Designing for Conversation: Bridging the Interaction Challenges

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ABSTRACT
This paper explores design issues encountered when providing augmented interpersonal conversation services across spaces. Technology support for audio interactions is pervasive, through personal devices, desktop applications, and environments supporting conferencing. We use communication models from the social sciences to inform our design of interactions and the interventions most appropriate to the support of audio-only communication. We address the mismatch of current interaction genres to specific aspects of human-human conversation. Based upon media-space research and current audio technologies, we then propose a design space for synchronous audio-only interaction services. We investigate and apply design guidelines for communication activities based on the desired spontaneity of interaction and the situational awareness disclosed. By making explicit the challenges to support conversation and by applying design guidelines based in application of social science models and media space research, we contribute and open discourse on enhancing interactive technology support for human-human conversation.

Keywords
Design guidelines, interpersonal communication, context-aware computing

INTRODUCTION
Interpersonal communication pervades and defines our lives, yet its complex and contextual nature challenges the design of services to enhance human-to-human communication in the daily activities of home and workplace. The irreversible nature of conversation is one difficulty. The spoken word is not amenable to the computation model of providing an "undo" for each human action. Communication cannot be cancelled, once a message is transmitted via body expression or language, it has an irrevocable effect on those who receive it. We may avoid speaking, but we are not able to escape communicating. Even when we intentionally avoid communication, our nonverbal cues and brevity of speech provide meaning to others. Communication pervades our lives, intentionally and fortuitously. Supporting this persistence requires audio services available whenever and wherever there are people. The irreversibility and omnipresence of conversation produce tensions that challenge interaction design.

While advances in communication technology have enabled anytime-anywhere connection between people, we seek ways to improve support for conversation and to ameliorate their shortcomings. The human action to create the conversational connection should feel as if it is an extension of the conversation, rather than a separate action distracting from the communication activity. This seamless interaction between the human and the service providing the audio connection characterizes "lightweight audio interaction". The lightness refers to the minimal intrusion into the user's primary activity of communicating and is independent of its content. A single button on the telephone provides a lightweight interaction, but the conversation following may be a frantic call to "911" or a casual exchange with a friend. We will explore how to provide lightweight interactions and contextual support for those times when speech is the preferred channel of communication.

As this class of technology support is pervading our everyday life, it is time to evolve corresponding design guidelines for emerging paradigms. Designers for interactive communication may look to existing guidelines, but do not find an adequate fit between their knowledge of the user activities and how to support these communication activities. The social sciences provide models of communication and domain knowledge essential to the design of conversation support. The designer can examine the variety of devices supporting everyday communication practices. Many media space projects extend communication via interactive technologies. From each of these domains, we explore what can be encapsulated as a principle enabling the designer to choose interactions based on user communication tasks, rather than personal deep knowledge of conversation.

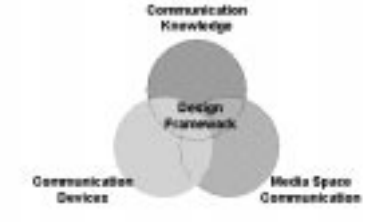

Figure 1. Defining a design framework for conversation

In this paper we will discuss interaction design frameworks for human-human conversation between places, where some knowledge of each person's situation is

shared across spaces. We first use communication models to motivate conversation specific guidelines and contrast them with innovative design principles for interaction. We derive a framework characterizing human conversation from devices supporting communication. We apply this framework to media space communication applications to show it covers the design space. We derive three design challenges for human-human communication between places and discuss their implications as guidelines.

EXPLORING CONVERSATIONAL MODELS

We first explore communication theory and use domain knowledge models to derive design guidelines for conversational technology. When designing interactive technology to enhance communication, one needs to understand language and how humans use it. Interpersonal communication is characterized by both simultaneous interaction with another person and a mutual influence on the persons involved. This meaning-making, shared experience is an essential part of being human [2]. From social science views of interpersonal conversation we develop design guidelines:

- Provide context which most directly maps to the environment, rather than to the culture.
- Support the significant events, like initiation and termination of communication.
- Apply constraints of the communication media to aide in disambiguating the message.

