But Does it Float? Reflections on a Sound Art Ecological Intervention

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ABSTRACT

This paper discusses the particular aesthetic and contextual considerations emergent from the design process of a site-specific sound art installation, the Wave Duet. The main argument of this paper proposes that beyond the initial motivation produced by new technologies and their artistic potential, there are many profound artistic considerations that drive the development and design of technologically mediated artwork in unique ways. The produced system was prompted by the investigation of the relationship between sonic objects and particular natural phenomena and as a result the mappings, physical and sound designs directly reflect these issues. It is also suggested that during the course of development, unintended issues may emerge and further inform how the work is perceived in a broader sense.

Author Keywords

embedded sound art installations, satellite ccrma, environmental sound art, site-specific art, buoys, sonification

ACM Classification

H.5.5 [INFORMATION INTERFACES AND PRESENTATION (e.g., HCI)] Sound and Music Computing, J.5 [ARTS AND HUMANITIES] Performing Arts

1. INTRODUCTION

In this paper, I discuss the general design process of a site-specific sound art project, the Wave Duet. I begin by contextualizing the work in relationship to site-specific sound art, sonification and embedded sound art installations. I then follow by discussing the multiple design and aesthetic choices that motivated the particular development of the Wave Duet's buoys. Finally, I reflect upon the processes and outcomes from this project in order to raise both artistic and critical issues.

Current technological developments, particularly in embedded computing, show great potential to free the artist and designer from traditional performance or installation spaces and further allow situating their work within environments outside of the hyper-connected modern world. Simply put, we can have truly autonomous interactive digital systems powerful enough to provide sophisticated interactive and sound synthesis capacities. The possibilities for artistic expression readily available are indeed vast and exciting. Although novel technological developments can motivate the exploration of different artistic possibilities, it is worthwhile to examine and reflect upon how artistic ideas drive the implementation of specific technological resources in order to achieve particular artistic objectives (also see [7]). Indeed, this is not an entirely linear process and is contextually dependent since it exhibits multiple recurring cycles of development and often presents diversions and derivations from the original idea or design in order to accommodate different contingencies [6, 14].

1.1 Site-specific Sound Art and Sonification

The artistic and aesthetic advances emergent from mid 20th Century art and music practices have challenged multiple notions of space, content and context in which the artistic act develops [9]. Context and process are brought to the foreground, while the role of the author is made, to a more or less extent, invisible. In a similar fashion, the spectator's role in the performance can change from a passive to an active role where their experiences and relationships to the work take a privileged position [10, 11]. Through these developments the conventions and rituals found in established artistic and musical practices, as well as how they are experienced are revalued in new contexts. In sound art the content and organization of sound becomes revalued and deconstructed such that the sonic materials are examined at the most microscopic scale, while sonic discourses at a macroscopic level may include sound events from the environment itself as part of its narrative and structure. This becomes evident in site-specific sound art where natural processes are granted agency for the creation of sound works [10, 2]. Indeed, objects of the natural environment are considered performers of the work. However, this issue could be better explained as a coupling or the mutual constitution between the natural process and the foreign art object(s) intervening in the environment, as exemplified by the works of Max Eastley [10] or Bennett Hogg [8].

In recent times, sonification has become a widespread practice for examining natural phenomena through the use of sound [5, 2, 13, 15]. Such processes are detected through the use of purposefully designed sensors not designed with aesthetic or artistic intentions. Once data has been captured, organized and prepared is it possible to represent these phenomena in a different perceptual mode by means of different sonification approaches. While Walker and Nees [17] observe that in addition to information delivery and alerting through sonification, events and data sets can be used for musical compositions. However, these authors refer to compositions employing traditional elements. Vickers and Hogg [16] identify four distinct sonification approaches employing musical materials: simple chromatic data-to-pitch mappings, ad-hoc frequency mappings, sonic organization based on tonal music principles, and sonifications exploring and deriving sounds from electroacoustic music traditions, particularly musique concrète. Contrasting Walker and Nees, Vickers and Hogg take into consideration aesthetic issues of sonification, music and sound art, and argue that an electroacoustic approach to sonification, 'whilst often lacking discernible melodies and harmonic structures, is still much easier to organise and decompose cognitively than atonal pieces' [16]. Additionally, they argue on behalf of such approach by noting that "The electroacoustic and musique concrete approaches may potentially lead to great success in sonification design given their dependence upon the notion of 'gesture' encoded into sounds" [16].

