Glitch Art based on Classical Music Tones

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***Abstract*—Glitch art is art that uses errors (glitches) in images, videos, and sounds that are intentionally created by destroying digital data or physically manipulating electronic devices. Glitch art is interesting in that it expresses unpredictable, accidental beauty. We are exploring the production methods and effects of glitch art, and as part of this research, we attempted to create glitch art by mixing images and classical music. Specifically, we simultaneously loaded image data and music data into the audio editing software Audacity to create multi-track data. This not only generates glitches in the image data, but also in the music data. Our goal is to generate glitch art by treating images as part of the music, and to make glitch art enjoyable to listen to. We have confirmed that this goal can be achieved by the method of this research. This research is unique in that it simultaneously realizes the visualization and sonification of glitches and creates a new type of art that brings about a shift in aesthetic sensibilities.**

***Keywords*—classical music tones, Glitch Art, sonification, visualization**

I. Introduction

Glitch art is art that uses errors (glitches) in images, videos, and sounds that are intentionally created by destroying digital data or physically manipulating electronic devices. Glitch art was born with the emergence of new media. It began with works that used glitches in televisions and video games, and today it has developed into a music genre called glitch music. Glitch art expresses the beauty of unpredictable chance. It has a charm that is not found in the beauty of pre-determined harmony, which is what attracts so many people. Furthermore, by deliberately introducing imperfection into art and finding beauty in the imperfection of the work, glitch art brings a different perspective from traditional artworks that aim for perfect beauty, and can be said to broaden the scope of appreciation of art in general.

We are exploring the production methods and effects of glitch art, and as part of this research, we attempted to create glitch art by mixing images and classical music. Specifically, image data and music data were simultaneously loaded into the audio editing software Audacity to create multi-track data. This not only generates glitches in the image data, but also in the music data. Our goal was to generate glitch art using a method that treats images as part of the music, and to make glitch art enjoyable to listen to as well. We confirmed that this goal could be achieved using the method used in this research. This is a unique study that simultaneously realizes the visualization and sonification of glitches, creating a new type of art that brings about a shift in aesthetic sensibilities.

This paper is structured as follows. Section II describes glitch art as the background of this research. Based on that, Section III describes the goal and basic approach of this research. Section IV describes the experiments conducted in this research and a discussion of their results, and Section V describes related research. Finally, Section VI concludes this paper.

II. Research Background

A. Glitch Art

Glitch refers to errors (problems) in images, videos, sounds, etc. that occur when digital data is destroyed or televisions or game consoles malfunction. The accidental beauty brought about by glitches has a charm not found in the beauty of pre-determined harmony, and over the years, pioneering attempts to use this in art have come to be recognized as glitch art. Pioneering works of glitch art include Nam June Paik's "Magnet TV" [1] and Jamie Fenton and Raul Zaritsky's video work "Digital TV Dinner" [2]. These are examples of glitch art that involve physical devices.

Glitch art has now developed into a musical genre called glitch music. The German electronic music group OVAL is considered to be the pioneers of glitch music, and a music festival named after GLITCH has been held annually since 2014.

Theoretical research on glitch art has also been conducted. Rosa Menkman has proposed using information theory to understand glitch art as a specific genre of contemporary art [3]. In 2010, Roas Menkman and others held the international conference on glitch, GLI.T/CH [4]. Research on glitch art has also been presented at the international conference, evomusart, which has been held annually since 2011.

B. Methods of Glitch Art

There are many tutorials available online on how to create glitch art [5]. Michael Betancourt categorizes the techniques used to create glitch art as follows [6]:

- Data Manipulation: Modify file data and create glitches
- Misalignment: Opening a file from one application in another application
- Hardware Failure: Causes a malfunction in the machine, generating sound or images
- Misregistration: Physical noise of analog media
- Distortion: Creating physical distortion using magnets, etc.

It is important to note that these techniques do not always work effectively. For example, destroying data through data manipulation may or may not result in the occurrence of a glitch. This randomness is 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.

III. Research Goals and Basic Approaches

A. Research Goals

Our basic goals in this study are as follows:

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- Creating glitch art in sophisticated ways
- Art expression through the cross-sectional manipulation of color (light) and sound

We do not simply create glitch art, but pursue sophisticated methods to achieve it. Even if an unreproducible, haphazard method allows us to see accidental beauty, it does not deserve to be called a method. On the other hand, a technique that produces the same results no matter when, where, or who uses it would negate the accidental beauty that is the appeal of glitch art.

