shown in Figure 6 by experience and MP gender. A highly reliable increase was found with increasing experience

( $F(3,3062) = 40.32, p < 0.0001$ ), and significant effects of gender ( $F(2,3062) = 3.18, p < 0.05$ ), and an experience  $\times$  gender interaction ( $F(6,3062) = 2.42, p < 0.05$ ) were observed. A trend for “females” to spend more time at home than “males” ( $F(1,2747) = 2.76, p = 0.09$ ) did not reach significance in this data (although it did in the first logging study). Another analysis showed that over the observation period, 13% of LambdaMOOers were always at home.

One’s home is a distinct room in the MUD, and so conversations within the home are private; they cannot be simply “overheard” and interrupted by others. This is also true of conversations using remote communication methods. Moreover, security conditions can be controlled by home-owners to prevent unknown or unwanted characters from joining them unexpectedly. These affordances may make homes especially attractive. Schiano and White (1998) reported that overall, LambdaMOOers spent a mean of 23% of their time in public rooms. Thus, 77% of their time was spent in private rooms, the vast majority of which are homes (one’s own or that of another). Interviewees described using public places primarily to meet people, especially initially, although most meaningful social interaction with familiars appears to take place in private. Private rooms were overwhelmingly preferred to public rooms for general use.

The logging data permitted the identification of the public rooms that were most actively used during the observation period, and their occupancy patterns. Table 1 presents the five most actively occupied rooms in LambdaMOO (not including functional “rooms” such as The Mail Room), and provides data on the percentage of time each room was occupied by at least one active user, the mean number of simultaneously active occupants overall, and the mean number of simultaneously active occupants given that the room was occupied. The Living Room, The Coat Closet (default “home” for guests and newcomers), and The Hot Tub are among the top five; all are in the central core of “Lambda-House.” These three rooms were among the top five most occupied rooms in the first logging study; they were also in the top five most frequently mentioned rooms in the survey. The remaining two rooms, Sensual

**Table 1.** *Most Actively Occupied Rooms in LambdaMOO*

	Percent of time occupied by 1 or more active users	Simultaneous active occupants (overall mean)	Simultaneous active occupants (mean when occupied)
Living Room	97%	6.01	6.19
Sensual Respites	84%	4.56	5.40
The Coat Closet	74%	3.70	5.01
The Hot Tub	70%	2.48	3.54
The Sex Room	44%	1.13	2.60

Respites and The Sex Room, reflect specific place preferences current at the time. (Interviewees report that sex is often a preoccupation, especially early on; our observations strongly support this.) Note the low occupancy rates even in these most actively occupied rooms, reflecting a preference for smaller-group interactions, even in public rooms. To some extent, this might also reflect a limit on the number of textual conversations that can be read and followed on a screen at once.

Overall, these results suggest that LambdaMOO as a whole does not typically function as a “great good place,” since small, private, exclusive interactions predominate. Still, some features of “great goodness” do obtain: conversation as a primary activity, high accessibility even at “off hours,” and a capacity for providing both a playful mood and psychological support (Oldenburg, 1991). Specific locations (such as The Living Room and The Hot Tub) may sometimes function in this way. Most experienced interviewees claimed to have felt more comfortable in public spaces in “the early days,” when the community was smaller and more closely knit and one could repair to The Hot Tub and know most of the people there. How such a sense of belonging might be supported as a community grows larger is a primary concern for designers of large shared virtual worlds. (See Donath, 1996.) Still, the major thrust of these results is counter to the “great good place” characterization, emphasizing the importance of supporting privacy, solitude, and small group interactions. Even in the MUD, there’s no place like home.

### 3.4 Spatiality

**3.4.1 Sense of Place and Space.** Does LambdaMOO provide a sense of place, at least more than other text-based forms of communication (such as e-mail and chat rooms)? Common wisdom assumes that they do, and that the spatial metaphor is in large part responsible (Rheingold, 1993; Towell & Towell, 1997). Indeed, this issue has been the source of some controversy in the LambdaMOO community. Since results on this topic, including previously reported data, are of special interest to readers of this journal, they will be presented here in some detail. As Schiano and White (1998) reported, survey respondents were asked to rate on a seven-point scale (1 = never, 7 = always) how often “you feel like you’re ‘in another place’ when you are on LambdaMOO” and how often “you have a fairly detailed mental image of that place while you’re ‘there.’” Mean responses were in the moderate range: 4.5 for the former question and 4.4 for the latter. In these responses to survey questions on felt experience and imagery, ratings reliably increased with experience, but no gender differences were found.

