Virtual Professional Community: Results from the MediaMOO Project[1]

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Abstract
MediaMOO is a text-based, networked, virtual reality environment designed to enhance professional community among media researchers. This paper analyzes experience with the system to date and highlights the value of Constructionist principles to virtual reality design.

Virtual Professional Community
Once or twice a year we stand with name badges sipping coffee in a corridor, exchange ideas over expense-accounted lunches, and maybe attend a few talks. Friendships are made and projects hatched. Then it's back home to file for expenses, perhaps write a trip report, and get back to "real work" and relative isolation.

MediaMOO is a text-based, networked, virtual reality environment designed to extend the type of casual collaboration which occurs at conferences to a daily activity.[2] Visitors to a conference share not just a set of interests, but also a place and a set of activities. Interaction is generated as much by the latter two as the former:

Person A: Can you tell me how to get to Ballroom A?
Person B: I'm headed that way now. It's up this way.
Person A: Thanks!
Person B: I see you're at Company X....

Person C: Is this seat taken?
Person D: No, it isn't.
Person C: I'm surprised the room is so packed.
Person D: Well, Y is a really good speaker....

A text-based virtual environment can provide both a shared place (the virtual world), and a shared set of activities (exploring and extending the virtual world). Like at a coffee break at a conference, there is a social convention that it is appropriate to strike up a conversation with strangers simply based on their name tags. On MediaMOO, you can read descriptions of people's research interests as well as their names, and this can form a basis for striking up a substantive conversation.

However, name tags alone are not enough. The best sorts of interactions occur when people participate in a shared activity and not just a shared context. On MediaMOO, this takes the form of constructing and interacting with the virtual world. The Constructionist theory of education emphasizes the value of constructing personally meaningful artifacts [Papert 80]. This theory has guided design decisions made in MediaMOO. For example, in most MUDs, the privilege to extend the virtual world is restricted to a small number of

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[1]Presented at The Third International Conference on Cyberspace in Austin, Texas, on May 15th, 1993.
[2]To connect to MediaMOO from the Internet, type:
```
telnet purple-crayon.media.mit.edu 8888
connect guest
```
If you have difficulty, send electronic mail to mediamoo-registration@media.mit.edu.

users. Everyone in MediaMOO is automatically a programmer with full privileges to create new objects and places in the virtual world.

This paper has two main goals. First, it documents experience with the MediaMOO project to date and evaluates its success as a virtual professional community. Second, it explores the application of Constructionist principles to virtual reality design.

What is MediaMOO?

MediaMOO is a text-based, networked virtual reality environment or "MUD"[3] running on the Internet. Its basic structure is a representation of the MIT Media Lab. Users connect in the LEGO Closet, and then step out into the E&L (Epistemology and Learning research group) Garden:

```
>connect guest
Okay,... guest is in use.  Logging you in as `Green_Guest'
*** Connected ***
The LEGO Closet
It's dark in here, and there are little crunchy plastic things
under your feet!  Groping around, you discover what feels like a
doorknob on one wall.
Obvious exits: out to The E&L Garden

>out
The E&L Garden
The E&L Garden is a happy jumble of little and big computers,
papers, coffee cups, and stray pieces of LEGO.
Obvious exits: hallway to E&L Hallway, closet to The LEGO Closet,
and sts to STS Centre Lounge
You see a newspaper, a Warhol print, a Sun SPARCstation IPC,
Projects Chalkboard, and Research Directory here.
Amy is here.

>say hi
You say, "hi"
Amy says, "Hi Green_Guest!  Welcome!"
```

Users from around the world connect to this virtual place to socialize, talk about their research projects, interact with the virtual world, and create new objects and places. People from the Media Lab are encouraged to build their own offices; users from other places can build their offices as well and connect them via a "virtual Internet." The system developers constructed basic infrastructure and a few interesting and evocative objects and places, but almost all the building was left to the users. This is not a result of time constraints, but is a central principle of the project that will be elaborated throughout this paper.

