Together in a crowded place

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ABSTRACT
This paper discusses the phenomenon of isolated urban personal stereo use and proposes a noninvasive way of reconnecting people. A visualizing device that mediates the audio being listened to on a personal stereo for other people in the immediate area is discussed. The designing of a prototype is discussed and the implications of its use examined.

Keywords
Personal Stereo, Isolation, Crowd, Commuting, Mediate, Audio, Visualization, Conceptual, Urban, Mp3, Communal, Space, Personal Bubble, Pure Data, PD, Processing, Arduino, Android, Bluetooth

1. INTRODUCTION
Together in a crowded place is an attempt to mediate current urban personal stereo[1] use. The idea is create a way of giving people a sense of what someone is listening to on their personal stereo without intruding on the listening experience. This is proposed to facilitate a reconnection of people in the current isolating environment that is urban life. The visualizer allows people to be connected but still immersed in their personal listening experience.

2. PROBLEM STATEMENT
Personal stereo listening can be viewed as a private experience for the individual user, however it is also an isolating experience for those nearby. An early design of the Walkman by Sony recognised the isolating potential of the device and incorporated a second jack and an orange button so that audio could be shared over the two headsets. "The orange button was like a panic button, an emergency 'share' feature. The company was that hesitant, Sony cofounder Akio Morita wrote later, 'to release a product that was somehow so selfish'." [1]

NIME'11, May 21-23, 2011, University of Michigan, Ann Arbor.

Figure 1: Sony's Original TPS-L2 Walkman [2]

The change in attitudes towards personal stereo use, from the first inception of the Walkman to its present day endemic use in urban society, is interesting. The personal stereo user now erects a personal bubble through its use, a kind of perambulatory analogy to a hotel "Do Not Disturb" sign. Its use signifies a blanket "No" to interaction.

Together hopes to change this dynamic with an audio visualizer for the personal stereo user. The point of the visualizer is to allow other people near the user to get a sense of what the user is listening to without disturbing the listening experience. This facilitates interaction in a crowd which previously had none.

3. RELATED WORK
Sound reactive t-shirts, often worn by party goers and clubbers, are available. These t-shirts visualize audio that is audible to everyone and act as an active fashion accessory. The device proposed for this project will be similar in output, but aims to visualize the audio that only the listener can hear. The implementations are similar, but their motivations are very different.

[1] The term personal stereo is used as an umbrella term for all mobile music players, including devices like Walkmans, iPods, mp3 players and smartphones.

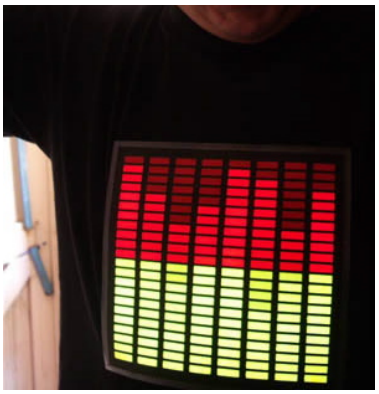

Figure 2: T-shirt equalizer [6]

Sounding Out the City [3] covers much of the conceptual framework of this project. The book deals with the idea of the personal stereo in the modern environment, as a method of dealing with boredom, as a protective bubble and a way of defining personal time. Vawter's Ambient Addition [4] is a project that addresses the isolation of personal stereo use. His solution was a reinvented personal stereo that uses real-time modification of environmental sounds to create a link between the listener and their surroundings. Other works like Sonic City [5] have also informed this project.

4. DESIGN CONCERNS

An important area for the project is to find a design that is unobtrusive and that fits in with how personal stereos are currently used. A wired prototype was made to test the idea, but the inclusion of the wire made it cumbersome. The design currently under development uses a visualization badge connected to a smartphone via Bluetooth. This fits in with how a user would normally use the device. The smartphone can be placed in a pocket or bag and the badge attached to a lapel or scarf.

The visualizer itself is a clip-on-badge containing RGB LEDs, an Arduino [7] and a Bluetooth [8] receiver. This makes the project easy to integrate with current use and requires little input from the user. The ultimate design for the project is an app for a smart phone that takes a feed from the audio output, visualizes the output and sends control information by Bluetooth to the physical visualizer. At present a method of taking a feed from the audio output from a smartphone has not been implemented.

5. IMPLEMENTATION

As a proof-of-concept the project was designed using a wired visualizer, embedded in a garment, with a laptop processing the audio. Once the concept was established the project was migrated to an Android smartphone and connected to the badge via Bluetooth.

5.1 Hardware

The hardware for the project was built around an Arduino Nano micro-controller. In the wired version the Arduino is used to receive information about the audio from the laptop and use this information to control the LEDs.

The LEDs are soldered onto a piece of strip board and connected to the Arduino via 7 wires. Six providing individual control over each of the RGB channels on each LED and the final wire acting as a common ground.

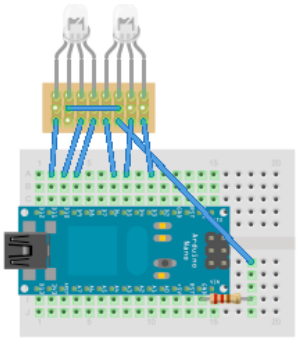

Figure 3: Hardware diagram

To create the visualization badge the light from the LEDs are passed through fibre optic strands. Each LED feeds 16 fibre strands and the strands are arranged in four rows of 8 strands. A pattern was created using a piece of strip board as a template and sticking the strands through the holes and fixing them in place. The rows for each of the LEDs were interspersed so that the output from the LEDs displaying the lower frequencies would appear on the lowest row and on the second highest row with the LEDs showing the high frequencies on the remaining rows. This was an aesthetic choice, and for music which has an interplay between high and low frequencies this provides a visual analogy.