1.2 Embedded Systems "in the wild": Examples of Outdoor Interactive Installations

Outdoor interactive installations provide specific design and realization challenges. As Birchfield et al. [3] observe, these issues are related to the expectations of the audience, characteristics of the outdoor site (vandalism, weather), as well as the logistics of the project. In effect, the nature of site-specific work demands different requirements and considerations than conventional sites, particularly in what could be considered harsh natural environments such as the seashore and ocean. Despite these issues, two art installation projects involving technologies in water-based environments are deployed under such conditions are exemplary: WHALE and 'Drowning not Waving'. The WHALE[1] project is a generative art and music project employing a purpose-built buoy fitted with an array of environmental sensors (temperature, barometric pressure, humidity) and an accelerometer tracking wave motion. These buoys are additionally fitted with WiFi communication capacities for transmitting data to a remote beach-side location where a base station generates sound and visuals from the received buoy data. An additional feature of this project is that the generated data is also uploaded to the Internet for real-time visualisation. 'Drowning not Waving'[2] consists of an array of floating speakers mounted on plastic waterproof containers producing drone sounds. Each speaker is wired to a multichannel audio system. In contrast to WHALE, audiences can directly interact with each individual floating speaker. Finally, an interactive installation of a different nature is presented by Barrass and Barrass [1]. The project of these authors consists of tangible experimental prototypes 'exploring the embedding of sonification in things'. While these prototypes are not site-specific, they serve the purpose of investigating 'technologies, sounds, materials and metaphors to define and illustrate the design space'. In other words, investigating the relationships between physical, material design and sonification strategies.

2. DESIGN AND IMPLEMENTATION: THE WAVE DUET

This section describes the development of the Wave Duet[3] (Figure 1), as well as the practical and aesthetic considerations that were taken into account during the design process. The Wave Duet was designed to explore the capacities and possibilities of embedded electronic applications within independent and autonomous sound objects within non-conventional, outdoor, natural sites. The project was conceived with the goal of bringing together and explore sound art, musical and sonification practices through a site-specific ecological intervention.

[1]http://www.generativo.es/whale/en/

[2]http://goo.gl/QXGq5L

[3]https://duplexhelixmusic.wordpress.com/projects/installation/cuartetodeoleaje/

Figure 1: The Wave Duet

2.1 Buoys

Traditional buoy design offers a vast range of designs according to their specific functions: from simple markers to highly sophisticated sensing buoys with remote satellite communication capacities. The original idea was for the buoys to represent the simplicity of a signalling buoy, particularly those with bells attached, and use this metaphor to implement a sound synthesis engine that would emulate those distant, ghostly, bell sounds. The produced sound would ideally mix, but not overpower the environmental sounds.

Available forms, such as waterproof plastic containers (as in 'Drowning Not Waving'), are easy and affordable options but they would not meet the physical resistance criteria. In addition, the actual design of such plastic containers would not suggest the shape of a buoy, rather they could be perceived as flotsam. Therefore, the need to design an object resembling a more conventional buoy shape. Although this aesthetic consideration is not entirely a problem in itself, it could be a compelling metaphor or artistic statement in another context. After sketching several designs, a spherical shape was preferred because its overall aesthetic appeal, as well as its possible ease in manufacture and assembly. The placement of the speakers of the upper shell was influenced by SlOrK's hemi-speaker design [18]. It was important to consider the materials of the buoys given the harshness of the environment: salt water corrosion, bumping and crashing into rocks, and so on. For this reason fibreglass was chosen as a sturdy, yet light, material. A buoyancy test revealed a critical failure in the original spherical buoy design given its poor buoyancy. The design had to be reconsidered without having to drastically change the overall shape as it would be a lengthy and expensive process. From this outcome a hemispherical design with a polyurethane foam base was chosen as more suitable within these constraints. This design satisfied both technical and aesthetic requirements since it did not stray to far from the ideal form off the buoy.