Contextual Perspectives of Communication

Contextual interpretation includes the roles, the place and time, the events and other communication surrounding this message, that affect the meaning [28]. The design of communication enhancing technology should acknowledge the technology's role within the contextual interpretations. Sociologists define many aspects of communication context, only those external to the human are amenable to technology support. For instance, a closed door may be interpreted very differently, depending on whether it serves as a threshold to an office, a classroom or a bedroom. Technology can detect the physical state of the door, but cannot always derive the situational context. Technology services may best rely upon those affordances which have a more direct mapping from the environment, and which do not vary greatly by the individual, their relationships and the cultural practices.

Models of Communication

Communication models inform the design of audio technology in supporting the significant events within conversation processing. The message transfer model helps envision words as actions and places the interpretation of the communication within the head of each participant. The transactional model of communication provides a social interaction interpretation. When conversation is analyzed through the collaborative model, sequences of actions from different speakers are seen to occur in repeated patterns. The collaborative and the transactional models both acknowledge a mutual affect on each party in the communication episode. For instance, a greeting requires a response, and similarly a compliment elicits a response from "thanks" to "it was nothing". These patterns are part of the larger set of rules governing appropriate communication within a specific context. For instance, face-to-face conversations have opening sequences: contact initiation, greetings and topic initiation. In office settings, conversation closing may be as simple as exiting the office, at the close of the topic discussion, with no verbal termination [26]. The initiation and closing of conversation are critical events for any design to address to sustain use in communication activity.

Applying a Language Use Model

We can apply the collaborative activity model to design human-to-human synchronous audio-only communication, within a trusted relationship such as an informal work team or a family. The collaborative conversation model develops "common ground" to minimize the effort of communication. Just as with any group process, there is a varying cost for using different media types and their corresponding benefits. For instance, when providing a reminder, an email text message will persist, while a spoken reminder will fade away. Clark and Brennan describe these differences as eight constraints on the grounding process, where constraints are desirable to reducing ambiguity in conversation (adapted from [5]):

- Copresence - A and B share the same physical environment.
- Visibility - A and B are visible to one another.
- Audibility - A and B communicate by speaking.
- Contemporality - B receives at roughly the same time as A produces.
- Simultaneity - A and B can send and receive simultaneously.
- Sequentiality - A's and B's turns cannot get out of sequence.
- Reviewability - B can re-view A's messages.
- Revisability - A can revise message for B.

If one of these constraints on the collaborative process is missing in a particular medium, there will be a higher cost to the conversation.

Synchronous audio communication has audibility, contemporality, and sequentiality constraints. A full-duplex connection has simultaneity for audible communication, but not for body language and gestures. Speech fades and is not able to be modified in real-time, so audio-only suffers from the cost of ambiguity due to lack of reviewability and revisability. Augmenting technology may alleviate lack of copresence through shared situation context across locations. The visibility constraint is purposely absent as a tradeoff for autonomy. One could

envision the use of technology, such as "real-time audio buffering" [6] to provide limited review capability and aid in disambiguating the message. These eight constraints from the collaborative model are useful in disambiguating conversation over a device such as an intercom or mobile phone.

Conversational Guidelines from Related Works

Technology in support of conversation is worthy of research efforts due to its prevalence and its goal to promote human-to-human interactions, as opposed to strictly human-to-computer. Not only have phone conversations become part of many facets of everyday life, but also various devices are converging to create even more challenging interaction scenarios. For example, we may use a personal electronic scheduler to facilitate creating an audio connection to an associate. Phones are augmented with a variety of context gathering and sharing services, such as "Caller ID" and voice messages. Synchronous audio connections are available from our desktop instant messaging clients and collaborative meeting tools, as well as through intercom systems built into the walls or the phone system. While traditional interaction guidelines fail to address the pervasiveness of communication interactions and the need to situate those interactions within the context of human-human interaction, we leverage those research efforts aimed at bridging this gap.

