# Synchronous Interaction Among Hundreds: An Evaluation of a Conference in an Avatar-based Virtual Environment

**Thomas Erickson, N. Sadat Shami, Wendy A. Kellogg, David W. Levine**
IBM T. J. Watson Research Center
P.O. Box 704, Yorktown Heights, NY 10598 USA
{snowfall,sadat,wkellogg,dwl}@us.ibm.com

**ABSTRACT**
This paper presents the first in-depth evaluation of a large multi-format virtual conference. The conference took place in an avatar-based 3D virtual world with spatialized audio, and had keynote, poster and social sessions. We studied it by drawing on logs, a survey and interviews with 30 participants. We develop a model – Coalescence, Focused Interaction, Remixing (CoFIRe) – of large synchronous interactions, and use it to discuss how the technology supported, or failed to support, the interactions that are the *raison d'etre* of conferences. We conclude by discussing the prospects for such large virtual gatherings.

**Author Keywords**
CSCW; collaboration, CVE; Second Life; spatialized audio; synchronous interaction; virtual environment; virtual world

**ACM Classification Keywords**
H5.3. Information Interfaces and Presentation: Group and Organization Interfaces: Synchronous Interaction.

**General Terms**
Design, Experimentation, Human Factors, Theory

## INTRODUCTION

"*It was the first virtual meeting to cross the threshold to being useful!* […] *But I'd still rather travel 30 hours.*"[FV]

While the exceptionally remote location of this informant was unusual, the ambivalence was not. In this study we describe a 500-person virtual conference, the activity that characterized it, and the experiences – positive and negative – that underlie its participants' ambivalence.

The conference in question came about in response to the worldwide economic downturn that began in 2008. Many organizations, including IBM, placed restrictions on travel. IBM restricted travel not related to client interactions, including the internal workshops, meetings and conferences that normally foster communication among employees. IBM challenged its employees to explore alternatives to face to face (FtF) gatherings. The conference that this paper examines was one of the responses to that challenge.


*CHI 2011,* May 7–12, 2011, Vancouver, BC, Canada.


Large structured gatherings such as conferences and tradeshows are important for two reasons. First, they bring people together to share, discuss and develop knowledge. Second, they enable participants to interact with one another, offering the possibility of forming new relationships and strengthening existing ones. It is well established that fostering relationships among people from different contexts is an important means of enabling the spread of knowledge. As Granovetter says, "… social systems lacking in weak ties will be fragmented and incoherent. New ideas will spread slowly, scientific endeavors will be handicapped, and subgroups separated by race, ethnicity, geography, or other characteristics will have difficulty reaching a *modus vivendi.*" [10, p 202]. In sum, large structured gatherings play an important role in business, education and government by supporting the production and exchange of knowledge, *and* the creation and maintenance of the ties that underlie these processes.

The importance of such gatherings is underscored by their frequency and cost. For example, during 2008, there were over 7,400 international conferences with an average of 638 attendees (about 4.7 million trips) – this includes only annual conferences that rotate among at least 3 countries [13]. Looking only at the US, in 2008 businesses spent about $45 billion on travel to conferences and tradeshows [24]. Broadening the scope to include "business meetings," another source [23] estimates that more than $75 billion is spent annually in the US to attend over a million meetings and conventions. However one slices and dices it, the numbers are large. In addition to the direct costs, travel also has externalized environmental costs such as consumption of non-renewable fuels, and personal costs. So it makes sense to explore the utility of large virtual gatherings.

But how well do such large virtual gatherings actually work? How well do they support not just knowledge exchange but the 'social work' that underlies it? As we shall see, little is known. The aim of this paper is to describe one such gathering, assess how well it worked, and discuss the problems and prospects for such gatherings.

## BACKGROUND

We know little about conferences, either online or FtF. Most studies come out of areas like tourism research or the

event management trade press (e.g., [23]). These focus on factors that affect decisions to attend conferences, but say little about how the work of the conference is carried on. An exception is Brecht, who provides a high level view of conference activity [2], but does not address the details of human interaction of interest to those in HCI. Finally, while HCI is exploring ways of augmenting FtF conferences (e.g., [18]), this line of work is informed by first-hand experience and by work on FtF dyadic and small group interaction (e.g., [8, 9, 15]), not by studies of conferences *per se*.

Likewise, virtual conferences have received little attention. Most work is either anecdotal (descriptions of attending conferences, e.g., [22]) – or prospective (proposing ways of augmenting virtual conferences, e.g., [4, 16, 21]). The closest to a rigorous evaluation is Jones' participant/ observer account of two conferences held in ActiveWorlds [14]. He offers suggestions for organizing conferences, but notes that they are limited by the personal nature of the research and calls for work using a mix of methods. To the best of our knowledge, this paper is the first to address this call with a mixed method evaluation of a virtual conference.

Moving beyond conferences, there is a considerable amount of work that looks at dyadic and small group interactions in recreational and social virtual worlds (e.g., [3]). Many studies have noted the difficulties of customizing avatars, managing facial, gestural and postural expression, and maintaining mutual orientation (e.g. [11, 19]). Nevertheless, studies – especially recent work on World of Warcraft [1, 6, 20] – also show that virtual worlds can support rich interactions characterized by sophisticated collaboration, and the development of in-world norms, and communities.

How well this applies to large structured virtual gatherings is an open question. As we have noted, there is virtually no research on the interactional nature of conferences. There is also little work on the use of virtual worlds in business contexts (but see [7]). In this paper we address this gap, offering an in-depth study of a large virtual conference.

## THE SETTING

### IBM and its Academy of Technology

IBM is a global information technology firm with over 300,000 employees. Its businesses range from hardware to software to consulting. IBM places a premium on its ability to be a thought leader, to provide cutting edge technology and services to its clients, and to maintain and tap a vibrant worldwide network of technical leaders.

