A Method to Create Audible Glitch Art

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Abstract

Glitch art is art that uses intentionally generated errors (glitches) in images, videos, and audio, created by destroying digital data or physically manipulating electronic devices. Glitch art is fascinating because it manifests unpredictable beauty. We have been exploring the production methods and effects of glitch art. As part of this research, we explored the creation and methods of glitch art that can be enjoyed aurally. Specifically, we first used image processing software to generate multi-layered data that mixed image data and music data as separate layers. Next, we loaded this data into audio processing software and applied audio processing to the image data portion, confirming that glitch art can be created without affecting the music data. This method is an extension of our previous method, but the purpose of our previous method was to generate glitch sound, and it was not able to generate glitch art. Moreover, this method generated unbearable noise sounds in music data, and could not be enjoyed aurally. In contrast, this study demonstrates a method that allows glitch art to be enjoyed not only visually but also aurally as music. This research is unique in that it simultaneously makes glitches visible and audible, and can be said to create a new type of art that brings about a shift in aesthetic sense. This is because the visually beautiful parts are merely audibly noisy sounds, and the audibly beautiful parts appear visually to be noise.

Keywords: glitch art, image processing, audio processing, audible

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Introduction

Glitch art is art that uses intentionally generated errors (glitches) in images, video, and audio by destroying digital data or physically manipulating electronic devices. This type of glitch art was born with the emergence of new media. It began with works that utilized glitches in televisions and video game consoles, and gradually developed into a musical genre known as glitch music. Glitch art, which manifests unpredictable beauty, has a charm that is not found in the beauty of predictable harmony, and this is what draws people to it. Glitch art can also be said to broaden the scope of art appreciation by deliberately introducing discordant elements into art and finding beauty in them.

We have been exploring the production methods and effects of glitch art, and as part of this research, we explored the creation of glitch art that can be enjoyed audibly. Specifically, we first used the image processing software Photoshop to generate multi-layered data that mixed image data and music data as separate layers. Next, we loaded this data into the audio processing software Audacity and applied audio processing to the image data portion, confirming that glitch art could be created without affecting the music data. The method in this research is an extension of a previous method we used, but our previous method was intended to generate glitch sound and was not able to generate glitch art. Moreover, this method generated unbearable noise sounds in the music data, and could not be used to create works that could be enjoyed audibly. In contrast, this research demonstrated a method that not only allows glitch art to be enjoyed visually, but also allows it to be enjoyed audibly as music.

This research is unique in that it simultaneously makes glitches visible and audible, and can be said to create a new type of art that brings about a shift in aesthetic sense. This is because the visually beautiful parts are merely audibly noisy sounds, and the audibly beautiful parts appear visually to be noise.

This paper is structured as follows. Section 2 describes glitch art as the background of this research. Based on that, Section 3 describes the goals and basic approach of this research. Section 4 then describes the experiments conducted in this research and a discussion of the results, and Section 5 describes related research. Finally, Section 6 concludes this paper.

Research Background

Glitch Art

A glitch refers to an error (problem) in images, video, or audio that occurs when digital data is corrupted or televisions or game consoles malfunction. The unpredictable beauty of such glitches has an allure not found in predictable beauty, and over the years, pioneering artists who utilised this in art have come to be accepted as glitch art. One of the earliest pioneering works of glitch art is Nam June Paik's *Magnet TV*, which altered the distortion of the television image by moving a powerful magnet placed on top of the television (Kellein & Stooss, 1993). The video work *Digital TV Dinner*, created by Jamie Fenton and Raoul Zaritsky in 1978, is a video recording of glitches created by operating the Bally Astrocade video game console by Bally Manufacturing (Betancourt, 2015).

Glitch art is no longer limited to works that use glitches in televisions and video games; it has now developed into a musical genre known as glitch music. The German electronic music

group OVAL (Popp, 2022) is considered a pioneer of glitch music, and a music festival bearing the name GLITCH (Festival, 2014) has been held annually since 2014.

Theoretical research has also been conducted on glitch art. Rosa Menkman has proposed using information theory to understand glitch art as a specific genre of contemporary art (Menkman, 2011). In 2010, Rosa Menkman and others organised the international conference on glitch, GLI.T/CH (McCormack, 2010). Research on glitch art has also been presented at the international conference EvoMUSART, which has been held annually since 2011 (Machado et al., 2013).

How to Create Glitch Art

There are many tutorials available online on how to create glitch art (Stearns, 2013; Temkin, 2009). Michael Betancourt has also classified the techniques used to create glitch art as follows (Betancourt, 2016):

- Data Manipulation: Modifying file data to create glitches
- Misalignment: Opening a file from one app in another
- Hardware Failure: Creating mechanical malfunctions to generate sound or video
- Misregistration: Physical noise in analog media
- Distortion: Creating physical distortions using magnets, etc.

It is important to note that these techniques do not always work effectively. For example, if data is corrupted through data manipulation, glitches may or may not occur as a result. This unpredictability is undoubtedly what makes glitch art so appealing, but the glitches in glitch art are necessarily limited to those that can be perceived by human sensory organs such as sight and hearing.

