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Sonification of Glitch-Video:

Making and Evaluating Audiovisual Art made from the Betta Fish

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ABSTRACT

The advent of computers for consumers has been supporting artists in various fields to develop their creativity into new territories. Computer-assisted sonification is one of the modern techniques which is available for the contemporary artist. Music and sound art usually derive from abstract inspiration and the same approach as true for aesthetic sonification. Non-speech audio as data can uncover-a potential for aesthetic purposes. This paper first describes how we experimented and investigated using glitch video of an aquarium fish as the input to sonification processing and audiovisual composition called "1(X)MB". We then report results from a listening test and discuss the project design as a whole.

1. INTRODUCTION

1.1 Glitch Art

In technical domains such as electrical engineering, 'glitch' is “a sudden, usually temporary malfunction or fault of equipment” [1]. To understand how the term applies within a creative domain, we have to consider 'glitch' metaphorically. The word “error or fault” applied to the functioning of a machine can be clearly defined. With a novel artwork or process, what constitutes an 'error' or 'fault' is often not defined within the piece itself, so there is no such direct meaning. Instead, we might consider the “aesthetics of error” for audiovisual composition. Technically, glitch artists exploit a technical error to disfigure sources such as information of images to create new meaning outcome [2] and 'glitch art' must disclose both the material foundations and change of media (or processes of digital media) [3].

Early examples of work that consciously exploited the glitch approach can be found in Nam Jun Paik’s work. For example, in *Magnet TV* (Paik 1965), he used a magnet to distort the television image, transforming a visual source into an abstract form that is 'glitchy' [4, 5]

> "*Magnet TV used a large magnet which could be moved on the outside of the television set to change the image and create abstract patterns of light. The power of attraction of the magnet deflects electronic beam from filling up the rectangular surface of the TV screen. -The field of lines is drawn up and builds veil-like patterns [witiin the] field of the magnet.*" *([6], p. 105)*

The definition of glitch led us understand the basic function of glitch art as the aesthetic of error and we used this method in the current artwork.

1.2 Sonification

The first definition of sonification was given by Gregory Kramer: “Sonification is the use of non-speech audio to convey information.” In [7] a developed version was given as follows: “Sonification is the transformation of data relations into perceived relations in an acoustic signal for the purposes of facilitating communication or interpretation” [8]. Several authors have pointed out that this definition does not give room for sonification with aesthetic purposes, such as sound art. Broader applications were discussed in [9] and an inclusive definition was recently formulated:

> "*Sonification is any technique that translates data into non-speech sound with a systematic, describable, and reproducible method, in order to reveal or facilitate communication, interpretation, or discovery of meaning that is latent in the data, having a practical, artistic, or scientific purpose” [10].*

In terms of sonification, what makes artistic purpose different from engineering is not the process but the ultimate purposes. Sound artists use an iterative design model, which includes observation, systematic study and data translation yielding a sonic output, and formal evaluation by listeners. The outcome of the evaluation is fed back into the design loop. Researchers in the field of sonification have proposed a number of useful concepts including earcons, iconic sonification, model-based sonification and so forth. They will not be further discussed in this paper and we refer to relevant chapters in The Sonification Handbook (e.g. [8][9][11]). Those methods are applied in various situations, both in science and for artistic purposes.

In the present "1(X)MB" project, we employed two established methods of data sonification: audification and parameter mapping sonification. These concepts will be discussed in the following section. Our project investigates the translation of an image stream into sound. As a work of an audiovisual art, it adheres to the aesthetics of glitch electronica, which a genre of an experimental electronic music that used an 'aesthetic of error', a.k.a. glitch, to generate unpredictable pattern of visuals or pattern of sounds in the artwork. In sonification, it is precision, understandability, and reproducibility that are of the essence. In glitch art, some of the core qualities are indeterminacy, enrapture, and surprise. What we have found stimulating for our work is the tension offered by these two diametrically opposite approaches to sound art, and the possibility of joining them.

1.2.1 Audification

Kramer defined audification as "the direct playback of data samples" that are ordered in time (though allowing for direct transformations such as time compression). Later, he elaborated the concept as follows: "audification is the direct translation of a data waveform into sound" [11]. Data are transformed into the human hearing range (approximately 20 to 20,000 Hz). One distinct example of audification uses seismic infrasonic vibrations that are transposed upwards so as become audible [12, 13].

1.2.2 Parameter Mapping

This method is the most widely utilized sonification technique. The desired inputs can apply to multi-purposes. For instance, through mapping aesthetics, the inputs able to transform into melodies or spatialization or musical functions. As Barrass and Kramer elaborated: "parameter mappings present data variations in auditory variations such as duration, brightness, pitch, etc." [14].

