Proximity-Based Chat in a First Person Shooter: Using a Novel Voice Communication System for Online Play

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ABSTRACT
Voice communication between players can have many benefits relative to text-based communication for game play and social experience in fast-paced multiplayer online games. However, previous research has highlighted some problems with existing implementations of voice-over-IP in online games and suggested the need to carefully design voice communication systems if they are to positively contribute to the game play and social experience of online multiplayer games. In this paper we present the results of a field trial of the "Immersive Communication Environment", a novel voice-over-IP system designed to support player communication in online games by simulating in the game world the way utterances travel through air in the physical world. We found that the proximity-based constraints imposed by this voice communication system created some advantage for players in terms of their game play and their experience of the game as a social event. The findings suggest that players benefit from voice communications systems that make socially salient information available to them according to interactional affordances and constraints that are sensibly designed and well understood.

Categories and Subject Descriptors
D.3.3 [**Programming Languages**]: User interfaces – *User-centered design, Voice I/O.*

General Terms
Design, Human Factors.

Keywords
Video games, computer games, multiplayer, first person shooters, voice communication, VoIP, game play, social experience, sociability, social translucence.

1. INTRODUCTION
To date, most online multiplayer videogames have predominantly relied upon some form of typed text messages for communication between players, and text is still an important medium for communication in these distributed computer games. However, many players of these games have appropriated a variety of third-party Voice-over-IP (VoIP) applications so that they can talk with other players. In addition, several online multiplayer games now have integrated voice communications features that enable geographically-distributed players to converse with one another. While the use of voice communication in online multiplayer games is growing, there is still much to learn about how best to design and implement these facilities. It remains unclear what kind of voice communication features will best serve different genres of games and how to configure these features for different game situations [7, 12]. Some have argued that the addition of voice communication to online games enhances the social experience of game play [6]. However, others have suggested that voice will detract from immersion in online role playing games, and that text should remain the preferred communication medium in this genre of games [1]. Further, while some research has shown that voice can improve communication and team coordination in a fast-paced action game [7], not all users readily adopt voice communication in online games [11]. Research suggests that this may be due to suboptimal configuration of the voice channel in some games [5] and has highlighted the need to carefully consider how voice channels are configured if they are to enhance both competitive game performance and the social experience of game playing [7, 12].

Most voice communication systems used in multiplayer games to date have been configured in a way that may be thought to be explicitly or implicitly drawing on a "two-way radio" metaphor [12]. Utterances are broadcast to all other players (or all team members) and can be heard equally well by all recipients, irrespective of their in-game situation. In effect, each player who has voice equipment (a headset and VoIP client) provides a "virtual walkie-talkie" to their game avatar. By contrast, some researchers have recently experimented with VoIP systems in which transmission quality varies with the in-game location of player avatars [2, 9]. The Immersive Communication Environment (ICE) system [2] simulates the passage of sound through air. Player utterances are rendered so as to sound as though they are coming from the location of the speaker's avatar, and players hear each other's utterances with a volume and clarity related to the distance between their avatars in the game-world.

In this paper, we present preliminary results from a study that has examined players' experience of, and response to, ICE. The starting point for our analysis of this study is to consider multiplayer games as technologies that provide a competitive environment and a social experience [11]. We draw on the concept of social translucence [4] in our analysis of players' use of ICE. Thus, we have been interested in whether limiting player communication according to avatar location affects game play and the social experience of multiplayer first person shooter games. In future research we plan to trial ICE in other genres of games.

2. SOCIAL TRANSLUCENCE

In the context of designing technologies to support online communities, sociability has been described as 'planning and developing social policies and supporting social interactions' [10: p605]. Sociability and usability are closely related yet usefully separated concepts for analyzing and designing technologies that support online communication. While usability concerns the interaction between a user and an artifact, sociability concerns the interactions between people that occur via artifacts. Under the rubric of sociability, we include the policies and norms as well as the design features of the mediating technology that govern and influence online behaviour. Although sociability focuses on the interactions between people, the mediating technology must be useful and usable if it is to support convivial and efficient social interaction [8].

