



THE VISUALIZATION OF INTERNAL BIOMETRICS AND THEIR EFFECTS

REFLECTION ON INTERACTION DESIGN

Pulse

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This report aims to outline the results of the visualization of internal biometrics, specifically, the heartrate. Using a multitude of electronics, as well as the iterative design process, conclusions are drawn to the effect of the visualization. Supporting background material is discussed to give an overview of the space, and where the project fits within this space. The design and development process of the installation, as well as personal achievements, are detailed. Measuring the success of the design is shown through an evaluation of the success criteria that was developed. Results showed that the response to the installation was overall positive, and generated the experience that was intended. Future applications of the installation in technology are discussed as a conclusion.

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Physical Computing & Interaction Design Studio Reflective Report

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Introduction

Biometrics are an ever growing field in today's society. Modern Biometrics focus on the utilization of control of access, and personal security measures based on biometric data (Atick 2001). Biometric data has the flexibility to be used for other applications. Pulse is an interactive art installation, designed to explore the boundaries and applications associated with the internal biometric, heart rate. There is no distinct problem that was set to be fixed with Pulse, allowing the open interpretation of results. The nature of Pulse is to create an environment in which end users will interact, respond and have a heightened sense of awareness of the heart rate. Pulse innovates this field of biometrics and brings visualization, through light, to produce an alien experience for end users. The neurological response of the visualization, followed by the physical changes in state in response to this, is one of the key areas of Pulse. In addition to this, Pulse promotes social interaction through the user's contribution to a collective display.

Design and development of Pulse took an iterative approach. Appropriate design, both for the interaction and the results had to be taken to ensure the desired outcomes. Design decisions all focused on achieving the key feature of Pulse, encouraging response from the visualization of the heart rate. The design of Pulse went outside the contemporary design directions. Major focus on the UX steered the final result of Pulse.

Observations based on the response of the user during the installation gauges the success of Pulse. Measure a neurological response is difficult. Measuring the facial expressions, initial response, body language and physical responses to holding and visualizing the heart rate is used to determine the success of the installation.

Background

SOCIAL INTERACTION

One of the main features of Pulse is to create an environment in which users will be able to contribute to the dynamic art display. Incorporating social interaction to the installation is done through this indirect way. Similar to the Index Pulse installation (Lozono-Hemmer 2015), Pulse indirectly promotes social interaction through allowing individuals to contribute to a collective display. Additionally, social behaviors and using biometrics as an icebreaker has also been explored (GeekPhysical - Biometric Social Interaction). This contribution promotes social interaction between the individual's network through the individual alteration of the display, and the feeling of contribution. Furthermore, Pulse interacts with users the personal creation of an object with their heartrate. The IKEA effect (Ariely 2012), connects the user on a deeper level with the object they created. Sharing this object with others, the display of something that they have created, promotes the social interaction between users.

BIOMETRICS & RESPONSE

Internal biometrics are an important facet of the Pulse project. Using Biometrics, and the data gathered, to generate a dynamic display and interaction is close to unique. The understanding of the heart rate, and the causes and effects that it can have on psychology is a relatively new field of research. Heart Rate Variability (HRV) is a tool that can connect the sympathetic and parasympathetic branches of the autonomic nervous system. (Heart Rate Variability 2015). This is also closely related to biofeedback, in the response to HRV (Lehrer, Gevirtz, 2015). Visualization of the heartrate and the intended response of the user is influenced heavily by these aspects. The Polyvagal Theory (Porges, 2015), describes a response to the nervous system. The connection of these theories to Pulse is complex, yet can be explained in a simple fashion. The original intended design for Pulse was to create awareness for the user of their heart rate. By visualizing the heart rate the user becomes aware of the heart rate. Depending on the HRV that is observed, users will have a neurological response and either subconsciously, or consciously alter their behavior, which then alters their heart rate. While this still connects Pulse to a medical benefit, by altering the deliverance of the heart rate it alters the response of the user.

