Wearable Aura: An Interactive Projection on Personal Space to Enhance Communication

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Abstract
This study focuses on how technology can encourage and ease awkwardness-free communications between people in real-world scenarios. We propose a device, The Wearable Aura, able to project a personalized animation onto one's Personal Distance zone. This projection, as an extension of one-self is reactive to user's cognitive status, aware of its environment, context and user's activity. Our user study supports the idea that an interactive projection around an individual can indeed benefit the communications with other individuals.

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

ACM Classification Keywords
H.5.m [Information interfaces and presentation (e.g., HCI)]: Miscellaneous

Introduction
In the recent released Internet Trends 2017 report, the penetration of SNS has been incredibly large; on the contrary, deficit of face-to-face communications is becoming more and more common. This study aims to offer a potential solution by proposing a device called Wearable Aura which can encourage people to interact in real world. In the sense

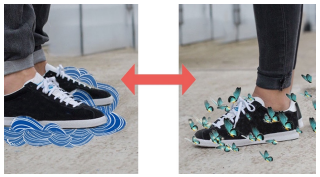

Figure 1: Before Auras interact with each other

Figure 2: When Auras interact with each other

of interactions, the Wearable Aura is like a spiritual pet that walks around the user wherever she/he goes. The aura is projected within the user's personal space. It can interact with the user and with whoever approaches close enough. The aura changes its status according to the user's cognitive state or other contextual clues. We aim to design the aura as an extension of the user by bonding it with the user's cognitive activities such as feelings and thoughts.

Studies have shown how walking a pet bridges private and public space –it is easier to build social connections with other people [1, 9]. We try to replicate the impact of pets to the humans' social interactions with the Wearable Aura. In the user tests of the first prototype, the Wearable Aura promoted different interactions with pedestrians who passed by the users. We believe the Wearable Aura can augment face-to-face interactions between people.

Related Works

Our approach relies on proxemics: a theory on perception of distances between individuals in social context [4]. Hall mentioned four distance zones: Intimate, Personal, Social and Public. People decide what distance to keep according to the intimacy level of their relationship. According to the proxemics theory, there is a correlation between physical distance and social distance [4].

Many works analyze the relevance of proxemics in humans' perception and adjustment of their spatial relationship with others and with the environment [6]. There is not so many works on interaction augmentation using the concept of proxemics, however, the study of Wolf et al. shows how interactive dynamic floor projection is an effective approach to influence people spatial relationships [8]. In the work by Tomitsch et al., they intend to improve social interaction by projecting one's social identity (Facebook profile details) on the ceiling, thus augmenting the personal space around the user. Augmentation was shown to be a conversation starter [5]. However, they do not focus on enhancing one's personality augmenting and showing one's emotional status.

Approach

Aura is defined as any subtle, invisible emanation or exhalation [3]. Atkinson described it as a oval shape radiation surrounding each individual on all sides for two or three feet [7]. In the design of Wearable Aura, we visualize "aura" as a personalized animation projected by a wearable device. We want to emphasize the thigh bonding between the device and the user, and make Wearable Aura a tool to augment user's personality. For example, Aura is quiet if the user is calm, brighter and lively if excited, or dark and slow if bored. We believe that this alive feature intensifies the communication potential of the Aura, since it is not just an animation but it becomes a communication media. Therefore Aura is connected to the cognitive status of the user, and the shape and configuration of the projections is adjusted according to it.

It does not only represent one's cognition, but it also acts like a 'spiritual pet' that can interact with the user and with the surroundings. Aura changes is aspect and behavior according to the surroundings, movements of the user and people who approach it. Hence, the Wearable Aura creates an Interactivated Space around the user [2], a responsive environment that reacts to the activities of people in real-time. Similarly to Wolf et al. this kind of augmentations does not only makes the projection 'alive', but also encourages people to interact with it [8]. Or another example: when pet owners are walking their pets, they can approach each other naturally. Therefore, we believe that walking with a living 'aura' can also lead to spontaneous social interactions.

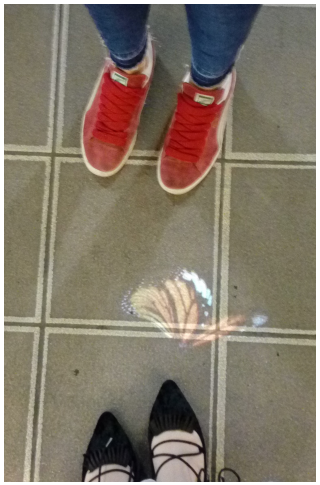

Figure 3: Interaction of projection during prototype test

Figure 4: Interaction of projection during prototype test

User Study

In this first stage of research, we aim to analyze the visual impact of the Aura and investigate if it generates interest in the manner we envisioned. We tested the first prototype of Wearable Aura with a qualitative research on people's reaction to it, with the of Wizard of Oz approach. We used mini laser projectors. The projection was manually controlled, and the projector was hidden from the subjects. The Aura was represented by an animated butterfly (about 15x15 cm size) projected in one's personal space, following the user and interacting with people around the user's personal distance. We ran two tests during the nighttime (around 9 p.m.). The participant wear the Aura and walk for about 10 minutes around the neighborhood (area near university and train station). We observed the reactions of people passing by and the interactions occurred between them and the Aura Wearer.