Concerning artistic purposes, many researchers and artists have used this method in their projects. The desired data sonification is possible to map to various domains. The systematic review of mapping strategies by Dubus and Bresin [15] charts a number of possibilities that have been tried. They investigated the parameter mappings in 179 published sonification projects from a database of 739 entries. Their meta-investigation focused on 60 projects that summarize strategies of mapping the domain of physical data to the auditory domain. For instance, they reported that the two most utilized mappings were 'physical location to spatialized sound location' and 'physical location to pitch', and, we employed to the art-work.

2. MAKING ARTWORK WITH THE BETTA FISH

Both authors of the present paper have experience working with found objects (in the spirit of Marcel Duchamps, Pierre Schaeffer, John Cage, and many contemporary artists) to create audio-visual compositions. In the present work, the first author employed his aquarium fish as the focal point of the artwork, to challenge his aesthetics. The fish in question is the *Betta fish*, also known as *Siamese fighting fish (Betta Splendens Ragen)*. It is native to Thai waters and can be found across South-East Asia. Fish-farmers have bred a variety of forms, such as a the 'Halfmoon-shaped' or 'Crown-shaped tail' variants. The fish's beautiful colorings and pugnacious behavior make the Betta fish attractive to enthusiasts who keep it in their home aquarium, or even for a kind of fish fighting sport that also involves money betting. The Betta fish has become a commercial Thai export product [16]. The 'Red Crowntail Betta' (see the figure 1) is the star of the show – the main performer and source of data in an experimental audiovisual project based on glitch-video sonification, called the 1(X)MB. The project is presented as a real-time generative audiovisual composition, consisting of fifty different phrases with a total duration of fifty minutes. The project has three main parts: video capture, video processing, and generative sounds. All analysis and synthesis of audio and video were made with Max (Cycling 74/ Ableton).

Figure 1. The betta fish (Crown-tail) the star of the art-work.

2.1 Video capture and Composition

The difference between image and video is the streaming of data. An image input represents constant data without any updates of new information. Whilst a video input reveals a streaming data which spontaneous and updates new data all the time. A real-time data affected through sonification procedures which caused nature interactivity in data changes and generate a structure of the artwork. In the video recording process, the record was taken by sixty minutes long shot. The fish were captured with the green-screen background for the reason to achieve a high-contrast image and flexibly manipulate in the video processing (e.g. replace the background and add glitch-process). The long shot video was selected and cut into fifty clips, each long one-minute. The video composition is based on resulting videos. They were divided into two set for the composition process. Firstly, the original video record with fine-resolution on the green-screen for image processing and sonification. Secondly, a low-resolution video replacing the white background for the main element of composition background, however, this process is not involved in the sonification process (see Figure 2). The main aesthetic of the artwork for the transformation of the video capture of the fish is glitch art. The input sources had given a significant role for the sound generative. Each fifty video clips contain a distinct glitch character and made a distinction in the final audiovisual outcome.

Figure 2. Placement of 50 video displays (background) are composed in Max using textures in Jitter).

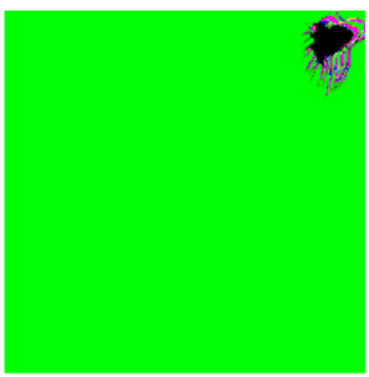

Figure 3. Example of a single frame of glitch-video featuring the Betta fish.

2.2 Generative Sounds

To achieve the aim of sonification, the first author created a custom patcher for the artwork called "kj.matrixscanX~" (see Figure 6). The custom program operates the sonification by tracking color data RGB (Red, Green, Blue) from the video source as a data matrix. Furthermore, the patcher allows sonification process to render the input as desire speeds (the unit of speed refer to frequency of the wave in Hertz) that cause variety outcomes (because of the input source and selecting render speed from the artistic intention). In generative process, two syntheses approach (see Figure 4) are implemented for the artwork with cooperated in selected systematic mapping of Dubus and Bresin [15]: Color data to rhythmic duration – refer to audification that direct translate color data into the waveform, Color-data to pitch – color-data into mapping pitches (as parameter mapping sonification), Location to spatialization – fish locomotion to panning.