One manifestation of its emphasis on technical leadership is IBM's Academy of Technology. The Academy is an organization of IBM's technical leaders that has existed for over 20 years. Election to the Academy is viewed as quite prestigious, and new members gain access to a network of technical leaders and executives. Academy members participate in company-wide studies, workshops, and an annual conference, the Academy General Meeting (AGM), that brings members together with senior executives. It is this last activity that is the subject of this study.

### The Technology Used for the Virtual Conference

Most of the AGM was held in a version of Second Life®[i] [17]. Second Life is an immersive 3D environment that represents users as avatars. Users control their avatars rather like puppets, using them to move about the virtual world, to communicate with other avatars via textual chat and speech, and to create, modify and interact with virtual objects such as clothing, devices, furniture, etc.

The version of Second Life used supported spatialized audio. Users wore headsets and as they spoke their in-world voices came from the correct direction, and varied in volume according to the distance between speaker and hearer. It also ran independently on servers inside IBM's firewall, making it suitable for confidential discussions, and displayed users' real names from the corporate directory.

Although the focus of this article is on the experience of attendees in Second Life, two other conference venues were deployed: a text-based discussion forum (open for the duration of the conference), and nine plenary talks held in physical locations around the world that were accessible in person, via streaming video, or via teleconference.

### The AGM Virtual Conference Center

The setting for the AGM consisted of several spaces: conference halls for the Keynotes (Figure 1); areas for social events (Figure 2), and a posters area (Figure 3). These areas were designed to resemble their real world counterparts. Thus, the conference hall had a podium and


Figure1. A keynote

Figure 2. A social event


Figure 3. A poster session

seating interspersed with aisles, even though neither the podium nor the aisles were needed. Rather, these set the stage, signaling the type of activity and participants' roles. This literal approach was complemented with 'magical' features that supported the intended activity. Thus, upon taking a seat in the conference hall, the user's camera and audio settings were automatically adjusted so that the projected slides filled most of the screen, and ambient audio (except for the speaker) was suppressed. Similarly, the posters area included a "directory wall" that allowed users to browse poster abstracts and teleport to posters of interest. There are many other examples, but as this paper is not about the design of the environment we only provide details where needed to understand the interactions we discuss.

### Events During and Prior to the Conference

The conference schedule (Figure 4) was single track for virtual events, with occasional overlaps for FtF plenaries. To accommodate the worldwide time zones, events were distributed throughout the 24-hour days.

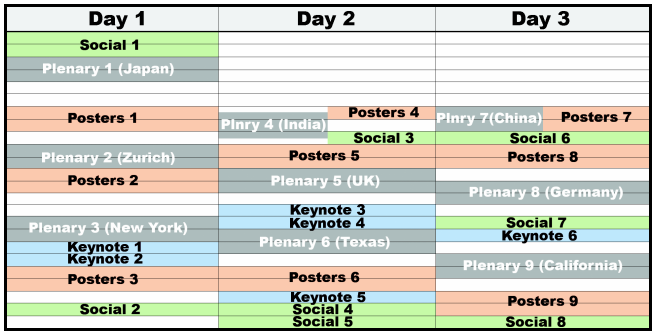


**Figure 4. The Conference Schedule**

Prior to the conference, 10 "on-boarding sessions" were held to acquaint users with the virtual world: how to move and navigate, customize their avatars, and interact with others (e.g., how to control their audio). While often such training is not widely used, the survey we will discuss later indicated that 73% of attendees reported spending 2 or more hours in preparation. In addition, an online forum for questions and problem reports was accessed by roughly half of those invited. Finally, invitees were sent email (cc'd to their managers) asking them to block out time on the calendaring system for the conference. All of this indicates that the AGM was positioned and received as a legitimate and important corporate event.

## METHODS AND DATA

We used quantitative and qualitative methods to study the conference. Attendance was logged allowing determination of the identity and home countries of attendees. Immediately after the close of the conference, a link to an online survey was emailed to all those invited to the AGM.

We iteratively developed the survey by reviewing online discussions of prior virtual meetings held at IBM, and via a pilot study of a conference held in a similar environment by an unrelated group. The final survey consisted of about 40 questions, 25 related to this study (AGM administrators added their own questions), and took approximately 10 minutes to complete. It consisted of a mix of Likert scale and short answer questions. Questions used alternating valances when appropriate; positive forms are used in this paper. Likert responses are pooled into "agree" and "disagree" categories. The survey was distributed the day after the conference ended and was open for a week. It was distributed to the 1095 Academy members and guests (e.g., presenters) who were *invited* to the meeting, but did not necessarily attend it. It received 444 responses (40%), though not everyone responded to every question.

Qualitative data were also collected. Three authors attended the conference as observers, taking field notes and screenshots; one presented a poster. Authors were not involved in the design of the virtual world or the conference. The week after the conference we interviewed 30 informants using a semi-structured protocol. Interviews typically lasted 30 to 45 minutes. All interviews were recorded; most were conducted by two people, one guiding the interview and a second taking notes. Data were analyzed by repeatedly listening to recordings and working over transcripts to extract emergent themes. Names, quotes and images are altered to preserve confidentiality.

## FINDINGS

### What Happened? The Event Itself

As an event, the conference appears to have been successful. 502 people attended from around the world, most returning for 2 or 3 days (Figure 5). About 350 people attended each day for the first 2 days, with a drop on the third day, perhaps because it had only one Keynote rather than 2 or 3 as on the previous days.

