

**Figure 1.** The drawing process

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# Metaphone: an artistic exploration of biofeedback and machine aesthetics

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## **Abstract**

The Metaphone is an interactive art piece that transforms biosensor data extracted from participants into colorful, evocative perceivable visual patterns on a big canvas. The biosensors register movement, pulse and skin conductance – the latter two relating to emotional arousal. The machine creates a traditional art form – colorful paintings – which can be contrasted with the pulsating, living body of the participants and the machine-like movements of the Metaphone. Participants interacting with the machine get their own painting drawn for them – a highly involving activity spurring a whole range of questions around bio-sensing technologies. The participants engaging with Metaphone have to agree to share their personal data, thereby expanding the interactive discourse while questioning the extension of the body with the machine and involving participants with public exposition of their inner worlds.

## **Author Keywords**

interactive art; biofeedback; bio-sensing technologies; machine aesthetics; artistic research;

## **ACM Classification Keywords**

H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.



**Figure 2.** Pattern drawn on a big canvas by Metaphone



**Figure 3.** The Metaphone machine

## Introduction

The Metaphone project is exploring ways of expressing aspects of emotional processes in an artistic manner. The idea is to involve the viewer in a biofeedback interaction. Biofeedback aims to reveal psychophysiological processes of the body of which we are partly or entirely unaware, by transforming a biological signal into a form that can be perceived by our senses in real-time.

The Metaphone is an interactive apparatus, an actuator, transforming the bio-data input taken from a participant. The participant's data is interpreted by the system, generating expressions using a traditional painting technique, see **Figure 1**, forming artistic expressions on a big canvas. It translates the biofeedback into a visible color scale using a preprogrammed pattern, see **Figure 2**. The Participants become an active part of the project through sharing their personal data. During the interaction emotional and psychophysiological qualities connect body and machine.

## Motivation

Biofeedback interactions are gaining popularity in the commercial world through applications that mirror your pulse, sweat levels or energy consumption [7]. There is for example, commercial systems such as the Nike Fuelband or Affectiva's bracelet, allowing users to interact with their arousal reactions or energy consumptions in real-time, as part of their everyday life. But an artistic rendering of such processes might reveal other aspects of what it means to engage with bio-sensing technologies and biofeedback. As the phenomenologists posit, the body is the mechanism through which one's experience is *lived*. The body is not an *object* separable from ourselves or our understanding of the world [8]. Our bodies structure our experience and place limita-

tions and opportunities on what we can experience. Biofeedback loops enter into this landscape, making what was previously invisible visible, instead of being accessible only through our bodily awareness. As such, it may improve our self-awareness, help us to master our physical reactions. Or as phrased by Richard Shusterman [6]:

*"Our experience of ourselves and our world is always embodied and involves somatic responses and feelings that are typically unnoticed though they are unavoidable and indispensable for our proficient functioning. We need a proper feel for our tools in order to use them most effectively; and this includes the use of one's own body in using other tools. For the body is our indispensable tool of tools, the necessary medium of our being, perception, action and self-presentation in the world."*

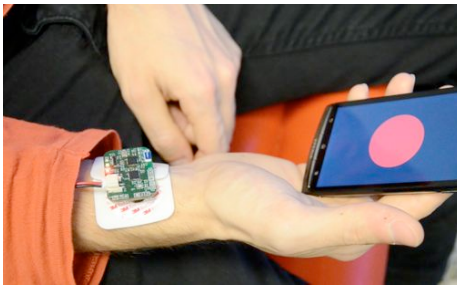
But while Shusterman advocates engaging in certain bodily practices, such as yoga, Feldenkreis or Alexander-technique, thereby learning more about your own bodies, biofeedback is an entirely different approach, involving users in interactions with data that is externalized from their bodies. We may want to take a more skeptical stance to these bio-sensing technologies: what happens when we expose these "typically unnoticed" somatic responses not only to ourselves but also to bystanders as part of an interactive art-piece?