Conversation enablers employ technology as an invisible tool to support human-human interaction, where the computer is no longer a partner [27]. This differs from the more common view of interaction as a dialog between the human and computer. The GUI genre of interaction exploits the human's cognitive capacity to analyze, as described by Norman's theory of action where cognition in the head guides this dialog [16]. Bellotti *et. al.* propose design guidelines modeled upon the human-human communication challenges identified by social sciences [3]. These guidelines are based upon Norman's seven stages of action, but are characterized by communicative properties, rather than cognition. These issues of address, attention, action, alignment and accident provide a framework to discuss communication between the human and technology sensing user actions addresses the machine-human dialog, rather than human-human.

To support human-human communication, the specific characteristics of conversation should be addressed by the interaction designer. One study of instant messaging revealed conflicts and ambiguity due to the opposing and overlapping perspectives of written and verbal communication conventions [24]. This analysis technique examined the interactions between communication practices to explain five conflicts and to define the scope of the design space for this genre of communication. These five tensions indirectly apply to design of interactive technology and provide a technique to better define the dimensions of technology-augmented conversation, very similar to the linguistic constraints of Clark and Brennan [5]. For example, the tension from lack of co-presence may be compensated by sharing situation information, but will not include gestures and body language that visibility would ease. The development of context-aware communication applications have been traced from a historical perspective to understand the issues related to their design. Schilit *et al.* characterizes these applications by the form of the communication action and by the acquisition of context [21]. The focus in this design space of communication is human-technology interaction, yielding design objectives for interaction with the tool. They include improving relevance, minimizing disruption, improving awareness and selecting channels. These provoke interesting challenges to the designer, revealing the depth of communication tasks, but there is not enough experience to use these guides to pare the design alternatives to those best matched to the user, the environment and the activities. The gap between what is sensed and what socially relevant information is revealed, may best be narrowed using human determination to keep semi-autonomous systems viable [21].

Monk applies "common ground" conversation theory, along with additional domain knowledge, to case studies informing the design of computer-mediated communication [13]. He sees a bridge between communication models and technology design using Clark's collaborative model for conversation [5]. Clark understands conversation as developing a "common ground", or things we know about the person with whom we are talking. The more we converse, the more ground benefits develop, and the easier it is to "repair" conversation slips. Applying the framework to a distributed meeting software tool revealed a lack of support for the signaling and grounding elements of meetings. This was fairly straightforward, but when used to analyze a videophone connection between medical specialists, the framework required augmentation and specialized knowledge to make any predictions.

The goal is to provide guidelines for the designer of communication services, independent of knowledge of communication theory. We propose such a framework, based on the contextual nature of conversation and constraints aiding the spontaneous disambiguation of the message. This framework is based in communication theory and its scope is verified against the current devices supporting conversation. We then examine the guidelines applied to media space technology, which extends conversation in a variety of ways. This framework may be used by the designer with little knowledge of communication models, but with a clear grasp of the user requirements for awareness and spontaneity.

DESIGN SPACE OF COMMUNICATION APPLICATIONS

From the perspective of context-aware audio communications, the constraints supporting grounding may be clustered into two types: contextual awareness and spontaneity of interaction. Contemporality, sequentiality, and simultaneity are each factors of the interaction speed and the connection type. Audibility, copresence and visibility each portray a part of the situational awareness. Grouping the constraints by overall function suggests a two-dimensional space for communication applications based on distinctions between "context awareness" and "interaction spontaneity" (see table 1 below).