Sociability is a useful construct for understanding computer-mediated communication, including that which occurs in online multiplayer game play [11]. To successfully enable cooperative, sociable interaction in digital environments, close attention should be paid to the forms of social interaction afforded by mediating technologies. In terms of designing online multiplayer computer games, sociability emphasizes the importance not only of planning for the interaction between the player and the game, but also planning for the interactions between the people playing the game [11].

We believe that voice communication can be a valuable addition to the game playing experience and the sociability of the game environment if it is 'socially translucent'. Social translucence is a design approach that emphasizes the importance of making socially significant information visible to participants in digital environments [4].

Social translucence has two dimensions. First, socially translucent systems make socially salient information available to participants. This visibility enables participants to be aware of others and their actions. This awareness helps bring the social rules, norms and customs that govern participants' actions and interactions into effect. It also allows participants to be held accountable for their actions. Visibility, awareness, and accountability are crucial to the sociability of digital environments because they enable participants to structure their interactions with one another in coherent and sensible ways [4]. Thus, in the design of sociable online games, it is important for users to be able to easily discern and identify the other users with whom they are interacting, and to be able to readily associate game activity and actions with particular identities and personas.

Second, socially translucent systems are not transparent; rather, communication within these systems is constrained. In the physical world, physical laws constrain communication and determine who can receive what information or communication in what circumstances. People use these constraints as a resource in social interaction. For example, it is far easier to see and hear a person standing by one's side than it is to see and hear someone across a crowded room, and this proximity constraint is routinely used in a host of communicative acts such as raising and lowering one's voice depending on one's intended audience and social situation. Similarly, in designing socially translucent systems, attention needs to be paid to the 'physics', or rules, that govern communication within these digital environments. Furthermore, if participants share an awareness of the constraints that underlie the visibility of socially significant information in a digital environment they can use this understanding as a resource for structuring their social interactions. Thus, we would argue, sociability within online game environments is enhanced by making socially salient information available to participants according to interactional affordances and constraints that are sensibly designed and well understood by those involved.

3. METAPHORS FOR VOICE CHANNEL DESIGN

Erickson and Kellogg [4] suggest that we approach the design of socially translucent systems by first asking what properties of the physical world support graceful, coherent and nuanced communication between people. Previously we have suggested that game developers can use a range of metaphors drawn from existing real-world communication technologies to structure the use of voice communication by players in different genres of games [12]. These metaphors can provide game developers with useful heuristics for the design and configuration of voice communication systems within multiplayer games. While the range of metaphors is large, we will limit our discussion to two which are most relevant to understanding the operation of ICE. Those metaphors are 'two-way-radio' and 'sound-in-air'.

Two-way-radio: most voice systems currently used with video games can be understood as operating according to a 'two-way radio' metaphor. These systems operate as if the avatar of every player was carrying a walkie-talkie radio set. When one player speaks, all players who are tuned to the correct channel are able to hear. The ability to listen to another player is not affected by position within the game or any conditions other than having access to the channel being used. Access to the channel can be conferred by being on the same team or group, or by subscribing to a third party service as part of a game playing group, clan or guild and having access to login details such as IP addresses, names and passwords.

Teams of players in first person shooters such as Counterstrike, or guilds and similar player organizations within Massively Multiplayer Online Role Playing Games (MMORPGs), who use third party VoIP services such as Ventrillo or Teamspeak can be understood as using a communication system that operates according to this metaphor. All players connected to these services can hear each other equally well regardless of their avatar's position within the game. Recent games with built-in voice communication facilities such as Battlefield II and Dungeon and Dragons Online (DDO) can also be understood as implementing a similar voice communication metaphor. For example, the voice facilities in DDO enable players in the same team to speak with each other with a quality and character independent of other game play states such as avatar position within the game-world. Players in the same team can speak with each even if their avatars are at opposite ends of the game world, yet they cannot speak with players in other teams, even if their avatars are standing next to them in the game world.

Voice systems configured to operate like two-way-radios are well suited to supporting the communication needs of small teams of players negotiating a large virtual space. The availability of channels allows communication to be restricted only to members of a team. However, radio is prone to channel congestion. In

games where a large number of team members share a voice channel, players are by necessity developing voice protocols and radio discipline similar to those used by real-world radio operators.

