New Approach of Cultural Aesthetic Using Sound and Image

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***Abstract*—With the help of science and technology, many interesting works of art can be created, including transforming sound into images. If we combine these images with cultural elements, new approaches to preserve existing cultures can be developed. We put some viscous liquid on rubber film which covers a speaker and played various sound. We then see marvelous shapes simulating the sounds that usually cannot be seen with the help of a high speed camera. I studied how the frequency of sound and liquid materials (water, pigment, foam, jelly) influence these shapes. High liquid viscosity reduces the liquid's jump height and maintains a consistent shape; low liquid viscosity enables higher jumps and transformations into small spherical drops. At the frequency of 32hz, liquid jumps are expected to reach the greatest heights. Sine wave sounds can propel liquid further than zigzag waves. I also made some interesting discoveries. If we use this approach to reveal ancient culture, it would be an innovative approach to revive the sounds and images of disappearing ancient cultures.**

Keywords—sound images; sound frequency; high-speed camera; liquid viscosity

I. Introduction

Science and technology developed exponentially when in the 21th century. The development provided new approaches for creating art works. With the help of computers, it is possible for us to transform sound into images.

These forms of art making can arouse the curiosity of viewers. This curiosity makes viewers pay closer attention to the art work. Meanwhile, this new way of thinking can be planted in the mind of people who see the art work, and inspire their imagination. If we combine aesthetic elements to new science and technology, we can create an appeal for things that we have never shown to people.

Linden Gledhill combined different colors of water based paints, and used sound as the trigger for the camera to capture intricate shapes [1].

The work made by Naoko Tosa named "Sound of Ikebana" was exhibited to the world, and gained a lot of applause [2][3]. This work succeeded in transforming sound into images with the help of a high-speed camera. The work was integrated with cultural elements, especially with elements of the ancient design of Japan called Rimpa. This influenced the world greatly, and improved global cultural communication.

Gledhill's work and Sound of Ikebana are both works made by the approach of science technology, which change sound into images.

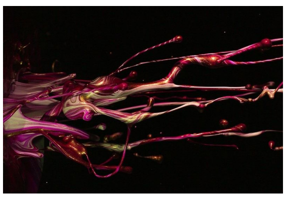


fig. 1. Work by Naoko Tosa.

Feng Chen from Kyoto University also examined how to transform sound into images [3]. However, her paper didn't discuss the influence of sound frequency on sound shapes, so I explore this aspect in this paper.

II. System Principles

To transform sound into images, we use a stretched rubber sheet covering a speaker. We then add paint or other materials on this sheet. A computer is used to control and play the sounds through the speaker. The sound vibration is then felt by the rubber sheet, and the sheet thrusts the material into the air. Various shapes formed by the paint in the air were then captured with our high-speed camera.

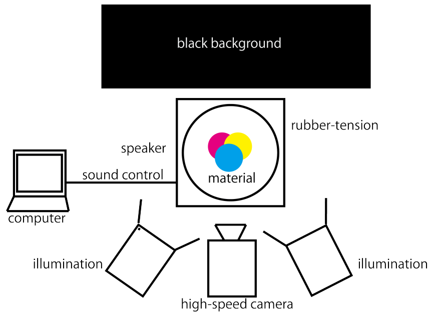


fig. 2. System configuration.

III. Experiment and Results

A. Experiment

Pure Data (PD), a visual programing language which provides interactive computer music and multimedia works, was used.

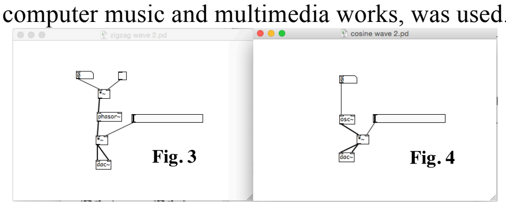


fig. 3. and fig. 4. The PD program for the experiment

I made this visual program to control the types of sound waves. Figure 1 displays a PD program for making zigzags sound wave. Figure 4 shows the program for sine wave sounds. We can use the little box on top to control the frequency, and use the long horizontal bar to control the volume. Among the different shape of sound wave, sine wave can vibrate the materials more than zigzag wave.

TABLE I.

