EEG Visualising Pendant for Social Situations

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Introduction

This poster discusses the EEG Visualising Pendant [Fig 1], an emotive wearable that maps and visualises EEG data from a NeuroSky MindWave Mobile Bluetooth EEG headset. It has been developed through several iterations as a doctoral research prototype for studies evaluating the use of bespoke, aesthetic wearables in the role of nonverbal communication.

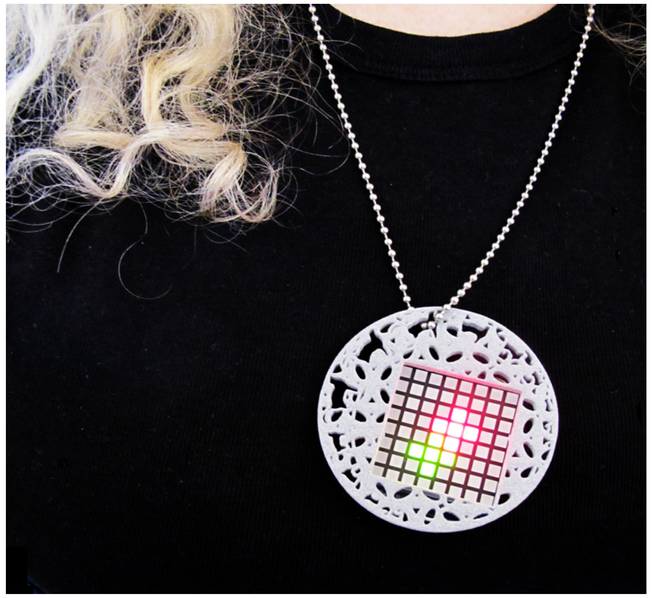

Figure 1 *EEG Visulising Pendant*, on chain

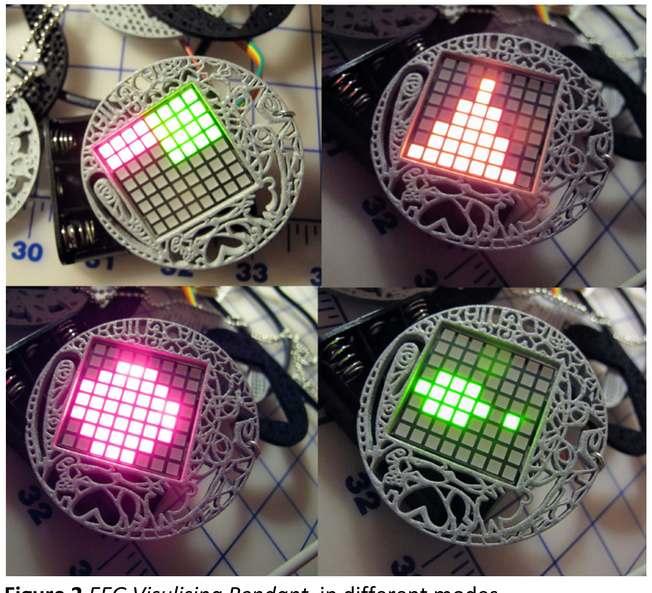

Figure 2 *EEG Visulising Pendant,* in different modes

Motivation

Reasons for creating the pendant were driven by the need to investigate whether it is possible to create a wearable that can relay nonverbal communication between the wearer and observers during social and formal interaction, and also to research the needs and requirements of users. Data visualised on the pendant via LEDs (light emitting diodes) is used as a visual cue to whether the wearer is concentrating on conversation or their attention is drifting away. Although this may seem like a very unsubtle method of communication, it is actually intended that as a unique approach it would be helpful in the avoidance of cumbersome social situations, where neither wearer or audience knows when to change the topic of conversation, let someone else do the talking or move along.

Pendant design

The EEG Visualising Pendant is approximately 2.4 inches in diameter and is an 8 x 8 LED (light emitting diode) matrix that is surrounded by a choice of bespoke SLS 3D printed or clay modelled interchangeable frames [Fig 3] to allow the pendant to become a personalised piece of jewellery. Data is mapped in two colours, red for 'attention' data associated with concentration and focus, green for 'meditation' data associated with relaxation or unfocussed states.

Data is supplied by the headset from NeuroSky's proprietary eSense algorithm on a scale of 0–100 [2]. As this technology is proprietary and not transparent, the author is not able to comment fully on the functionality of its eSense algorithm or the reliability of its output. Data is reflected as growing and constricting shapes on the LED matrix in the form of circles, diagonals and rectangles [Fig 4]. The pendant also has live, record and playback

User studies

To determine the opinions and requirements of potential users and observers of this technology, feedback was sought in interviews, critiques and surveys from focus groups and field test with fifty participants [1]. For the scope of the focus groups, three groups with four women, grouped into different age ranges and a forth focus group was conducted at the Quantified Self Europe with male and female participants. Twenty-two field tests were carried out with women and men to measure reactions and collect the experiences of those who wore an emotive wearable prototype in 'real world' social and formal situation.