The first MUD or "Multi-User Dungeon" was developed in 1979 as a multi-player Dungeons and Dragons game. In 1989, a graduate student at Carnegie Mellon University named James Aspnes decided to see what would happen if the monsters and magic swords were removed, and instead each user was allowed to help extend the virtual world. Aspnes' project, which he called "TinyMUD," became less like a game and more like a community. There was no longer a score or goal, but instead a gathering of people who enjoyed one another's virtual company and worked together to extend the virtual world.

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[3]For an introduction to MUDs, see [Curtis 92] and [Bruckman 92-3].

At the MIT Media Lab, we decided to see whether this technology which began as a game could be adapted to a more serious purpose: enhancing professional community among media researchers. We chose to build on top of the MOO ("MUD Object Oriented") software developed by Pavel Curtis at Xerox PARC.[4] System development began on October 28th, 1992, and MediaMOO was opened to the public on January 20th, 1993, with an opening celebration called the MediaMOO Inaugural Ball, scheduled to coincide with Bill Clinton's inauguration as President of the United States. As of May 7th 1993, MediaMOO had 327 participants from at least thirteen countries, including Austria, Australia, Canada, Denmark, England, France, Ireland, Israel, The Netherlands, Norway, South Africa, Sweden, and The United States. (See Table 1.) The population has grown over time, with peaks at special events and troughs on weekends. (See Figure 1.) MediaMOO runs on a Sun SPARCstation IPC where it uses 25 Mb of RAM. The database is currently 4 Mb on disk.

Table 1: MediaMOO People and Characters

People Registered[5]	327	
Registered Characters[6]	375	
Identified Characters	279	(74%)
Anonymous Characters	96	(26%)
Multiple Characters	48	(13%)
Anonymous Character Only	48	(13%)

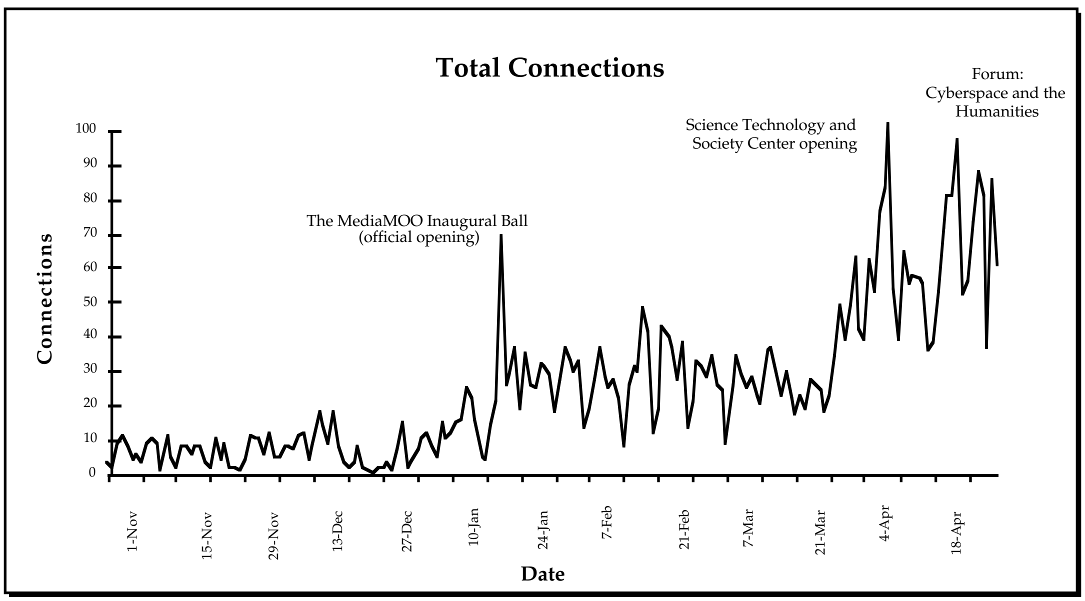

Figure 1: The MediaMOO Population

A Community of Researchers

While people of a wide variety of ages and backgrounds do MUD, the majority of players on publicly announced Internet MUDs are college students. On MediaMOO, we wanted to attract media researchers. We advertised selectively on electronic mailing lists devoted to

[4]The MOO software was developed by Pavel Curtis at Xerox PARC and generously made available to the public for free. It can be obtained via anonymous ftp from parcftp.xerox.com in /pub/MOO.

