Avatars Meet Meetings: Design Issues in Integrating Avatars in Distributed Corporate Meetings

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ABSTRACT

The difficulties remote participants of distributed meetings face are widely recognized. In this paper we describe the design of an avatar-based e-meeting support tool named Olympus, which aims to ameliorate some of the challenges remote participants face in distributed meetings. Olympus provides a customizable peripheral display on the bottom of existing e-meeting solutions. An initial observational study was conducted of the use of Olympus in 6 meetings, three each of a status meeting and a presentation meeting. By illustrating how avatars were used in the two meeting types, we hope to surface design issues and refine our understanding of how avatars may be useful in the design of online meeting spaces.

Categories and Subject Descriptors

H.5 [**Information interfaces and presentation**]: Group and Organization Interfaces – *Web*.

General Terms

Design, Human Factors.

Keywords

Distributed meetings, avatars, virtual worlds.

1. INTRODUCTION

Distributed meetings are becoming increasingly common in organizations. While they offer organizations the potential for cost savings through reduced travel, such meetings have not been without their challenges. Research on distributed meetings has documented numerous obstacles faced by participants in these meetings such as reduced trust and feelings of isolation [2, 21], reduced engagement due to multitasking [27], lack of cues causing difficulty in jumping into the conversation [20], and reduced awareness of other participants' presence and understanding [19, 39].

There has been recent interest in exploring the value of using virtual worlds for distributed meetings. In particular, the popularity of 3D virtual environments such as Second Life (www.secondlife.com) has caused researchers to ponder whether the use of avatars can mitigate the bottlenecks of distributed meetings [16, 17, 25, 37]. Yet empirical explorations of what avatars are really good for have been few and far between.

Over the last several years, our research group has sought to understand what value avatars add to distributed corporate meetings. Our work in this area has been inspired by three streams of thought: 1) social proxies, 2) ludic design, and 3) phatic communication.

Social proxies are minimalist graphical representations of the presence and activity of participants [8]. They provide a social context for interaction through cues of users' activities without eliminating all vestiges of privacy. Social proxies can take advantage of the human ability to draw inferences from traces of activity, and support social processes such as conversation, which allows groups to function effectively [9]. While an avatar is generally thought to be an animated pictorial construct, it can also be as minimalist as dots on a screen. The first research question we wish to explore in this paper is the avatar preferences and interactions of users in different types of meetings through a tool that allows choices of different avatar representations. When will avatars be used for chat and gestures? Will users move around with their avatars to engage in conversations with others nearby?

Ludic design espouses a vision where work mixes with leisure, where the mix of enjoyment, experience and play are looked upon as essential [e.g. 12, 23]. In this design philosophy, playful experiences emerge from interactive products that allow users to have a playful approach while using them [23]. In corporate meetings where the primary purpose is to get work done, avatars may provide a means of engaging in social play that makes the meeting more engaging and interesting. By integrating a primarily social tool in the productivity oriented context of corporate meetings, we wanted to see how such a social tool would be appropriated. Our second research question is: What do conduits of playfulness add to serious task oriented meetings?

Phatic communication can be thought of as communication that is low in information or data but is nevertheless high in significance and/or meaning [36]. It has often been observed as 'small-talk', which has been described as 'crucial in holding a community or society together' [10]. Phatic technologies are designed to foster social bonds rather than to communicate information. As Vetere et al. claim, these technologies support the maintenance of social relationships by satisfying the need to feel connected [36]. A tool that fosters such phatic communication may enable information exchange similar to outeraction [29] – communicative processes

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that produce a feeling of connection with others. Our final research question follows from this: Is there evidence that avatars increase social bonds through phatic communication?

We utilized the concepts of social proxies, ludic design and phatic communication in the design of Olympus - a Flash-based (www.adobe.com/flashplatform) strip of avatars presented at the bottom of an e-meeting solution that acts as a peripheral display providing awareness of meeting participants. This paper describes the motivation, design and user study of Olympus. Our goal is to surface design issues when integrating avatars into distributed corporate meetings by addressing the research questions outlined above. First, we begin by reviewing relevant prior work on meetings and meeting support tools. We then reflect on our own experience designing 3D virtual environments that acts as motivation behind the design of Olympus. The design is then discussed. Next, we empirically examine design considerations through two case studies of real world distributed corporate meetings. Results of the case studies are presented and we conclude with implications for avatars in meetings.

2. RELATED WORK

2.1 Review of Meeting Types

There are varieties of meeting types, and by extension, distributed meetings. The 'Description and Classification of Meetings' (DACOM) study provides a classification system for meetings [33]. The DACOM categories of purposes and activities of meetings include 1) information seeking, 2) problem solving, 3) giving information, 4) generation/discussion of ideas, 5) delegation of work, 6) inspection of fixed objects, 7) decision making, 8) negotiation, and 9) presentations. Obviously, a meeting could fall under multiple categories. Monge, McSween & Wyer [28] extend this taxonomy to include 1) develop plan, and 2) review product/process status. Easton et al. [6] argue that there should be a match between features of the meeting support tool and the type of meeting it intends to support. The size of the meeting also has implications for meeting support tools. A videoconference may be suitable for a small number of people, but inappropriate for meetings with over a hundred attendees. A contribution of this research is to determine the type of meetings in which an avatar-based meeting service makes a difference.

2.2 Meeting Support Tools and Avatar Based Tools

There have been a number of tools for supporting distributed meetings. For example, Meeting Central provides a suite of software to support distributed meetings [39]. Distributed Meetings (DM) is a system designed to broadcast and record meetings, as well as allow browsing of archived meetings [4]. There have also been various implementations of 'smart' meeting rooms that use sensors and virtual reality techniques (e.g. [11, 13, 15, 30]). These systems provide promising avenues of research, but also require users to either use expensive equipment or proprietary software.