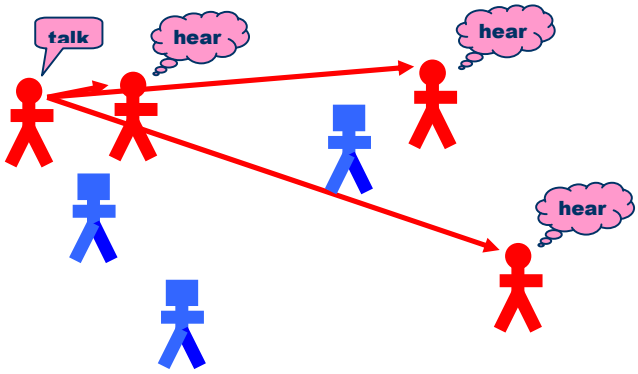

Figure 1. two-way-radio metaphor.

We would expect the two-way-radio metaphor to be well suited to games that involve the coordination of groups of soldiers, vehicles and the like who are moving through a large space. However players of games in which this is not the main activity may be better served by communication tools based on other metaphors. The two-way-radio metaphor may also be inappropriate in a game set in a historical period prior to the invention of radio. And players may wish to converse with other players who are not on their team.

Transmission of sound through air: In the physical world, when we engage in face-to-face conversations, our voices are carried from speaker to listener as sound waves traveling through air. The volume and clarity of these transmissions are related to the distance between the speaker and the listener: the sound of a speaker's voice is attenuated over distance and the distance a voice will be carried to a listener depends on the volume of the speaker's voice. A speaker can shout to be heard at a large distance and/or by a large number of people; or can whisper close to someone's ear so as not to be overheard.

Voice communication systems for video games can be designed to replicate these properties of the transmission of sound through air. Using this communication metaphor, only players whose avatars are close together in the game world can communicate with each other. Communication is unconstrained by team membership or channels. If team members wish to converse they must come together at a meeting point in order to communicate as a group. Similarly, players can freely talk to other players who are not part of their team provided they are in close proximity in the game world. Players can listen in and eavesdrop on each other's communication, if their avatars are close enough within the game world. However, problems may occur in massively multiplayer games when large groups of players collect within the same part of the game world. Unrestricted and unfettered communication could lead to an unintelligible din if the voice system is not designed to control the effects of crowds on its performance.

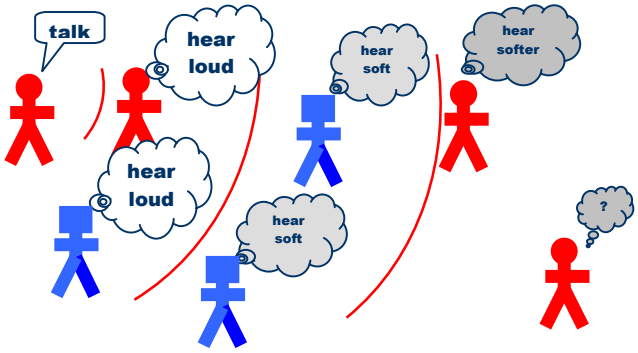

Figure 2. sound-in-air metaphor.

There are other metaphors such as point-to-point telephone communication that could be drawn on as heuristics for designing voice communication systems for multiplayer video games. In some games or game genres it may be desirable to provide several voice communication methods to players and allow them to switch between them according to circumstances.

We have described two metaphors that can act as heuristics for the design and configuration of voice communication systems. In our study we examined the impact of one of these metaphors – the transmission of sound through air – on game play and social experience. In the next section we describe ICE, a system designed to render players' voice communication within three dimensional games space by simulating the transmission of sound through air.

4. INTERACTIVE COMMUNICATION ENVIRONMENT (ICE)

The ICE system was designed to provide a realistic sound scene for multiple players to communicate using voice in a virtual environment [3]. Rather than simulating radio communication, ICE simulates the transmission of speech sounds traveling through air. Speech travels between players with a volume, clarity and direction related to the relative positions of the players' avatars in the game world. Using ICE, players whose avatars are close to each other can hear each other clearly, while those whose avatars are far apart cannot, and players can tell the direction from which voices are originating. Properties of the virtual environment, such as the placement and reflectivity of walls and other obstacles, are also taken into consideration by ICE when calculating the transmission of a player's speech.