## The Metaphone

The apparatus is an electromechanical device, using open-source hardware and free software, reacting according to participant's bio-data. Different bio-data is transformed into a colorful spiral pattern, where different colors represent different data, see **Figure 3**. Movement of the different parts of the machine harmo-



**Figure 4.** Participant is interacting with Metaphone through EEG sensor



**Figure 5.** Participant is wearing biosensors



**Figure 6.** Khut, Distillery: Waveforming work

nizes with participant's pulse, heartbeat or sweat. The pictorial artwork is growing on the canvas, leaving a trail for participants to explore visualization of their emotional status and psychophysiological processes. Here biofeedback comes in the process of shaping the visual part of the drawing as well as by providing participants with live communication with their own body and emotional status.

The sharing of personal bio-data with others appears in the interactive process with other participants and bystanders, and, afterwards, with other people at the exhibition of the pictorial artwork as the artwork is given away to the participant.

### **Artistic process and inspirations**

The project evolved out of an artistic practice-based research process. The process can be characterized as a process of iterative reflection-in-action, combining methods from iterative design, reflective practice and theory.

Reflection-in-action is a method whereby the knowledge embodied in professional practice is exercised and developed, including framing and reframing problems, exercising knowledge during practice and reflecting on the results [5]. This is how the three stages of the Metaphone machine were developed: design, reflection, re-design, etc. First the interactive apparatus picked up on vocal expressions. In a second step, bio-sensing technologies were connected with an electroencephalographic (EEG) sensor, see **Figure 4**. The interactive apparatus receives brain impulse emission and translates the signal into color. In the third phase of the Metaphone project, the drawings are based on data

from biosensors, see **Figure 5**, picking up on aspects of the participant's emotional processes.

Artistically we were inspired by Jean Tinguely's (1925-1991). His work had a significant impact on the understanding of the role of technology in Modernism. Tinguely's machinery provoked the very core of the role of the artist vis-à-vis the art produced. In a series of mechanical interactive machines – *Métamatic* (1955-1961) – he explored the idea of art being generated by the machine rather than the artist. Tinguely's art is querying the mindless overproduction of material goods in advanced industrial society of the last century. Tinguely's machinery and generativity in arts thereby questions the disappearance of the author or artistic intention, instead opening for an interaction between the artwork and its audience. Similarly, in the Metaphone project, we expand on the art viewers' role, changing the contract between artist, art-piece and viewer. The participants engaging with Metaphone have to agree to share their personal data, thereby expanding the interactive discourse while questioning the extension of the body with the machine and involving participants with public exposition of their inner worlds.

Recent digital interactive artworks have been involving viewers in biofeedback interactions. One example is the Brainball Game from Interactive Institute (Sweden) [3] – a game physically controlled by players' brain waves. The artist George Khut [4] has based his work on psychophysiology and biofeedback, creating links between visualizations of bio-data, see **Figure 6**, and participants' experience. The artist Marco Donnarumma [2] involves himself in artistic and musical performances, combining biophysical processes with bio-sensing and interactive technologies.

Metaphone combines explorations of biofeedback with the *machinic* tradition, following on from Tinguely, exploring the aesthetics of the machinery. As Broeckmann frames it: “*As an aesthetic principle, the machinic is associated with process rather than object, with dynamics rather than finality, with instability rather than permanence, with communication rather than representation, with action and with play. Machinic art acts as the facilitation of aggregations of bodies and forces in which no meaningful differentiation can be made between human and machine. The functionality of the machinic itself becomes the core of the aesthetic force it exerts, creating a phylum that does not distinguish between human and machine agency*” [1].

Similar to Khut and Donnarumma, Metaphone questions the role of biosensors and exposures of our most intimate experiences in front of others, but by transforming these data using an aesthetically interesting moving machine, with the different machine-parts exposed, it makes the role of technology more evident and accessible for discussion and questioning.

### **Installation at the CHI conference**

Installing and situating the artwork at the CHI conference is particularly interesting as it creates for an interactive participation with technology-aware participants who, in many cases, understand bio-sensing technologies. Designing for a particular time and space in the conference agenda, taking the properties of the premises into account, will provide for a specific understanding and context of the installation. By carefully crafting how it is situated, we aim to evoke discussions on dichotomies such as private and public, open and reserved, common and unique properties. Interpretation of artistic media in a scientific context, such as CHI,

provides for a different kind of perception and understanding of this art-piece. Intuitive approaches and improvisation come into account as artistry enters the technological milieu to open new perspectives within HCI. In this sense, we aim to make Metaphone part of the on-going debate on the role of the body in HCI and the role of somaesthetics [6].

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