More recently, researchers have begun to investigate the use of graphical avatars in meetings. Welbergen et al. describe the design of a 3D anthropomorphic presenter that presents information based on captured meeting data [37]. Harry & Donath use avatars' position in various spaces of a virtual world as a reflection of meeting participants' feelings [16]. The SLMeeting website by Lucia et al. interfaces with the popular Second Life virtual world to provide support for online meetings [25]. Porta-Person is a rotating remote controlled display that shows a remote participant's video image or animated representation [38]. Although not designed with a graphical avatar, the 'Embedded Social Proxy' telepresence device shows a constant video feed of a remote participant that can be moved to wherever a meeting is being held [35]. Project Wonderland (https://lg3d-wonderland.dev.java.net/) provides a toolkit for building 3D interactive virtual worlds, including meeting spaces. While not specifically designed for distributed meetings, Comic Chat [24] and ExMS [31] employ innovative uses of avatars for messaging. Finally, websites such as Weblin (www.weblin.com) and RocketOn (www.rocketon.com) allow users to interact with avatars on a webpage. Given the interest and prevalence of avatars in meetings, it is surprising that only a few studies (c.f. [18]) detail their use. Our study aims to contribute to this body of research by empirically investigating the value avatars add to real-world corporate distributed meetings.

3. DESIGN MOTIVATION

The design of Olympus was motivated by our past experience developing immersive 3D virtual environments.

3.1 Embedding a Virtual World on the Desktop

Our prior work involved designing a virtual world that integrates into a collaborative software development environment [32]. The system was designed to explore how a Windows desktop based virtual world could support meetings and socializing in distributed software teams of a large information technology (IT) services company. In pilot trials, we found that adoption was low. When we inquired about their low usage, users emphasized the high barriers to entry. Significant time had to be invested to download, install, and configure the virtual world. Running it demanded computing resources that dwarfed the development environment. Our experience was consistent with researchers who suggest that the success of collaborative systems is dependent on the costs and benefits of usage to the individual user [1, 14]. As the barriers to use are reduced, more users participate. Based on this experience, we felt that a more lightweight approach would increase adoption. Rather than support completely 3D environments, we focused on one interesting aspect of virtual worlds - the expressiveness of avatars. We implemented this in a lightweight manner without placing significant demands on users in terms of computing power and time needed for installation and configuration. Employees are typically reluctant to go through such hassles for their meetings.

4. OLYMPUS: A LIGHTWEIGHT VIRTUAL WORLD

Based on the lessons learned from deploying a virtual world in an enterprise setting, we built Olympus. Our philosophy was to augment existing e-meeting solutions with avatars. The Olympus client is Flash based. The server uses both a commercial product for state sharing and a web proxy service to help mash up our Flash-based avatar service with existing web-based slide and screen sharing services in the company. We streamlined the login process for the company's e-meeting services into a single, shareable, authenticated URL. As a result, Olympus works across Flash-enabled browsers and operating systems. By mashing up with existing e-meeting solutions, users do not log into a virtual

Figure 1. The complete Olympus interface. Presentation space (A) was minimized to reduce height of screenshot.

world for a meeting. Instead, we bring the virtual world to users in a familiar e-meeting context via one click with zero hardware or software setup. Our approach emphasizes the expressiveness of avatars, and minimizes decorative features of a virtual world.

Figure 1 displays the complete user interface of Olympus. The main area of the interface is dedicated to slides or screen sharing (A). Every user in Olympus is represented with dots along two parallel lines. A user's own avatar is represented with a slightly larger green dot (B), while others are represented with orange dots. Hovering over a user's dot with the mouse (C) reveals the user's name, job description and contact information. There is a text box at the bottom of the interface (D) that allows users to enter chat. Chat appears as chat bubbles as well as in a scrolling chat log (E). Depending on entered text, the avatar will automatically display certain gestures. For example, typing in a '?' at the end of a sentence will trigger the 'dunno' gesture. Users can minimize the scrolling chat log to just show a single line of chat if they want. On the right of the interface there is an area for users to scroll through over 30 gestures (F). Figure 2 illustrates some sample gestures. Users can preview a gesture, hold a gesture, or add a gesture to their favorites. However, the easiest way to gesture is to type '/' and start typing in the name of the gesture. Olympus will display an auto-complete dialog based on entered text.

The interface provides a stage for presenters and participants to queue up to ask questions or comment (G). The stage provides meeting participants with awareness of who the presenter is, as well as an avenue for remote participants to be more visible, should they choose. Participants go on the stage by clicking on their own avatar and confirming they want to enter the stage. There is a limit of 3 participants on the stage. Others are queued up with a number in the order they clicked, and the dot representing them displays their order in the queue (H).

Figure 2. Some sample avatar gestures.