Whereas most VoIP clients work independently of the game being played, ICE must read game world maps and be integrated with the game software so that information about avatars and the game world can be input to the calculation of sound scenes. For our user trials, ICE was integrated with two team-based first person shooter games: Counterstrike Source (CS) and Wolfenstein: Enemy Territory (ET).

ICE did not restrict vicinity chat to team-mates only; enemy players whose avatars were close to a speaking player were also able to hear a player's utterances.

ICE was also equipped with a hot-key that allowed users to temporarily switch to a "walkie-talkie" mode that allowed

communication with the whole of the player's team irrespective of their location in the game world. This did not mute the transmission of a user's voice into their avatar's vicinity; and all players with avatars in close proximity were still able to hear the transmitting player's voice as well.

5. THE STUDY

In the trial, ICE was used by a group of co-workers who had already played ET with each other at least once a week for several months and continued to play this game as part of the ICE trial. Initially seven participants were involved in the study but two more joined after the first couple of weeks. Participants were all experienced players of ET. Most of them also had experience with using VoIP clients such as Roger-Wilco, Teamspeak or Ventrillo as part of their previous gaming experience, which enabled them to draw comparisons between ICE and these other systems.

Participants were asked to continue playing their regular ET session, but to use ICE to communicate while playing during the study. Players were observed and videotaped while using ICE. Two participants were 'shadowed' during each trial session. 'Shadowing' refers to participants being observed and video-taped during the session to collect information on how they set up ICE, any difficulties experienced, how ICE influenced their game play and their interactions with other players, and so forth. Each player was shadowed once, with one player shadowed twice (on the first session and again at the final session). In addition to being shadowed, each participant was asked to keep a diary in which they were encouraged to record their experiences of using ICE, whenever they had time to make an entry, e.g. between game-play sessions, after a session, at home, and so forth.

A pre-trial interview was held with all participants approximately one week before the trial commenced. Interview questions sought participants' demographic data, their history with game play and their experience with online playing and other voice technologies.

Post-trial, the participants handed back their diaries for analysis, and participated in an informal 'close off' session to discuss impacts on game play. The researchers analyzed the pre-trial questionnaires, the video logs and observational notes, and the diaries. The trial lasted 4 weeks; however after the trial players chose to continue using ICE. After several more months of use they participated in a more formal focus group.

In the rest of this paper, we present a preliminary analysis of the participants' reactions to ICE and comparisons of ICE with other VoIP systems.

6. PLAYERS' EXPERIENCE OF A PROXIMITY-BASED VOICE SYSTEM

In line with other studies, the participants in this study reported that voice improved both game-play and the social experience of online gaming, compared to text communication. More significantly, players compared the proximity-based communication provided by ICE favorably to the two-way-radio style of communication provided by other voice systems. We report this in detail below.

It is worth noting that it took time for players to accustom themselves to ICE and for them to realize benefits from it. In part, this was due to technical difficulty getting ICE to work reliably for all players in the first couple of game sessions. It was also due to players taking time to become familiar with ICE, and accustomed to talking out loud while playing. After several months of using ICE regularly one player commented in a focus group discussion:

> *Now that we've used it for much longer […] it's actually become part of the game as well. You actually start to miss it. Like when you're shouting and someone is not responding. Things like that. You're actually using it a lot more, whereas previously you had to make a conscious effort to use it.*

Over time, ICE was appropriated by the players and became an important part of their gaming sessions.

Technical problems early in the trial mean that, in some sessions, teams included members who were not using voice. In these situations teams tended to fragment into two groups: those with voice communication and those without. Although all team members had access to text chat, team members with ICE tended to stop paying attention to the text channel, and to team members who were restricted to it. The cognitive load of attending to multiple channels within a fast paced game was too high for most players most of the time, and players tended to focus on the most immediate and easiest communication channel available. Examination of the word count of text logs before and during the trial indicated that text usage decreased significantly with increased use of ICE.