[5]Some people have more than one character.

[6]This does not count the 33 guest characters and 5 utility characters. There are a total of 413 character objects in the database. Of these, 289 have connected within the last month.

media studies, and required people to submit a description of their research interests to register. While we have said no to some applicants, it is primarily a self-selection process.

In most MUDs, characters are anonymous. People who become friends can exchange real names and email addresses, but many choose not to. Conventions about when it is acceptable to talk about "real life" vary between communities. In most MUDs, people begin to talk more about real life when they get to know someone better. However, in some communities such as those based on the Dragonriders of Pern series of books by Anne McCaffrey, talking about real life is taboo.

On MediaMOO, we wanted to promote discussions of "real life" and real research interests. Consequently, we offered users the opportunity to get an anonymous or identified character, or both. Since there was already a function called @whereis which returned the location of a character, we implemented a function @whois which returns their real name, if they choose to be identified. Real names are set by the system administrators to lessen the chance that people will pretend to be who they are not. We also implemented functions so that people could carry a description of their research interests on their character.

It surprised us that almost all users chose to be identified. To date, 74% of users chose to have only an identified character, and 13% chose to have both anonymous and identified characters; another 13% chose to be completely anonymous. (See Table 1.) Two days after the opening, one user who had been anonymous sent in this request:

> I have enjoyed MediaMOO so far and like the direction it is headed. With these forums and such I believe I would like an identifiable character, but would like to continue with my anonymous character as well.

Users clamored for extensions to the functions provided for finding people. At users' request, we made the function @whois return the person's email address as well as real name. One user asked to be able to reveal his/her email address, but not real name. A user whose character is named Daniel (Daniel Rose in real life) wrote a function @char to find the characters associated with a particular person's real name (the inverse of @whois). Users requested that @whois with no arguments return a list of the real names of everyone currently logged on. A user named cdr (Ken Schweller) made a research directory, enabling people to find all the users who mention a particular word or phrase in their research description. The idea of having identified characters and research interests has proved popular and successful.

A "Third Place"

In *The Great Good Place*, Ray Oldenburg eloquently argues for the importance of "third places," places which are neither work nor home. The book's subtitle is "Cafés, coffee shops, community centers, beauty parlors, general stores, bars, hangouts and how they get you through the day." Oldenburg summarizes:

> Third places exist on neutral ground and serve to level their guests to a condition of social equality. Within these places, conversation is the primary activity and the major vehicle for the display and appreciation of human personality and individuality. Third places are taken for granted and most have a low profile. Since the formal institutions of society make stronger claims on the individual, third places are normally open during the off hours, as well as other times. The character of a third place is determined most of all by its regular clientele and is marked by a playful mood, which contrasts with people's more serious involvement in other spheres. Though a radically different kind of setting from the home, the third place

> is remarkably similar to a good home in the psychological comfort and support that it extends. [Oldenburg 89, p. 42]

The population of third places are self-selected—people go to a café because they choose to and not because they must. From this self-selection process emerges a group of people with some degree of common interests and values. Traditional third places draw people from the local geographic area. On the Internet, MUDs become third places which draw people with common interests from all around the world. People from the opposite hemisphere can become a part of your daily life. On MediaMOO, those people also share research interests. MediaMOO is perhaps best described as an endless conference reception. The conversation fluidly moves between personal and research issues.

As Oldenburg points out, conversation is the primary activity in third places, and MediaMOO is no exception. Most of those who chose to respond to an email survey of randomly selected MediaMOO users stated that they had had interesting conversations and met new people in their field through MediaMOO. Paul (Paul Dourish) writes:

> I've met a number of people whom I've talked to about my research and theirs, although I think there are fewer (probably just the one or two) whom I've actually talked to enough to refer to as “new professional contacts”.
>
> One I met while he was a Guest; we started talking after he read my research description. The other I met early on when I was stumbling around asking all sorts of people for help on doing things just after I got my character.