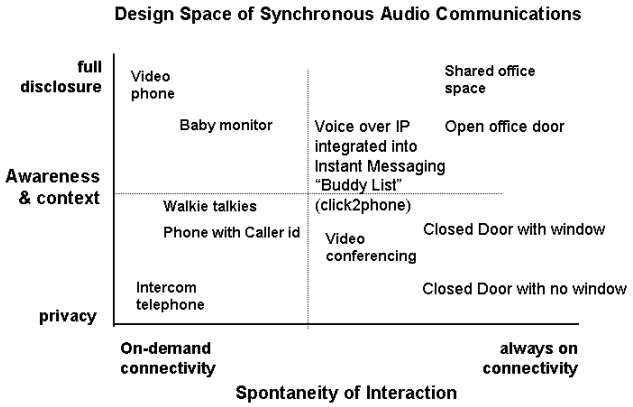

Table 1. Synchronous Audio Design space

Along the awareness dimension, absolute privacy of information is at one end of the continuum, with public disclosure of information at the opposite. For example, an intercom preserves privacy as it has no information about the activities or people co-located with the intercom station (except what can be heard through the audio channel), but a video phone discloses information about the situation at the phone (*i.e.*., what is seen and heard through the communication channel). Along the "spontaneity" axis, communication may require an explicit user action to create a connection such as selecting the appropriate phone number and manually dialing the number. At the other end of this dimension, would be speaking to the occupant of an office from their doorway. The state of the door and any view through the door will provide availability context, along the awareness axis. The axes do not imply greater worth on any part of the range of associated values, but do provide a means to compare what is supported by each communication affordance.

We explore the scope of this communication theory based framework with respect to its coverage of current communication devices. Intercom and telephones are commonly used within work groups and the home for conversation and have been extended to support richer human interactions. After justifying the coverage of this framework for devices, we then apply it to media space technology (see table 2).

EXPLORING COMMUNICATION DEVICES

Interpersonal communication is defined as contact between persons, ironically synchronous audio technology is most often device or location-oriented. Intercoms, common to both business telephone systems and homes, support place-to-place communication by connecting the calling station to one or more other stations at a single location. This is appropriate for broadcast and monitor modes, when calling either all locations or a specific station, but it is disruptive when trying to reach a person. Some research systems have tied location information to telephone systems [25] but they still require explicit interactions with a device, taking attention away from the primary activity. In the usual intercom model or telephone station model, the participants are tied to the location of the equipment. Neither conversant is able to change location to continue their activity while conversing or to gather materials to support the conversation.

Lessons from Intercoms and Telephony

There are three general problems with current audio technology support of informal, interpersonal communication. Conversation is person-to-person, but the technology supports device-to-device or device-to-location connections instead. The interaction to initiate communication distracts from the activity of conversation, by requiring too much explicit interaction by the initiator. There is no support enabling the humans to determine, prior to initiating the connection, if this is an appropriate time to converse. The devices adhere to the information passing communication model, lacking support for the social interactions. The intercom and telephone require explicit manual actions and provide no presence information. They are lower in spontaneity and contextual awareness, both of which are needed to support the collaborative nature of conversation. To inform design of a context-aware conversation system for the home, we interviewed eight individuals from six families concerning their communication preferences within the home [11]. Intercom systems were not sufficiently valued in the home to justify their expense, yet there were times when current communication practices failed or were undesirable. This implies the need for better communication and interaction support. Conversation interaction design guides should address lack of situation awareness and the explicit user actions required to create a connection.

Lessons from Augmented Telephony

Several projects have attempted to provide more awareness of the other person and to lower the connection creation cost of telephony services. One effort is to integrate contextual information into telephony communication systems to better support social protocols, such as enabling person-to-person connections at appropriate times. In some instances, the telephone owner explicitly enters contextual information to be shared with any callers. Once

the potential caller has this context information, the application allows the caller to decide the appropriate communication action, such as continue the call, leave a message, or even cancel the call [12,17]. Turning this around, Taming the Ring enables the recipient of a cell phone call to discretely send an appropriate pre-recorded voice message, such as "in a meeting, I will call you later" [18]. In this case, the recipient determines the context to send to the caller in real-time and the caller is still expected to respond appropriately. These context augmentations to telephony provide some means of negotiating best communication situations and support person-to-person connections.