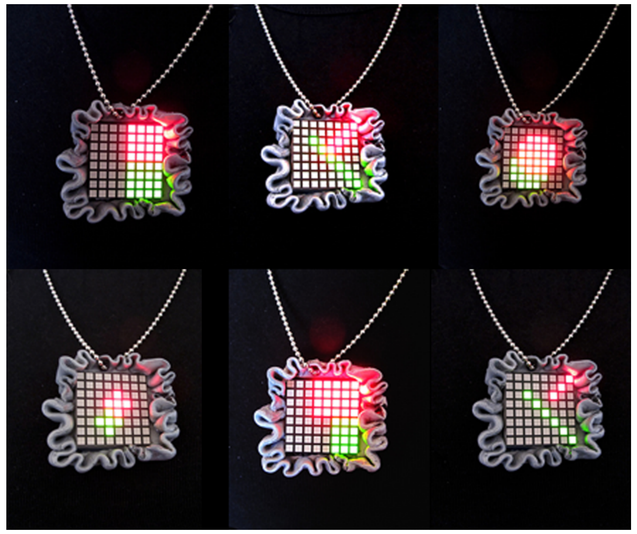

Figure 3 *EEG Visulising Pendant*, data patterns

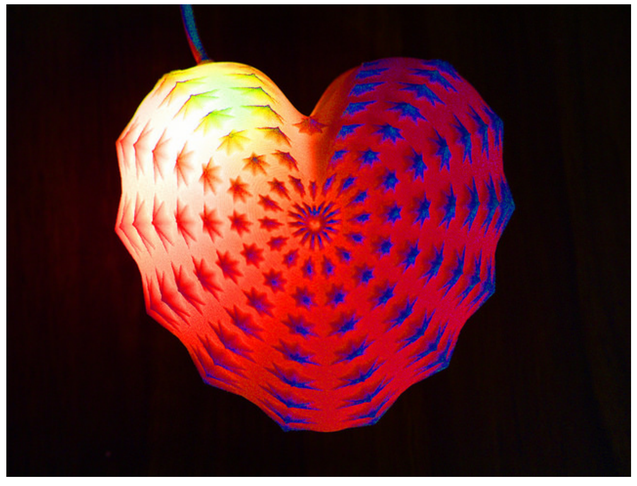

Figure 4 *EEG Visulising Pendant*, data patterns

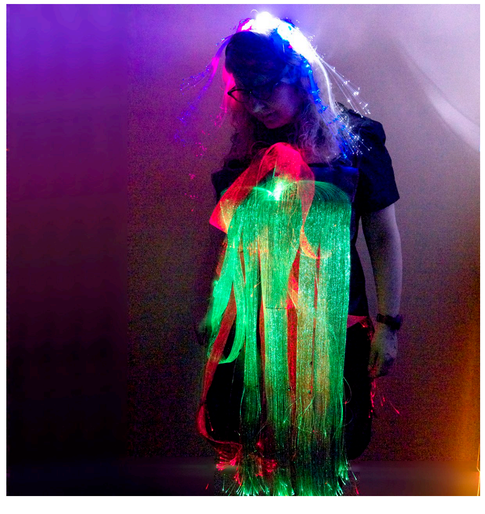

Figure 5 *ThinkerBelle EEG Dress*

Summary conclusions

- The research established that there is a potential audience for wearables that convey forms of nonverbal communication to communicate during human interaction.
- Insights from user studies discuss attitudes to wearing such artifacts, form factors and personal choices in terms of aesthetics and functionality, such as perceived usage compared to actual use in public situations.
- How participants compared the visualisations to 'secret' or covert visual language suggested various uses, especially between groups of friends.
- Testing highlighted issues around the usability of the pendant, as well as how one size does not fit all in terms of aesthetics and design.
- Feedback also determined issues with design of the pendant that were not obvious at the planning stage. Observations around wearing technology in public and influenced where on the body and in what form the potential wearers would like a display to be situated, if at all.
- Participants revealed in feedback that they would like bespoke or personalised elements included in wearables.
- Privacy issues also shaped how potential wearers would be willing to wear such devices and how the display might be configured.
- The record and playback functionality [Fig 2] introduces the term 'emotive engineering' to describe how users of emotive wearables might use the record and playback functionality of these devices to change the synchronicity of visualised data, to potentially manipulate social and formal situations. This is remindful of Goffman's [3] theories around the presentation of the self.
- From this research two new bespoke emotive wearables were created, ThinkerBelle EEG Amplifying Dress [4] [Fig 5] and AnemoneStarHeart EEG Pendant [5] [Fig 4].

References

[1] Ashford, R., *Responsive and Emotive Wearable Technology: physiological data, devices and communication,* PhD thesis, 2018.
[2] NeuroSky, 'MindWave Mobile User Guide' 2011.
[3] Goffman, E., The Presentation of Self in Everyday Life, 1959.
[4] Ashford, R. *ThinkerBelle EEG Amplifying Dress*, ISWC Adjunct Proceedings, Osaka, 2015.
[5] Ashford, R. *AnemoneStarHeart*, ISWC Adjunct Proceedings, Heidelberg, 2016.