The process of helping new players, often called “newbies,” is an important part of MUD culture. For Paul, the process of being new and reaching out for help has led to his most meaningful professional contacts— once while he himself was new, and once while he was helping another new player. The context of the MUD in these instances provided a shared context and shared activity which promoted social interaction.

A number of users commented that their most meaningful interactions on the MUD were with the “regulars”—the people who use MediaMOO the most and are most likely to be logged on at any given time. Oldenburg emphasizes the importance of “the regulars” to a third place—they give a place its character.

Some question the value of the sort of interaction which takes place on MediaMOO. One user wrote that “frankly it strikes me for now as a schmooze place for people with nothing better to do, not a place where more productive things will happen than already happen in other communicative modes.” We do not share that perspective for a variety of reasons. Is spending time at a conference reception a waste of time? Most veteran conference-goers attest to the fact that the conversation at coffee breaks and receptions is usually more valuable than the sessions attended. The exchange of ideas and networking which take place on MediaMOO are similarly productive. One might question whether these benefits can be obtained with less time commitment through other media—but this analysis ignores other benefits of the MediaMOO. For media researchers, coming to understand this medium may be interesting in itself. There are also personal, emotional benefits that come from participating in a “third place,” such as relaxation, friendship, good conversation, and a sense of belonging to a community. In short, if you enjoy it, then you will reap benefits from it which go beyond that pleasure. Some people do not enjoy it, and that is certainly a valid point of view. It is a strength of the medium that the community is self-selected—everyone who is there wants to be there.

It's worth noting that to determine whether an activity is "productive" requires a definition of what it means to be "productive," and this quickly leads to questions of an ethical and philosophical nature. MediaMOO challenges the boundaries between work and play, forcing one to rethink what counts as productive.

Online Colloquiums and Forums

The kind of networking and casual collaboration which occurs at conferences does appear to be taking place on MediaMOO. It seems natural to extend the conference metaphor to literally have meetings on MediaMOO. This has been tried several times with mixed results. Alan (Alan Wexelblat) writes:

> I've been to the Ball and a few other gatherings. I thought they were OK, but a bit jabbersome.

Conversations in MUDs are often multi-threaded. When large numbers of people all talk at once, each of those threads can become very short—rather like a tailor's scrap bin. Users have experimented with a variety of computational ways to improve the quality of discussion. Wade (Wade Roush) organized a forum on Cyberspace and the Humanities, which more than 40 people attended. The forum took place in two different "conference rooms," each with a different method for focusing conversation. In one, users are all allowed to talk at once and tag their comments with a relevant subject line.[7] In another, a limited number of people can talk at a time and there is a queue for those wishing to speak.[8] This increases the coherence of the conversation but takes an already slow medium and slows it further. Oracle (Randy Farmer) writes:

> I attended the Cyberspace and the Humanities get together for awhile. It was clear that the wide-open discussion didn't work very well, it got a bit nicer in the moderated room. I don't think much came out of the meeting, 'cept maybe that many more experiments in group discussion need to happen. I'll gladly help!

There seems to be interest and potential in exploring new ways to improve the quality of forums and group discussions. However, it is possible that the problem resides in too literal an application of the metaphor of a conference to virtual space. A virtual meeting is not a conference or colloquium; to call it that is a *metaphor* borrowed from an existing medium and applied to this new medium which we do not yet completely understand. Many early movies were like recorded plays. The camera was pointed squarely at a stage and never moved. It took years of experimentation to develop new techniques such as close ups and zooms. Early automobiles were called "horseless carriages." We are still at the horseless carriage stage of cyberspace. Initiatives for improving online gatherings must not just stretch ways the technology can create a conference, but stretch the metaphor of "conference" to create a new form of social and intellectual event for this new medium.