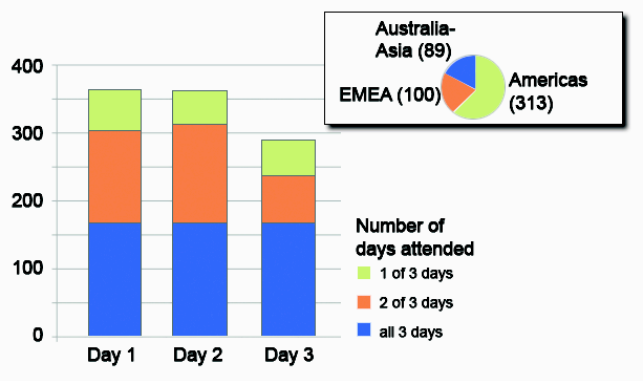


**Figure 5. Attendance in Second Life by day and geography**

All events we observed had significant attendance, and most participants appeared to use voice (spatialized audio) as their primary communication mode. Keynotes and Socials were well attended and often seemed crowded. Posters were not crowded. There were typically a few dozen people in an area that could accommodate hundreds (only a third of the posters were staffed per session). It was

not uncommon to see a presenter standing alone, although there were also always posters with visitors.

### How Well Did Things Go? Problems and Perceptions

The Second Life technology did not work flawlessly. Only 20% of the survey respondents reported that they experienced *no* problems. The rest experienced difficulties ranging from audio problems (52%) to server lag and machine crashes (35% and 31%), to difficulties logging on (27%). While a few participants experienced these problems to such a degree that they couldn't effectively participate in the conference, most experienced the problems intermittently or were able to work around them.

Two questions assessed respondents' feelings about the success of the conference as a whole (Table 1).

| Questions\Responses | Agree | Disagree | N |
|---|---|---|---|
| Overall, the Virtual AGM was a good experience | 66.2% (229) | 33.8% (117) | 346 of 444 |
| The time invested in installing and using the technologies … was worthwhile | 73.1% (285) | 26.9% (105) | 390 of 444 |

**Table 1. Success of the AGM in general**

Three other questions asked whether particular technologies worked well for their portions of the conference. Of those who responded, 54% (172) agreed that Second Life worked well; larger majorities of 86% (186) and 81% (191) felt the text-based forum and the video broadcasts worked well. Finally, the survey asked about the interactions in which they engaged (Table 2). Majorities said they 'bumped into' acquaintances, had informal small group conversations, and spoke to strangers. 40% reported meeting at least one new person with whom they expected to maintain contact.

| Question | Agree | Disagree | N |
|---|---|---|---|
| I unexpectedly encountered at least one acquaintance | 59.4% (167) | 40.6% (114) | 281 of 444 |
| I got into at least one informal conversation with a small group | 64.7% (189) | 35.3% (103) | 292 of 444 |
| I got into conversations with strangers | 52.4% (155) | 47.6% (141) | 296 of 444 |
| I met at least one new person that I expect to maintain connections with afterwards | 40.0% (118) | 60.0% (177) | 295 of 444 |

**Table 2. In-conference interactions**

### Experiencing the Conference

While it is interesting to see that a large scale virtual conference actually worked, so far this account leaves many questions unanswered. How did it work? What worked well? What was cumbersome? What did not work? To answer these questions we will look both at the fine-grained detail – how participants accomplished their interactions – and at the circumstances in which their participation was situated. We do this by drawing on interviews with 30 informants to assemble a richer picture of the AGM.

It is challenging to present qualitative data gleaned from interviews with many informants; the risk is that the reader will be overwhelmed by a multitude of details that form a fragmented picture of what transpired. To counter this, the qualitative data will be interleaved with a series of imagined accounts of users' experiences that present an accurate and coherent sense of what we observed. We emphasize that the details in the accounts are all real, drawn from the experiences of informants; what is fictional is the attribution of multiple details to a single user, and the narrative in which those details are embedded.

### Experiencing the Conference: Avatars

*Joost materialized in the Conference Center, surrounded by other avatars. To his surprise a few had quite outré appearances. But most hadn't spent much time on their appearance and looked eerily similar. He'd tried to make his avatar look like himself – but the settings seemed designed to make you look young and buffed, not 50, balding and a bit portly. So he'd settled for young and fit, with hair, and made sure that he looked business-like but distinctive. Now he was off to the conference, first walking and then flying. The system's performance was great, but that was thanks to his assistant who had upgraded his machine after problems during the on-boarding session.*

Informants generally agreed that they couldn't recognize others by their avatars. This was not seen as a problem because avatars had their users' real names floating over them, something informants found *very* useful. They reported recognizing the names of people they'd been on conference calls with, and looking up names in IBM's online directory to find out more about them.

Informants' efforts to customize their avatars ranged from none to hours spent on the task. One said that "*after a while it was just a sea of people who amazingly looked like they all came from the same family.*"[IZ] Those who customized reported several motives. Some simply wanted to avoid appearing as the default avatar. Others, especially first timers, were interested in presenting an appearance that was appropriate: "*I just prefer to be in formal dress … I think it's just making the person more approachable. Today if I go into an environment like this and someone has blue hair, I don't think someone will go up to them as easily as if they are just standing around in a suit.*"[OQ] Another said: "*I did go so far to get a business suit, etc. I tried to look like I would in a real business environment. And that was funny because a lot of people were in shorts and stuff; and that was kind of fun, but for me as a first-time attendee, it was important to look more professional.*"[DR]

A smaller number were interested in projecting a more individual identity. "*My avatar has blue hair and sparkly boots. … I wouldn't say it's not professional – it looks different and unique. That's the kind of look I was going for.*"[QE] Yet at other times it can be important to portray one's membership in certain classes. The same informant

said that as a female <ethnic> scientist involved in outreach activities, there were times – for example, speaking to groups in the <ethnic> community – that she would want to look <ethnic>. "*Sometimes you want to know how many women are here? How many <ethnics> are around here? That is hard to do in Second Life… and it's important to do if you are trying to encourage broader representation.*" [QE]

