

A study on the expansibility of sound-responsive visual art contents

Qianqian Jiang¹, Jean-Hun Chung²

¹ Doctor's course, Dept. of Multimedia, Graduate School of Digital Image and Contents, Dongguk University, Korea

² Professor, Dept. of Multimedia, Graduate School of Digital Image and Contents, Dongguk University, Korea

¹qq13075335680@163.com, ²evengates@gmail.com

Abstract

The relationship between sound and vision was experimentally confirmed by physicist Ernst Florens Friedrich Chladni as early as the 18th century and formally entered into systematic research. With the development of emerging media technology, sound reactive type visual content is not limited to a single visual interaction based on the vibration of sound, and its visual content shows a diversified and scalable development trend according to different purposes in many fields. This study analyzes the development and changes of sound visual art contents from early stage to modernization, and analyzes the development characteristic of sound visual art content in different fields and scene environments influence by interactive media, new media technologies and devices by means of case analysis. Through this research, it is expected that the sound reactive type visual art content can continue to develop and extend in the existing fields, while explore the scalability of the application of sound reactive type visual art content in more fields.

Keywords: sound-responsive, Visual art contents, sound vibration, visual feature

1. Introduction

1.1 Research background

In the past art scope, music and visual art were two independent art individuals. With the integration of new media and digital media art, the concept of music visualization based on information visualization also began to appear. It is also an artistic means of presenting the changes of sound in a visual form. In the 18th century, physicist Ernst Florens Friedrich Chladni connected sound and vision by using the visual mode presentation experiment of the sound of violin, metal board and fine sand, and opened up a new idea of music visualization from the physical level.[1]

Usually, music is an artistic form of expressing emotion and thought in the form of hearing. But there are experiments show that the visual stimulus is stronger and more impressive than auditory stimulation.[2] The appearance of sound reactive type visual art makes "see" music possible. The flexible use of sound information on vision makes it have broad application prospects of entertainment, education, art, commerce and so on.

Manuscript Received: April. 17, 2022 / Revised: April. 20, 2022 / Accepted: April. 23, 2022

Corresponding Author: evengates@gmail.com(Jeanhun Chung)

Tel: +82-2-2260-3767, Fax: +82-2-2260-3767

Professor, Dept. of Multimedia, Graduate School of Digital Image and Contents, Dongguk University, Korea

1.2 Research purpose and method

For most people, do not understand the meaning and artistic conception of music in many cases, or can only feel love to a certain melody or lyrics. Especially deaf mute, they are even unable to experience the sensory experience brought by music. Images and sounds will have different meanings and effects depending on the purpose of use.[3] Therefore, the visual art form that uses pictures and images to interpret the emotional content of music is very important.

Since the development of the concept of sound reactive type visual art, it has been presented in different visual forms in different application fields. This paper hopes to study the innovative research of the visual art content of music visualization through the influence of the concept of information visualization on the visual art of music, based on the times, from the aspect of its application type, combined with case analysis to study the innovative research of the sound reactive type visual art contents.[4]

2. Theoretical research

2.1 Information visualization

Information can be presented in many ways, such as vision, hearing, touch, smell and so on. The presentation of information on a visual way is information visualization. Information visualization is an interdisciplinary field, which aims to study the visual presentation of large-scale non numerical information resources.[5]

2.2 Research on the theory of sound visual art

Sound reactive type visual art representation can also be understood as sound visualization, it is a branch of information visualization. It takes music sound as the information carrier, vision as the core, with the help of a variety of new media technologies, music sound information is presented in the form of graphics, animation, images and other ways, which is a popular communication mode of audio-visual combination.[6] The creative purpose of sound visualization may be artistic expression, or it may be pure information visualization.[7]

2.3 The types of music reactive type visual art contents

Music sound reactive type visual is music sound visualization, at present, music visualization is mainly divided into interactivity, real-time, dimension angle, experience and audio data type five categories. In Table 1, many small branch types are covered in the general classification of music visualization. With the development of visual arts in recent years, the overall characteristics of music visualization have begun to tend to be interactive, soft real-time, three-dimensional (3D), and immersive.

Table 1. Music sound Visualization classification[8]

Type	Features
Interactivity	Divided into non-interactive visualization and interactive visualization. Most visualizations are interactive.
real-time	Respond to system instructions within a specified time. It is divided into soft real-time and hard real-time
dimension	Divided into two-dimensional and three-dimensional. At present, many visual content creations is developing in 3D direction

Sense of experience	Divided into an immersive, half-immersive and non-immersive three kinds
Audio data type	Divided into two types of natural audio visualization and structural audio visualization.



3. Research on the content of music sound reactive type visual art

The characteristics of music sound reactive type visual art are influenced by the technology and art of the times. Its development has experienced the development process from static to dynamic, from one-way information transmission to two-way information interaction. As a new art form, sound reactive type visual art is not only a single integration of music and image, but also a means of integrated artistic expression in many fields, such as digital audio, animation, image processing, virtual reality, acoustics, aesthetics and so on. [9]

3.1 Analysis of the times changes of music sound visual art

The early interaction of music and vision. The interaction between early music sound and vision can be divided into two types of dynamic and static.

