THE GLENNIE APP & WEARABLES

WHITEPAPER

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UNDER THE PURVIEW OF MINISTRY FOR GOOD.

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AN OVERVIEW

PROBLEM STATEMENT

Sound, especially music, has a direct cognitive response to our memories[1]. This response links directly to our emotions and it is one of the reasons we can remember scenarios so vividly from many years ago. Studies have shown[2] that adults who are deaf were found to have less dense representations of early autobiographical memories, fewer categories of information, including visual-spatial information, relative to hearing adults.

Memories and emotions are the hallmarks of a human life; how different do deaf people recall their lives without music as a stimuli?

MISCONCEPTION OF DEAFNESS

Deafness as described in an essay[3] by Evelyn Glennie, a profoundly deaf Scottish virtuoso multi-percussionist:

> *"There is a common misconception that deaf people live in a world of silence. To understand the nature of deafness, first one has to understand the nature of hearing.*
>
> *Hearing is basically a specialized form of touch. Sound is simply vibrating air which the ear picks up and converts to electrical signals, which are then interpreted by the brain.*
>
> *The sense of hearing is not the only sense that can do this, touch can do this too. If you are standing by the road and a large truck goes by, do you hear or feel the vibration? The answer is both. With very low frequency vibration the ear starts becoming inefficient and the rest of the body's sense of touch starts to take over. For some reason we tend to make a distinction between hearing a sound and feeling a vibration, in reality they are the same thing."*

USE OF VIBRATIONS TO TRANSLATE AMBIENT SOUNDS.

Sound — even the most minute of differences — can be felt by the body through vibrations. Glennie contends that hearing is a form of touch, and that everyone, whether deaf or not, processes sound in an individual way.

This finding was backed by Dr. Dean

Shibata, a professor of radiology at University of Washington, whose studies suggest[4] that the experience deaf people have when ‘feeling’ music is similar to the experience other people have when hearing music.

This forms the basis of our hypothesis when designing The Glennie App and Wearables. We use haptic feedback to augment ambient sound, such as car horn, crowd cheering, or public announcements, into vibrations to communicate to the wearer.

IMPLEMENTATION OF SPATIAL TECH

The system is implemented as a smartphone application that features the conversion of audio in the environment to three modes of output: a) Haptic feedback conversion, b) Cymatic visual generation, c) Context-speci c information about input audio

All three outputs are contextually driven, e.g., tension and noise level in crowds can be represented by vibrations and visual intensity, lyrics from music are displayed as the informative text output, and different vibrational patterns can be programmed for different music. Cymatic visuals will provide symbolic visualizations of the sound. Music fingerprinting is employed for identifying songs, allowing for output modes to be context driven.

Multimodal output delivered simultaneously to the user gives an emotionally-evoking multisensory experience.

THREE MAIN CHALLENGES

1

Sign Language
is Not Universal

2

Barrier to Communication
with Non-Deaf People

3

Limited access to
Collective Effervescence

DOING IT FOR NATIONAL PRIDE

Each year, as the country prepares to celebrate the nation's birthday, one can feel the built up of hype in the air as we join our voices to sing iconic songs that instill in all of us a sense of camaraderie and national pride.

The sense of togetherness is termed as Collective Effervescence[5] and studies have shown that the sources to create such a moment involves both focused (face to face) and unfocused (gestures and symbols) interaction by a large group of people[6] often times in an environment that relies on sound.

Examples of such environments can be found at music festivals, congregations, and national day celebrations.

> *"Being in a crowd gives some sense of being 'where the action is."*[7]

For the first phase of the project, we are building a use case for the deaf community to gain access to the Collective Effervescence from national festivities through haptic feedback, cymatic visuals and contextual information via their mobile devices.

OBJECTIVES

(A) To instil a strong sense of national pride for everyone including the deaf.

Through publicity of the project, society will witness the strength in national spirit and camaraderie across people of races, creeds, and now, hearing abilities.

(B) To foster an inclusive society especially for the deaf.

The features allow for closer inclusivity in the festivities where the deaf would ordinarily feel excluded because of the significant role that music and sound has in National Day celebrations.

(C) To provide and grow a digital community for the deaf.

The vast majority of deaf people in Singapore are not registered with the Singapore Association for the Deaf (SADeaf), resulting in isolation from the rest of society. Working with the SADeaf as collaborators,

we will connect the existing community of deaf people with more deaf users of the application.

(D) To provide a source of information and resources for the deaf.

There are many programs and tools that help the deaf improve their quality of life and integration with society. Apart from the National Day features, the application will also serve information and access to resources to help the deaf.

MEASURING SUCCESS

We will track the number of deaf users at the National Day Parade and other events via the Glennie App.

We will use the following statistics as an indication of how well the application has reached out to society and how much it has contributed to the growth of the deaf community:

1. Number of downloads of the Glennie App.
2. Amount of media coverage and social attention given to the cause.
3. Growth in the number of registered deaf following the release of the application

BUDGET & STRETCHED GOALS

Target 1 — SGD 50,000 Raised

Audio to haptic feedback conversion

Audio to cymatic visual generation

Application-specific information about input audio

Target 2 — SGD 150,000 Raised

Ambient music identification

Sound classification

Context-specific haptic feedback, cymatic visuals and information display

Target 3 — SGD 250,000 Raised

Comprehensive speech-to-text model

Computer vision-based sign language interpreter

Wearable Device Prototype

Target 4 — SGD 450,000 Raised

Mass production of Glennie Wearables

TECHNICAL SPECIFICATIONS

The Glennie App and Wearable system is being developed in phases, each of which will implement and release new major features to enhance the lives and inclusiveness of the deaf community with the rest of society. The major feature release roadmap are as follows:

Phase 1

Phase 1 of the system is implemented to convert audio to three modes of output. The first mode is haptic feedback, second is cymatic visualisation, and third is informative text. All three outputs are contextually driven based on situations, e.g., tension and noise level in large crowds can be represented by vibrations and visual intensity, lyrics from music are displayed as the informative text output. Multimodal output can be delivered simultaneously to the user, resulting in a multisensory experience that compensates for the loss of hearing.

Haptic feedback is delivered via the device vibration motors and programmed to be intuitively representative of the nature of the sounds, i.e. To simulate a mosquito sound, the phone will vibrate gently but at a high frequency.

In the past, we have implemented nature and physics-based cymatic visualization in the form of water cymatics, i.e., the simulation and visualization of water waves formed from the perturbation of the water medium by physical sound waves. This was achieved with a physical water cymatics setup that was deliberately art directed and tuned to create aesthetically pleasing and emotionally engaging sound-induced water movements for a wide range of audio signals. Spectral analysis of the sounds will be performed, specific bands of sound frequency and amplitude will be identified and mapped to different cymatic and haptic patterns.

Encapsulating the system will be a downloadable mobile application that can be run on smartphones. The microphone of the mobile device will be used to receive sound from the environment. The mobile application will be designed fully-functioned for the benefit and enjoyment of deaf users.

A push notification will alert the user when there’s a change of mood in the

environment. The user also has the option of wearing an IoT device that will analyse the wearers mood and match it against the mood in his surroundings.

Technical specifications for later phases will be revealed after we have achieved the required budget for Target 1.

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