It seems likely that online meetings will be more successful when networked video and audio systems become more generally available. Text is a tremendously expressive medium and has advantages over graphics and audio for some applications. For example, in less than a moment one can write that "at the top of the hill is a gnarled peach tree," and this conjures up an image in the reader's mind. It would take considerably longer to draw such a tree, and less would be left to the imagination. Audio and video will not replace text-based VR, just as television didn't replace radio or magazines but simply changed what

[7]This conference room was programmed by Barry (Barry Hayes).
[8]This conference room was programmed by Daniel (Daniel Rose).

they are used for. Online meetings are one application where the greater bandwidth of audio and video may be needed.

Contributory Objects

Building amusing and/or useful MUD objects is a means of creative expression for the designer, and completed objects promote social interaction for the community. One design paradigm which has proved particularly successful is the idea of a contributory object. For example, in the dressing rooms of the MediaMOO Ballroom, it is possible to design new costumes for the clothing racks:

```
>northwest
You step through the velvet curtain into the women's dressing room.
Women's Dressing Room
The dressing room is a clutter of gowns, hats, and gloves from all different eras.
Type 'examine rack' for more information.
Obvious exits: east to Ballroom Foyer and south to The Ballroom
You see women's clothing rack and a gold plaque here.

>list rack
Outfits on the rack:
1: a classic black cocktail dress and snakeskin pumps by Amy (#75)
2: a floor-length, strapless, pink-taffeta, ball gown and long, dangling rhinestone
earrings by Amy (#75)
3: a red silk dress with a black, patent-leather belt and high heels by Amy (#75)
4: a marigold, lower calf length dress, with an off-shoulder top and an elegantly
pleated skirt by Lenny (#115)
5: a three quarter sleeved, cotton knit dress, in basic blue by Lenny (#115)
6: a ribbed, cotton sweater-dress, cut to mid-thigh, in white by Lenny (#115)
7: a halter wrap dress, cut to mid-thigh, colored in pastels with a distinctly tie-
died look to them by Lenny (#115)
8: a knit, royal-purple trankdress, belted at the waist, with a full, sweeping skirt
by Lenny (#115)
9: a black evening dress with long, delicate sleeves, made entirely of lace by Lenny
(#115)
10: a ribbed cotton turtleneck and clean, neat, denim jeans by Lenny (#115)
11: a three-quarter's length black leather trench coat, with black stockings by Lenny
(#115)
12: an off-the-shoulder black velvet dress with handmade wide white lace all along the
slightly veed neckline by Michele (#120)
13: a gorgeous red dress with a slight sweetheart neckline, buttons down the side, a
flared, mid calf length skirt, and a slit to the hip by Lenny (#115)
14: black leather one-piece jumpsuit with glistening alloy lapels by Guest (#113)
15: frayed jeans and a rather faded Phish t-shirt by Paul (#559)
16: a floor-length green-sequined evening gown, matching sling-back heels, and
dangling diamond earrings by Amy (#75)
17: a narrow-cut, black silk dress with a slit almost up to the waist, and spike heels
by Amy (#75)
18: clean but well-worn jeans, a faded Phish t-shirt and a comfortable old pair of
Birkenstocks by Drave (#176)
19: black shoes, black socks, black jeans, black shirt, black jacket black earrings by
Amber_Guest (#700)
20: a floor-length royal-purple velvet dress with a scalloped neckline, fitted bodice
and flowing skirt, with matching purple suede shoes and opaque purple nylons by Robyn
(#575)
21: a shimmering jester's costume, in mauve and lavender, with a headdress of orchids
and dove-feathers, and turquoise pendant earrings, set off by turquoise high-heels by
Mauve_Guest (#702)
22: a slinky, classic little black dress by slim (#913)
23: A glowing violet Indian Sari with Paisleys. by Guest (#113)
24: absolutely nothing by Guest (#113)
25: a sheath-style ball gown made of Shantung silk in deep, hunter green.  This lovely
dress comes with matching pumps by Tarot (#1749)
```

```
26: black leather thong with matching bustier, whip and pink high-heels by
Ivan_the_Unstable (#1769)
27: black leather, crotchless teddy by Guest (#113)
28: an ensemble in off-white: two-piece, calf-length dress, high boots, long cape,
fake fur muff and hat by Guest (#113)
29: a pair of Guat pants and a Grateful Dead t-shirt by Chartreuse_Guest (#696)
30: a t-shirt reading: Duke- Back to Back National Champions.  Blue basketball shorts.
Shoes by Nike.  Jacket by Starter. by Ochre_Guest (#689)
```