The first generative approach is audification. It operated through the video input that tracking color-data and converted data into a waveform that directly generated a sound. As a glitch-video process and fish locomotion are affected to most of the sound outputs like "noise" which caused discontinuity, non-periodic waveform.

The second sound generative process is parameter mapping sonification. It extracts color-data into four triangle wave-generators. The mapping range of color data is in the MIDI range from 44 to 127, and from MIDI range converted into the frequency domain which is between 103.826 and 12543.853 Hz. Audio panning was determined by tracking the movement of the fish by horizontal location in the aquarium (See Figure 6). We found out that the fish locomotion data could implement to the stereo panning function which fits the video screen. The original long shot video (50 minutes) of the fish has recorded a fish movement and plot it with Jitter. The resulting shown that the movement of fish is arbitrarily moved which affected to sound generative process. Instead of mapping fish locomotion to pitch which has been applied by many artists, the meta-study by Debus and Bresin showed that the frequently mapping method is location to spatialization. As a fish's locomotion and glitch-video sonification gave a significant character of sound generative through the audiovisual artwork.

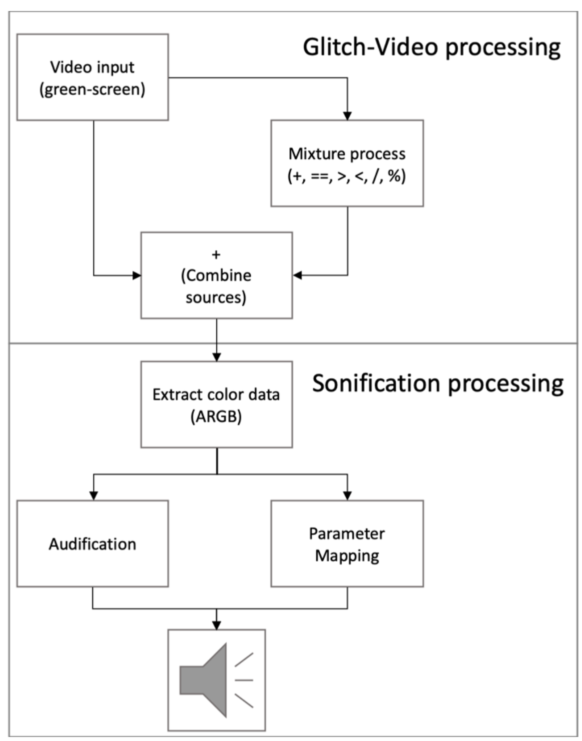

Figure 4. Audiovisual generative schematic.

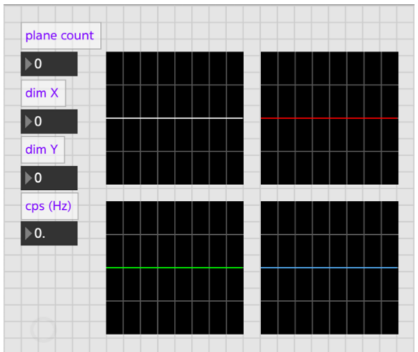

Figure 5. Custom sonification patcher "kj.matrixscanX~" in presentation mode.

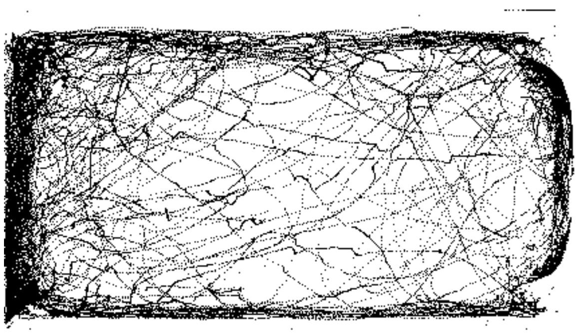

Figure 6. Record of the betta fish's locomotion through the end of the video.

3. EXPERIMENTATION AND EVALUATION

To evaluate the audiovisual artwork, we conducted a pilot survey and a listening test (N = 8). The volunteering participants were university undergraduate music majors. We selected an excerpt of 8 minutes duration and presented it in a group listening situation. The participants then responded individually to questions and evaluations in a protocol. The main results are shown in Figure 8. The participants reported that they perceived the glitch-video affected the sonification process, and that it also affected the sound generative process. The association between fish movement and audio spatialisation was weak (4.6 on a scale between 0 and 10), but between movement and noisiness it was stronger (6.8/10), The video input represented a significant role to generates repetitive and randomness patterns that visually interact with the artwork process.