Users reported trying to make their avatars look like themselves, with little success. One said, "*It seems like the avatars are aimed at somebody who is using virtual life as a game or escape, not for business. So they make everyone young or good-looking. And every feature that doesn't … is hard to get.*"[IV] Informants felt this was important because, "*You wanna see how the person looks in real life so in the future if you get a chance to go to that particular site, you know how the person looks like and it feels a little more real.*"[BR] This holds true in reverse as well: "*Someone came by to my poster and I sort of recognized the name. The avatar looked very young and had sandy blonde hair and was very casual … Later when I looked them up in <the directory>, it was like a General Manager, who was 40 years older than the avatar looked*!"[DR]

In summary, the role of the AGM in promoting connections among employees had effects on avatar customization. Many were interested in being "appropriate," either out of concern for making a good impression or being approachable. Most interesting was the desire of some for a stronger link between virtual and real appearance, reasons ranging from being identifiable in the real world to the expression of gender and ethnic identity.

### Experiencing the Conference: Keynotes

*Sue's first event was a keynote. Others had happened, but they were during the wee hours of the morning Toronto time, so she'd passed. Then, since she was in her office, she'd been dragged into an 'emergency' meeting with a client. Now, finally, she was in the conference hall. She pointed at a seat and issued the "Sit down" command: this sat her avatar in the chair and adjusted her settings so that the slides filled her view and the speaker's voice came through clearly. But the experience was not perfect: there was lag, with slides taking a while to fill in; worse was that sometimes an avatar would teleport onto the stage next to the speaker, and blunder around before figuring out where it was. Very distracting! Streaming video might be better! Still, there was a text window where people were chatting, and she could look around and read the name bubbles of who was there. Why, there was Tian whom she hadn't seen in ages! It was nice to feel like she was part of a group.*

Many informants felt that the Keynotes were not worth the overhead, and that video streaming would have been better. They cited problems with lag, slide resolution, and sound (in line with the survey findings). Several noted (and we observed) that avatars would inadvertently teleport onto the stage during a presentation. And one informant remarked: "*You know how you see people on the stage doing dumb stuff? It's a little different when **your** name is on it!*"[UA]

A few liked having Keynotes in the virtual world. Some liked recognizing friends in the audience, or enjoyed the opportunity to converse in the chat channel. Most interestingly, some said they liked the feeling of being with others, in a way that video and web conferences didn't support: "*It's more participatory than a telephone conference call plus slides. I think some of it is you know you can if you want to look around, you can see other people in the virtual hall*"[IZC] Another remarked on a feeling of camaraderie: "*What was delightful was the number of people that showed up. … It made it feel worthwhile that I stayed up until 1 in the morning.*"[FV]

### Experiencing the Conference: Social Events

*It was evening in Bangalore, and Ramesh was logged in from home. His daughter had demanded a bedtime story, and he couldn't convince her that he was really "at" a conference – obviously, he was at home. But now she was asleep, and he was at the conference – lost! But he could cope: he'd IM'ed a colleague and she'd teleported him into the Social with her. This was his second Social. The first was conveniently at 8:30am his time, but few Europeans or North Americans had come at what were very late or early hours for them – the lazy bums. So to talk to the rest of the world **he** was the one who would have to stay up late: That's life in a 'global' corporation – hah! At least **this** Social was going well. The host had everyone in a circle, introducing themselves one by one. It was rather organized for a Social, but it was working: he'd already made note of two people to contact later. In contrast, the other Social had been awkward. People had formed small groups, but it was hard to tell whether you were welcome to join. In real conferences people noticed as you approached, and smiled and made room. But in the virtual world people often didn't notice – peripheral vision wasn't as good. Instead, he'd approached a group unnoticed and ended up feeling like an eavesdropper when he'd overheard a private discussion.*

Our impression from observations and interviews is that not as many people attended the Socials as the other venues – as one person said, "*getting a virtual glass of wine isn't as attractive as a real glass of wine!*"[IV] But because those attending could cluster together (unlike the spatially distributed posters), the Socials felt busier. Some liked this: *"Part of the reason this was easy is that everyone was moving around with the same expectation* [of meeting people]"[ZI] And: "*It was just nice, like being in a café … there were cups and you could take one, and there were people flying over. It just felt very comfortable, and like the poster session it was a good way to meet people.*"[DR]

Most had more mixed reactions; several mentioned a highly structured Social that contrasted with the more informally organized Socials. "*The first Social worked better, I thought. Because it was an organized Social, if that makes*

*any sense.* [The host] h*ad people introduce themselves and make comments – but it was a one-conversation Social. The other Social was more relaxed, but you couldn't really do one of those without running into other conversations that are going on*."[IZ] Another said "*The first one was really good. Everyone was together. There was a common discussion… Everyone got introduced. I think that was fine. …. The second meeting was split up more quicker. I didn't get a sense of common things…* [small groups] *walked off in different areas to have private discussions*."[ONK] Others echoed these sentiments, although one informant felt that the structured Social was "stupid" and "very artificial" and that while such organization would be "*fine for a group of ten people, it's not so great in a group of 25 people.*"[LT]