Olympus acts as a customizable peripheral display allowing users to choose the amount of information they want displayed. The interface allows users to toggle between four avatar modes by clicking (I). Figure 3 provides sample screenshots of each mode. When users log into Olympus for the first time, they are presented with an avatar customization window similar to figure 4 that displays a set of randomly generated avatars. Users can select an avatar to quickly enter the meeting and later customize it by

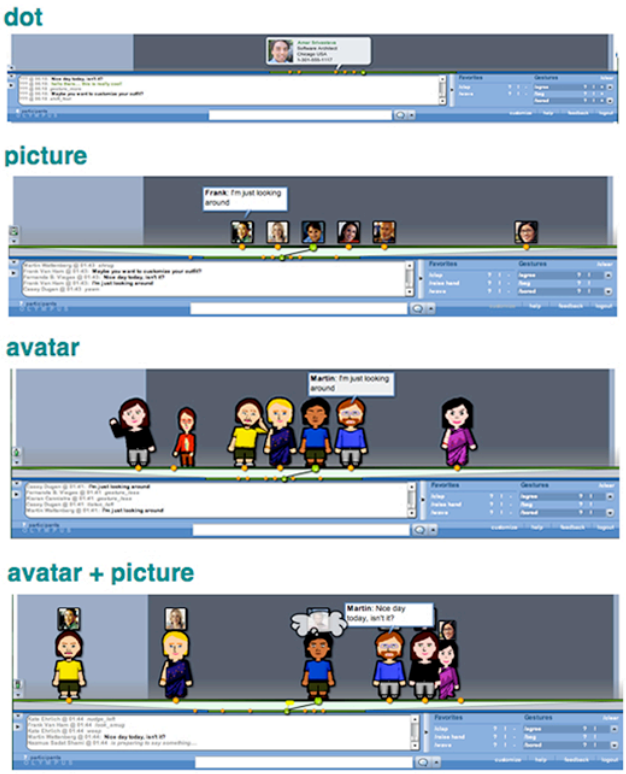

Figure 3. Four different modes of avatar representation.

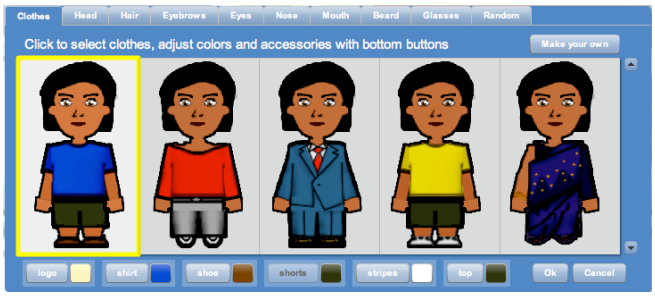

Figure 4. Avatar customization dialog.

clicking 'customize' from within the interface. This allows users to get on with the meeting without spending much time customizing their avatars. The avatar customization window allows users to customize the clothes, head, hair, eyebrows, eyes, nose, mouth, beard and glasses of an avatar by clicking on the corresponding tabs illustrated in figure 4. Our avatar creator was modeled after the popular Nintendo Wii™ Mii creator. Users can also upload their own content by downloading a photoshop template, making changes, and uploading it back to the server.

4.1 Different Avatar Representations

We were interested in exploring which mode, from minimalist static to animated expressive, would be chosen by users in the context of different meetings. The different modes could be considered as different representations of social proxies. These are: a) dot, b) picture, c) animated avatar, and d) animated avatar with picture, as shown in figure 3. Users can move around horizontally in all modes. In light of the 'uncanny valley' effect [26] - the tendency of humans to feel uncomfortable with avatars that photo-realistically resemble humans - our avatars are intentionally cartoonish. As a manifestation of ludic design, we felt cartoonish avatars would encourage playful behavior.

By default the first time a user logs in, they are asked to customize their avatar and are then presented in 'avatar' mode at the center of the screen. As avatars are the only customizable representation, we wanted a user to have an avatar they were comfortable with before entering the meeting. A user's avatar will always be at the center of the screen regardless of which way she moves, akin to a first person shooter perspective. She has the option of switching to any of the other 3 modes. Switching a mode renders all avatars to appear in that mode to her. 'Dot' mode provides the most minimal representation where users are represented with dots. 'Picture' mode, where users are represented with pictures from the corporate directory, is a more expressive yet static representation. 'Avatar' mode is a more expressive animated representation where users can customize the look of their avatars and gesture. 'Avatar with picture' mode combines the animated expressiveness of avatars with the static representation of a picture. Users can animate their avatars in the two avatar modes through a selection of over 30 gestures. In this way, Olympus provides four representations of avatars as social proxies.

It is worth emphasizing that the scrolling chat log can be collapsed to display a single line of chat, thus further reducing the space Olympus takes up. Olympus remembers the mode a user is in so the next time they log in, they will be in the same mode as when they last logged out.

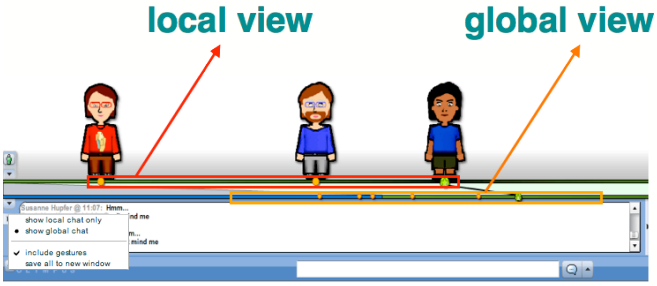

Figure 5. Scoped chat showing local and global views.