In this study, a sophisticated method means a unified method based on a certain format. This does not contradict the five methods listed in the previous section. For example, in the case of data manipulation methods, this is achieved by systematically organizing and unifying the methods of manipulating data. However, rather than completely prescribing everything, a certain degree of freedom is left. In this way, room is left for the emergence of accidental beauty.

We have also been working on coloring sound [7]. Utilizing that knowledge, in this research, we aim to express art that crosses over color and sound. Color and sound have something in common: they can both be represented and processed as waveform data. By representing color (light) as waveform data, we can recognize color differences that cannot be recognized by human vision.

This study is an extension of reference [8], but differs significantly in the following respects.

- A glitch art production method that focuses on tones

Our previous methods dealt with music very roughly. As a result, the quality of the glitch art we created was low, and it could not be said that it looked good as an artwork.

B. Basic Approaches

The basic approach of this study is as follows (Fig. 1).

- Basic glitch techniques: Combining misalignment and data manipulation
- Preprocessing 1: Image data conversion (preparation for misalignment)
- Preprocessing 2: Divide classical music data into tones
- Audio processing: Mixing image data and music (tone) data to create multi-tracks
- Checking the glitch effect: Checking the glitch effect using image display software and audio playback software

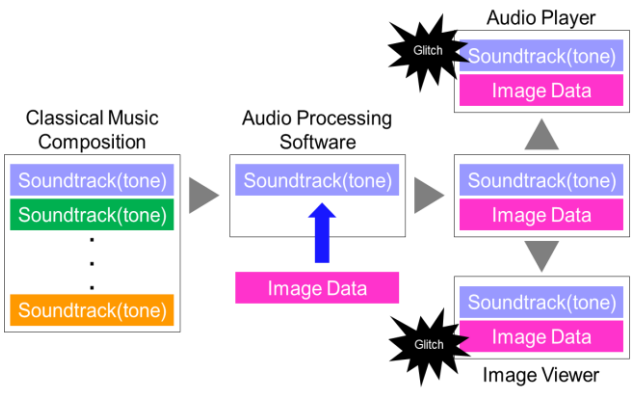

Fig. 1. Basic approach.

First, we combine misalignment and data manipulation as glitch techniques. Specifically, we load image data into audio processing software and perform data manipulation. To do this, we first convert the image data, as image data cannot normally be loaded into audio editing software. Therefore, we first convert the image format to RAW [9] format. RAW format image data refers to unprocessed image data from digital cameras, etc., and RAW images are "raw" image data that are the source for generating images such as JPEG [10]. There are several types of such RAW images, but in this study, we adopt the TIFF [11] format. The TIFF format is a pixel-based image format that is not strongly dependent on a specific application.

Next, the music data is divided into tone units. The classical music data used in this study is assumed to be in MIDI format [12]. Music data in MIDI format is often composed of multiple soundtracks, and each soundtrack is music data in tone units. For example, one soundtrack consists of violin parts, and another soundtrack consists of trumpet parts. The key idea of this study is to create glitch art by mixing the data divided into tone units with images.

This mixture of sound and image creates two glitches: the sound part becomes a glitch when displayed as an image, and the image part becomes a glitch when played back as sound.

Fig. 2. Original image.

IV. Experiments and Discussions

In this study, we conducted experiments to create glitch art based on the approach described in the previous section. Below, we will explain the details of an experiment and its results step by step.

A. Pre-Process

The original image used in this study is shown above (Fig. 2). This original image was in PNG format, so it was converted to TIFF format using the image processing software Photoshop.

In addition, we selected Tchaikovsky's Nutcracker (Waltz of the Flowers) as the music piece and used its MIDI file. This piece is composed of 16 instrumental parts (Fig. 3).

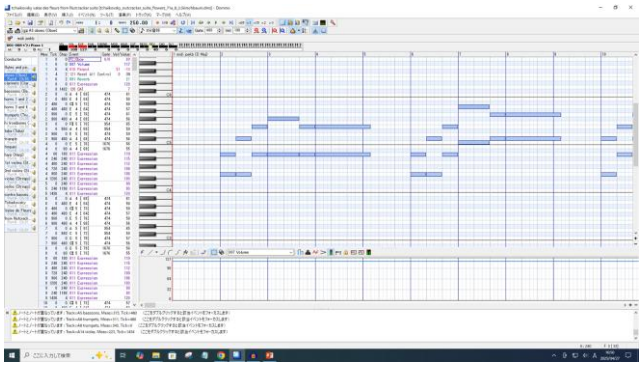

Fig. 3. MIDI file of Tchaikovsky's Nutcracker.

