http://dx.doi.org/10.14236/ewic/RESOUND19.22

# Exploring the Cross-Species Experience and the Coevolutionary Capacity: Sensorial Transcoding and Critical Play Design of *Bio-Sonic Sense*

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**This paper investigates the concept and development of *Bio-Sonic Sense*, an artistic interpretation of bio sonars, as an attempt to create a cross-species experience. It examines the potential of sensory transformation through technology-specifically, transcoding visual to audio-with the purpose of communicating the mechanisms of ultrasonic communication employed by marine mammals. *Bio-Sonic sense* is the result of using artistic practice and critical play, in order to disseminate the effects of noise pollution on marine life. This paper proposes that those practices should be explored as methods that can design for the use of technics as tools that can expand the human senses, thus allowing the exploration of non-human "worlds".**

*Cross-Species Experience, Transcoding, Echolocation, Coevolution, Critical Play, Play Design, Bio-Sonic Sense (2019)*

## 1. INTRODUCTION

The effects of the Anthropocene are shaping the planetary condition. Specifically, extinction of species, ocean acidification, global warming, climate change, and accumulation of technofossil. The concept of the Anthropocene argues that it may threaten the contemporary material existence and even the future of entities (Steffen et al., 2011, p. 862). At the same time, it also produces a tremendous amount of philosophical ideas and artworks (Parikka, 2018, p. 51). Davis and Turpin (2015) posit that the Anthropocene is "a sensorial phenomenon" and "art can provide a polyarchic site of experimentation for living in a damaged world" (pp. 3-4).

This paper discusses the possibility of creating a cross-species experience in response to an ecological issue on marine noise pollution and its effects (Farina, 2016, pp. 48-50). This interdisciplinary artistic research, Bio-Sonic Sense (2019), aims to make a prototype device and explores an ultrasonic communication system of marine mammals by expanding human perception using transcoding to provoke embodied experiences of animal life.

In the following, this study introduces the concept of coevolution that has formulated our prototype relation and describes methodological approaches in play design and discusses the operating systems and potential of *Bio-Sonic Sense*.

## 2. THEORIES AND METHODS

### 2.1 Exploring the Coevolutionary Capacity

The dichotomy of human-nonhuman has operated as a source of oppression and for non-human beings in the world by not acknowledging their agency (Grusin, 2015, p. xi). However, in response to this, several attempts towards listening to neglected entities including nonhuman and animal are being urged in varied disciplines.

How can we create an artistic practice which offers experiences of embodied marine mammals' life? Regarding beyond-human perception, Bio-Sonic Sense investigates whether humans can feel

echolocation or how human senses evolve in terms of sound.

The earliest artistic experiment on echolocation can be found in Vespers (1968) composed as a prose score by Alvin Lucier. The piece adapted portable pulse oscillators, which are designed for acoustic environments and the blind, to use echoes for orientation and the echoes could slightly reveal the topology of surrounding space. Besides, Vespers suggested an exploration of beyond-human perception to the performer: "Dive with whales, fly with certain nocturnal birds or bats, or seek the help of other experts in the art of echolocation." (http://alvin-lucier-film.com/vespers.html).

The concept of coevolution takes a significant position to outstretch the limits of human perception. According to Hayles (2012), coevolution refers to the continuous interwoven relations between humans and technics and explains the modification process which operates on each other─human and technology (p. 10; p. 30). Technics can be employed to enhance our senses to create transcendent experiences.

Therefore, the prototype of Bio-Sonic Sense decides to embrace technical knowledge to experiment with the coevolution of human senses. It encapsulates the early critical minds into technology spotlighting sonic sense since the aquatic environment is a sonic space that is filled with the sound produced both by submarine creatures and human interventions. It endeavours to an interactive hybrid space producing personal soundscape experience through bodily engagement regarding the sonic context in underwater and anthropogenic noise.

The methodological approaches in play design will augment the experience of this coevolutionary capacity.

### 2.2 Methods and Value Goals

Sicart (2014) describes play as carnivalesque, appropriative, disruptive, autotelic, creative, and personal. Being personal, play draws from the sentimental, moral, and political memories of the participant. By connecting those memories with the present experience, it allows the participant to discover their personal expression inside the environment–leading to a stronger "understanding of the world, and through that understanding, challenging the establishment, leading for knowledge, and creating new ties or breaking old ones" (Sicart, 2014, 18).

In their article, Gaver, Beaver, and Benford (2003) describe the effects of ambiguity in designs. One of the types of ambiguity that they describe is "Ambiguity of Relationship." This type of ambiguity exists when a design makes us question our relationship with a specific object and "what our lives would be in consequence" (Gaver et al., 2003, p. 237). As a design practice, this type of ambiguity induces self-reflection in regards to our aesthetics and morality–this aspect complements the personal effects of play, to create a self-reflective and emotional experience.

Flanagan (2009) describes the process of designing play as the process of designing for possibilities. Play is becoming more and more established in our society and culture, and designing for possibilities means having an inclusive, and fair design that participants with different playstyles can engage with.