4.2 Place and Space

In an in-person meeting people typically sit beside those with whom they want to have informal side-conversations, as a form of phatic communication [36]. We wanted to use that as a metaphor for Olympus. Prior research has shown that minimal representations of users moving around in space facilitated social interaction [8, 9]. We felt that allowing users to move around would enable them to stand beside others they wanted to be near and have informal conversations with, even though they could not do so in person. To prevent conversations from getting tangled and difficult to follow, we implemented a scoped chat. As can be seen in figure 5, each user in Olympus is represented with a dot along two horizontal parallel lines. The top horizontal line, with slightly larger dots, is the 'local view' and only shows those visible on a user's browser screen. Other users may go off screen, but even if they do, they are always represented by a dot on the bottom horizontal line. That line, with slightly smaller dots is the 'global view', which shows everyone in the meeting. Whenever a user chats or gestures, a little yellow chat bubble appears in the global view (see avatar + picture mode in Figure 3), providing awareness of activity of users not on the screen. Users can hover over the dots on either of the parallel lines to reveal more information about the people represented through the dots. Our rationale behind the local and global view was to accommodate a larger number of meeting attendees by giving them extensive horizontal space to move around in, and to allow participants to separate into clusters. We intentionally did not implement private chat in Olympus. In the organization in which this was deployed, instant messaging was widely popular and employees were comfortable having secure private conversations in it. In Olympus, users have the option of viewing everyone's chat or just those in their local view. Additionally, it allows users to save the entire chat transcript from the beginning. So users that arrive late can get caught up on what transpired during their absence. The chat log options are shown on the left in Figure 5.

5. A TALE OF TWO TEAMS: CASE STUDY OF OLYMPUS

In order to understand the usage of Olympus in authentic settings, we had two teams, 'intranet editors' and 'innovators club', of a large IT services company use Olympus in three of their meetings. We felt a study over three meetings would lessen biases of novelty and learning.

The intranet editors team consists of 8 team members (3 male, 5 female) who are in charge of managing the publication of relevant articles on the corporate intranet. They normally use an online video conferencing system to conduct their weekly *status meetings*. These meetings run from 30-40 minutes depending on

the agenda. Their average tenure in the company was 13.1 years and the average time working on the team was 1.9 years. The team leader characterized the purpose of his status meetings as:

"First of all it's a team coordination meeting so that we can address any issues regarding the projects we're working on. I would then say it's a team management meeting so I'm able to communicate to my employees and hear from them. And then there's a very crucial social component that's intentional. Because this is a geographically dispersed team, one of the intentions of the meeting is to have some social cohesion."

The innovators club is a loosely connected group of individuals that come together weekly to hear an hour-long *presentation* on a topic on innovation relevant to the company. It has an official membership of 215 individuals but an average of 15 members attend any given meeting. Although there is a team lead that organizes the meeting by scheduling speakers, there is very little sense of formal hierarchy among team members. Everyone participates remotely through an audio conference with slides shared beforehand through email. Their average tenure in the company was 19.6 years and they had been involved in the club an average of 3.3 years. The purpose of the meeting, in the words of the team lead:

"Give people awareness of innovation activities that matter within the company mostly. After that, having people try out tools. Third reason is so that they can begin to find each other and create awareness of what others are doing."

6. Method

In the meeting invites of the two teams, members were provided a link to our project website that had a video, FAQ and background information about using Olympus. Realizing everyone would not use this information, we provided a brief demo of Olympus at the start of the first of the three meetings (hereafter referred to as meeting 0). We discarded all data from meeting 0 realizing that it would be colored by novelty or learning effects. Nonetheless, meeting 0 served the purpose of making team members familiar with the system while they engaged in their regular meeting activities. The data reported in the case studies are from meeting 1 and 2 of both teams. We collected three forms of data; a) a log of all user actions, b) observations of meetings and recorded audio, and c) 15 minute semi-structured interviews scheduled as close as possible to the conclusion of the meeting. The majority of the interviews were conducted within two days after the meeting. All members of the editors team were interviewed after meeting 1 and 2 (N=16). Among the 34 employees that attended meeting 1 and 2 of the innovators club, 23 of them agreed to be interviewed. With the participants' permission, the interviews were recorded, transcribed, and analyzed using Grounded Theory [34].

We adopted a case study approach as we did not have control over team size or task. This is thus not a controlled experiment, and our results should not be interpreted as such. Real teams using Olympus for real tasks provided us with a preliminary understanding about the use of avatars in meetings.

7. Results

7.1 RQ1: Avatar preferences and interactions

7.1.1 Time spent in different avatar modes

In order to see differences in the time users spent in particular modes, we ran a one-way repeated measures ANOVA on the

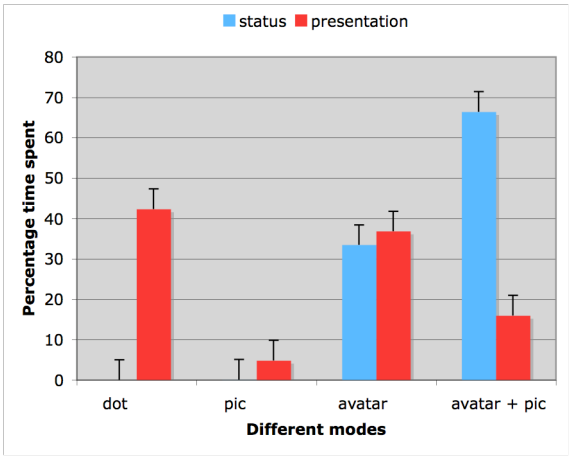

Figure 6. Percentage time spent in different modes by users that changed mode at least once.

normalized percentage time users spent in each mode. When a new user logs in for the very first time, they are in avatar mode by default. Olympus remembers the mode users were in when they log out, allowing us to use mode as a measure of preference. We calculated total time in each mode, discarding the time new users spent in avatar mode when they first used the system. Essentially we only considered the time starting from when a user changed mode from the default. Normalized time for each user was calculated by dividing the total times spent in each mode, by the total time spent in the meeting and converting it into percentage. We only included users that changed modes at least once since this demonstrated to us that they were aware of other modes. In this way, our measure is intentionally biased against 'avatar' mode since it was the default. In all likelihood, there were more users that preferred 'avatar' mode. Six out of 8 users changed modes at least once in the editors meetings, indicating 2 users always stayed in avatar mode. On the other hand, 19 out of 28 users changed modes at least once in the innovators club meetings, indicating 9 users always stayed in avatar mode. The blue bars in Figure 6 show the percentage time users spent in each mode in the status meetings, and the red bars in the presentation meetings. For the status meetings, the results show a significant effect of mode type on the percentage of time users spent in a mode (F[1,10]=6.47, p <0.05). Post-hoc pairwise Bonferroni corrected comparisons reveal that users spent significantly more time in avatar + pic mode than dot mode ($p < 0.05$) and pic mode ($p < 0.05$) in the status meetings. As a reason for preferring avatar + pic mode in the status meetings, participants mentioned:

