Wearable Aura: Interactive Personal Projection to Bring People Closer

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Abstract
This project focuses on how technology could encourage and ease awkwardness-free communications between people in real-world scenarios. We propose Wearable Aura, a device that is able to project a personalized animation around the user. This projection, as an extension of oneself is aware of the context, reacts to user's activity, and interacts with anybody nearby, initiating an interplay with people and taking the burden of making the first move. The Aura, as an enliven spiritual pet, floats around user's feet. We believe that externalized interactive representation of the user in form of a spiritual pet can ease and facilitate the communication, serve as a conversation starter, and make the interactions between people more fun. We believe that Aura will help the people to engage and gather in both, new and already existing, communities.

Author Keywords
Wearable devices; Social interaction; Communication; Proxemics; Personal distance; Display; Aura.

ACM Classification Keywords
H.5.m [Information interfaces and presentation (e.g., HCI)]: Miscellaneous; See [http://acm.org/about/class/1998/]: for full list of ACM classifiers. This section is required.

Introduction

Social networks are penetrating our daily lives and getting broader every year, allowing us to easily get in touch with strangers online. On the contrary, face-to-face communication often remains problematic, especially with unfamiliar people [5]. In real-world communication with unknown people happens to be awkward or uncomfortable. Could be arduous to break the ice and have an interaction with somebody not familiar, even when sharing the same community, event or space.

The goal of this research is to take advantage of technology to ease and encourage awkwardness-free verbal and nonverbal communication between people in real-world scenarios. To tackle this problem we propose Wearable Aura. This device creates a customized and interactive floor projection inside user's Personal Distance [6]. The Aura, as an enliven spiritual pet that floats around user's feet, is aware of the environment, reacts to user's movements and above all interacts with anyone nearby. Basically, it initiates the interaction with people around the user, taking the burden of making the first move away from user's shoulders.

We believe that Aura will enhance connections between people, bringing them closer. We chose to design a device to help people interacting in the real world because we think that face-to-face communication is crucial for being part of a community. We want to replicate off-line the ease and facility of starting communications on-line. Moreover, studies show that more people feel connected to others, the more satisfied they were with their lives [10], which only highlights the importance of social connections.

Research and Establishing Requirements

Our vision of Wearable Aura is an extension of oneself. According to the definition, the aura is a subtle and invisible exhalation [4]. Panchadasi described aura as an oval shape radiation surrounding each individual on all sides for two or three feet [9], which perfectly matches the feel and the area of interest for this project. Since the aura animations will be attached to the user when wearing the device we also imagine it as a spiritual pet, floating around user's feet, responding to one's movements and to the surrounding environment.

We started from observing how people behave and engage in communications in real-world scenarios. According to our observations, we deducted the requirements of awkwardness-free verbal and nonverbal communication:

- Maintaining a comfortable distance in communication
- Need for a conversation starter and attention catalyst
- Sense of genuine personal connection

We found it very interesting how people set the distance between them reciprocally. To feel comfortable, people have an untouchable personal area of a variable size around them. According to Edward T. Hall, the anthropologist who coined the term "Proxemics", humans usage of space in inter-human interaction is based on the social and effective relationships between them. He mentioned four distance zones: Intimate (less than 8 inches), Personal (1.5-4 feet), Social (4-12 feet), Public (more than 12 feet). The size of each zone is influenced by numerous factors (culture, gender, attitude, and so on). People decide which area occupy according to the intimacy level they have with the interlocutor. According to the Proxemics theory, there is a correlation between physical distance and social distance [6]. In other words, the intimacy and connection between individuals influence their physical distance. Since Distance is an actual

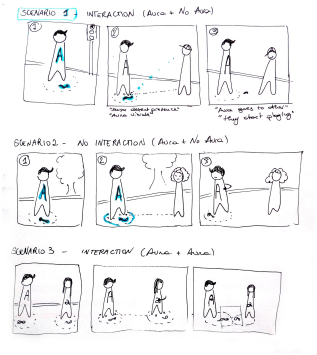

Figure 1: Storyboard of user scenario: utilizing Aura in public spaces to facilitate people's interactions

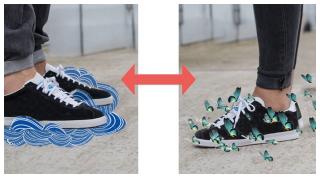

Figure 2: Before Auras interact with each other

Figure 3: When Auras interact with each other

part of non-verbal communication between individuals, we see it as a design opportunity. We aim to manipulate this area to affect and modify the behavior of people, changing the distance between them to give them more chances to communicate.