In addition, interviewees unanimously stated that LambdaMOO provides a strong sense of “being there.” Some attributed this to the ability to explore, navigate, and interact with objects and other characters, while others credited the richness and flexibility of text, especially in the evocative visual detail that descriptions can provide. Most interviewees reported traveling the space

more in the early stages of their experience; consistent with the findings reported earlier, they said they stayed home and socialized more over time. Yet the survey ratings cited above show an increase, not a decrease, with experience. And no gender differences were found, despite the fact that (as also reported by Schiano and White) the logging studies suggested that “males”—especially early on—may tend to travel more than “females.” (This reached significance in the first but not the second study.) While various factors may contribute to the “sense of place,” these results are consistent with recent findings by Towell and Towell (1997), that ratings of feeling “a sense of actually being in the same room with others” were more closely related to social interactivity than to spatiality in social text-based virtual environments.

Additional analyses explored the issue of spatiality in LambdaMOO. As Schiano and White (1998) reported, 50% of survey participants responded affirmatively when asked if they have a “mental map” of LambdaMOO; 45% affirmed that they had “customized [their] navigation” in some way. Males and more-experienced members were more likely to respond affirmatively to these spatial questions; similar gender and experience effects are also commonly found in spatial tasks in the real world. (See, for example, Schiano, Schwartz, and Millis (1996).) Yet, overall, survey respondents reported “feeling lost” fairly infrequently (mean = 2.8 on the seven-point scale). No gender difference was found in this data, although a significant decrease with experience was seen. Perhaps those who navigate less have less opportunity to get lost, at least until they have learned the environment somewhat. While these results suggest that many people do engage spatially with LambdaMOO, they are not inconsistent with the view that having a “sense of place” may require neither spatial navigation nor even a “mental map.”

What it means to feel a sense of place in a virtual environment is a complex question, closely related to that of the meaning of *presence*. Substantial research has been devoted to defining and measuring presence in the context of immersive displays (e.g., Held & Durlach, 1992; Robinette, 1992; Slater, Usoh, & Steed, 1994; Schloerb, 1995; Sheridan, 1996). Yet, as Towell and

Towell (1997) argue, this work tends to be applicable solely to systems supplying sensory experience and to exclude textual forms of communication and interaction. Perhaps, as the Towells claim, presence in MUDs relates more to “social presence” (see Heeter, 1992) and includes feelings of deep interaction (the “dramatic presence” of Kelso, Weythrauch, & Bates (1993)) and “flow” (Fontaine, 1992). While this approach seems reasonable, it does not account for individual differences in spatial engagement, or for other factors such as interactivity with objects in the environment and vividness of textual descriptions, which may also contribute. These questions, while intriguing, cannot be resolved here. However, new results on the topic of spatiality in LambdaMOO were gained from further analyses; these new findings are presented below.

**3.4.3 Mental Models of the MUD.** Spatial mental models (commonly called “mental maps”) can be derived from text as well as from direct spatial experience. Franklin and Tverksy (1990) demonstrated that when people learn small-scale immersive environments through simple narratives, a characteristic “spatial frameworks” pattern in memory retrieval is found in which the narrative’s three spatial axes are used to model the space, with the up/down axis more cognitively accessible than the front/back axis, followed by the left/right. Schiano, Rubman, and Colston (1996) replicated this pattern with immersive environments in “real life”; they also found spatial gender and age effects. Room descriptions in LambdaMOO use compass directions as the primary spatial axes, but they are otherwise very similar to the narratives used in this research. This suggests that to the extent that people do create spatial mental models of LambdaMOO (or at least its core rooms), similar spatial framework effects should be observed.

A set of survey questions asked, “Suppose you’re in the Living Room facing south. What room is to your . . . front/back/right/left?” The canonical “facing” direction in LambdaMOO is north; reversing this to south was designed to increase task difficulty. Responses were scored on the basis of a spatial mock-up of The Living Room created from information in the room’s descrip-

**Table II.** Performance on Spatial Frameworks Survey Questions

	Overall mean	Males	Females	Experts	Novices
Correct Orientation	38%	41%	28%	39%	00%
N/S Consistency	46%	49%	37%	57%	25%
E/W Consistency	32%	34%	26%	54%	19%

tion and other popular sources. Results were coded in terms of whether the correct (“south-facing”) orientation was used overall, and then for consistent placement in north/south and east/west axes, independent of correct orientation. Table 2 presents these results, first for all survey participants, and then comparing males and females and “experts” (highest level of estimated experience, over 1,000 hours in character in LambdaMOO) and “novices” (lowest level of estimated experience, under 10 hours).