"Even an unchanging picture of someone gives me more cues to who they are than an avatar… I don't think I get that level of information from avatars quite yet. But the avatar does add something -- some of the members used the expressions and gestures and the playfulness is useful and enjoyable to me."

"While video might be more serious and help you really see what people are saying and how they are personally gesturing, the avatars give you a sense of their personality and it gives you kind of another outlet to talk about. And even when we use the video camera we would use the like change yourself into an avatar thing. So having the avatars definitely adds to that and the gestures they can do."

For the presentation meetings, the results also show a significant effect of mode type on the percentage of time users spent in a

mode ($F[3,54]=3.28$, $p<0.05$). Post-hoc pairwise Bonferroni-corrected comparisons reveal that users spent significantly more time in dot mode than picture mode ($p < 0.05$). No further pairwise differences were found ($p > 0.05$). Users reported that collapsing Olympus down to dot mode allowed them to focus on the presentation slides, which was their main purpose behind attending the meeting.

7.1.2 Avatar customization

Users found the avatar customization process to be extremely smooth. Members of the editors team spent on average 54.46 seconds (*max*=4.9 minutes, *min*=10.8 seconds) per avatar customization session. On average a participant customized their avatar 5.9 times (*max*=15,*min*=1) across both meetings, with the majority of customizing occurring during the 'social' time of the meeting. However, two remote participants customized their avatars a few days ahead of the meeting so they would be ready. This suggests that most users tweaked their avatar incrementally. When we asked users how easy was it to get a fairly representative avatar in a short amount of time (1=not at all, 9=extremely easy) the mean response was 8.57 (*SD=0.53*). In interviews, users mentioned that they spent significantly more time trying to customize their avatar in a manner that would resemble them in other 3D worlds such as Second Life, often with much frustration. This is reflected in the following quote:

"For me I'm not as enchanted by them as I think most people are… I go there to exchange ideas with people. Being able to, you know the primmed hair and the blinged out shoes and all that is nice to have and makes it a very rich space. But I would almost be just as happy in IRC if it was organized better visually. For me the technical things that slow it down or cause hiccups often compromise what's being done in terms of idea exchange."

Members of the innovators club found the avatar customization process to be extremely smooth as well. Members of the team spent on average 83.42 seconds (*max*=8.58 minutes, *min*=52.8 seconds) per avatar customization session. On average a participant customized their avatar 1.8 times (*max*=7, *min*=1). Since most members were new to Olympus for the meetings they attended, the number of customizations is smaller compared to the editors. When we asked users how easy was it to get a fairly representative avatar in a short amount of time (1=not at all, 9=extremely easy) the mean response was 8.1 (*SD=0.8*).

Interestingly, across both teams, participants customized their hair the most (39 times), followed by clothes (35 times), beard (33 times), glasses (33 times), and head (32 times). This is consistent with Ducheneaut et al.'s finding that distinctive features of avatars such as hair matters [5].

7.1.3 Avatar gestures and chat

An aspect that sets Olympus apart from traditional e-meetings is the ability of participants to gesture. Figure 7 displays the amount of chat and gestures in meetings 1 and 2 of the editors meeting, as obtained from the log. We started counting 5 minutes before the scheduled start of the meeting *(t-5)* since some participants logged in early and we wanted to include their data. The category of 'social' was determined when there was sustained social banter not involving work. For example, at the beginning of the meetings, participants commented on each other's avatars.

D (to female colleague whose avatar had a moustache): Wow you got a little buzz on your upper lip there. Let me tell ya puberty is tough!

M: You need a wax job. Wax that moustache.

Y: You look like my Aunt Louise.

'Work' was determined when the team leader started the formal meeting with utterances such as *'I want to go around the table for some updates.'* Carefully looking at Figure 7 (a) and (b) reveals a pattern of chat and gesture use. The beginnings of the meetings are characterized by high use, followed by a decrease coinciding with the start of 'work'. There's a little strip of 'social' in the middle of Figure 6 (a) when the team leader made a point to use Olympus to 'clap' in admiration of the work of a team member. This led others to gesture and joke as well.

Figure 8 displays the amount of chat and gestures in meeting 1 and 2 of the innovators club. There was no activity before the scheduled start time of *t* in these meetings. The category of 'presentation' in the charts refers to the start and end of the presentation. 'Non-presentation' includes the time allowed for participants to join at the beginning, and for Q&A at the end.