The hardware was assembled as shown in Fig 3 along with the badge and embedded into a jumper. Fig 4 shows two examples of the visualizer implemented in a garment, one when it is inactive and another when it is reacting to music.

Figure 4: Visualizer lit and unlit

A hole was cut in the lining of the front pocket of a jumper. The Arduino was fastened into the pocket and the cables were run through the hole up inside the jumper to the position of the visualizer. Only the visualizer is visible from the outside – the rest of the hardware is hidden. The visualizer was then sewn into the left breast of the jumper, where one would normally find a manufacturer logo. This was so that the badge wouldn't be distracting

when not being used, but would be in a visible position when active.

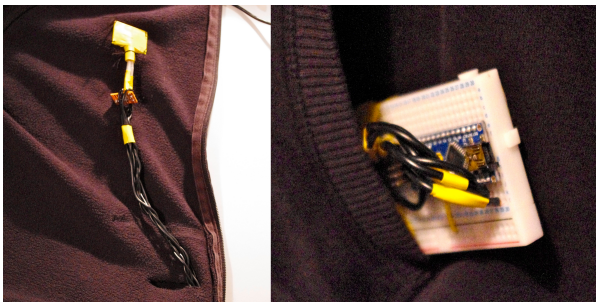

Figure 5: Hardware implementation

Following on from this prototype the version of the badge currently under development is a standalone piece of hardware, which will be enclosed in a satchel that can be hung around the neck. The satchel will contain an Arduino with a badge attached, connected to a smartphone via a Bluetooth receiver. The control information for the LEDs can be passed to the Arduino via Bluetooth and no longer needs to be wired. This allows the visualizer to be more easily integrated with current personal stereo use. This implementation is a more unencumbered experience which facilitates user immersion by removing the distractions of the wired version, allowing the user to remain unaware of the technology.

5.2 Software

The project is implemented on the Android using Pure Data (PD) [9] and Processing [10]. When the users open the app they are asked to connect to Bluetooth devices, where they can select the Bluetooth receiver corresponding to the badge. The user is then presented with a screen with two buttons. These buttons allow the user to play two audio files that have been stored in PD. When the audio is played the PD patch does a Fast Fourier Transform (FFT) analysis of the audio. The analysis procedure takes a running average of several frequency bands. These averages are passed by Bluetooth to the Arduino. On the Arduino the averages are used to control the LEDs.

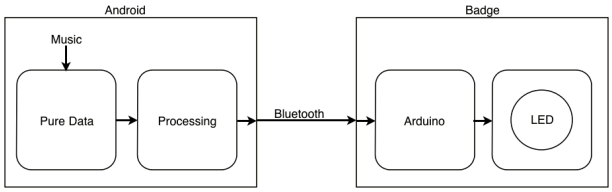

Figure 6: Software flow chart

The LEDs are fed with three values, one from each of the averaged frequency bands. This allows the frequency content of the sound to control the outputted colour of the visualization, while the intensity of the light is controlled by the combined power of the frequencies in the three bands. This implementation allows there to be a perceptible difference in the visual output depending upon the frequency distribution and the overall intensity of the song being listened to.

The current implementation uses two wav audio files embedded in the application. This was done to test the idea, but is impractical in a real world scenario. Future implementations will take a feed of the audio at the output of the Android. This will help to reduce the size of the application, as including audio greatly increases the file size, and provide a mediated representation of what the user is listening to.

6. DISCUSSION

The current visualizer suffers from a lack of brightness in high ambient light. This needs to be improved in subsequent designs. Possible ways of increasing its effectiveness might include using side glow fibre optics that could run along the seams of garments or experimenting with thermo luminescence paint and electro luminescence wire. The visualizer could be customized, on a user-by-user basis so that users could make it to suit their own lifestyles and tastes.

User trials of the project would be a useful step to see if and how users might use this type of device. It might turn out that users aren't interested in the connective element of the project, but like the idea of using the visualizer as a fashion statement. Or perhaps they would like to use the visualizer while listening to the music with their friends instead of listening on their own with headphones. These kinds of questions could be answered by a qualitative study.

7. CONCLUSION & FUTURE WORK

This implementation of the project has proved that it is possible to provide a realtime visualizer for use with a personal stereo. The visualizer provides a visual representation of the music being listened to for people near the user. This acts as a form of non-sonic connection allowing people to observe a representation of what the user is listening to.

While this implementation has proved the concept there are many areas of the project that need to be improved. At present the design is too cumbersome to be used on an ongoing basis. The physical footprint of the badge device along with the ease of use of the software needs to be streamlined. The project would also benefit from user testing to find out if it is practical for day-to-day use, or should be a restricted to being a feature festivals or concerts.

Future implementations will build upon this to realise the original intention of the project, a smartphone application and standalone badge. To complete the application the output audio needs to be fed into the application and the

Bluetooth transmission needs to be improved. Once this has been completed the project can be wrapped as an application and can be made available to download. The hardware also needs to be streamlined to improve its usability to make it fit in with user lifestyle.

An area for future work could be creating some semantic connection between the music and visualization. This would mean looking at possible emotive responses to different types of music and creating appropriate visualization mappings. This might be implemented by using the ID3 tags from the mp3 files to extract the song genre and create different rules for how different genres are displayed.

An interesting follow on from this project might be to make customizable badge kits so users could make the badges themselves. These kits would provide all the basic components and instructions and would allow the user the option to customizse their badge to suit their own tastes and lifestyle. They could then download the app and integrate it with the badge.

8. ACKNOWLEDGMENTS

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