There are two underlying issues here. One has to do with group privacy. In general, voices carried much farther than people expected, and this led both to instances of inadvertent eavesdropping, and (once the 'loudness problem' was recognized) a concern that one's conversation would be overheard or would interrupt others. The conference setting did include "voice isolated areas," but most attendees weren't aware of them. Instead, some reported that they were reluctant to talk: "*There were times when I could have talked and didn't because I would have interrupted three other conversations that were going on quite a ways away from me.*"[IZ] Others compensated by moving their talks away from the main group: "*What I saw was people like* [C]. *He'd take someone and walk way up one of those ramps going to nowhere until* [he could have a private conversation]. *And that meant the Social wasn't working very well. You should be able to talk to this person and take a few steps and talk to that person, and not feel like you were broadcasting to a hundred people.*"[IZ]

The second issue had to do with the difficulty in knowing whether it was OK to join a group already engaged in conversation. "*In Second Life it becomes really strange to try to get into those discussion groups. It doesn't feel natural at all. It is hard to understand whether they've gone to the side because they don't want to disturb, or if they want to have a private discussion.*"[ONK] This is exacerbated because the cues used to assess if it's OK to join a group in real life are absent: "*I am missing all of this nonverbal communication forms: seeing someone, making sure they look back* [before I] *go and talk to this person.*" [ONK]

Although the Socials worked, they worked best when they were organized to support a single structured conversation. This avoids the privacy and joining-a-group difficulties, but some felt that these interactions were artificial or unnatural. Attempts to maintain group privacy by moving off succeeded, but tended to fragment the Social and undermine the spontaneous mixing that was one of its aims.

### Experiencing the Conference: Poster Sessions

*At first Tian had spent time in the poster directory area, where she'd browse the wall of poster abstracts and teleport to whatever interested her. But now she'd changed her approach, and she was strolling down the boulevard between the lines of posters. Sometimes she'd see a crowd and be drawn over out of curiosity; other times, she'd see a poster with only the presenter there, and go over because she felt sorry for the person. She'd presented a poster in another session, and knew how it felt. But she'd had some good chats at her poster and made some good contacts. She'd even talked to a VP! Unfortunately, she hadn't recognized him. His name had rung a bell, but she couldn't place it; later she looked him up in the corporate directory and immediately recognized him from his picture: his real life appearance – middle-aged, portly and balding – was not hinted at by his young, well-muscled avatar. Humph!*

To our surprise, given that poster sessions never appeared crowded, our informants repeatedly told us that the posters were the most successful aspect of the virtual conference. "*I seriously almost felt like I was there – it was amazing. I've done a lot of posters in real life, and you almost got that same feeling because you could see people walking by. When I first got there, someone I knew flew down to say hello and it was just so cool bumping into them. And then when I gave my poster, I could see people walking by, and you got the same feeling: are they gonna stop to see it, are they going to come in? It was great because I met some people that I know in RL, and that was nice. I met some people that I've only met on the phone, and it felt like really meeting them, almost. And then some people who I never met before, but only knew their name. It was really great! It felt like I had really networked with them. So in the end, I was very pleased with how it worked and how I really felt, and on that first day when I had spent so many hours in it, I felt that I had been away – on a trip.*" [DR] Another said: "*I was very surprised that I actually found it useful. I did have interactions with people… Some of my friends came by, and I engaged in technical conversations while we were reading and exchanging information about certain posters. All in all it was a positive experience and it worked much better than I anticipated… I really didn't believe it was going to work, but I think it did!*" [BF]

While some teleported directly to posters of interest, many also reported more conventional forms of navigation: "*I went to* [DR]*'s poster session not because I looked at the schedule and decided to go; but because I was in the space and saw that the poster was by* [DR]. *So then I went over; and that stimulated the thought that I should share the benchmarking stuff with her. So that was all accidental. It mirrored a face to face type of meeting.*"[AB] A number of others reported being attracted to a poster because it had a crowd (i.e., social navigation [5]): "*And in one case I went in because there were several people there; so it kind of had the appeal of "oh, well, he's already talking to those people, even if it's something I'm not smart enough to ask questions about, I'll go and hear what he's saying to them.*"[AC] Or because they saw someone they knew at the poster: "*If I saw a person I knew who was looking at a*

*poster, that was a natural magnet to see because I knew who this person was and what their interests were. Seeing who was attending which poster was helpful in guiding me in what I might be interested in as well.*"[BF]

The overhearing and other problems discussed in the case of the Socials tended not to occur in Posters. In part this was because the posters area was much larger and so participants were more spread out; and in part it was because the posters area was designed so poster booths were sonically isolated. That is, people walking through the posters area could see who was present, but could not hear conversations in the booths. Conversely, those in a booth could talk among themselves, but did not overhear or interrupt conversations in neighboring booths. This aspect of the design may be why Posters seemed better suited to spontaneous socializing than the Socials.

## DISCUSSION

We've established that the virtual conference was fairly successful. Perhaps the most convincing metric is that of the 300-350 people who came each day, majorities returned for a second and sometimes even a third day (Figure 5). Furthermore, each event had active participation, and majorities of survey respondents agreed that the virtual AGM was "a good experience," and that Second Life "worked well." Given that 80% of the survey respondents experienced some sort of technical difficulty, we can take "worked well" as referring to supporting the aims of the conference, rather than delivering a flawless technical experience. Here majorities of survey respondents reported bumping into acquaintances, getting into small group conversations, and talking with strangers, just the sort of interactions one would hope that a conference would afford.

While it is interesting to establish that a virtual world *can* support a professionally-oriented synchronous gathering of hundreds of people, it is more interesting to understand *how* it does so, and what is effective and what is less so. Informants consistently reported that Posters were the most successful, providing a remarkably parallel enactment of FtF poster sessions and supporting the casual encounters and talk that are a core aspect of conferences. Those attending Socials reported enjoying them, although paradoxically the most-liked Social was highly structured. The more informal socials were marred by two factors: sound that carried too far, and the difficulty of knowing when it was OK to join a new group. Keynotes were least successful, with many believing that streaming video would have been more effective, although a minority enjoyed being in the audience and looking around, seeing who else was there, and engaging in textual side chat.