The two meetings display slightly different but related patterns. Similar to the editors team, there was much activity at the beginning, which slowed down as the meeting progressed, and then picked up again towards the end. In addition to similar social banter that was expressed in the editors team, participants of the

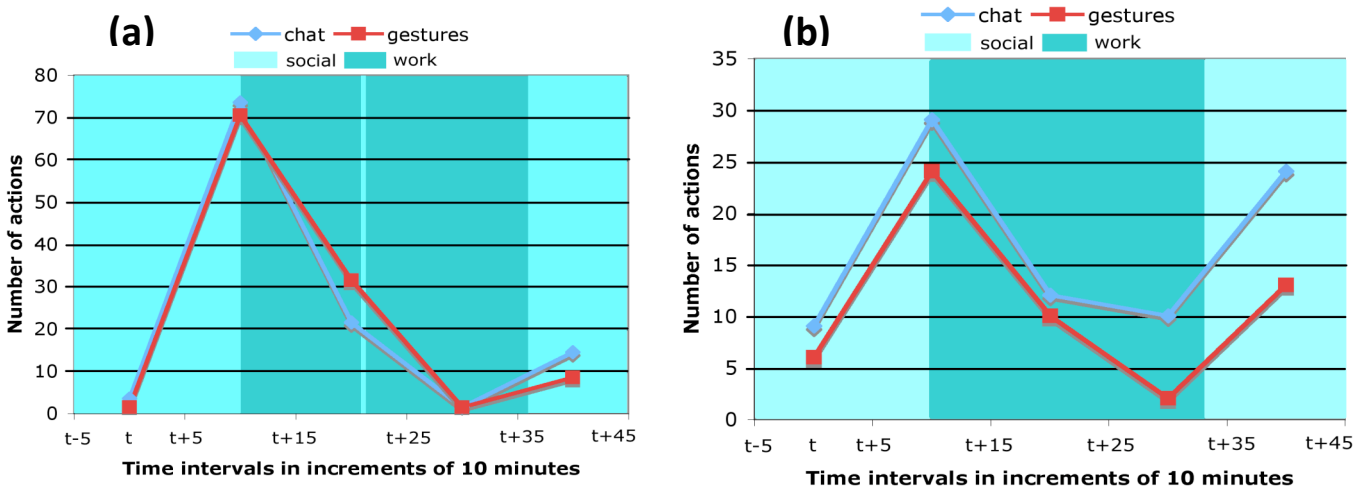

Figure 7. Amount of chat and gestures over meeting content and time in (a) meeting 1 and (b) meeting 2 of the editors team.

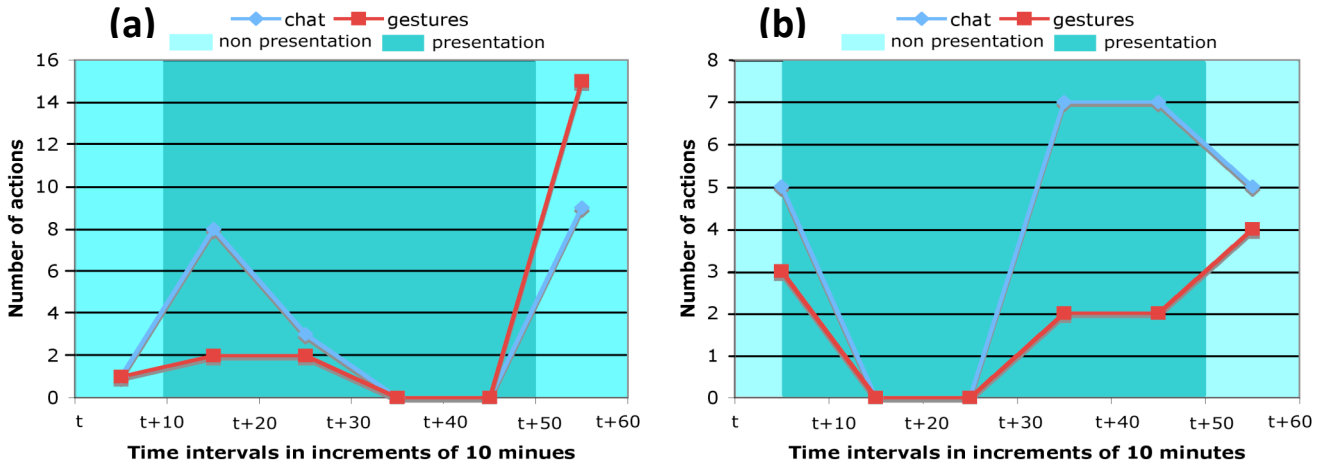

Figure 8. Amount of chat and gestures over meeting content and time in (a) meeting 1 and (b) meeting 2 of the Innovators club.

innovators club used chat and gestures to ask and answer questions. Since attendance was fluid (only two users attended all three meetings), many of the users missed the demo of Olympus during meeting 0. Consequently, during the beginning of the meeting, they were using chat and gestures to ask other meeting participants how to use Olympus. The chat and gestures towards the end were related to asking questions or making comments to the presenter, as well as for social exchanges. The presenter was quick to notice questions during meeting 1 and provided answers almost instantly during his presentation. The presenter during meeting 2 was not as skilled, but other members contributed in providing answers and comments through the chat interface.

The 5 most frequently used gestures by the editors team were as follows (numbers in parentheses are the number of times a gesture was used): clap (20), agree (6), wave (6), laugh (6), smile (6). Although these were positive, some negative gestures were also used, e.g. nodoff (4) and sleep (3). The top 5 frequently used gestures by the innovators club were: clap (6), agree (5), wave (2), think (2), and look at watch (2). Interestingly, the top 3 gestures of the editors team and the innovators club were the same.

It is noteworthy that the majority of users would just type in gestures with '/' rather than use the list of gestures on the right of the interface. Users also rarely used the 'Favorites'. Typing was more natural and easier to do.

As mentioned in section 4.2, we implemented a globally scoped and locally scoped chat. The default was global. Among the 16 users in the editors team, 8 used the local chat. Among the 28 users in the innovators club, 14 used the local chat. This indicates that the scoped chat feature was about equally useful to some, but not others.