Research Goals and Basic Approaches

Research Goals

Our goals in this study are as follows:

- Aiming to express art through the cross-sectional manipulation of sound, color (light), and light.
- Creating audible glitch art with elegant techniques.

We have previously worked on colorizing sound (Amano, 2018). Utilizing that knowledge, in this research, we aim to express cross-sectional art that spans sound and color. Sound and color have something in common. Specifically, they both have wave properties. Waves in sound represent tone, while waves in light represent color. Color is the reflection of light, and light and sound are sine waves with different frequencies. In other words, both can be represented and processed as waveform data. Sounds that cannot be perceived by the human ear can be perceived visually if they are represented as waveform data, and colors that cannot be perceived by the human eye can sometimes be perceived audibly.

Furthermore, we do not simply create glitches, but also pursue the technique itself. A haphazard method is not what we aim for. On the other hand, a method that produces the same results no matter when, where, or who does it would negate the unpredictable beauty that is the appeal of glitch art. In this research, an elegant method means a unified method based on a certain format. This does not eliminate the occurrence of unpredictable glitches.

For example, when it comes to data manipulation techniques, an elegant method is achieved by systematically organizing and unifying the methods of manipulating data. However, this does not completely prescribe everything, and it allows for the target parts of data manipulation to be set arbitrarily. By doing this, we can expect to see the emergence of the unpredictable beauty that is the appeal of glitch art.

Basic Approaches

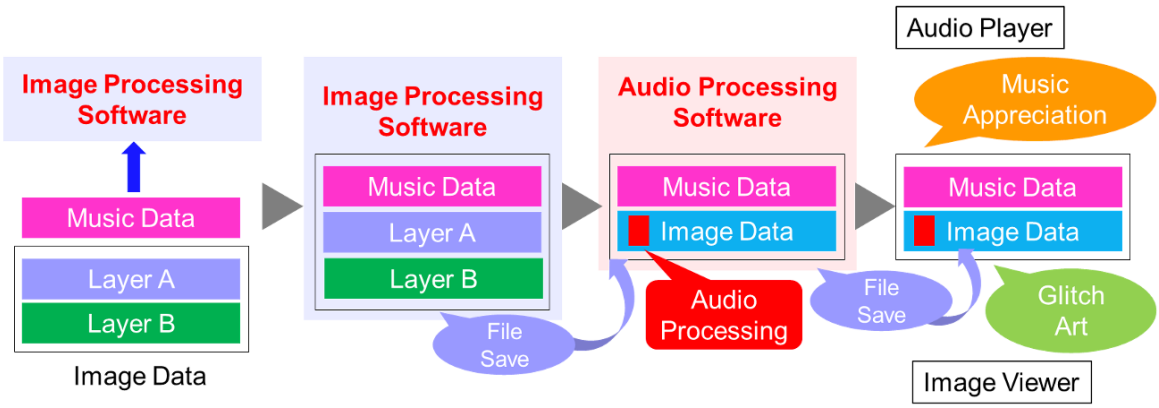
The basic approach of this research is as follows:

- Manipulating sound as an image
  - Sounds that humans cannot perceive can be processed as image data
  - Image processing can be applied = elegant manipulation
- Manipulating images as sound
  - Colors (light) that humans cannot perceive can be processed as audio data
  - Audio processing can be applied = elegant manipulation

First, by manipulating sound as an image, it becomes possible to process sounds that humans cannot perceive as image data. Then, by applying image processing to sound, it becomes possible to create glitches. Furthermore, by manipulating images as sound, it becomes possible to process colors (light) that humans cannot perceive as audio data (waveform data). Then, by applying audio processing to images, it becomes possible to create glitches. In conclusion, the elegant method that this research aims to use is a method for creating glitch art based on image and audio processing that is fundamentally based on misalignment.

Next, we will describe specific methods that build on this basic approach (Figure 1).

Figure 1
Overview of Our Approach



The key points of the basic approach in this research are as follows:

- Image Processing: Multi-layering of music and image data
- Audio Processing: Applied only to image data