Table 2. Sound Visualization Classification[10-11]

Type	Works	Period	Artistic features
Static sound visual art		1923	Musicality painting. Think of separate lines or shapes as the external sound of painting. Utilize the musicality of points, lines and surfaces in painting to present the sense of music in the form of images.
Dynamic Sound Visual Art		18th century	Using violin, metal plate and fine sand, through the vibration change of music sound, the fine sand on the metal plate present various changing patterns

Static sound visual art tends to express musicality with visual elements such as graphics and lines in painting. In fact, there is no musical sound, but an art of feeling sound from painting. In 1680, the British scientist Robert Hooke sprinkled flour on glass and formed patterns through the vibration of sound. This experimental phenomenon identified the early development of dynamic sound visual art. In the 18th century, physicist Ernst Chladni began to carry out systematic research based on the discovery of Robert Hooke's experiment, and formally proposed the research of let the vocal body to vibration can be visualization by using the violin vibration experiment. The interaction between early music and vision is also a development process from static to dynamic.

Sound and visual art in the 20th century. In the 20th century, the art works that express sound in a regular visual art form through different interactive medium have begun to take shape. Swiss scientist Hans Jenny founded cymatics on the basis of Ernst Chladni's violin vibration experiment. A voice is a sound produced by trembling that comes out through resonance.[12] The vibration change of sound wave frequency generated by sound can interact with solid substances such as powder and liquid, and form clear geometric

shapes such as circle, tetrahedron and datura.[13] The sound and visual art in this period has a regularity, which can show a clear visual art pattern according to the ideas in combination with different interactive medium according to the vibration frequency of sound waves.

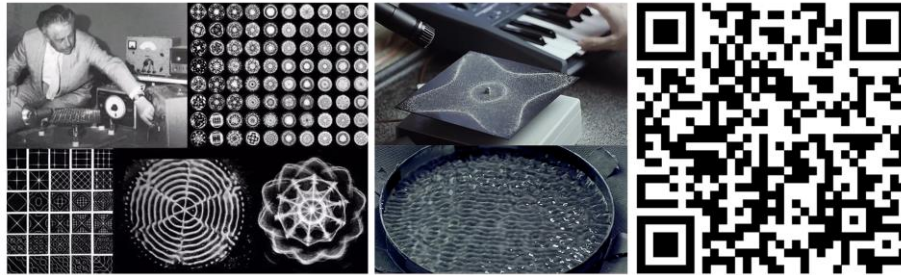

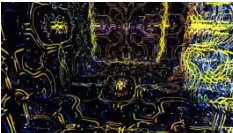




Figure 1. Hans Jenny experiment and similar physical vibration experiments

Application of modern sound and visual arts. Modern sound visual art continues to expand on the basis of sound vibration visual experiments. In the 21st century, the application field of modern sound visualization is also more extensive, not only in the field of design, but also in business, education, medicine and other fields have been widely used.

Table 3. Application and characteristics of modern sound visualization

Application field	feature
Interaction of modern planes	 <p>It is widely used in mobile music software. When playing the music, the tone, rhythm and other elements of the audio will be extracted for visual transformation.</p>
Combining with virtual reality technology	 <p>The music sound is visually transformed, and the virtual reality technology is used to integrate vision, hearing and touch, so as to increase the sense of audio-visual immersion</p>
musical education	 <p>It is mostly used for children's early music education. Transform music line score into visual form, improve children's intuitive understanding and perception, and increase interest through audio-visual combination.</p>
commercial application	 <p>Usually, the vibration change of music sound rhythm is combined with LED and other devices to set off the scene atmosphere with the change of visual light.</p>

Sound is most commonly used in visual arts is music sound plane visual interaction, virtual reality music sound visual expression, music visual education, commercial music sound visualization display, etc. Under the influence of new media technology and installation equipment, the visual art content and expression of sound has been widely expanded and applied in the development of modernization. The main development direction is visual, immersive, interactive and interesting on the forms of expression.

3.2 Case analysis

In order to bring better sound and visual effects, modernization sound and visual arts are also different in

terms of interactive medium, new media technology and installations according to the needs of the scene when presenting the content.

Public art sound visual content. The sound and visual content design of modernization public art makes up for the audience's psychology of no longer satisfied with isolated and static art display, and realizes a new public art display mode that is dynamic, interactive, and music visual dominant.



Figure 2. Infinity Field Bangkok

Figure 2. Infinity field Bangkok is a sound reactive types public art by SOFTlab on the Mekong river bank in Bangkok, Thailand in 2020. As a modernization music sound reactive types visual public art, music, LED device and visual light are expanded and integrated. After the light is activated by sound, the LED in the device will fluctuate with the rhythm of music and sound waves, showing different lighting effects. Coupled with the reflection field formed by the mirror surface and the surrounding environment, especially at night, under the combined effect of the light field and sound field environment, it brings a strong visual impact and emotional resonance.