7.1.4 Avatar movement

We allowed avatars to move around thinking users would want to stand near certain people and engage in conversations with them. We calculated a correlation between movement and chat and gestures by counting the number of chats and gestures entered by users within 3 minutes of moving their avatars. Contrary to our expectations, movement and chat was negatively correlated ($r = -0.21$, $p < 0.05$) in the editors team. Given that the editors team was relatively small in size, users did not move their avatars much and preferred to chat from wherever the avatars were located. There was no correlation between movement and gestures ($r = 0.09$, $p > 0.5$). We performed the same analysis for the innovators club. Movement was not correlated with chat ($r = 0.17$, $p > 0.05$), nor with gestures ($r = 0.06$, $p > 0.05$).

The stage in Olympus was intended to make the presenter prominent and provide feedback to the presenter about questions/comments from the audience. In the editors team, members were familiar with each other, knew each other's voice and could recognize who was talking. The norm of going on the stage to present or ask a question did not emerge and consequently the stage was not used much. In the innovators club meetings, the presenters went on the stage during their presentations. However, meeting participants did not use it to queue up to ask questions. Again, most members were new to the system and the norm of going onto the stage to ask a question had not been created.

7.2 RQ2: Playfulness in serious task oriented meetings

Ludic design espouses a vision where work and play intertwine to create an enjoyable experience. The editors team used the avatars as a vehicle to introduce fun and play, typically at the beginning of the meeting.

L: Oh nice the weird goatee guy just clapped.

(clearly audible laughter by the others on the audio).

D:[Z] is cheering. Nice cheer [Z]!

The end of the meeting would typically be characterized by gestures such as 'laugh', 'wave', 'ciao'. Some users would use their avatar to crack parting jokes.

Q: I tried to gesture Swedish but it didn't happen

E: Oh [Q] is freaking out. What did you do? /weep?

Q: Yes I did weep.

E: Cry does the same thing. Oh good, it knows synonyms.

Users sometimes tried to compensate for the limitations of the technology through humor. When reminding team members to be careful about the H1N1 virus, the leader of the editors team commented:

P: We need to add that gesture to Olympus.
T: Did you see I tried forward slash 'hand wash'. No, it just does

'hand wash'. I'll bet 'clap' looks like 'hand washing'. Oh yeah look (laughter) my guy's washing his hands!

The other meeting participants then used the 'clap' gesture to wash their hands, which added some levity to the meeting. Some found it easy to introduce humor in the meeting through avatars:

"I'm on the phone so I don't get the visual cues letting me know if this the good time to jump in. So if I want to crack a joke I can easily do it without interrupting someone."

While we witnessed the above playful interactions in the editors team, the innovators club members did not engage in much playful interaction. Perhaps the nature of the meeting was responsible for this. The status meeting of the editors team had a goal of making team members comfortable with each other so they could work together effectively. The use of playful humor through avatars allowed team members to be more comfortable with each other. On the other hand, members of the innovators club were not working on a project together. They were there to listen to a presentation, and minimized the avatars to dots to reduce distraction.

The avatars did not interfere with the instrumental aspects of the meetings of the two teams. When we asked members of the editors team about how well the meetings achieved their purpose, the mean response to this question (1=not at all, 9=extremely well) was 7.43 (*SD*=1.13). The mean response of the members of the innovators club on the same question was 8.0 (*SD*=1.17).

7.3 RQ3: Social cohesion through phatic communication

Both the editors meetings and the Innovators club meetings were characterized by the use of avatars for socializing before and after the meeting. One may expect socializing before meetings, but in our experience attending distributed corporate meetings, people typically do not stay afterwards since they usually have work to attend to. Somewhat surprisingly, avatars enabled phatic communication even after the meeting. Participants of both meeting types were geographically distributed, and some participants had never met their remote colleagues in person. As mentioned in the previous section, participants took advantage of the playfulness of the cartoonish avatars to engage in social banter in the editors team meetings. According to our participants, this may have increased team bonding through social play.

"There was a team building element to it that was apparent the first couple of times we used Olympus. I'm not sure how effective it was in advancing the agenda of the meeting, but I think it was very effective in building cohesion in the group."

Another participant mentioned:

"I like the avatars. I like the sensation of being with people. It just makes it more personable. I like seeing the funky people. I usually put their [corporate directory] pictures on top. There's a sense of being together, even though they're cartoons. If I move closer to one person that means I'm giving them more attention."

Participants used the line-up of avatars as an expression of team camaraderie:

"I need a screenshot of this. This is like a team photo. I'm just bummed we don't have the full crew here."

8. DISCUSSION

This research was motivated by a broad interest in understanding the impact of avatars in distributed corporate meetings. We argued that lightweight implementations of avatars would reduce barriers to entry and make the experience more enjoyable through phatic communication. Consistent with our philosophy, participants were quickly able to join avatar-enabled e-meetings in one click, and create representative avatars of themselves. Participants in the editors team commented that they could tell whose avatar was whose without having to mouseover to find out.

A philosophy of ludic design is that fun and play leads to an enjoyable and engaging experience. Participants had fun fooling around with avatars before and after the *instrumental* aspects of the meetings. A consequence of such social play was increased social communication among team members, which has been shown to lead to stronger social relationships and improved team morale [22]. Casciaro and Lobo found that having an active liking of team members was necessary for task competence and leveraging the intellectual capital of organizations [3]. The value of avatars in corporate meetings may lie in improving team cohesion [7]. One of the reasons people travel to attend meetings is the opportunity to engage in informal communication afforded through face to face (FTF) interaction. As much as avatars can encourage such informal communication when FTF interaction is not possible, they may provide value. Participants reported that the way their remote colleagues would customize their avatars gave them a sense of their creativity. The gestures used by their remote colleagues gave them a sense of their personalities. These affordances of the avatars allowed meeting participants to get a better sense of the remote colleagues they were working with. As an example of the value of the playful avatars, a participant mentioned:

"But from my perspective it's like I'm not doing business with resources, I'm doing business with people. And I do need to understand who they are. Because we all have moods and we all have our funny personality quirks and if we're all going to work together we need to um [sic] take those into account and see each other as whole individuals. So I do see avatars helping sort of advance that effort of people working with people as opposed to resources collaborating on an initiative."

