ISEA2015
Proceedings of the 21st International Symposium on Electronic Art
ISSN: 2451-8611
ISBN: 978-1-910172-00-1

[Personal Nature]: An Artist's Approach to Assistive Technology

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Abstract

[Personal Nature] is an artistic intervention rooted in assistive communication technology. By using physiological sensors on the body a sonification is created, this is to amplify the minute non-verbal communication cues found in our heart and breath rates, temperature, and in the amount of moisture found on our skin, all processed through time. The goal of this sonification is to replicate the sounds of a park through real world recordings including birdsong, children's laughter, wind and water as to create a space conductive to communication. The intended user of this technological intervention is a person who is in a coma or is otherwise (seemingly) unresponsive and their loved ones. This article explores the artist's process of using art, design and research methodologies. By looking at the disruption through the lens of different philosophies while considering the benefits of nature, music therapy and communal healing this paper attempts to fully explore aesthetics within the hospitals critical care unit.

Keywords

Assistive, Communication, Sonification, Embodiment, Art, Design, Therapy, Music, Data, Generative

Introduction

When tragedy strikes and a loved one is in an accident or their illness increases causing them to lose consciousness there is an abundance of emotions including anxiety, stress and confusion. These emotions can cause an even larger disruption in communication. Families have been known to talk about the patient as if they were not present or even worse sit in silence. [1]–[3] Considering Shusterman's somaesthetics, these emotions can be transferred to the patient through unintentional communication such as touch and tone of voice. [4], [5] Current medical information tools greatly support the medical staff but do not necessarily benefit loved ones. This information is compounded when consciousness is viewed on an axes between awakeness and awareness; meaning that many seemingly unresponsive persons are more awake or aware than they appear. [6]

[Personal Nature] is an interactive intervention rooted in medical informatics research [1], [2], where the autonomic nervous system (ANS) is regarded as a great indicator of stimulus and response; particularly emotion. [7] The *[Personal Nature]* prototype is guided by artistic intuition and aesthetic research with aims at shedding light on the lack of aesthetic consideration in the hospital soundscape. Using sonification concrète methods, recordings containing snippets of real world sounds and synthetic representations are triggered to play and have their variables change according to sensor data (speed, L/R, volume, etc.). The goal is to create a virtual space which is conductive of positive communication, specifically that of a park or picnic setting. By using birdsong, children's laughter, wind and water sounds an expectedly relaxing yet cognitively alert environment is created. [8] At higher levels of awakeness and awareness the environment changes reflecting the non-verbal communication of the person with impaired consciousness' ANS; when these levels are lower a presence for the individual is still created, both of these outcomes and the spectrum in-between can be conductive to community healing.

Disruption

Reflecting on Lefebvre's rhythmanalysis the body is viewed as a bouquet of rhythms, from the individual rhythms of the cells to the variety of cycles in the organs. [9] When a person is ill it is thought that there is an arrhythmic function in the body or in parts of the body. This could be an invasive bug, constantly reproducing cells or a malfunctioning organ lessening blood filtration. For Lefebvre in rhythmanalysis there is embodiment which involves being in tune with one's body in order to cognitively catch the arrhythmia as early as possible. This can lessen or even prevent disruptions in one's health and wellbeing.

When this rhythmic function is disruptive to the point of impaired consciousness (IC); communication channels are obviously strained. This is when well-intentioned loved ones can unintentionally increase stress or anxiety in the person with IC. Not knowing whether you can be heard or understood can be very stressful to loved ones and medical staff. This can cause them to lose their perception of personhood for the affected individual "because they cannot demonstrate the putative cardinal human attributes of co-presence and reciprocity." [1, p. 2] All of this could become apparent to the person with IC through the somaesthetics (touch, tone of voice, goose bumps, etc.) of their loved ones and caretakers. [5]

When lifesaving machinery is employed there is often an abundance of tubes, pumps and sensors. This dras-

tically changes the visual and auditory appearance of the affected person, further complicating the already strained communication channels. The beeps and whirs of the machines indicate certain aspects of the ill person's health but their meaning is often only clear to medical staff and trained professionals. This is troubling considering many persons with IC can hear and/or feel (physical touch) more than they are able to visibly or audibly indicate. Is this technology not disruptive in this case?

Un/disruption

The person may lie completely still, present in the room yet lacking presence. However they most certainly embody presence. Even if the person is in the deepest coma their presence is still important for communal healing. By externalizing the recovery process communal healing means that the "healing transformation may take place in the group rather than the individual." [10, p. 36] This is where the loved ones having a more relaxed and confident somaesthetic is important as it may be interpreted by the individual with IC.