In her book, Flanagan (2009) proposes a model to design for critical play. Her model consists of 7 steps: (1) Set a design goal/mission statement and values goals, (2) develop rules and constraints that support values, (3) design for many different play styles, (4) develop a playable prototype, (5) play test with diverse audiences, (6) verify values and revise goals, and finally (7) repeat.

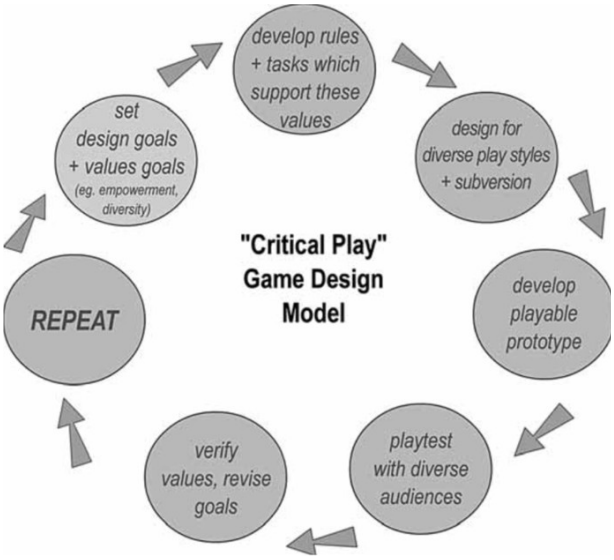


*Figure 1: Critical Play Game Design Model (Flanagan 2009, 257)*

The aforementioned design method allowed us to include critical play in our final installation, and to accommodate the diverse audience that is expected in an exhibition. Through playfulness though, participants can appropriate the artwork, allowing them to engage in a deeper level with it.

The next section describes the artistic exploration that we developed, using those methods, to explore our theoretical questions.

## 3. TECHNICAL FRAMES AND SOUNDS

### 3.1 Technical framework

In order to apply, Flanagan's (2009) method (Figure 1) to the artwork, first we had to set our mission statement. Our goal is to create an underwater experience to the participants that exposes them to the effect of underwater noise pollution, thus creating compassion and understanding towards the effects of human architecture and engineering to marine life.

To support our value, our installation focuses on the auditory and haptic sense–auditory since it emphasizes sound pollution and haptic to allow for exploration of the created space–while constraining the visual sense. The main interaction mechanic is emulated echolocation–auditory feedback that the participant can use to understand the location of other objects in the surrounding environment. The interaction mechanics are designed to provoke ambiguity of relationship, creating an environment in which participants will project their own values and imagination, try new identities, and question those values (Gaver et al., 2003). In order to design those mechanics, the following three design principles were used, as described by (Gaver et al., 2003, p. 239):

(i) Offer unaccustomed roles to encourage imagination.
(ii) Point out things without explaining why.
(iii) Introduce disturbing side effects to question responsibility.

By constraining the visual sense, along with our underwater narrative-experienced through the soundscape-we create an unaccustomed role to the participant, as described by the first principle. In regards to the second principle, the installation needs to be playfully appropriated by the participant, the interaction is sensorial and embodied. No prior explanation is given to the participant-the participant is only presented with the objects of the installation. Finally, in regards to the third principle, hitting an object or the wall by accident is a disturbing side effect that asks the following question: "Was it the participant's or the designer's fault?" This relates back to the effects of noise pollution to the submarine creatures.

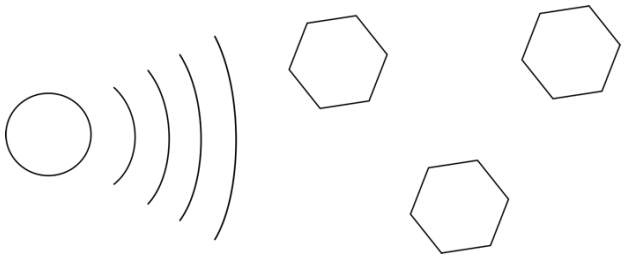

*Figure 2: Concept drawing of the prototype*

Excluding the participant, the overall experience consists of 2 elements: the apparatus and the environment. To accommodate a diverse audience, we focused on creating three elements to be explored by the participants:

- a soundscape in apparatus that emulates an underwater sensation.
- objects in the surrounding environment to be explored haptically.
- a box that acts as a protection to the head of the participant, allowing them to move freely in space in any manner they wish to.

The experience we created during the Summer Camp 2019 in the space of CATCH in Helsingør consists of the following elements: sonar apparatus, and 3 plastic objects.


*Figure 3: Image of Sonar apparatus*

Sonar apparatus:

- A Raspberry Pi 4 with an ultrasonic distance sensor (SainSmart HC-SR04) and a pair of headphones (Sony MDR-XB550AP)
- A box, to stabilize the device on the person's head, and to restrict the person's vision
- A powerbank to power on the Raspberry Pi

*Figure 4: Image of the Environment*

Installation environment:

- A dark room surrounded by walls
- 3 plastic objects hanging from the ceiling

In the beginning of the experience lies the Sonar apparatus. To participate in the experience, a person positions the apparatus on their head and enter the room. Once in the room, the participants receive audio feedback from the apparatus regarding the distance of the objects that are in front of them. Using that feedback along with their haptic sense, they can navigate and explore the space.