Another participant mentioned:

"I like having something other than the phone so you get a sense of peoples' personalities and you get conversation going."

During the instrumental aspects of the meetings, some participants considered the avatars to be distracting, especially during the presentation meetings where participants wanted to pay attention to the slides. This highlights the tension between applying ludic principles, as operationalized through playful avatars, in business contexts. According to one participant:

"When I really wanted to focus I found myself ignoring the avatars. When there's a level of urgency or intensity the voice becomes the most important part."

Another participant was torn between the distraction and utility:

"It's just that thing again. It's distracting a little but it also gives me more information."

In order to achieve increased adoption of avatar use in distributed corporate meetings, future research should investigate design approaches that balance the social and task oriented aspects of

meetings. For example, a possible design might be to only make the avatar of the presenter visible during the instrumental aspects of a meeting.

During meeting 1 of the editors team, there was an incident where a user was glad to take advantage of the affordance of an avatar as a social proxy. Some participants were self-conscious about having a constant video feed of themselves when they were not presentable.

A: You can't believe how happy I am that you guys can't see me.

D: I figured that after getting emails from you at like 2 in the morning that you'd want to ditch the cam for today.

The editors team reported liking the gestures, but they also felt it was an added step that they did not need to perform when video conferencing. Puppeting an avatar required additional effort that was not required when using video conferencing. Although there was sometimes a lag in the video that made it difficult to read body language, they still felt that was preferable to puppeting an avatar. Nevertheless, they were inclined to agree that for larger meetings where little webcam windows become impractical, avatar gestures could make a difference. They suggested adding a 'webcam' mode as an addition to the existing modes for smaller meetings. Another possible design alternative could be to automatically detect a user's facial expressions and puppet an avatar accordingly. Such alternatives will need to be weighted by aspects such as the costs of computational power and lack of 'plausible deniability' against the perceived benefits accrued.

Avatar preferences of the innovators club suggest that when the goal of the meeting is to focus on the presentation, non animated representations may be adequate. In addition to using chat and gestures to ask questions without interrupting the presenter, members of the innovators club used the dots to get awareness of who else was in the meeting, something they could not do in their usual audio conference. Some reported finding a friend, one who they didn't know would be attending, and having a bit of informal conversation. *'The whole idea of having the avatars and having the little pop up information makes it easy to go around.'* To improve this experience further we suggest tools that provide cues of connectedness such as shared contacts or skills that can serve as ice-breakers and facilitate social conversation.

One theme that emerged prominently in our interviews with participants was multitasking during meetings. Participants were concerned with two forms of multitasking. One is working on tasks unrelated to the meeting. Another is paying attention to both the presenter and others' avatars. According to one participant:

"On teleconferences there have been times when people put themselves on mute and do their own work. When someone asks a question, there is silence. It seems like people disengage 80% of the time. The meeting becomes longer."

Interviewees felt interacting through avatars made them more engaged in the meeting since they needed to puppet their avatars and pay attention to others' avatars, leading them to work less on unrelated tasks. For example:

"I think it kept me more engaged on the slides as opposed to having the temptation to switch over, you know, multitask. Typically in a presentation you're listening to, you can wander off with other thoughts unless there's things to keep your attention."

On the other hand, some participants reported wanting to multitask during the meeting, but if their avatars were non-responsive, that would give away the fact that they were multitasking. Participants mentioned that the amount of multitasking they did was a function of how much work they had on their plate. Designers need to consider whether they want to support multitasking or provide for 'plausible deniability' when using social proxies such as avatars.

Contrary to our expectations, we did not find a correlation between movement and chat/gestures. Olympus was designed in a manner in which movement was not necessary to engage in the meeting, it was an optional element. In 3D worlds such as Second Life, movement is an integral part of the experience, as it is required to explore the virtual world. Our findings suggest that when movement is not required for participation, users may not engage in it. This may lead to the so-called 'statue effect' where avatars just line up and do nothing like statues. When designing for movement around space and place, designers should consider whether movement is essential for engaging in the experience, the costs and benefits to the user for such movement, and how easily the user can figure out how to move around.

Interestingly, the editors team could have continued using Olympus after the study but did not, while the innovators club did. The editors were already familiar with each other, whereas perhaps the innovators club saw the potential of Olympus to increase member familiarity.

9. CONCLUSION

This paper discussed how we utilized concepts of social proxies, ludic design and phatic communication to develop a meeting support tool. We deployed it in two different types of meetings; a status meeting and a presentation meeting. Our results suggest that avatars are helpful when the purpose of the meeting includes socializing, whereas minimalist dots are adequate when the purpose is to focus on a presentation. Additionally, avatars are useful for socializing before and after a meeting, which may lead to increased team cohesion. Avatars may provide little value for meetings with an instrumental task, but for meetings that include a social component, they may encourage informal information exchange through playful interaction. This may be particularly useful for newly formed distributed teams where team members are just starting to get to know each other. Our observational study thus provides an initial understanding of the affordances of different forms of avatars for different types of meetings and offers suggestions for their use in real-world distributed meetings. Further research is needed to empirically test these assertions regarding the affordances of avatars.

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