From this MIDI file, 16 sound data (mp3 files) were generated for each tone using music production software.

B. Audio Processing

Next, load the image file (tif) into the audio editing software Audacity [13]. Since image files cannot be loaded using the normal file open operation, use Audacity's "import raw format" function (Fig. 4). Also, specify the following options:

- Encoding: U-Law
- Byte order: big endian
- Channels: 1 channel

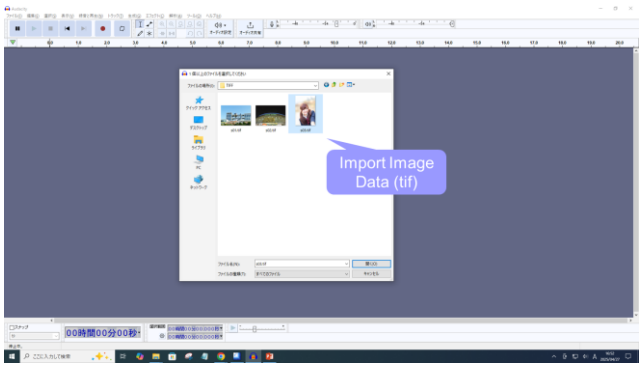

Fig. 4. Import image data into audacity.

Fig. 5 shows the image data loaded into Audacity.

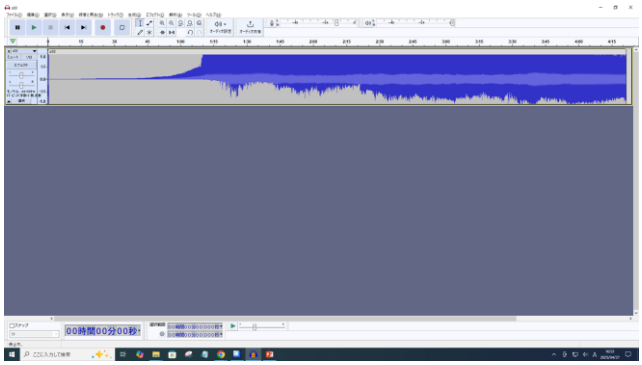

Fig. 5. Image data in audacity.

Next, load the music data. In order to compare the generated glitch art, we will load music data that includes all the tones.

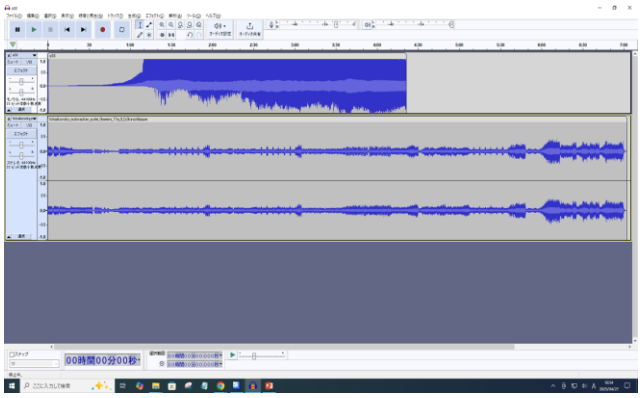

Fig. 6. Loaded sound data into audacity.

Fig. 6 shows music data loaded into Audacity. As can be seen from the figure, the music data is in stereo format.

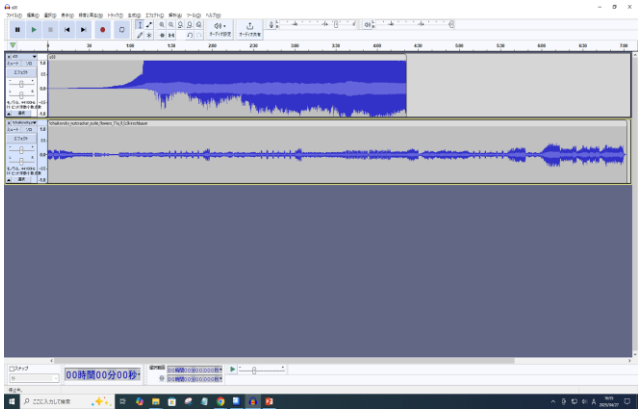

Fig. 7. Multi-track: Image and sound in audacity.

As far as we have experimented, glitch art cannot be generated if the audio remains in stereo format. Therefore, we convert the stereo audio to two mono tracks and delete one track (Fig. 7). Audacity has a function for this purpose.

Finally, save the multi-track data above as a single file. Again, you cannot save it as a normal file, but export it as raw data (Fig. 8). Audacity has a function for this purpose.