In the section of free-form responses in the protocol, one participant commented that it was "interesting to see the conversation of video data to audio data" and "fifty fish contained in fifty grids. Focus is on one fish at the time; the area it covers within the grid affects the texture of the sound. The source of repetitiveness seems to come from visual marking. However, most of audiences were confused with spatialization effects. The placement of video composition and glitch process given an illusional effect that made a confusion in spatialization to participants.

4. DISCUSSION

Relating to this artwork, most of the research sources available in interactive or real-time sonification. It lacks a good academic source for glitch-video sonification. We found paper that given crucial information for the study of the working system and art aesthetic. A motivation works relate to this area included the visual music project from Knees, Pohle and Widmer [17] gave a significant example in real-time sonification. Their project purpose a video captured of a landscape from a train journey. The sonification design translated the color information from the center column (vertical column) of the real-time video into a musical piece.

Furthermore, the study that has relevance in the idea of aquarium fish included the project of Walker et al. a group of developers presented the "Aquarium Fuse" [18]. They implemented a real-time sonification in which a movement of fish affected to a generative melody. The project also allows visitor interaction through a user interface to creates a counter-melody to the fish part. The work by Mercer-Taylor and Altosaar had proposed the project by tracking fish movement through musical notes that caused a mixture of harmonies [19]. The live-electronic music project of Eloul et al [20], the project works by mapping fish motion by tracks three-dimensional properties through DJ-electronic music performance. The goal of their project is to realize a technology art into club culture that audiences will enjoyable and pleasant experiences for participants in a live performance at a music club.

A mapping method of 1(X)MB is different from those mention studies. The artwork based on real-time sonification on glitch-video that a significant theme to our artistic development. The visual properties (i.e. dimension, color, sound) are manipulated to transform into another perceptual domain. The association of sonification process through glitch-video into glitch-sounds that causes the noisiness and unpredictable rhythmic patterns is mainly important. Though, there are some aspects that are omitted and did not implement in this audiovisual artwork: Fish's location controls the pitch/frequency, volume and sound processing as filter or delay and the location effects to video's render speed. For future development, we will explore the systematic mapping through new versions of the artwork that will improve the sound and composition design.

5. SUMMARY

A fixed media version of 1(X)MB was screened at the Seoul National University Museum of Art on 12 December 2019 as part of the event "MO:ving::vement:::tion::::". In this version the 50 phrases of glitch-video are compressed from 50 minutes to 7.28 minutes duration.[1] The comments

[1] link of the work https://www.youtube.com/watch?v=2Zg5wEGmJm0&t=62s

from the evaluation gave important information and these will help us improve the sonification design approach in future work. Glitch art embraces an 'aesthetic of error'. Methods to combine glitch video and generative audio are possible to explore further. For sound outcomes in 1(X)MB, we focused only on noise. However, we realized that the generative aesthetic in future works should not rely solely on noise. The source data should be fully exploited and mapped to other possibilities for various sonic features, such as melody, harmony, rhythm, texture, instrumentation, and timbre. In conclusion, we think that a well-defined and systematic sonification mapping approach can yield remarkable, aesthetic, and surprising artworks.

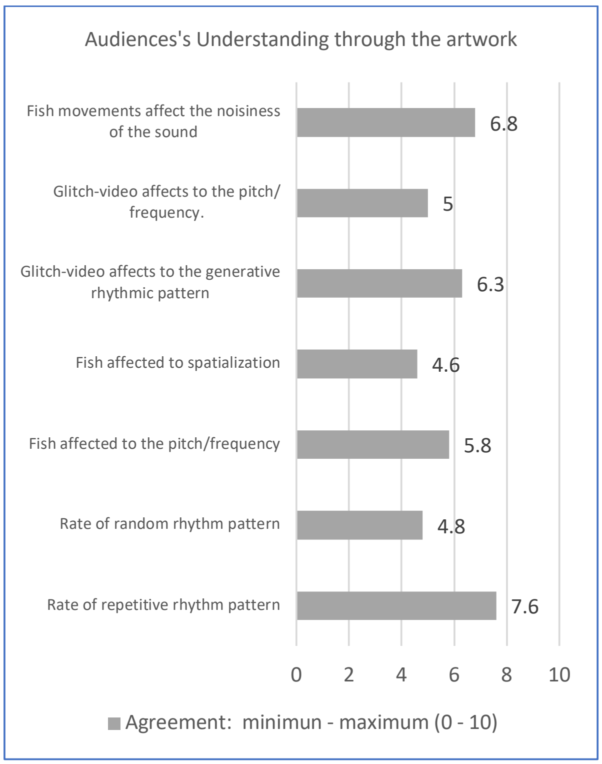

Figure 7. The evaluation of the presentation.

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