In the environment there are 3 plastic objects hanging from the ceiling that can be located using the audio feedback given by the sonar apparatus, and can be explored haptically. In order to create different interactions in the environment those 3 objects were designed to have different materiality:

- The cube is surrounded by cellophane wrapping and is light.
- The keyboard is plastic and heavy.
- The biodegradable cups are one unit when in equilibrium, however, they are connected by strings that allows them to separate when they are touched.

By including these 3 objects we attempt to create a playful and interactive environment that invites the participant to explore it.

*Figure 6: Prototype in action.*

### 3.2 Sound and soundscape

We intended to collage the natural sound source and computer signals as a means to generate soundscape. First of all, we collected sounds (e.g., a helicopter, leaves, birds, seawater and, footsteps) around CATCH, Helsingør and selected sounds of birds and seawater lapping by the small waves since *Bio-Sonic Sense* is related to the biosphere.

*Figure 5: Recording sounds around CATCH in Helsingør, Denmark.*

Second, the sonar sound uses a bird chirping as a sample. The sample is then processed with Pure Data, a graphical sound programming environment in real-time. The distance is transcoded into sound by altering the following elements of the playback:

- The duration of the feedback delay,
- the amount of feedback of the reverberation,
- how often the sound is repeated.

In the as background sounds in the prototype there is a sea soundscape. That sea soundscape was created by capturing the sounds of the sea of Helsingør. A preview of the sound elements of the prototype are available here:

https://archive.org/details/bio-sonic-demo.

## 4. DISCUSSION

The initial motivation of *Bio-sonic sense* was to create an experience that explores "how marine life is affected by noise pollution.'' Marine mammals use echolocation as an auditory stimulus in order to understand space. Noise pollution in the marine environment disrupts their spatial understanding. In order to communicate that to the participant, we needed to create an experience that will transcode visual elements to auditory elements, thus removing our need to rely heavily on visual stimuli to understand the surrounding space and its objects.

For the participant, the moment they wear the apparatus, they enter the magic circle (Stenros, 2014). Their senses become disconnected from the exhibition environment, and their experience of their surroundings is affected by the feedback of the apparatus. Bio-sonic sense is set in an immersive exhibition space and on the boundary of human-animal relations, with both of those elements causing the emergence of boundary play (Nippert-Eng, 2005). By its design, Bio-sonic Sense requires participants to possess the 2 elements described by Nipperd-Eng (2005) in order to engage in boundary play. First, players must share the normative expectation of where is the boundary between human and animal. Second, they need to find the exploration of that boundary amusing. That emergence of boundary play blurs the border of play and non-play, corrupts the experience, and communicates to the participant that the ideas presented are non-fictive.

For Grusin (2015), human identity "has always co-evolved, co-existed, and collaborated with the nonhuman" (p. ix). *Bio-sonic Sense*-by invoking that co-evolution, coexistence, and collaboration-transports the participant to the world of marine mammals allowing them to experience the identity of those animals, and see "what it is to be them and what it is to be ourselves in their eyes" (Lugones, 1987, p. 17).

In terms of *Bio-Sonic Sense,* a critical play design process, our research is preliminary, with further evaluation required to research the effects of the prototype. However, our attempt was to explore the use of technics through artistic practice and critical play, in order to create installations that afford the exploration of non-human "worlds" (Lugones, 1987, p. 17).

## 5. CONCLUSION

*Bio-Sonic Sense* is an interactive prototype that transcodes the visual to the auditory sense. The prototype is the result of an attempt to employ artistic practice and critical play in order to create a cross-species experience and explore the concept of coevolution: the continuous interwoven relations of humans and technics. Our prototype is an artistic interpretation of the bio-sonic abilities of marine mammals along with the conditions of their surrounding environment, with a focus on the effects of noise pollution. It produces an explorative space regarding non-human entities while evoking critical awareness on anthropocenic issues.

## 6. ACKNOWLEDGEMENTS

*Bio-Sonic Sense* was developed during 2019 Summer Camp held in CATCH Center for Art, Design and Technology, Helsingør and the conference RE: SOUND, the 8th International Conference on the Histories of Media Arts 2019 hosted by CATCH together with Aalborg University and IT-University of Copenhagen. We want to thank the academic supervisors Laura Beloff and Morten Søndegaard as well as CATCH supervisor and organizer Majken Overgaard. This project was also supported by CONACyT and PAEP through the Graduate Music Program of National Autonomous University of Mexico, National Research Foundation of Korea Grant funded by the Korean Government (NRF-2018-Global Ph.D. Fellowship Program), JSPS KAKENHI Grant Number JP17H04772, the Danish Architecture Center, the Innovation Fund Denmark, and Realdania.

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