Many augmented telephone systems integrate the contextual information with the ability to easily initiate the appropriate communication. For instance, *live addressbook* uses click-to-dial technology to automatically create the connection between the phone numbers currently specified for each person in the call [12]. This has the added benefit of providing one personalized interface to control calls, relieving the caller of dealing with other phone interfaces (pay and metered). Calls.calm provides a means for the caller and callee to interact and determine a good choice of time and communication channels [17]. This smooth transition into the connection seems to "stretch" the initiation for the caller in a very natural and productive manner. Augmented telephone systems are exploring how to lessen the interaction cost by coupling the connection request with the contextual data, usually explicitly entered by the callee for use by caller to determine when and how to communicate. A design goal is to leverage the environmental processing power to support more interaction modes than is possible on current telephones.

Lessons from Audio Integrated with Instant Messaging

Instant Messaging services provide context along with communication channels, including interactive text and audio. While IM's interactive text messages are common to desktops, the audio component is not widely used. Voice-over-IP technology is in general not of sufficient quality to be used in place of cell and landline telephones. There is not the same critical mass of use for the audio services closely coupled to text messaging. However, their quiet, text messaging provides an interactive medium to negotiate the context of the communication, even changing modes as needed [15]. These interactive negotiations accomplished within IM exemplify the need for designers to look the ways the new technology modifies the social interactions.

EXPLORING MEDIA SPACE COMMUNICATION

We have investigated design guides from the perspectives of augmenting communication devices. Now we apply the framework to communication interactions within the media space created by technology. We revisit the framework and populate the grid with media space projects (Table 2). Media space research includes multi-media spaces, desktop informal communication, and audio-only spaces. Media spaces illustrate the common tensions in communication device augmentation: privacy vs. awareness, persistent vs. on-demand connection, and social vs. device context.

We examine the shared approaches to supporting conversation through using lightweight contextual interactions, supporting social interactions, and using the media to mediate the message.

At the instantaneous end of the axis is an always available media space, where two places are persistently connected and the interaction for communication is often part of the communication activity itself. This sort of seamless interaction between the environment and the communicators is the ideal "lightweight" audio interaction. While this lightweight interaction may be desirable for many audio communication interactions, it is not always possible. This model of the space of audio interaction may aide the designer in creating appropriate tools for each communication activity context, including the relationships and situation. This suggests an approach to designing and categorizing audio services, where there is a trade-off of privacy for fuller awareness and on-demand connections for the continuity and transparency of a persistent communication channel.

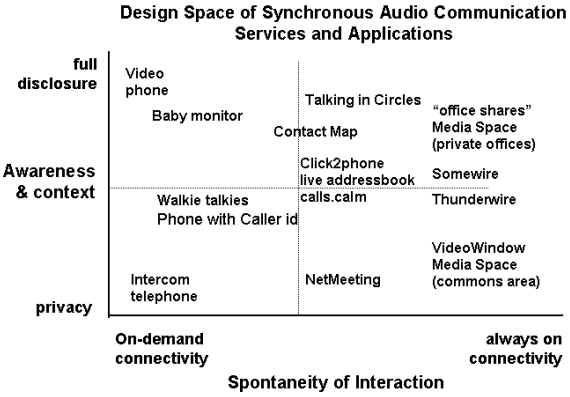

Table 2. The design space of media spaces

Media Space Contextual Interactions

In contrast to the explicit user interactions with devices to create connections, media spaces provide seamless interactions along with presence information. The persistent connection of media space uses the medium itself to create a group interaction [4,9]. Desktop conferencing tools couple awareness information with a means of creating a connection, usually through a GUI [7,23]. In contrast, the Somewire audio-only space finds the graphical and tangible interfaces are not suited for audio space interactions [22]. An audio space acts like a service and seems to work best with a simple interface; users do not understand or use most audio controls, such as

fading, bass and treble. Media spaces and desktop conferencing couple presence information with interactions, inherently enabling persistent, context-aware, lightweight communication. The philosophy of less is more for interface design is one lesson taken from the variety of media space interaction techniques surveyed.