Performance on this task was not high, even for experts. (The “facing south” instruction may not have been necessary or may have been more effective than anticipated.) However, the overall pattern of results is consistent with spatial framework predictions; performance on the north/south axis was superior to the east/west axis with significant effects of experience ( $F(4,494) = 5.76, p < 0.001$ ) and gender ( $F(1,494) = 5.76, p < 0.01$ ), and a reliable interaction ( $F(5,494) = 3.51, p < 0.01$ ). Increased experience was associated with robustly superior performance for each measure. Male spatial superiority was also demonstrated; this reached significance for correct “facing” orientation ( $F(1,494) = 7.77, p < 0.02$ ) and north/south axis consistency ( $F(1,494) = 9.43, p < 0.01$ ).

Related spatial superiority effects for experts and males were found in analyses of performance on additional spatial tasks, including the specificity of spatial direction-giving in response to survey questions (e.g., “How would you get from The Living Room to The Arcade by ‘walking’ [i.e., navigating], not ‘teleporting?’”), and the degree of organization and detail of drawn maps of LambdaMOO. These results, while too complex to be discussed in detail here, converge well with those presented above. The demonstration of classic spatial cognition effects in memory for at least core areas of Lamb-

daMOO suggests that a substantial proportion of users did construct a spatial mental model of at least part of this totally text-based environment.

Overall, the findings described in this section suggest that LambdaMOO does provide a sense of place for many members, despite the fact that it’s purely text-based, and despite a usage pattern that is highly and increasingly focused on sociality, even at the cost of navigation. The notion of “sense of place,” like “presence,” is a complex one and may incorporate—but not require—spatial experience of the environment. New results indicate that performance on spatial tasks regarding core areas of LambdaMOO, while not very high, does show patterns of effects that correspond well with classic findings in the spatial cognition literature. This suggests that a substantial proportion of users did construct a spatial mental model of at least part of the environment that they experienced only textually. While various factors, including social ones, can contribute to a strong “sense of place,” the observation that “real-life” spatial patterns can be replicated even in a purely text-based virtual environment is intriguing. This may be taken to suggest, as Donath (1996) has argued, that established principles in the design and use of real spaces may also apply to that of virtual—even purely text-based—ones.

#### 4 Conclusions

Multiuser virtual environments are growing increasingly common, and many new challenges are being faced in understanding, evaluating, and designing these systems. The characterization of “life in LambdaMOO” given here stems from a comprehensive, data-driven approach that is sorely lacking in previous MUD research. Each individual study comprised by this project had its

limitations (e.g., sampling biases are unavoidable in survey and interview research, and even the logging data may reflect temporal cohort effects), but the benefit of the “convergent methodologies” approach is that conclusions drawn from robust patterns across multiple methods can be treated with much greater confidence than those gleaned from any single approach taken alone. The logging studies provided data on objective measures taken across the entire population, but more-subjective survey and interview results were invaluable in contextualizing these findings.

Generalizations must always be made in careful consideration of the context; strictly speaking, the findings reported here apply only to LambdaMOO during the period in which the studies were performed. Yet the major thrust of these results is robust and reasonable, and suggestive of very general, “common-sense” psychological and social principles. While we would clearly expect similar principles to hold in similar systems, the extent to which these data are applicable to quite different social virtual environments is, of course, an empirical question. The significant advantage of this work over previous MUD-related research is that it provides a clear basis for addressing just this sort of question.

This project has gathered a great deal of data regarding user and use characteristics, identity and gender role-play, sociality and spatiality in LambdaMOO. In the process, certain rather provocative popular claims regarding the prevalence of identity and gender role-play were shown not to hold, at least for most people, in this classic social MUD. In addition, some intriguing results regarding the sense of place and space in a purely text-based virtual environment have been made available. Perhaps the primary lesson from LambdaMOO in these results is the strong emphasis on sociality, which seems only to increase with experience, even at the expense of navigating the virtual world. Contrary to expectations, small, private, even exclusive social interactions were found to be the rule and not the exception. What Whyte, an urban planner cited in Donath (1996), emphasized in discussing the design of real spaces may thus also apply to the design of social virtual environments: “What attracts people most, in sum, is other people. If I labor the point, it is because many spaces are designed as

though the opposite were true and as though what people like best are the places they stay away from.”

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