2.2 Embedded Electronics

While the buoy design was the first and most important thing to consider given the aims of the project and environment in which is to be deployed, it was also deemed necessary to select low powered electronic components that could yield a relatively long performance time due to the autonomous nature of the project. A number of micro-controller options, such as Arduino and ARM-based platforms, were considered due to their low power operation and ADC capacities. However, these platforms currently do not support sophisticated synthesis environments when compared to Beagleboards or the Raspberry Pi. These later options also provide a much viable development option when coupled with Satellite CCRMA[4] running Pure Data. Each buoy's hardware consists of a ADXL-335 three-axis accelerometer for sensing wave motion; an array of eight infrared LED sensing pairs arranged around the circumference of the hemisphere for object proximity detection connected to the microcontroller; a Teensy 2.0 for ADC conversion and interfacing with the Raspberry Pi running a Pure Data patch in 'headless mode'. The DAC is provided by a Behringer UCA202 audio interface further connected to a battery powered Class-D stereo audio amplifier. The output of each amplifier channel is connected to two speakers wired in series.

2.3 Mapping and Sound Design

The sound design of the Wave Duet was mainly motivated by the aesthetic concern in which produced sounds would posses a distinct quality to be perceived as different from the sounds of the environment, but not too different as to be heard as entirely foreign. Initial synthesis testing in Pure Data involved the direct one-to-one mapping of the accelerometer values to control elements of different additive, subtractive and FM synthesis patches. Out of all these methods, additive synthesis was the most satisfactory given the richness and timbral quality of the produced textures. Additive synthesis, when not presenting harmonic relationships between the different oscillators, presented a sound quality distinct enough to mix with the sonic space of the seashore. However, as observed from these initial tests, one-to-one mapping of chromatic pitch values creating a monotonous ascending and descending of chromatic pitches when the accelerometer moved at faster rates.

The most interesting aspect of the additive synthesis method was achieved when the pitch movements were slower thus creating a drone-like sound. This observation prompted the exploration of a drone aesthetic and while this particular approach was motivated by my own sonic practices, it was further prompted by notions stability and gradual change within the sea environment. It was also observed the overall slow rate of change between different drone sounds would leave a space for interjecting more noticeable sounds. As mentioned before, it was of interest to employ the metaphor of the distant and decaying ringing bell from an old-fashioned buoy. In this manner, a more traditional element from simple signalling buoys is retained. Additional efforts were made to avoid entirely random chromatic or tonal changes, hence this ping was generated through a Brownian-movement-like melody algorithm (Figure 2).

3. OBSERVATIONS AND REFLECTIONS

The most obvious implication emerging from this project is the actualization of highly mobile and autonomous art installations within non-conventional, outdoor, sites of performance. By being completely battery powered, the Wave Duet's buoys can roam independently for several hours without the need of mains-power or even a supporting computer and sound system. Although not without is issues regarding battery power [4], the system is robust enough to successfully perform during a considerable amount of time. In one sense, this autonomy provides a sense of continuity with other non-digital site-specific art practices developed since the 1960s.