Media Space Social Interactions

There has been considerable interest in explicit scaffolding of the social interaction, especially to enhance group communication. The Talking in Circles visualization provides persistence to the conversation, enabling group membership, similar to the "cocktail-party-effect", and awareness information, such as length of time chatting [19]. The *social proxy*, an animated, graphical representation of chat in Babble, portrays the group conversation, individual presence, and history of activity [8]. ContactMap, a desktop representation of a user's social network of contacts, provides visual presence of a contact and serves as a reminder signal of to whom and when to communicate, through a variety of modes [14]. These desktop communication tools use visualizations to overcome the fading of speech and they employ graphical animation to support conversational turn-taking. Visual representations of context and animations of activity, may be the best design choices to augment the audio-only communication.

Media Space Mediates Communication

The last characteristic we visit is the use of the audio medium itself to mediate the communication interaction through audio signals, presence information, and background awareness cues. There is a need to balance non-intrusive awareness against privacy-preserving awareness. The *shared audio space* technique uses an audio icon constructed from the person's voice, but with no discernable words [10]. The audio icon is modified to portray audio characteristics such as volume, portraying presence information, but not conversation,that would disturb the listener and impinge on the privacy of the speaker. One solution to the disruption of audio signals and presence information is to scale the audio interface to be appropriate for the current context of use. Nomadic Radio, a wearable device relying upon contextual information to infer location, uses an audio-only interface to signal email and news updates, as well as providing "VoiceCues" to identify the sender of an email [20]. This wearable device also provides awareness to the user via a background sound of flowing water, again tuned to the user model it builds and location information. These systems illustrate some ways the audio channel may be used for mediating communication, notifying and providing background awareness.

APPLYING A CONVERSATION DESIGN FRAMEWORK

Our vision to design the best conversation support for a sensor-rich environment is shaped by aspects of communication theory and its application to communication technology. For the types of communication activities we expect to support, there are two dimensions of tensions to balance: privacy vs. awareness and persistent vs. on-demand connection. The conceptual guidelines derived from applying the framework to devices and media spaces:

- Provide appropriate awareness, balanced against persistence of connection.
- Fit the interaction to the communication activity, providing a uniformity across modalities and providing appropriate feedback.
- Support mediation and signals with minimal intrusion, by learning about the user and the context of use.

These challenges deal with the social concerns of human-to-human communication, rather than the technical infrastructure required for such a system. We look at why each of the issues in turn as a challenge and how guidelines can provide *a priori* influence for the interaction design.

Provide Appropriate Awareness

The wealth of environmental and situational context must be presented appropriately to support the desired human communication activities. To understand communication tasks within our workgroup, we interviewed six student and staff lab members. There were three types of information mentioned: background awareness, focused attention for a room, and brief historical trends. In addition to the self-reports of lab members we have seen these same types of human activity supported in existing communication technology. Peripheral awareness to acquire general location awareness knowledge is the most powerful though invisible use of MediaSpaces [4]. The "glance" mechanism within Montage fills in detailed information [23]. History of the conversation is integral to the construction of social proxies in Babble [8] and the Calls.calm interaction [17]. The communication actions map into three classes of context-awareness: general awareness, focused attention for a place, and brief history. The design tension between sharing awareness context to support conversation events vs. what is needed to provide spontaneity of connection is one guide to help the designer narrow the design alternatives. There is often a trade-off of reciprocity of revealing situational awareness to ease the time required to connect. The designer will balance the sharing of context with the need for spontaneity.