### Interaction Among Hundreds: CoFIRe

While this paper's title refers to "Synchronous Interaction Among Hundreds," that should be qualified. While hundreds can interact simultaneously – think of an audience doing a standing ovation, or a large group doing a line dance – it is *not* the case that such large scale interaction is rich in interpersonal communications. Hundreds simply can't talk with one another simultaneously. Instead, the prospect that large gatherings offer is that one person will be brought into proximity with many others in a setting that allows some of the brief contacts to morph into interactions.

Remarkably, little work investigates the mechanics of such large scale interaction. To the best of our knowledge, only Goffman [8] looks at what he calls multi-focused gatherings (multiple small group interactions within larger unfocused gatherings), and his focus has been on the individual small groups, rather than on the interaction as a whole.

To frame our discussion we propose a model of large scale social interaction that begins with Goffman's observations, but takes a perspective that embraces the large scale interaction of multiple groups. Beginning with a large unfocused gathering, three things must happen to support productive large scale social interaction:

- **Coalescence**. First, interactants in a large gathering need to coalesce into small groups to enable coherent conversation. This includes both the formation of a group *ex nihilo*, and its growth as others join it.
- **Focused Interaction**. Second, a group needs to initiate and manage its focused interaction. In addition to the usual issues attending the conduct of talk [8, 9, 15], as Goffman has noted, small groups embedded in large gatherings face special challenges such as needing to "shield" their interactions from the gathering, while also managing the degree to which their interaction "drifts" from the settings' norms. [8, pp 151-190].
- **Remixing**. Third, as time goes on, groups must change their make up over time – a group dissolving *en mass*, or individuals joining and leaving it – to maximize the possible interactions. Only through this remixing can the promise of large scale interaction be realized.

Let's briefly reexamine the AGM in light of CoFIRe. While informants generally expressed satisfaction (if not unmarred by complaints) with both Posters and Socials, it is notable that the Socials did not work in the way they ought to. The Social that participants spoke most favorably of was the 'structured' social. It worked because the host transformed it into a round-the-table, "one-conversation" at a time event. In the less structured Socials, while participants formed small groups, the interaction broke down at that point. Because sound carried too far, the ability of the groups to manage their conversation was disrupted. While some groups moved away from the gathering to preserve group privacy, the increased inter-group distance inhibited remixing. Furthermore, as many reported, it was difficult to join an existing group. For people in an existing group, the restricted peripheral vision characteristic of virtual worlds meant it was difficult to notice someone on the periphery. Even if an outsider was noticed, it was cumbersome to produce the social cues – eye contact, nodding, smiling – that indicate welcome. And for the outsider, there was often

a reluctance to approach closely enough to be noticed, for fear of intruding on a private conversation. In sum, problems with sound and difficulty with producing cues disrupted the social mechanisms that supported CoFIRe; the only social that 'worked,' was the one without CoFIRe.

Another example of inhibition of coalescence and remixing had to do with co-navigation. Two informants noted that at FtF gatherings, one thing that would happen is that they would encounter a more senior colleague, and end up walking around the conference together, with the senior colleague introducing the junior to new contacts. "*The one thing I miss most, being a new academy member, is that walking around with someone that I've known from before who is an old time academy member, and using that contact to get to know new people.*"[ONK] This didn't happen at the AGM because it is cumbersome for two people to walk around together: the subtle cues that enable people to co-navigate in real time are missing.

In contrast to the Socials, the Posters worked more like their real world counterparts. It is significant that Posters offer structural support for each stage of CoFIRe. A poster provides a concrete nucleus for a group to coalesce around. The poster also provides a focus for interaction, and a set of mutually understood roles – presenter and audience, and at the same time supports private group interaction by spatial separation and built-in sonic isolation for each poster booth. Finally, the posters area supports remixing by making it possible for newcomers to see (but not hear) nearby interactions, and to see who is in each group (taking advantage of participants' floating name bubbles). Remixing is also facilitated by the norm that poster presentations are public conversations. In sum, Posters largely avoided the problems that disrupted CoFIRe in the Socials, through the presence of structural features (sonic isolation; poster booths), and associated social norms.

### Why Its Called "Second" Life

In the movie *Avatar*, the protagonist's mind is projected into an embodied avatar, enabling him to inhabit an alien world while his real body lies unconscious in a glass coffin. Unfortunately, those in Second Life have left behind real bodies that are neither unconscious nor sealed away.

As illustrated in the vignettes, that may mean that they are in their offices, at clients' sites, or at home. While a few were able to block their calendars and close their doors, the vast majority were visible and accessible. And sitting at their desks, typing on their computers and talking into headsets, they looked – to their colleagues and their families – just like they looked on every other day. Even if their managers agreed and their calendars were blocked, interruptions still happened. "*If I'm going out of town it's easy for me to say 'hey, I'm going out of town so I can't handle this client coming into my center and having a meeting.' It's expected if you're in town and in your office, that you don't prioritize an Academy meeting over a client.*"[QE] The same is true in the personal sphere: *"I only have a few times that I can rely on other people to, say, take my son to his piano lessons. If I were going away, I would bend over backward to get a neighbor to take him or cancel the lesson or something. But I didn't feel it was warranted here; I want to save those things.*" [DR]

These issues arise on a smaller scale too. Almost every informant admitted to multitasking while in the AGM. Some appreciated it as a benefit, and noted that they would do the same at FtF conferences. But most were ambivalent about multitasking: "*I think multitasking is necessary from time to time; it's not clear that you give your best to any of the activities that you do. … The older I get the more I think multitasking is a bad practice; I think it trains you to have ADD; I think it's a societal issue, not the technology.*"[DR]