ICE allowed players to hot-key between its featured "proximity" mode of voice transmission and a broadcast or "walkie-talkie" mode like that found in other VoIP systems. Initially players tended to use the broadcast mode to converse with team mates. However as the study progressed players discovered advantages of the proximity system and they reverted to the broadcast mode less often.

> *If you have six people on Ventrillo at the one time, you can lose track trying to listen to three conversations at once, whereas with ICE you can only hear people who are nearby, which in many respects is what you want. You want to filter out all the rubbish that's not relevant to you.*

As this player discovered, proximity can act as a filter for relevance. That is, the proximity mode allowed players to only talk to other players who were in their immediate vicinity, and therefore most likely to be involved in the same action.

> *It's very easy and natural to do that with ICE. You can just react to a situation immediately and call 'look-out' or whatever, and you don't think twice about it.*

A call for help - "more ammo" or "I need a medic" – was best answered by someone close by. Proximity based voice communication meant that such a call was "automatically" addressed to players who were most likely to be in a position to help. Anyone hearing the request knew it was coming from nearby and likely to be relevant to them. Likewise, warnings such as "two enemies round the corner" and "look out - landmine" were only useful when the speaker was nearby. During game-play, directions and commands were often situationally relevant: for example "go left", "follow me" or "get the truck". As these examples indicate, players' utterances while using ICE were highly indexical. The awareness of player proximity enabled by ICE became an

interpretive resource drawn on by players to make sense of the rapidly unfolding situations in which they were engaged.

> *For me the proximity – i.e. I can hear them therefore they are close to me – was a lot more important than whether it was coming from the left or right.*

ICE allowed small conversation groups of two or three people to form and disband easily and fluidly as the game progressed. In existing VoIP products, where many players share a single voice channel, multiple and overlapping conversation threads often develop and it can be difficult to resolve who is talking to whom about what. However, while using ICE players tended to form and disband conversation groups as they moved their avatars around the game-world, based on who was in close proximity to them at any particular moment. They were able to do so, in a relatively easy and naturalistic way, without the need to manually select or configure voice channels as they went, as is necessary in other VoIP applications.

Proximity based communication was used by teams to develop plans and strategies on-the-fly as they moved through the game world.

> *The team is running off with four or five guys on a particular map - in those ten or fifteen seconds from point A to Point B we might have already hatched a plan on ICE, and been discussing a plan, and been using that opportunity moving as a group… Whereas, without it… you miss that.*

ICE also influenced how players moved through the game world. In the first game session we studied, after around 90 minutes of experimentation with ICE, players from one team adopted the strategy of waiting at the respawn point for fellow team members to appear, so they could discuss what they would do next. As a result, rather than individual players respawning and running off to tackle game objectives alone and in an uncoordinated fashion, players started tackling those objectives as a group. In this game session, the practice of moving together to stay within communication range resulted in significantly improved team performance, because the players tackled game objectives en masse. This change to game play was carried over into subsequent sessions and became a feature of team play: Players were keen to point out that ICE helped them play as a group in which they worked together, rather than as collection of individuals who were all notionally on the same team, but not engaged in collaborative play.

> *Before, we never planned anything, we just ran off. Now, pretty much before each and every game, we huddle together and we decide right, you're going to be engineer and you're going to be medic and we try to have some sort of a plan. […] Before it was pretty much everybody on their own.*

The proximity restriction within ICE encouraged players to stick together in the game world. This not only improved their game performance, but helped support player experience of the game as collaborative engagement.

When playing on some of the smaller maps, voice chat was not used as frequently as when players were roaming through larger three dimensional game-worlds. Players explained that on smaller maps it was possible to see most of what others players were doing, which lessened the need for communication. Strategies on smaller maps were also simpler, reducing the need for planning and coordination. On larger maps, with complex objectives, players used ICE more for planning and coordination.

