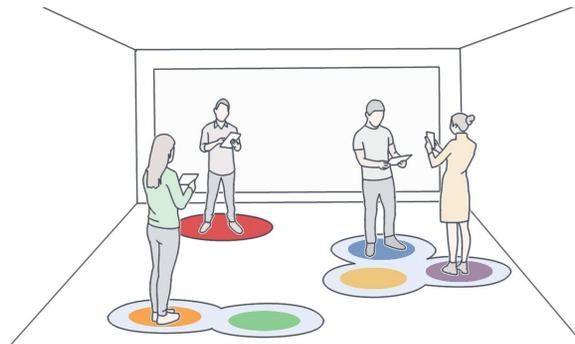# Beyond Eery Space: Applying Gradual Engagement to Remote Proxemics

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Figure 1: Eery Space

Abstract

Current collaborative solutions do enable verbal and visual
communication between all participants. However, remote
people feel a lack of presence in the meetings, rendering
a feeling of not really being there. The outcome is an inef-
ficient communication, which can hinder the collaborative
work. Eery Space, on the other hand, succeeds at bringing
geographically distant people together at the same virtual
space, and provides the necessary devices and feedback
for participants in virtual meetings to interact with each
other using remote proxemics. Despite that, the current
approach uses fixed distances initiate proximal interactions
producing abrupt transitions between interaction stages.
On the other hand, gradual engagement introduces seam-
less transitions between stages. In this position paper, we
discuss the inclusion of gradual engagement into remote
proxemics and propose a design model for future interac-
tions.

Author Keywords

Interaction Design; Remote Proxemics; Multiple Surfaces;
Collaboration; Awareness; Eery Space

ACM Classification Keywords

H.5.2 [Information Interfaces and Presentation (e.g. HCI)]:
User Interfaces

Introduction

Nowadays, virtual meeting environments play an important role in bringing geographically separated people together, and are broadly used in business and engineering settings where experts around the world engage in collaborative tasks. Furthermore, it is usual to resort to virtual environments depicting real world problems in the form of 3D CAD models, to jointly and remotely discuss solutions. However, remote people feel a lack of presence in the meetings, rendering a feeling of not really being there. The outcome is an inefficient communication, which can hinder the collaborative work. As a matter of fact, current videoconference and telepresence solutions do enable verbal and visual communication between all participants.

Eery Space [11] aims at bringing other forms of non verbal communication, namely social interactions through proxemics, that have not been explored to their full potential. In the Eery Space, everyone, despite of being local or remote, have their place and intimate space assured, to maintain their availability to establish interactions, as depicted in Figure 1. Also, several presence awareness techniques are contemplated in this shared locus. Using a large scale display, a projected floor and personal handheld devices, people can see each others representation and quickly realise their location and status on the virtual meeting. As a matter of fact, these awareness techniques render Remote Proxemics possible, since they effectively highlight the presence of remote people. The current state of the art regarding remote proxemics, employ the usage of fixed proxemic dimensions [3] for people to engage in collaborative tasks. Although, user studies suggests that remote proxemics do enable collaboration but it lacks some desired fluidity. We believe that remote proxemic interactions can be improved by allowing a more fluid model like gradual engagement [9]

and f-formations [6, 10]. Thus improving the user experience in virtual meetings.

In this paper we take a step to improve remote proxemics by introducing gradual engagement to provide seamless transitions.

Related Work

Our work builds on related research involving virtual meetings and proxemics applied to ubiquitous computing (ubicomp) environments. In virtual meetings, technology plays a decisive role in providing the necessary means for people to communicate and collaborate while not sharing the same space.

The theory of Proxemics describes what interpersonal relationships are mediated by distance [3]. Furthermore, people adjust their spatial relationships with other accordingly to the activity they are engaged on, be it simple conversation or collaborative tasks. Greenberg et al. [2] argued that proxemics can help mediate interactions in ubicomp environments. Furthermore, they proposed that natural social behaviour carried out by people can be transposed to ubicomp environments to deal with interactions between people and devices, and even, by devices talking to each other.

When ubicomp systems are able to measure and track interpersonal distances, digital devices can mediate interactions according to the theory of Proxemics. Effectively, Kortuem et al. [7] demonstrated how mobile devices can establish a peer-to-peer connection and support interactions between them by measuring their spatial relationship. Proximity can also be used to exchange information between co-located devices either automatically or by using gestures [4]. This is illustrated by the GroupTogether system, where Marquardt et al. [10] explored the combination of

proxemics with devices to support co-located interactions.

Vogel and Balakrishnan [12] developed design principles for interactive public displays to support the transition from implicit to explicit interaction with both public and personal information. By segmenting the space in front of the display, its content can change from public to private for distinct users or the same user at distinct occasions, and different interactions become available. Similarly, Ju et al. [5] applied implicit interactions using proxemic distances to augmented multi-user smartboards, where users in close personal proximity can interact using a stylus, while users at a distance are presented with ambient content. More recently, Marquardt et al. [8] addressed connecting and transferring information between personal and shared digital surfaces using interactions driven by proxemics. In this environment, digital devices are aware of the user's situation and adapt by reacting to different interactions according to context. Ballendat et al. [1] introduced a home media player that exploits the proxemic knowledge of nearby people and digital devices, including their position, identity, movement and orientation, to mediate interactions and trigger actions.