An interesting side effect of this was that people didn't hang out between sessions. As one said, "*When there was time between events I was here at work and so I'd get back to doing my normal day job.*"[QE] Thus, whereas in FtF conferences the best time for interaction is *between* events, in the virtual conference, that's precisely when many vanished (or at least abandoned their avatars). Similarly, the evenings – an important period for socializing during FtF conferences – did not function in the same way: "*Even in the evening… when you're here* [at the virtual conference] *I expect everyone goes home at night and puts their laptop away and that's the end of it. At* [a former, FtF AGM] *there's stuff all night, you're socializing with people and that's part of the whole meeting.*"[IV]

Indeed, several informants said that an advantage of FtF conferences was the spatial segregation from day to day life that it required. Besides the spatial segregation, which took you out of view of your colleagues, for those who had to travel long distances there was also a temporal segregation that lowered the likelihood of interruptions from work or family life: "*It is easier to block your time, it is easier to get wide acceptance that you are away on a conference when you go. Especially for us in Europe when we go to the U.S. So we're off the time zones. It is easier for us to be really isolated and work dedicated on the conference*." [ONK].

## CONCLUSION

The virtual AGM was reasonably successful. Hundreds of people came each day, and large majorities returned for one or two more days. Majorities were positive about the value of the conference and the virtual world technology, and majorities reported engaging in the sorts of social interactions a large gathering should afford.

In examining the conference venues, we found varying levels of success. The Posters, to our surprise, and to that of many of our informants, worked well, often feeling similar to 'real' poster sessions. Participants also said positive things about the Socials, but they worked best when they were least like a canonical, informal social. In the case of Socials, structure compensated for features of the virtual

environment that disrupted the coalescence, focused interaction and remixing of small groups that characterizes large scale social interaction. Keynotes were least successful, although a few liked the feeling of being part of the audience, and the possibilities for peripheral and backchannel interaction it enabled.

However, while the explicitly designed AGM venues were generally successful, two entwined issues detracted from the overall atmosphere of the conference: the lack of interstitial periods, and the demands of "first life." First, unlike a FtF conference schedule, events in the AGM often immediately followed one another, for the obvious reason that time is not needed to support physical movement from one place to another, or for coffee breaks or snacks. Even when there was interstitial time, attendees would often 'step out' of the conference due to the second issue: the demands of 'first life'. Because of the demands of 'first life', and the fact that participants are not segregated from their family, friends and co-workers, virtual AGM attendees tended to vanish during gaps in the program to attend to business during the work day, and often preferred to spend non-work hours with family and friends. Overall, while the explicitly designed conference venues were successful in supporting many of the functions of a FtF conference, the lack of interstitial periods – which in FtF conferences afford communication and relationship building – was a clear shortcoming.

Having argued that the AGM was successful, we need to acknowledge some limitations on that claim. First, respondents tended to be those who actually participated in the conference. Although 54% of those invited did *not* attend, only 12% of the respondents were in that category. While this means that the survey provides a relatively high resolution picture of those who attended, it offers little insight on those who chose not to attend. Second, the population of IBM's Academy of Technology is not an ordinary one. Individuals are chosen, in part, for their technical acumen. The bottom line is that these results cannot be taken as an indication of how successful the technology would be for a general population. What the study *can* tell us is that under some conditions – for example, given a technically adept, motivated population – a large virtual conference can be successful.

One other issue deserves discussion here. Throughout the paper we have compared the virtual conference to its FtF counterparts. As many have argued (e.g., [12]), online interactions develop their own internal rationales and characteristics, and using their real world counterparts as a basis for a comparison may be a mistake. We agree, but in this particular instance we believe our approach is appropriate for two reasons. First, the virtual AGM that we studied was in fact a replacement for what had been a long tradition of FtF conferences. This was well known by our informants, and most made explicit and unsolicited comparisons between virtual and FtF conferences. Any account that reflects what our informants told us must necessarily take up the relationship between the virtual conference and its real counterpart. Moreover, the design of the conference setting mirrored many of the structural features of FtF conferences, even where unnecessary. Second, the majority of our informants were not "fluent" in Second Life, or in large virtual conferences. While online interactions do develop their own logics and structures, it takes time for this to happen, especially in events that involve so many participants. We believe, for this case, that it is premature to look for new interaction forms that have emerged to suit the characteristics of this new medium: virtual conferences are just beginning their evolution.

### Prospects for Large Virtual Gatherings

While we characterize the virtual AGM as a success, it is important to recognize, as noted in our opening quote, that it was not an unqualified success. Not a single one of our informants felt that it was as good as being there. They viewed the AGM as a substitute for what had formerly been a FtF event.

While our informants recognized and generally accepted the reasons for this, they also were concerned about the longer range effects. "*I understand it's a huge expense bringing all these people together. But I wonder about the long-term ramifications of not having people meet face to face; I just wonder if that's going to pay off for us over the next ten years.*"[AB] A repeated theme was that while they met people at the virtual AGM, it was harder to really connect. "*I may have a name jotted down from someone I ran across in a poster session, but that's different from meeting and talking to them FtF.*"[QE]. And "*What I find is that if I can meet people once in RL, then I can get that to carry on for many years. Because I'll talk to them and network and sort of cement the relationship. So it's hard, because I feel like I didn't get the chance to do that and it'd be nice to have a FtF to meet a lot of these people just once. And then maybe year after year, it would work remotely. So maybe the solution is to find a way to do a FtF every 3 or 4 years.*"[DR] Others were less sanguine: "*At the end of the day the company's got to bite the bullet, you know? You can't build a culture virtually. You can't do it.*"[OV]

There is, obviously, no final answer here. Having begun this evaluation with skepticism about how effectively a virtual world could support a large conference, we find ourselves surprised. Clearly some aspects of the virtual world support the fluid interactions that are important to gatherings of this sort, whereas others fall short. It seems to us that some of the shortfalls – the difficulties with sound, the cumbersome nature of some interactions – can be ameliorated. Furthermore, careful design of event and environmental structures to facilitate CoFIRe may be able to compensate for disrupted or inhibited social mechanisms. For example, an artifact that produced a translucent cone of silence might address some of the problems of Socials, or a

minimalist vehicle might enable dyads to effectively co-navigate and thus better support introductions.