Commercialization sound visual content. The visual art design of sound has various types on commercial applications, such as bars, concerts, music festivals, electronic music performances, etc. Different interactive medium is used to set off the atmosphere with a strong scene visual impact.

A musical fountain is a movable fountain created for entertainment or commercial activities. With water and light as the interactive media, affected by the sound of music, the water column of the fountain will change in height and shape. At the same time, the color of the light will also change rhythmically. It has high viewed value and entertainment value.



Figure 3. China Xi'an Dayan Pagoda Musical Fountain

Virtual reality sound visual contents. With the popularization and development of VR and AR technologies, games that use VR to display sound and vision have also become a hot topic nowadays. In Figure 4, the VR game "Visionarium" is a music-driven virtual reality experience game on the Steam platform. While playing music, the virtual game interface changes visually with the rhythm of the music creating a more impactful and more realistic immersive psychological experience than plane visual transformation, not only visually but also psychologically put people in their shoes to "feel" the music. [14]



Figure 4. Visionarium 2 - The Descent

4. Conclusion

Through research, it is found that most modern music sound visual art works are continuously extended based on the violin sound vibration experiment of Ernst Chladni, a German physicist in the 18th century. The emergence and application of emerging media is the development condition of sound reactive types visual art.

The content of modern sound visual art is presented in various ways in different fields, but they are all influenced by the principle of early sound dynamic visual resonance. According to the different application fields and purposes, the interactive medium and methods used are also different. Some studies have shown that the visualization of sound can be applied to the fields of music education for hearing-impaired children and emotional therapy for autistic children, but it has not been comprehensively applied at present. On the

contrary, the application and development in the fields of graphic design, public art, commerce, games, etc. have become more and more mature.

Through the research of this paper, we hope to provide the basic data of sound visual art for professional practitioners and researchers in various fields, continue to develop and extend the sound visual content in the existing fields, and explore the scalability of the application of sound reactive types visual art in more fields.

References

- [1] Z.Y. Qu, "Talking about the possibility of application of music visualization in modern times," *Popular literature*, 2021, No. 01, pp. 41-42.
- [2] T.X. Qu, D.J. Huang, and K.N. Tong, "A review of music visualization research," *Computer Science*, 2007, No. 09, pp. 16-22.
- [3] Kang-iL Um, H.J. Kim, "Functional Analysis of Music Used in Film <A clockwork Orange>," *International Journal of Advanced Smart Convergence (IJASC)*, Vol. 9, No. 4, pp. 101-105, 2020.
DOI : <http://dx.doi.org/10.7236/IJASC.2020.9.4.101>
- [4] X.Y. Shan, and J.H. Chung, "A Study on Video Content Scalability Using Holographic Production Technology," *Journal of Digital Convergence*, Vol. 18, No. 5, pp. 425-432, 2020.
DOI : <http://dx.doi.org/10.14400/JDC.2020.18.5.425>
- [5] Baidu baike, Information visualization,
<https://baike.baidu.com/item/%E4%BF%A1%E6%81%AF%E5%8F%AF%E8%A7%86%E5%8C%96/7278850?fr=aladdin>
- [6] Baidu baike, Music visualization,
<https://baike.baidu.com/item/%E9%9F%B3%E4%B9%90%E5%8F%AF%E8%A7%86%E5%8C%96>
- [7] Ren, M.X., *Application Research of Music Visualization Dynamic Design on Mobile Terminals*, master. Thesis. Jiangnan University, Wuxi, Jiangsu Province, China., 2020.
DOI : <http://dx.doi.org/10.27169/d.cnki.gwqgu.2020.000802>
- [8] J.P. Wang, "Research progress and application examples of music visualization," *Entertainment Technology*, 2018, No.05, PP. 11-16.
- [9] Y.J. Guo, "Discussion on the Development of Music Visualization Art," *Modern Music*, 2019, No.08, pp. 165-166.
- [10] https://www.sohu.com/a/398029763_100189613
- [11] D. Wang, "Research on Kandinsky's Abstract Painting Art Based on Musicality," *Journal of Pingdingshan University*, 2016, No.01, pp. 125-128.
- [12] S.W. Hahm, "Convergence research on the speaker's voice perceived by listener, and suggestions for future research application," *International Journal of Advanced Smart Convergence (IJASC)*, Vol. 11, No. 1, pp. 55-63, 2022.
DOI : <http://dx.doi.org/10.7236/IJASC.2022.11.1.55>
- [13] <https://www.ttssoo.com/huanqiushiye/maitian-quanshi-youshengyiny.html>
- [14] Steam, Visionarium, https://store.steampowered.com/app/1917860/Visionarium_2_The_Descent/