It was clear that ICE lead to more conversation between players. While much of this was related to game play, the voice channel was also an important medium for social engagement and enjoyment. While players could see benefits for game play in terms of planning and better team coordination, they also highly valued the social experience enabled by ICE. A plan that failed disastrously was enjoyed as much as one that worked. Pleasure was found in the sharing of the experience with others. In a focus group discussion, one player noted in reference to how ICE enabled team members to make tactical plans, "*And then, five seconds later you see your plan totally disintegrate*," which was met with general laughter, and another player laughingly added, "*And then we're screaming at each other, 'where are you going? (more general laughter)'*" Indeed, players who had returned to playing ET on ISP game servers without ICE, noted that the games had become "silent" and "so quiet". They missed the banter and chat enabled by ICE and reported finding the game far less enjoyable without the ability to converse with other players.

We observed other interesting and innovative uses of proximity voice transmission, as players became more familiar with the system and began to experiment with it. In ET there is a period while the game starts when players are free to roam the playfield but are unable to interact with it. Some players discovered that during this short period it was possible to lurk near the opposition team's start area and listen to their conversations, unseen, in the hope of discovering their plans. They also found that during the game they could hear enemy players discussing game actions such as calling air-strikes, and were able to use this information to their own advantage. Spying and eavesdropping thus became a new strategy involving movement and position that was not possible without ICE.

Conversely, players were also aware they could be overheard by the opposing team, and some used that knowledge to try to mislead the opposition. For example, during one game, two players who were defending a building tried to create the impression that there were many defenders present, by running to different points in the building and calling out using different voices. These players wryly noted after the session that the tactic didn't work and that *"…although you might do that to try to enhance performance, it didn't quite help (laughs)."* However they enjoyed the experience and spoke about it enthusiastically.

Some players taunted enemies when they were within hearing distance and found that ICE lent itself to vocal exchanges with the opposition that would not have been available if they were using a team based, two-way-radio style voice system. They enjoyed being able to engage in banter with opposition players. In particular, they found the proximity features of ICE made this kind of interaction more appropriate.

> *You're not going to taunt someone in Roger-Wilco, or something similar, you're not going to do that to everybody, but you'll do it just with that individual in front of you and it's a conversational thing.*

In ET, injured players are sometimes left incapacitated on the ground. Players made use of their own episodes of incapacitation

to taunt the opposition and to shout to their comrades the positions of nearby enemy players. One player said he did this to encourage opposition players to take the time to "finish him off"; reasoning that this wasted the enemy's time and diverted them from more important game objectives.

These incidents, among others, helped create a strong social experience for players. In fact, the contribution made by ICE to the social experience of the game was as at least as important, if not more so, than any contribution to player performance. The ability to chat, taunt and interact with others in game-world proximity heightened the sense of presence and playing-with-others and increased enjoyment in both the game and the telling of the game after it was over. This made the game more immersive and more fun.

> *[ICE] is very much an extra dimension. If you're a very good player I'm sure you can find a way to enhance your skill with that anyway. If you're not, if you're just sort of there to have fun, at least you can take away that added dimension, and not really worry about whether it's enhancing your performance or not.*

Although ICE resolves voices so that they are heard as if they are originating from the same location as the speaker's avatar, early in our first study players reported having trouble identifying which avatar's player was talking. While they could determine the direction a voice came from, it was still not always easy to put the voice together with a particular avatar. This was particularly true if a group of avatars was standing together. In response to this feedback a visual indicator that appeared above the avatar of a speaking player was implemented. The addition of a visual cue helped players identify who was speaking and improved their perception of sound localization within the game. It would seem that, much as in the physical world where we draw on visual information such as lip movement, gestures and so forth to help us locate and focus on a speaker in a crowd, voice localization systems will benefit from the addition of visual cues to indicate who is speaking at a given moment.

In addition, early in the trial there were some problems with the normalization of volume levels from the players, resulting in some players' voices being much louder than others. This usability problem created a number of problems for the use of ICE that severely detracted from the experience for some players. It became difficult to use the volume of a voice to resolve distance. Also, some voices drowned out others, and some were almost impossible to hear because they played at too low a volume. These problems were dealt with as the study progressed, but they indicate that reducing usability issues such as these is crucial to creating voice communication systems that contribute positively to the experience of playing games.