Another source of inspiration were pets. Pets are usual and common topic starter to generate a conversation when the owners are walking them. Studies have shown how people walking with a dog are more likely to experience social contact and conversation than people walking alone since pets facilitate social interactions. Pets give the sense of trust, are a casual conversation starter and attention catalyst too, therefore they prevent the awkwardness effect that happens when a stranger invade one's Personal Distance space. Walking dogs promote and encourage genuine interactions and conversations between strangers [1, 12]. Pets are a valuable example of a bridge between people in public spaces. Inspired by it, we aim to recreate this mechanism and achieve the same spontaneity in social interactions in our design. Therefore we conceived Aura as a visible spiritual pet, floating into user Personal Distance space.

Further, we analyzed previous projects and researchers, to investigate how other people approached this topic. Former studies analyze the relevance of Proxemics in humans' perception and adjustment of their spatial relationship with others and the environment [8]. Instead, the topic of manipulating artificially Proxemics zones to improve human interaction is not well developed yet. However, a study from Wolf et al. shows how interactive dynamic floor projections are an effective approach to influence people spatial relationships [11].

Different studies investigate how to enhance people's communication through augmentation of one's "personality" in their personal space. The work by Tomitsch et al., intended to improve social interaction by projecting one's social identity (Facebook profile details) on the ceiling, using the visualization as a conversation starter. It is an effective breaking-the-ice tool, but people felt uncomfortable due to privacy issues related to the data shown publicly [7]. In our concept, the user can decide what Aura to show and how it should behave, so private data will not be exposed unless the user wishes it. Similar to our concept, the work of Cassinelli use projection around the user as a representation of their emotional expression [3]. However, this design aims only to express people status and not to stimulate interactions.

Since our design objective is to improve interaction in the real world, Aura has to be a touch point to initiate the communication. Consequently, it has to be visible with bare eye, without the use of additional interfaces, to reduce the physical barrier and encourage the face-to-face communication. It also necessitates to be placed into one's Personal Distance space, and, as a pet, to be interactive with both, the user and other people approaching.

Initial Design

Continuing our research, we started to sketch different storyboards to visualize Aura. We conducted several informal interviews using the storyboards and some sketches to illustrate our idea. We received interested feedbacks and suggestion for implementation. We found out that people like the idea of having Aura placed around their feet, on the floor. People also stated that it would spark their curiosity and would increase the likelihood of a contact. Interviewees expressed the wish to have different animations and we realized animation should be self-representative, besides having an interactive function.

Figure 4: User test at Keio Grad School Forum in November 2017.

Quotes from user's feedbacks

"I enjoy Aura because it goes outward and inward: it gives the reason to interact with people around but it also protects personal space; the changing video gives you a reason to feel the surrounding at your own pace". User (Taiwan)

"I think wearing Aura is fun. People would stop by and have conversations, especially children will play with me. It reminds me of childhood and I like to play with people instead of talking about the weather". User (China)

In this perspective, we used low fidelity techniques to create the first prototype and test the idea. We decided to start with a simple graphics that could catch people's attention. We utilized a smart laser beam projector(5x5x5cm), and an animation of a butterfly. The projector is small and light enough to be held in the hand or hidden in the sleeve. We simulated the movement of the Aura animation by manually moving the projector pointing the Aura onto Personal Distance area. This setup was used to test and analyze the possible impact of the device.

We run two sets of tests around 9 p.m. in two different locations. The first one is a quiet area near the university. We ask separately to two participants to wear the Aura and have a walk for about 10 minutes in the neighborhood. We observed and tracked the reactions of the people encountered. Around 10 people clearly express curiosity and attempted a verbal interaction with the participant. Around 3 went closer to the Aura to interact with the projection. Most of the people encountered glanced or smiled at the participant. We compared these results with the ones from the same experience of walking in the same place, but without the device, which leads to receiving 2-3 glances and no more.

The second test was run in Shibuya, one of the most crowded areas of Tokyo, for around 20 minutes walk. The goal was to understand if the different impact of the Wearable Aura in a diverse context. It was interesting to notice how the projection was noticed from only a 30% of the people, differently in the first test the rate was around 90%. However, the effect of the interaction was much stronger. Some people actually started the conversation, and some clearly played with the projection.