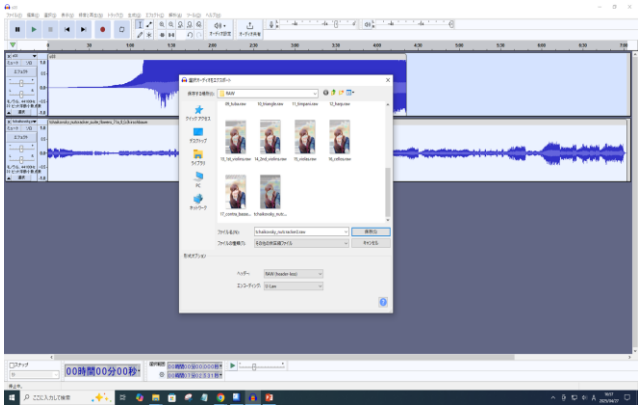

Fig. 8. Export multi-track data from audacity.

When exporting, you will need to specify the following options:

- File type: Other uncompressed files
- Header: RAW（header-less）
- Encoding: U-Law

C. Glitch Effects

When the file created in this way was displayed using image display software, the glitch art image shown in Fig. 9 was confirmed.

Fig. 9. Glitch art.

Looking at Fig. 9, we can see the glitch effect throughout the image. How should this be evaluated as a work of art, and whether it can be evaluated at all? This may be a matter of debate, but there is no denying that the glitch effect is too great. Furthermore, rather than an expression of accidental beauty, which is the true joy of glitch art, it looks like the original image has simply had noise applied to it. The reason for this is thought to be that there is too much data in the song.

Therefore, we attempted to generate glitch art using music data divided into tone units, and were able to obtain good results as we had intended.

Fig. 10. Glitch Art based on Triangle Part (Tone).

Fig. 10 shows glitch art generated by extracting only the triangle part (tone) from music data and mixing it with the original image. The result is clearly different from music data that includes all the tones. The reason for this is the amount of music data. The triangle part only makes up a limited portion of the song, so the amount of data is clearly small and unevenly distributed. The result is the glitch effect seen in the figure above.

Fig. 11. Glitch art based on tuba part (Tone).

Fig. 11 shows glitch art created similarly using a tuba part (tone). A different glitch effect can be seen from the triangle part. As mentioned above, the original music data consists of 16 instrument parts, and in this study, 16 types of glitch art were created. Due to space limitations, it is not possible to show all of the results, but we obtained some very interesting results.

The created multi-track data can also be played back using Audacity. It has been confirmed that the image causes glitches in the sound, but this will not be covered in this article.

D. Discussions

By mixing sound data and image data, we were able to generate glitches in both sound and image and confirm their effects. The glitch art created by this research is significantly different from conventional glitch art in the following ways.

- Enjoy glitch art images musically
- Enjoy glitch sound visually
- A new artistic expression that transforms aesthetic sensibilities

The works that combine glitch art images and glitch sounds using the techniques of this research can be described as a new artistic expression that transforms aesthetic sensibilities. This is because the artworks are visually beautiful but not audibly beautiful, and vice versa. In particular, we would like to emphasize that these are the same work. Not only can such artworks be enjoyed by people with visual or hearing impairments, but they can also be said to be artworks that make us reconsider what beauty is.

V. Related Work

Phillip Stearns has published many glitch art tools and glitch-related artists online [14]. There are also a number of artists who publish their own glitch art works online [15]. The

method of creating glitch art using Audacity is not original to this research. In our previous research [8], we also attempted to generate glitch art based on audio processing using Audacity.

There is also a technique called datamoshing, which creates errors when playing videos, and research is being conducted into its effects and techniques [16]. There are also attempts to combine contemporary dance with glitch art [17]. They have proposed a method of creating glitch art that uses errors (glitches) in the sensors that capture dance motion in mixed reality images.

The differences between these glitch art works and research and this research are as follows:

- Mixing images and sound
- Simultaneous image and sound glitches
- Glitch art that can be enjoyed both visually and aurally

In addition, unlike our previous research, this study adopted a method that focuses on tone, which allowed us to improve the quality of glitch art.

VI. Conclusion

In this study, we proposed and experimented with a method to simultaneously realize enjoyable glitch art and glitch sound by mixing image data and music sound data as a multi-track. This research breaks new ground in glitch art and renews our sense of beauty beyond glitch art alone.

Future challenges and prospects are as follows:

- Experimenting with a variety of musical genres
- Analyzing the characteristics and trends of glitch art based on tones
- Creating beautiful glitch art by combining tones

Conflict of Interest

The author declares no conflict of interest.

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