>**wear 1 from rack**
`You slip into a classic black cocktail dress and snakeskin pumps.`

At the MediaMOO Inaugural Ball, people spent as much time in the dressing rooms as in the ballroom itself. The costumes on the rack are effective conversational props. More important, however, is the fact that it is easy to contribute a new costume to the rack. One can simply type "design 3Cyberconf T-Shirt and mirrorshades for rack" and it is added to the collection of available costumes with the designer's name attached. Contributory objects offer a lower threshold to participation than actually programming a new object. The user has a sense of having taken a first step towards mastering the computational environment, and a sense of having contributed something to the community.

There are a variety of contributory objects around MediaMOO, including bartenders that you can teach new drinks, a talking picture that you can teach to come alive when it is looked at, statues of famous sociologists and historians of science that you scribble on (designed to promote discussion of their work), and a projects chalkboard for ideas for new objects and places. The majority of users asked to name one of their favorite objects on MediaMOO cited one of these items.

It is interesting to note that attributing the contribution to a person is an essential feature—it allows the person to take pride in what they have done, and discourages virtual vandalism. Even though guests are effectively anonymous, there have been few inappropriate contributions to the costume racks (as you can see in the unedited list which appears above). However, at one point it was possible to add messages to the bartenders without attribution. One might add something like "Bill starts rearranging the kegs of root beer behind the bar" to the program for Bill, the bartender in the Root Lounge. Unfortunately, people added messages that were trivial or obscene and even deleted other people's contributions since the program allowed it. The software will be rewritten to provide attributions for messages added like the other contributory objects around MediaMOO.

Contributory objects are an example of the application of *Constructionist* ideas to virtual reality design. Seymour Papert, designer of the Logo programming language, believes that people learn best when constructing personally meaningful artifacts. Papert seeks to empower children by helping them to develop a sense of mastery over computers and computational ideas. The Logo language is designed to have "no threshold and no ceiling"; it is easy to begin participating, and the system is powerful enough to continue to challenge a more experienced user. A contributory object is an easy route to initial participation which can open up into the greater power of mastering the underlying programming language.

Constructionism involves two types of construction. First, it asserts that learning is an active process, in which people actively construct knowledge from their experiences in the world. (This idea is based on the theories of Jean Piaget.) To this, Constructionism adds the idea that people construct new knowledge with particular effectiveness when they are engaged in constructing personally-meaningful products. They might be constructing sand castles, LEGO machines, computer programs, or virtual objects. What's important is that they are actively engaged in creating something that is meaningful to themselves and to others around them.

Constructing a new costume is an act of self expression which benefits the individual and the community. Langdon Winner remarks that "Social activity is an ongoing process of world-making" [Winner 86]. In MUDs, this is literally true. Contributory objects facilitate this literal sense of world construction.

Virtual Representations of Real Places

In addition to being able to contribute to objects, MediaMOO users can design and program new objects and places. The center of MediaMOO is a virtual copy of the MIT Media Lab. There is a psychological power in the ability to construct a representation of a real place in the virtual world which is your own. The challenge was: how do we let people build offices in California and Australia without trying to build everything in between? We developed a "virtual Internet" as a technique for spatial ellipsis. Users from other places can build their own offices by connecting them via the virtual Internet. You step inside a computer and dematerialize into a collection of packets, and can then travel through a tree-like structure, going down to root and back up through the hierarchy (actually a much more orderly arrangement than the real Internet!) Each user can add his or her own Internet site, if it is not already there.