Influence of Different Quantity of Paint*

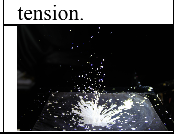
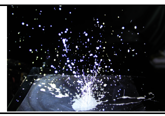
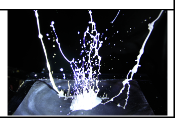
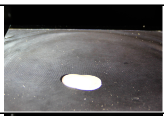
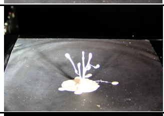
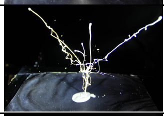
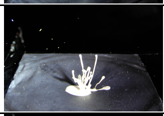
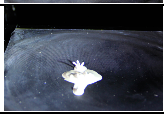
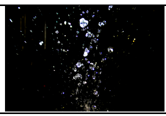
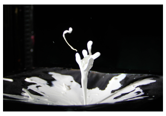
Amount of paint	3ml	6ml	10ml～
Phenomena	A small and unclear inverted triagle fountain was created on the center of the tension.	A clear inverted triangle fountain was created on the center of the tension.	A big inverted triagle shape was generated like a erupting volcano.
			

TABLE II.

Influence of Frequencies of Sound*		
Frequency	***Phenomena***	
~12hz	Paint created some waves but didn’t eject at all.	
12hz~18hz	Paint integrated to the center of the tension and gradually began to eject from the tension.	
18hz~30hz	Vibration became stronger, and paint ejected further. Some paint ejected out of the rubber-tension. And the shape that paint changed is interesting.	
30hz~34hz	Vibration became strongest. Paint jumped very high, and out of the tension.	
35hz~60hz	Vibration decreased gradually. The shape of paint is like when it’s 12hz~18hz, but the number of branches is more than 12hz~18hz.	
60hz~	The jumping of paint became very low. And the shape of the paint was like small flowers.	

*Other variates were same.

TABLE III.

Influence of Viscosity in Different Materials*		
Material	**Phenomena**	
Water	Water jumped from the center of the rubber-tension and then rapidly change to small sphere shape drops. And it jumped very far.	
Paints	The height that paints jumped is only half of water’s. Andidn’t seprated to small drops and maitained a unbroke shape. Finally, it change to stream shape.	
Foam	Though the shape of foam changed a lot, but it didn’t be seprated.	
Jelly	Jelly only simulated big waves on the surface, but didn’t jump at all.	

*Other variates were same.

TABLE IV.

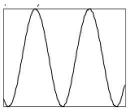
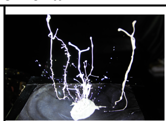
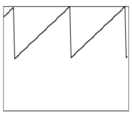
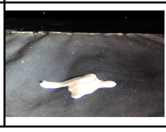
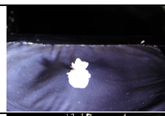
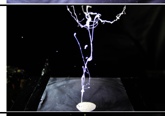
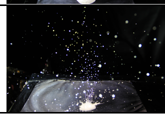
Influence of the Shape of Sound Wave*			
Type of wave		**Phenomena**	
Sine wave		The vibration provided by sine wave is significant.	
Zigzag wave		The vibration provided by zigzag wave can’t even make paint jump.	

TABLE V.

Influence of Viscosity in same material*		
Viscosity	***Phenomena***	
High Viscosity	The paint didn't be seperated or jump up from the tension. But changed its shape to a small flower.	
Medium Viscosity	The paint jumped further than high viscosity. And the shape was interesting, which changed into stream shape.	
Low Viscosity	When the paint ejected to air, it changed to small drops immediatly. And it jumped furthest.	

*Other variates were same.

B. *Result and Analysis*

We know from the experiences above that, with a small amount of water, the shape in which water jumps is not clear. When the water quantity is large, the water is propelled further. Sound frequency also influences the vibration and the shapes formed by the liquid. Under 12hz, the water is barely displaced. From 12hz to 30hz, the vibration of the water is observable. At approximately 32hz, the water vibration is at its strongest, then gradually decreases and disappears disappears at 60hz. When we are operating at a good frequency (especially 32hz), the vibrations make the paint jump highest, or jump into various shapes. The viscosity of the materials also influences the shape. The material remains intact when its viscosity value is high, forming various shapes when propelled materials by the speaker. Materials with low viscosity divide when kinetic energy propels them upward such as water. As for foam (a material with low viscosity), since the quality of the material was too low, the material was not able to absorb enough kinetic energy. So foam was not greatly displaced despite its low viscosity.

With high viscosity liquid and high frequency, we can simulate mountains; with low viscosity liquid and low frequency, we can simulate rain. By properly understanding these elements, we can control the shape of sound images.

IV. Conclution

From the experience above, we discovered that the shape of sound can be controlled to some degree. However, there still are some aspects of sound shaping that are unknown. For example, what phenomena can be created if we use the human voice as the vibration source, or a combination of deferent color materials? So I will continue to conduct research in this field. My home country, China, has a long history and sophisticated culture. In the next step, I am going to try to combine ancient Chinese culture (especially by using the bronze bell, an ancient Chinese music instrument, as the vibration source, and use the cinnabar or lapis lazuli as paint) with this kind of brand-new approach to create an artwork, with the ambition of helping more people understand Chinese culture.

References

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