Lefebvre described the present as static whereas presence is the present when time is considered; when poetry is considered. [9] Take into account the medical staff on their routine visits only a stationary number or small range of data is collected. However projects such as *[Personal Nature]* look at these physiological signals through time, amplifying the smallest changes in nonverbal communication. In most medical settings the presence of the unconscious person is reliant on disruptive albeit lifesaving technology whereas rather than attempting to add an additional layer of perception and communication. Initial research into using sound and the ANS such as Holland Bloorview Kids Rehabilitation Hospital's (HBKRH) *biomusic* has shown an increased perception of personhood for the seemingly unresponsive person [5]; to me this indicates an improved projection of embodiment because of or resulting in greater empathy. The individual's non-verbal communication and rhythms are being made poetic through sonification, generative music, and technology.

Out of my experiences with my immediate and extended family members I put great thought into how this technology could be used as an artistic medium. *[Personal Nature]* is the result of my empathy and experience combined with an extensive literature review and artistic intuition. I knew the resulting sonification had to be unobtrusive yet the ebb and flow of its rhythms had to be obvious. An environment conductive to positive communication is to be achieved. Through the simulation of a natural setting a picnic or backyard barbeque soundscape is created. A place of communal conversation, of reminiscence and laughter rather than the clinical and sanitized setting.

Nature

In our increasingly technological society many people are separating further and further from nature. This is exceptionally true for those in the hospital, though the need for sterility is understood. Surgical patients whose "rooms with windows looking out on a natural scene had shorter postoperative hospital stays, received fewer negative evaluative comments in nurses' notes, and took fewer potent analgesics than 23 matched patients in similar rooms facing a brick building wall." [11, p. 420] Nature art has also shown to reduce visible restlessness, noise level, staring and queries to the reception desk while increasing social interaction in hospital emergency waiting rooms. [12] Similarly patients supported by respirators and in mild comas (Glasgow Point 9 and above) showed and reported reduced anxiety, agitation and lower blood pressure when played nature sounds on headphones over a matching control group of no intervention. [13] The generative and rhythmic elements of nature and evolution as well as their effects on our health greatly inspired *[Personal Nature]*.

Music Therapy

Working with persons suffering IC and their loved ones is familiar ground for music therapy. From gathering loved ones to reminisce and write personalized versions of the affected individuals favorite song [3] to active adaptive music therapy sessions where the therapist plays an instrument and/or sings a song in response to the individuals heart and/or breath rate. [14] Throughout Leslie Bunt's book *Music Therapy: An Art Beyond Words* whistles which sound like birdsong appear always being linked to the feeling of freedom. [15] Music therapy techniques and methods greatly influenced the creation of *[Personal Nature]*.

Sonification Concrète

Applying Edgard Varèse's concept of musique concrète to sonification Paul Vickers saw the need for a spectrum between concrete and abstract as well as scientific and artistic sonifications. [16] This created a space for a variety of scientific and artist sonifications within the same sphere; allowing for a focus on listenability and aesthetics while still offering scientific material. John Neuhoff describes how evolution has affected our neurological and cognitive architecture making us exceptionally sensitive to real world sounds; our brains process these sounds differently than erratic beeps and buzzes. [17] Often times we neglect how often we use our ears to measure. Think about boiling a teapot: listening to the level of the water as it reaches the top, the clicks and subsequent whoosh of the gas stove lighting, the groan as the boil begins and finally the whistle (or if you're like me the 'almost whistle'). By using real world sounds there is a chance to "tap into perceptual and 'meaning making' processes that cannot be accessed with sounds that are more artificial." [17, p. 80]

Implementation

Data for this work was obtained through Thought Technology's Biofeedback system which includes non-invasive sensors for: heart pulse rate, breath rate, skin temperature

and galvanic skin response (GSR). I applied the sensors to my body gathering a baseline as well as emotionally stimulated (YouTube) data. This data was stored to a CSV file to be accessed in the prototype creation. *[Personal Nature]* is composed as follows:

Heart Rate – Birdsong/Children: Peaks in the heart rate data trigger a randomized clip of either birdsong or children playing/laughing. The greater the peaks distance from below zero (louder on the left side) and above zero (louder on the right side); this is to amplify the influx in the heart rate. Birdsongs are often considered auditory signifiers that all is well in the environment [8], I believe that the sounds of playing children enhance this concept.

Breath Rate – Water: The breath rate controls the speed and volume of a looped audio recording of water gently lapping at the shore. As the breath quickens so does the pace of the water lapping at the shore which also becomes louder. Schafer is very explicit in his writings on the connection between waves and human breath [18], one that I found pertinent for this project.