On the other hand, some issues seem less tractable. Providing user interfaces that enable avatars to give (and give off) the social cues that underlie much of our interaction is a difficult problem. And so, at a more practical level, is the tension between first and second life, and the ensuing scarcity of opportunities for unstructured social interactions that create and reinforce social ties. Whether a virtual world can, on its own, sustain a vibrant culture over the long term is very much an open question.

## NOTES

[i] Second Life is a trademark of Linden Research, Inc.

## ACKNOWLEDGMENTS

Thanks to Chuck Goodwin, Christine Halverson, Pam Hinds, Bonnie Nardi and John Tang for literature help, and to our anonymous reviewers for useful comments. Thanks to the IBM CIO's office for funding portions of this work, and to the Academy for supporting our access to the AGM.

## REFERENCES

1. Bardzell, S., Bardzell, J., Pace, T., and Reed, K. 2008. Blissfully productive: grouping and cooperation in world of warcraft instance runs. *Proc. CSCW 2008*, ACM Press (2008), 357-360.
2. Brecht, M. A. Study of Meeting and Conference Behavior. PhD Thesis, John Hopkins University, 1980.
3. Churchill, E. F., Snowdon, D. N. and Munro, A. J. (eds). *Collaborative Virtual Environments*, Springer, 2001.
4. De Lucia, A., Francese, R., Passero, I., and Tortora, G. SLMeeting: Supporting collaborative work in Second Life. *Proc. Advanced Visual interfaces*, ACM Press (2008), 301-304.
5. Dourish, P. and Chalmers, M. 1994. Running out of space: Models of information navigation. Short paper presented at *HCI'94* (Glasgow, UK).
6. Ducheneaut, N. and Moore, R. J. 2004. The social side of gaming: a study of interaction patterns in a massively multiplayer online game. *Proc. CSCW* 2004, ACM (2004), 360-369.
7. Ellis, J. B., Luther, K., Bessiere, K., and Kellogg, W. A. Games for virtual team building. *Proc. DIS* 2008, ACM Press (2008), 295-304.
8. Goffman E. *Behavior in Public Places: Notes on the Social Organization of Gatherings*. Doubleday Macmillan, New York, 1963.
9. Goodwin, C. *Conversational Organization: Interaction between Speakers and Hearers*. Academic Press, New York, 1981.
10. Granovetter, M. S. (1983) The strength of weak ties: a network theory revisited. *Sociological Theory 1* (1983), 201–233
11. Hindmarsh, J., Fraser, M., Heath, C., Benford, S. and Greenhalgh, C. Fragmented interaction: Establishing mutual orientation in virtual environments. *Proc. CSCW 1998*, ACM Press (1998), 217-226.
12. Hollan, J. and Stornetta, S. Beyond being there. In *Proc. CHI 1992*, ACM Press (1992), 119-125.
13. International Congress and Convention Association. Statistics Report: The International Association Meetings Market: Abstract for non-members. 2008.
14. Jones, M. L. 2000. Collaborative virtual conferences: Using exemplars to shape future research questions. *Proc. CVE 2000,* ACM Press (2000), 19-27.
15. Kendon, A. *Conducting Interaction: Patterns of Behavior in Focused Encounters*. Cambridge University Press, Cambridge, MA, 1990.
16. Lee, S. J., Fox, E. A., Marchionini, G., Velacso, J., Antunes, G., and Borbinha, J. Virtual DL poster sessions in second life. *Proc. 9th ACM/IEEE-CS Joint Conf. on Digital Libraries*, ACM Press (2009), 473-474.
17. Linden Labs, Inc. www.secondlife.com
18. McDonald, D.W., McCarthy, J.F., Soroczak, S., Nguyen, D.H., and Rashid, A.M. Proactive displays: Supporting awareness in fluid social environments. *ACM Trans. Comput.-Hum. Interact. 14*, 4 (2008), 1-31.
19. Moore, R.J., Ducheneaut, N. and Nickell, E. Doing virtually nothing: Awareness and accountability in massively multiplayer online worlds. *J Computer Supported Cooperative Work, 16*, 3 (2007) 265-305.
20. Nardi, B. and Harris, J. 2006. Strangers and friends: collaborative play in world of warcraft. *Proc. CSCW 2006*, ACM Press (2006), 149-158.
21. Shami, N.S., Cheng, L.-T., Rohall, S., Sempere, A. and Patterson, J. Avatars meet meetings: Design issues in integrating avatars in distributed corporate meetings. In *Proc. GROUP 2010*, ACM Press (2010), 35-44.
22. Teigland, R. Born virtuals and avapreneurship: A case study of achieving successful outcomes in Peace Train – a Second Life organization. *J. of Virtual Worlds Research, 2,* 4 (2010), 1-24.
23. Oppermann, M. and Chon, K. Convention participation decision-making process. *Annals of Tourism Research, 24,* 1 (1997), 178-191.
24. Oxford Economics USA. The return on investment of US business travel. September, 2009. Retrieved from http://www.ustravel.org/sites/default/files/09-10-09_Oxford%20Economics.pdf on January 13, 2011.