7. DISCUSSION AND CONCLUSION

In this paper we have presented a preliminary analysis of a field trial of ICE, a novel VoIP system designed to support player communication in online games by simulating in the game world the way in which voices travel through air in the physical world.

In line with previous research [5, 6, 7, 12], participants in this study were enthusiastic about using VoIP in a fast-paced team shooter game, and confirmed that voice communication has benefits over text-based communication in these types of games. However, we were interested in whether constraining player communication according to avatar location is an advantage for players in terms of their game play and their experience of the game as a social event.

While ICE seemed at first glance to be a restriction of the broadcast mode typical of VoIP products used in games, the restriction ICE imposed in fact brought about some improvements in player-to-player communication. The restricted communication provided by ICE gave players affordances and constraints they could use to increase the intelligibility of their communication. In effect, ICE added extra socially relevant information to the voice channel: players received not only speech but a sense of how close the speaker was, and in which direction, and they found it easier to associate a voice with an avatar and a particular player. In team games such as ET where the negotiation of space is key to success, information about other players' positions is a valuable resource. ICE acted as a filter for relevance in that only voices from players close by in the game world – and therefore able to interact immediately in game play – could be heard.

Previously we have argued that the value of voice communication is enhanced if it is "socially translucent" [4, 5]. A communication system should deliver not only speech, but socially salient information about the speaker, such as who and where they are. Socially translucent systems are not transparent; rather they are constrained. People use these constraints as a resource in social interaction. When participants share an awareness of the "physics" or rules that govern a communication system, they can use this awareness as a resource for structuring their social interactions. Thus we have previously argued that sociability within online game environments can be enhanced by imposing constraints to communication that are well understood by users [5]. Although ICE constrains communication, in doing so it provides players with interpretive resources for making sense of what others are saying.

As the use of VoIP becomes widespread in online games, and especially massively multi-player games, the opportunity and need exist to explore ways of configuring voice channels beyond simple all-to-all broadcast modes. We recently proposed design metaphors which would be well understood by players and could be implemented to structure voice communication in online games [12]. ICE represents an initial step beyond the two-way-radio metaphor typical of current VoIP systems.

Voice systems that emulate two-way radio are typically disconnected from the mechanics of game play. The VoIP systems adopted by many players of games such as Counterstrike and World of Warcraft exist and are used in parallel with game play. The VoIP systems packaged with Xbox Live and games such as Dungeons and Dragons Online are much the same in this respect. In most cases, the system of voice communication used is abstracted and largely independent of game mechanics. Designing a richer set of communication metaphors that are integrated within the fabric of a game's mechanics could make achieving and maintaining communication between team members a significant part of the game strategy, necessary in order to succeed in the game. Activities such as finding radios and telephones, stealing an enemy's radio, jamming and spying on enemy communications, exchanging mobile phone numbers and so on might provide for richer game play and social interaction than the simple "all to all" voice metaphor can.

The field-study reported in this paper represented a common scenario for multiplayer gaming: a group of friends and acquaintances who play together on a semi-regular basis. In such a scenario, players know each other and there is an expectation that they will play together in the future. We acknowledge that this social situation is not the only one for multiplayer gaming. Much multiplayer gaming occurs on game servers hosted by ISPs, game companies and the like, where players are unlikely to know each other. These scenarios are socially different and this is likely to have an effect on how a communication medium such as ICE is used. Such a scenario is currently under investigation. In a subsequent trial ICE has been made available for use with ET and CS through a semi-public release of the client software to a larger group of beta-testers. Participants in this trial have been playing in their homes, and do not necessarily know each other. They have been playing together on ISP game-servers, and have been free to use the system as much or as little as they wanted. Game play data has been collected from the servers and game playing sessions have been recorded. We have also conducted focus groups with these participants and are currently analyzing this data.

We also acknowledge that player communication may be quite different in game genres other than the one used in this study. ET is a first person shooter game with strong team-based objectives. Other game genres have different forms of game play and represent different social situations. We are also interested in the use of VoIP in the Massively Multiplayer Online Role Playing (MMORPG) genre of games. We are currently conducting a study to investigate the use of a voice client built into a new game of this genre.

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