The results might be influenced by the novelty of a personal projection following one's steps, meanwhile, it makes us believe that Aura is a possible bridge to enhance communication with strangers, acting as an interactive catalyst and possible conversation starter. We found out that people are more willing to interact when steady, rather than walking. This makes us reconsider the user scenarios and utilization context. The experiment also established that the interaction occurs only if the people face each other, so aura doesn't need to be all around the user, instead, in one's eye span. Finally, we recognize that the interaction is really short because the reaction of the Aura is not interesting enough, due to the repetition people get bored and lose interest after a couple of seconds.

We presented our research's first results at Ubicomp 2017 in Hawaii [13]. The concept was commented as a very interesting possibility to encourage human interactions.

Wearable Aura

With the feedback from first user tests, we designed the second prototype. First of all, we improved the interaction. We want the animation to be more reactive to approaching people, and to generate a more interesting interactive space around the user [2]. Since our study is based on Proxemics zones, we think that the animation needs to respond to the distance between the user and surrounding people. So in the next prototype, the animation was dynamically changing according to the distances to people approaching the user, in order to invite them to come closer and interact more. To implement it we have installed a distance sensor on a shoe and used the distance measured by the sensor to control the animations using Processing. Conceiving Aura as a tool for user's self-expression, we designed different animations and allowed the user to pick his or her favorite one, to make it feel more personal.

In the second prototype, we used butterfly, jellyfish, and

Figure 5: Interaction during Keio Grad School Forum in November 2017.

Figure 6: Prototype evolution: all the technology embed in a single device.

bubbles, combined with different animations reacting to the distance changes. To increase the spontaneity, we prefer the user not to be distracted by manipulating the projector. Therefore it was fixed into a pouch bag with a hole for the projector lens. Both, the sensor and the projector are connected via WiFi to a computer, where the behavior of the animation is controlled automatically using a Processing program. The prototype was exhibited at Keio Media Design Forum, in November 2017, Japan. Around 20 visitors had a genuine interaction with the projection and with the aura wearer. 5 volunteers tried wearing it and interacted with others. We avoided any preliminary explanation to test the instinctive reaction of people.

We observed how people got interested in realizing that their movements have caused a change in the animation. At first, the projection on the floor sparks people's interest. As they see it reacting to their steps they try different position and steps to discover how it changes. In comparison with the previous prototype, people spent longer time engaged with the projection, having more moments and chances to engage in interactions with the user. However, the complexity of the projection made it a bit confusing to someone to understand why it keeps modifying. On the other hand, the projection led to playful interactions and further question to the user. Moreover, we observed and interviewed the 5 people who wore the Aura, to understand the user herself or himself feelings and impression of using our design. People perceive Aura as a fun way to entertain alone and with others, replacing annoying and boring small talks.

The gestures and interactions of both user and approaching people are the starting point for designing new animations and gestures of the device, as turning on and off function. Furthermore, people couldn't understand where the projection is coming from and this generated wonder and curiosity. We believe that technology needs to be naturally integrated into people life. Particularly in this case, into garments and it shouldn't hinder people's movements. Therefore our final goal is to embed all the technology in a single wearable device as a pair of shoes.

Conclusions and Future Work

We believe that Aura is a tool to stimulate and enhance communication in any context. The concept can be deployed in any social situation, for example, conference, party, schools, etc. Currently, we just tested a public exhibition and public space situations, but we expect to also test in entertaining situations in which people look for interaction, such as gatherings, events, or clubs. Another limitation so far is that every culture has different distances at which the private space begins, and actually every person has a different perception of space. We also plan to embed all the technology in one single device, to give the user more freedom and spontaneity.

As mentioned above we would like to test more scenarios in the future. We will also individualize the coverage space of the aura animation to be adjustable for each user. Besides, we are currently working on making the Aura more personal and to improve the connection with the user. There is an ambition to reflect or synchronize personal emotional status through Aura, change the Aura's behavior, interactions and animations depending on the emotional state of the user. We believe this will increase Aura ability and variability, making it more interesting as an actual communication tool. We believe emotional tracker will also help to build a connection with the user and set the precise Personal Distance area to be used, according to each person. Finally, the last challenge we are working on is enabling multiple Auras to interact and communicate with each other.

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