About 30% people encountered clearly express curiosity, and attempted a verbal interaction with the participant. Around 10% went closer to the Aura to interact with the projection. Most of the people encountered interacted non verbally with the participant, smiling or glancing (see Figure 3). We compared these results with the ones from the similar experience run without the device, which led to few glances and no more.

We run a second test in Shibuya, one of the most crowded areas of Tokyo, with the same equipment, supposing that a more lively context will augments the impact of the Aura. In the second location the projection was noticed by around 30% of the people encountered, differently from first test (around 90%). However, the effect of the interaction was more intense and lasted longer. Several people started a proper conversation, and some openly played with the projection (see Figure 4).

The results may be influenced by the novelty of a personal projection following one's steps, but at the same time they make us believe that the Wearable Aura is a possible bridge to enhance communication with strangers, acting as interaction catalyst and possible conversation starter, especially if people are willing to interact with each other. In those cases, people already have the clear intention of meeting other people, so we believe Aura will be a valuable tool to simplify and enhance it.

Envisioned Setup

There are three major parts in the system: the input sensors, the Aura translator, and the output device. Several technologies are already available to implement The Wearable Aura system (see Figure 5).

The Input Sensors

The Wearable Aura requires two input groups of sensors: motion and space awareness sensors and cognitive state sensors. The motion and space awareness sensors are distance sensors and an IMU. These will be used to map the surroundings of the Aura to adjust the projection. The cognition input sensors will offer the information of the user's cognitive status. All the data will be transfered to the Aura Translator System.

The Aura Translator System

The Aura Translator System will render the animations according to the input data. The cognitive data will determine the status of the aura animation; the motion data will determine the behavior; while the geometry of the environment will determine the position.

The Output Device

The output is an animations rendered by the Aura Translator System and project around the user. Taking the wave animation as an example, the Aura output device will dis-

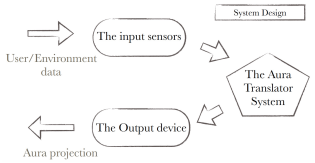

Figure 5: System design

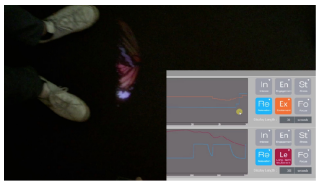

Figure 6: prototype test with Emotive

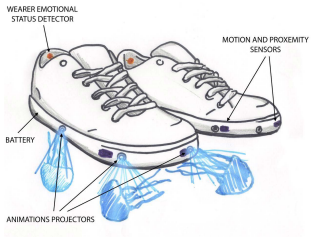

Figure 7: Sketch of Wearable Aura device embedded shoes. Input sensors, output appliance, and battery are all part of the shoe design.

play strong waves animation when the Aura translator system detects that user is excited, calm waves animation for neutral state, and slow and dark bubbling waves for bored or relaxing state.

Prototype Test

In this test, we used Emotive Insight as the cognitive input sensor. It is a wearable headset with mobile EEG system that detects emotions such as excitement, relax, bored and so on. The data is displayed on a EEG software. We asked a participant to wear the Emotive Insight while we used his excitement data group (orange curve; see Figure 6) as the input data. We utilized an animation of a flying butterfly to present the aura. The flying speed changed according the excitement levels through the Aura translator system, a coded program on a PC. All the components are connected wireless trough wifi. During the prototype test, the participant perceived the butterfly flied faster and more aggressive when he got more exciting, and slower and calmer when he got relaxed.

Future Work

For the future work, we will focus on three aspects. Firs of all, instead of having the user wearing multiple units of devices, we aim to design one single wearable item, such as a pair of shoes (see Figure 7). In addition, the current Aura animation is a 2D floor projection, we expect to project 3D animations in the future. Moreover, if possible, we would like to display the aura animations without a physical projector. Moreover, We plan to test in what kinds of scenarios the Wearable Aura can be used as a tool to enhance communication. We expect to test in entertaining situations in which people look for interaction, such as gatherings, events, bars and clubs.

Acknolledgemnts

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