[4]https://ccrma.stanford.edu/~eberdahl/Satellite/

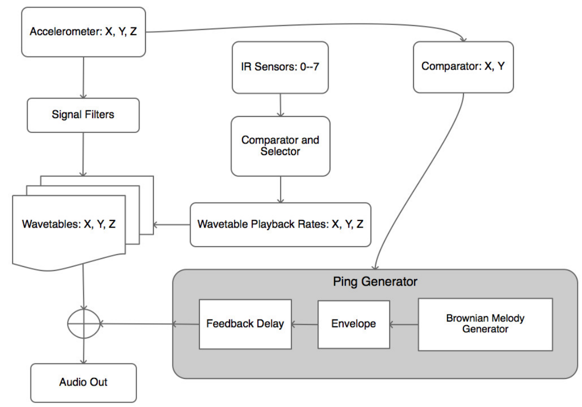

Figure 2: Sensor and Sound Mapping

Although achieving this autonomy is mainly due to current technological developments, the principal motivating factor for developing this project was to investigate the relationship between sonic objects and natural processes. Indeed, the importance of technology cannot be denied, but in pursuing artistic ideas technology becomes secondary and contextually dependent on a multitude of factors influencing the design process. In a similar fashion to what Barrass and Barrass explore [1], the Wave Duet attempts to look into the materials, function and site in order to arrive to a sonic object whose form and sound design are intrinsically linked to the traditions and contexts in which these objects are deployed. This process, therefore, implied examining the complexities of wave motion, as well as the entire environment, in order to imagine a range of design and interaction possibilities. Technology would only come into play later once such patterns where understood and particular solutions were required. Nonetheless, observing the movement of the buoys highlighted the complex dynamics of the environment, as well as making it obvious that abstract knowledge of such processes do not accurately represent it since these are far too complex to reduce to a simple model or equation.

The use of particular communication technologies would have produced much more sophisticated sonic objects, but as Birchfield et al. observe, it was deemed that the presence of virtual or broadcast elements would remove the work from the physical world [3] and thus abstract, or disconnect, the directly perceived interactions between the environment and the buoys. For the spectator, this would render a much different experience of the work given that the perceived visual and aural events would be inconsequential since any mapping, synthesis, or visualization process could effectively be substituted by another. Vickers and Hogg's [16] observations regarding the success of a sonification approach dependent on gesturally encoded sounds becomes evident given that wave motions carry with them specific actions that are imagined upon listening.

Designing sounds that attempted to mix with the natural environment required thinking specifically about texture and space. As explored with the Wave Duet, dense textures achieved the design aims by producing sounds that can effectively be perceived as both foreground and background in relationship to environmental sounds. These sonic drones can blend into the background as observed when a nearby passing fishing boat's engine sound was confused with the sounds of the buoys thus making both sound sources undistinguishable or when the sounds of crashing waves became more intense and masked the buoys. Additionally, because of the static nature of the drones, there was sufficient space to introduce contrasting motivic elements (e.g., pings) that accentuate the presence of the sound objects within the environment. The non-natural timbre of the buoys demanded attentive listening from the spectator given their artificiality and particular place within the broader sonic space, thus shifting the sound of the buoys to the foreground. Given this particular outcome, any other musical or aesthetic choice would have been interpreted as much more disruptive in this context.

The experience of developing and observing the Wave Duet in action unintentionally prompted reflecting upon the ecological impact of the project. Specifically, this issue relates to the types of materials used, their toxicity and sourcing. It is unavoidable to think about how these materials are disposed of and how they react with salt water during long periods of time as they may be gradually be released into the ocean environment. While the ecological impact of this particular project may be perceived as relatively low, in tracing the entire production and developing chain it is evident that the broader impact may in fact be greater. Recently, these issues have been made much more visible within HCI practices (for example see [12]). This project further motivates the consideration of the impact of the entire assemblage of manufacture and distribution, as well as designers and users within the particular domain of NIME practice.

4. SUMMARY

In this paper, I have presented the Wave Duet, a site-specific sound art installation, as a case study exploring different artistic practices. The main goal of this project was to investigate the relationship between sonic objects and natural process, particularly the interactions between the sonic buoys and the wave motions in a shore environment. While technological developments often motivate specific designs with this practice, this paper employs the Wave Duet's development process to exemplify how technology takes a secondary role due to the contingent nature of the artistic and design process. As presented in this paper, by observing particular aspects of development and the buoys themselves in action further stimulates thinking about unexpected or unintended issues that may emerge. In this particular case, it was reflecting about the environmental impact of the project and its materials.

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