Skin Temperature – Wind: As the temperature rises and falls so does the volume and speed of looped recording of wind rustling leaves. A warm breeze or a cool wind can often affect our perception of temperature often bringing attention a change in weather.

GSR – Wind: Using a prebuilt open source wind generator the data from the GSR changes different aspects of the pitch and tone. The sound replicates wind as it moves past the ear. Similarly to skin temperature the moisture on our skin is often made apparent when a gusts of air flow over our bodies.

The system is built using Max 6; a visual node based programming platform. The values of the sensor data are highly manipulated as to scale them to useable values in the sonification process. This is a part of the amplification process as it is the fluctuation in values that are important not the specific numbers themselves.

Discussion

I am aware that this is an area of research full of ethical questions, ones that as an artist may require more scrutiny. I remain worried that some may question the artist's role in this sensitive situation; that they might consider me all too hopeful. I understand that the patient may not have any response; that it may not be interpreted clearly or *[Personal Nature]* may be more of a hindrance than help. Yet I feel compelled to try. For example take Thomas a child involved in the *biomusic* research at HBKRH. His parent went from describing their interactions with him as this:

> "You're coming in [to the room] and you aren't really sure if they know that you're there (C2)" [1, p. 6]

to then speak of him in this way:

> "It makes me feel like before [his disability] when he was very lively. It makes me think of the lively boy before. The sound represents his character… I would want to have it on. The sound keeps on; it feels like my son still exists." [1, p. 6]

It is this dramatic emotional shift that compels me.

My work process has changed drastically in the creation of *[Personal Nature]*. During different parts of this transdisciplinary project I have viewed it from many perspectives including artist, designer and technologist but also as patient, loved one and hospital staff. By employing different creative strategies I found that I was able to overcome many technical, psychological, theoretical and aesthetic issues.

This media calls for an artist's intervention, for artists' intervention. As someone who has spent countless hours confused at the side of a loved one I believe it is a media worth investigation. I believe I am able to help ease this disruption. I find inspiration and solace in the words of R. Murray Schafer: "The sense of hearing cannot be closed off at will. There are no earlids. When we go to sleep, our perception of sound is the last door to close and it is also the first to open when we awaken." [18, p. 11] *[Personal Nature]* may reach the person with IC and it may not; either way it fills the silence [1] and could possibly complete the other side of a conversation for their loved ones at their side.

Conclusion and Future Work

This work aims not to heal in the traditional sense but to provide comfort and presence for often but not purposefully objectified persons, their caretakers and loved ones. As this is a media project the aim is to provide a means for communication no matter how minimal, a dialogue which offers a greater chance for connectedness. Considering Baumgarten's sensual aesthetics and the bodies reaction to human contact, the sensed beauty of a loved one speaking and touching us, exposed through the ANS. The automatic reaction invisible but now audibly represented though time. *[Personal Nature]* is really at the starting point at the moment. Currently sound is the major focus and offers a wide range of location options to replicate; for instance beach or rainforest environments or even possibly replicating a home environment with all the hums of electronics and sounds of loved ones. However I see the chance for a full perceptualized experience. By this I mean I see room for visualization and haptic options. By doing this I believe there will be a more immersive experience allowing for an even deeper connection.

As sensor technology is continuing to mature and become more affordable I also see growth in mobile iterations of this project. By using Bluetooth and smartphone technology the options for gathering and interpreting data grow immensely. For example the current wearable sports and training technology is a market *[Personal Nature]* may add to among other novel possibilities.

Finally as an artist I see great potential for performative and installation iterations as well as the ability to explore a variety of emotions while recording the data. Being

able to create a space sonically, visually and haptically using such personal and raw expression excites me.

[Personal Nature] Example

A sample sonification can be found at this URL: https://soundcloud.com/davee_d/personal-nature-examples

Acknowledgements

My master thesis and *[Personal Nature]* advisors Prof. Dr. Frieder Nake, University of Bremen and University of the Arts Bremen, and Dr. Barbara Rauch, OCAD University. Special thanks to Dr. Elaine Biddiss and the LiveIT/PEARL labs, HBKRH, for access to the sensor technology and informal meetings.

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David Dowhaniuk is an artist, designer, technologist and theorist in the area of digital media. He has a Bachelor of Fine Arts from OCAD University and a Master of Science from the University of Bremen. Experimentation has always been a focus of his work, from the early year's double exposing film through the fast-paced visual effects industry to his current interest in patient/doctor communication and emotional aesthetics in the hospital. He draws much of his inspiration from spending time in nature often hiking, cycling. canoeing or tobogganing.