Figure 2
Audio Data Conversion

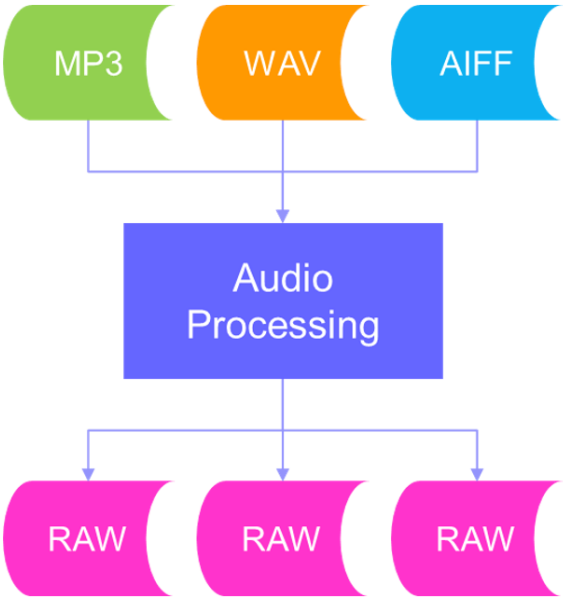
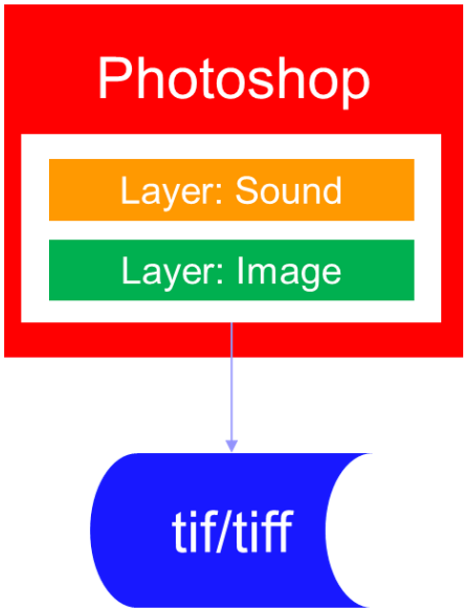


Figure 3
Multilayer Data With Music and Image



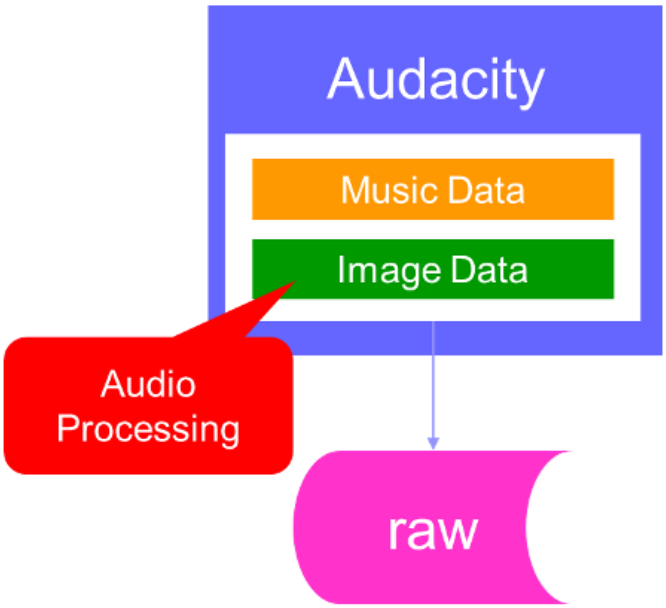
First, prepare the original image data and music data. Next, load this data into image processing software. In this case, the image data and music data are each placed on separate layers. Layers are like the sheets that make up an image, and in many image processing programs, a single image is composed of multiple sheets stacked on top of each other. This layering makes it possible to perform image processing such as compositing and modifying multiple images without affecting the original image. One thing to note is when loading music data. Music data cannot usually be loaded into image processing software. Therefore, the music data must first be converted. Music data formats include MP3 (MPEG-1 Audio Layer-3) (John et al., 2012), WAV (RIFF waveform Audio Format) (IBM Corp. et al., 1991), and AIFF (Audio Interchange File Format) (Apple Computer Inc., 1989). Music data in these formats is structured based on a specific data structure and cannot be loaded into image processing software in its current state. For this reason, the music data format is converted to RAW (Raw Image Format) (Fraser, 2004) format (Figure 2). RAW format is a pixel data format that is not strongly dependent on any particular application.

After converting the music data to RAW format, the image data and music data are loaded into image processing software (Figure 3). Details will be given in the next section, but the important thing to note here is that the two are placed on separate layers. Also, no image processing is applied to the music data layer. If image processing is applied to the music data, glitches will occur in the music data, and it is highly likely that the music will be unlistenable. Conversely, no glitches will occur if image processing is applied to image data. This is because applying normal image processing to image data is not a destructive operation on the data. The most important point is that the image data and music data that have been loaded into the image processing software and converted into multi-layers are saved as a single file. The file is saved in tif/tiff format, which is a type of RAW format. At this point, no glitches will occur.

Next, the multi-layered data (data containing a mixture of images and music) that has been converted into a file through image processing software is loaded into audio processing software (Figure 4). As this is not a normal music file, some ingenuity is required, but details

will be given in the next section. After loading it into the audio processing software, audio processing is applied, but care must be taken here as well. The loaded data is a mixture of images and music, and audio processing is applied to the image data. This is because applying audio processing to music data will affect the music data, and it will no longer be the original music data. There are also some points to be careful about when applying audio processing to image data, but these will be discussed in the next section. After going through the above steps and saving the file, the occurrence of glitches can be visually confirmed. Furthermore, to check the music audibly, audio playback software will be used, but as the file format is RAW, only a limited number of audio software programs can play it.

Figure 4
Audio Processing to Multilayer Data



Experiments and Discussions

Image Processing

First, in this study, we used Pachelbel's Canon as music data. The original file was in MP3 format, but we converted it to RAW format. For details of this preprocessing, refer to the reference (Amano, 2023a).