Pulse

DESIGN

Iterative design was important throughout the creation of Pulse. Effectively producing the desired outcome and experience required design at every point of the interaction. Body language was an important aspect of the design of Pulse. It was originally intended that users would read their heartrate outside of the normal, submissive posture that is present when taking heart rates. Incorporating an open, powerful stance during the interaction promotes confidence and inclusiveness in the project (Hedwig 2012). A sturdy stance, with outstretched arm palm face down on the table was designed into Pulse to build on the desired response.

Design of individual objects for the users to hold also promoted the intended experience. The object was designed to hold safely and securely in the hand, while still holding all the proper hardware that was required. Testing and re-evaluation of each design aspect of the project was done to effectively ensure the success.

Individual contribution to the design was always highlighting the important of gauging the response of the users. Generation of the heart rate, and the personal experience of end users were additional contributions. The achievements reached, both personally, and as a group were high. Iterations of the designs effectively achieved the desired goals.

DEVELOPMENT

Development of the hardware and software was done mostly by an individual. The personal contributions to this section of the project was heavy. Working with new forms of technology, encountering failures, and solving these problems was a common occurrence throughout the project. Alterations to the design was based on the development of the project.

Conclusions

OBSERVATIONS

Throughout the final display of Pulse, observations were taken during the interaction, as well as in-depth discussions with users after the interaction. Of the approximately 200 users that passed through the installation, a variety of different experiences were observed. Determining the success, and the experience that Pulse created was important to these metrics. The below table outlines the most notable of interactions of the exhibition.

Table 1

Interaction Type	Description
The IKEA effect feeling (Ariely 2012)	One of the most observed interactions with the installation was that users exhibited a sense of connection with the object. Users would feel as though the IOs belonged to them, as it contained their heart rate. This observation was surprising, not only because users had a heightened sense of connection, they would then also show this to their networks. Users would show this to their friends and partners. They would display a sense of personal connection with the object. This was satisfying to see, and opens up more areas for the future of Pulse.
Unique Interactions	Many of the observations and discussions with users produced different results. Discussions with users after they had interacted with the installation revealed that all users had a positive experience. Both stages of the interaction, contributing to the

	art, and the process of transferring your heart rate was new and exciting to users.
Unexplainable, Alien Feeling	Although this is a very hard aspect to measure with the audience, it was seen, and discussed with users on the experience that they felt. The majority of users explained the feeling as new yet peculiar.
Clutter of Experiences	One of the observations that was not apparent until the exhibition of the project was the overwhelming interaction time frame. Within a few seconds once the heart rate was found, it would add it to the display, as well as add it to the object. There was no specific focus at this point in the interaction. This may have been detrimental to the both experiences. Remedying this in the future would require further separation of the experiences, perhaps making one turn into the other. Such as once users have their object, they can then use this to add it to the display.

S U C C E S S C R I T E R I A

The success of Pulse was judged on a few key areas. These areas, including failure or success discussion, were as follows,

1. Initial Response of Interaction

The initial response of the system was a crucial criteria. The surrounding environment, the outside observer looking in, and the overall feel of the installation was being reflected on the initial response of the users. Observations, as well as feedback from users, suggested that the initial response to the installation was very positive. This aspect of Pulse was successful.

2. Social Interaction

Promoting and influencing social interaction was one the key areas of Pulse. Although this was achieved in an alternative way. Majority of the users would interact with the system with their friends around. Although they had just watched their friend interact with the system, they were still willing to interact and increase the socialization between them. Achieving social interaction was considered a success for Pulse.

3. Intuitive System

Design alterations were made towards the end phases of the project that had negative effects on the intuitiveness of the system. Intuitiveness of the system was considered non successful.

4. Intended Experience

The intended experience, the feeling achieved when users were able to hold their heart in their hand, was perfect. All users who came through the interaction experienced this. The design process was immensely successful in this regard.

Overall, Pulse was considered to be a successful interaction that achieved the main experiences that were initially intended. Based on the observations, as well as the results from the success criteria of Pulse, further future applications can be explored. Future uses of Pulse can be refined to fit into the space and evolution of biometrics in technology. Continue integration of Pulse and the visualization of heart rate can be incorporated into the medical field. Background information explored, as well as the observed results, opens up the beneficial side of Pulse, and how it may be applied to an application that further improves the health of users. The visualization of the heart rate, as an individual object, and as a social contribution, has effects that can be applied in future technologies.

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