Design Space

The Eery Space [11], as depicted in Figure 1, brings together remote and co-located users side by side on a shared space. This virtual locus relies on remote proxemic interactions while providing awareness for both local and remote users with projected floor circles. Also, Eery Space counts on fixed distances to start and terminate interactions, which, despite being near to normal social interactions are still somewhat far from the way people interact, meaning that transitions between interactions are still abrupt. In the other hand, the gradual engagement approach [12, 9] takes advantage of multiple degrees of proximity to mediate proxemic interactions.
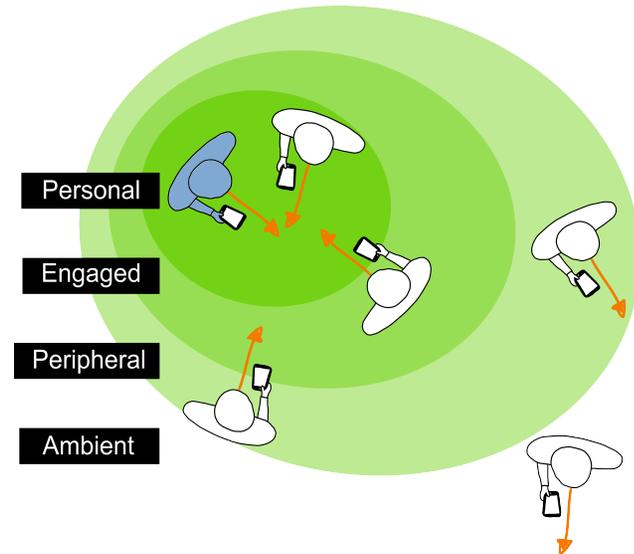

Figure 2: Gradual Engagement in Eery Space

In general terms, Eery Space can be enriched with new workflow dynamics. Gradual engagement can improve interactions in various tasks including data visualization, communication and content creation, instead of the previous way of interaction. Figure 2 depicts the new proposed model for remote interactions, by dividing the distance between two people in proxemic distances. Another important aspect is the orientation of one person among the others which also is an crucial factor to define the Eery Space's interaction stages. Following the previous generalization of the interaction model, we can now describe the new enrich Eery Space interaction stages:

Ambient Interaction
In this interaction stage, people present in the Eery Space

can easily take a glance to the state of the meeting by looking to the projected floor. They can only get an overall glimpse of who is present and what are they doing. Despite that, people physically closer, or in any of the other stages, if their orientation do not match a close encounter [10], the system deal with them as if they were in the Ambient stage, i. e. interactions and floor cues.

Peripheral Interaction
People passing by this stage are able to access peripheral information the collaborative tasks performed by the others.

Engaged Interaction
People inside this stage implicitly makes notice what is being discussed and can communicate with the contents owners.

Personal Interaction
On this stage users can interact directly with each other and edit content, if the content owner gives access to the other users.

Thereby, we propose new approaches for the collaborative features supported by Eery Space, taking into account the gradual interaction stages, summarized on Table 1.

Communication
Communication takes advantage of close encounters that determines the intention to broadcast speech to others. Although being relatively far from each other, the body orientation of a person toward others can reveal the intention of joining the work group.

Creating and sharing content
Content creation is the contribution of information to any media and most especially to digital media for an end-user/audience in specific contexts. In this The content in-

Interaction stage	Communication	Create Content
Personal	Hear & Talk	Read & Edit & Obtain Ownership
Engaged	Hear & Talk	Read & Edit
Peripheral	Hear	Read
Ambient	Floor cues	

Table 1: Interaction stages

volved may be images, video, audio and multimedia as well as text. All people can be content producers and may be able to share with others.

Despite that, body language and device orientation can provide the necessary cues to automatically determine if the person wants his work to remain private. In this instance, eery super space closes the sharing connection while in private mode. We also emphasize that the one(s) who have the ownership of the content are the ones who defines the interaction stage at a given time.

Conclusions and Future Work
Virtual meetings play an important role in bringing geographically separated people together and are broadly used in business and engineering settings where experts around the world engage in collaborative tasks. Therefore, Eery Space proposes an interesting method to join the normal social interactions on virtual meetings in a shared space.

In this work we expand Eery Space and the dynamics of remote proxemics by adding gradual engagement mechanisms to the current model. Accordingly, we described the design space for future remote proxemic interactions.

As future work we plan the development of a prototype to conduct formal studies and expand the design space proposed to accommodate multiple surfaces, such as large

scale displays, tabletops and handheld devices.

Acknowledgements

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