Daniel (Daniel Rose) writes of his first experience on MediaMOO:

> I logged in first as a Guest, and came out in the E&L Garden. I had never been to the Media Lab IRL [in real life], so I felt a bit lost.... Then I met Michele, and when she found out I was from Apple, she said that someone had constructed our building, and she'd take me there.... When we stepped out into the Apple R&D building atrium, I felt this incredible shock of recognition... More than that, I felt a sense of relief that there were places here that were familiar and home to me just as the Media Lab was to you. And all of this was from a couple of lines of textual description.

The actual text a user sees when they arrive at apple.com in the virtual Internet and step out looks like this:

```
apple.com
You are in a maze of twisty little passages.
You see the back of a computer screen here.
Obvious exits: down to com and out to Apple Computer R&D Atrium

>out
Your packets gather in a glob, and then flow into the screen!  You
feel yourself rematerializing.
Apple Computer R&D Atrium
You are in a glass atrium, four stories tall. Offices look out
from the walls.  Beyond the glass wall to the east, there is some
arcane construction taking place.  A walkway exits the atrium to
the west.
```

To most people, this is a rather unremarkable description. The idea of rematerializing might appeal to *Star Trek* fans, but the room description itself is bland—it sounds like an office. However, to Daniel this provoked a "shock of recognition" and a sense of belonging. Representations of the real give users a sense of comfort and make the medium more appropriable: if your office is there, then you belong there.

Author Comments and Community Comments: A Lesson in Constructionism
One of the first additions we made to the MOO software was to allow comments to objects they created. We envisioned that this would serve as a kind of documentation—if a programmer hoped others would use an object, he or she could put useful information on the comments message. (Reuse of code is encouraged and facilitated by the object-oriented nature of the programming environment.)

Months later as part of early preparations for a MUD for children, we decided to develop a "Generic Commentable Object." If an object is commentable (made to inherit from Generic Commentable Object), then anyone can type "comment on <object name>" and anyone can read all the comments that have been made on an object. It wasn't until after Albert (Albert Lin) implemented this feature that it occurred to us that it was similar to the comments message, with one important difference: the comments message is controlled by the owner of an object; the commentable object creates a dialog among members of the community about the object.

The second design better embodies the participatory philosophy of MediaMOO. It assumes that the community of users have worthwhile things to say; the privilege to comment is no longer reserved for the author of the object alone. Valuing participation and respecting the contribution of each individual are principles inspired by Constructionism.

Future Directions: A MUD for Kids
The MediaMOO Project was conceived in part as preparation for a MUD for kids. We believe that this technology can provide an authentic context for children to learn reading, writing and programming. In these virtual worlds, writing and programming become means of self-expression to a community of peers. MUDs are a Constructionist playground.

Developing good MUD objects is as much creative writing as programming. One hypothesis of this research is that divisions between the humanities and the sciences are often too sharply drawn and counter-productive, and a more holistic approach has advantages for many children. A second hypothesis is that the social and contextual nature of these worlds may help young girls to be more comfortable with computers.

If kids are really to make good use of MUDs, however, it will be necessary to improve the programming language and the interface. We are developing a multiple-window client program which we hope will make the system more usable. We are also currently developing a scripting language to make MUD coding easier. We hope to apply lessons learned in the development and use of the Logo language to make a MUD language more accessible to kids.

At the conclusion of *Mindstorms*, Seymour Papert describes his vision of a technological samba school. In samba schools in Brazil, members of a community gather to prepare a performance for Carnival. Everyone is learning and teaching—even the leads need to learn their parts. People of all ages learn and play together as a community. Papert believes that computers can create a kind of technological samba school, and we believe MUDs may begin to realize that vision.

Conclusion: Constructionism and Virtual Reality
In much current research, virtual reality is like Disneyland: artists design wondrous creations for users to experience. If this technology is "interactive," it is in the limited sense that hypertext systems are interactive: there are multiple paths through the material, and the system has a limited ability to react to the user. However, the ways in which the

system reacts are designed by the artists and engineers who constructed it and not by the users.

If the power of this technology is to be unleashed, users need to be the creators and not merely consumers of virtual worlds. We believe that Constructionist principles are of central importance to the design of VR systems. MediaMOO is an exploration of this idea.

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