Interaction Fits Activity

There is tension between the attention required for interaction with the technology and the attention given to

the communication activity itself. Providing the best fit interaction for initiating and mediating communication is especially complicated when using context and changing location common to informal work groups. One design approach is to provide a single interactive sequence, which will operate across modalities, beginning with a variety of visual displays. This is similar to the *live address* approach of providing a uniform interface from desktop or PDA for all connections to an individual, whether to their cell phone or the hotel room phone [12]. There is also the need to provide feedback in the appropriate mode. For instance, one may initiate a conversation at a public touch display InOut Board and then move down the hallway into a private office. The conversation travels with you, and so the communication system must provide responses based on the new location. The office may only have a speaker and microphone available for notifications and interactions. The audio system infrastructure must smoothly handle these transitions, with no explicit action from the user. Audio levels should adjust to the characteristics of the new space and the user's activity within this place. The design guideline to minimize the distraction of the interface mechanism from the conversation requires a trade-off with awareness information; to provide appropriate feedback, the system must know the context of each user and their environment. For the designer to provide the best fit between activity and interaction, there will be a minimum level of personal and environmental awareness required to make such a match.

Supporting Mediation and Signals

Minimizing the intrusiveness of conversation requests while providing enough information for the human to make a timely decision about participating is another design goal. In some environments, audio service applications may use environmental context to sense audio levels and determine how to minimize intrusion when delivering the notification. As Nomadic Radio has explored the costs of interruption vs. the value of information [20], the notion of dynamic scaling of notification based on context may be tied to each person, knowing where they are located and coordinating signals from a variety of services.

The interface modality and scaled notification scheme can make the initiation of conversation more transparent, but how can the design support the social interactions within a communication event: the initial greeting exchanges and graceful termination? Intercom systems, unlike phones, simply barge into the audio space, denying the recipient any opportunity for plausible denial of the communication [15]. The interaction should allow for reciprocal contextual signaling; both initiator and recipient will receive awareness information, prior to audio-connection creation, enabling more graceful social interaction from either conversation endpoint. This is in contrast to most augmented audio systems that provide awareness to only the initiator or the recipient, but not both [12,17,18]. The design model of interaction should be able to provide context to both recipient and initiator, supporting the transactional nature of conversation, rather than simply the interactions.

This reciprocal context signaling supports the human developing an internal model of what is appropriate for each situation and relationship, and acting on internalized patterns and rules for this communication context. Models of specific relationships are situated within a temporal and spatial framework for social protocols of conversation. Design should provide some support for learning user profiles to scale the interface to both the user and the environmental context. The trade-offs here revolve around the persistence of the connection to learn the user model and to provide adequate contextual support based on the model. This needs to always be present, and may create tensions where users prefer the privacy of a connection-based communication system.

CONCLUSION

We have presented a framework to define the communication interaction space and the corresponding conventions derived from survey of existing technology devices and communication application systems. The conceptual guidelines developed are to:

- Provide appropriate awareness, balanced against persistence of connection.
- Fit the interaction to the communication activity, providing a uniformity across modalities and providing appropriate feedback.
- Support mediation and signals with minimal intrusion, by learning about the user and the context of use.

The goal of these guides is to inform the design of interactive, augmented audio services for interpersonal conversation.

We envision using social science models and metaphors, alongside empirically derived principles for design of interactions supporting conversation. As more innovative applications supporting conversation are developed, such specific guidelines can be iteratively improved based on evolving language models and experience with the applications. Future work would employ specific metaphors used in social sciences to describe the theories of interpersonal interaction. For instance, the Johari window is used in many different graphical representations to discuss self-awareness, and the extent to which that information is shared between people [2]. It is set up into four stages or openness situations, that appear as the four panes of a window. Such an explicit metaphor may be useful in helping users determine what levels of awareness

and connectivity are best suited to their communication styles. Interaction with a virtual Johari window can reflect the system's current view of the participants or may provide an easily understood mechanism to teach the system qualitative user preferences.

Our explorations have focused on social science models of communication, devices supporting audio connections, and media spaces technology. From these we have developed a framework addressing conversation interaction and tensions associated with awareness. The three design challenges, presenting appropriate awareness, supporting lightweight interactions, and mediating conversation activities, have been explored across the two dimensional space of awareness vs. spontaneity. We propose this conversation framework as a starting point for dialog on the design of lightweight conversational interactions - accounting for how we communicate and interaction paradigms of conversation that have been successful in communication devices and media spaces.

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