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BACHELOR'S THESIS
on the topic:

Development of a series of posters “The Shape of Sound”

Performed by: a student of the BED-20 group

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ABSTRACT

The purpose of this paper is to study the use of sound visualization in visual design, to provide multi-element and multi-dimensional communication effects for visual projects, TouchDesigner is a visualization software that can be used for interactive design through the creation of various types of components and effects of the "wiring". Firstly, we analyze the themes conveyed by the sound and explore their translation into the construction of visual content; secondly, we import music elements and extract their musical characteristics in TouchDesigner, a visual programming platform, and generate dynamic visual effects on the constructed basic graphic elements, with the dynamic part serving as the interactive experience of the sound, and the static part being processed by frame-cutting and combined with the layout to be interpreted as the main visualization of the static poster and the derivative visualization of the poster. Derivative visual posters are interpreted to constitute a more complete visual picture and emotional interactive experience in sound visualization design, enriching the creative expressiveness of the static visual work, the multiplicity of the communication process and the sound memory points.

Key words: Sound visualization,TouchDesigner, Dynamic interaction, New media art;,Poster Design .

CONTENT

INTRODUCTION

Relevance of the study.New media art is a kind of comprehensive art that integrates the era, technology and society, usually using the latest technology to provide multi-dimensional sensory experience that traditional art can not achieve, it is a kind of art that creates immersive and interactive works through hearing, sight, even smell, touch and other ways, and it is also a reflection of all aspects of today's social life. Among them, sound visualization is a basic and indispensable member of new media art nowadays.

The purpose of the research:to study the use of sound visualization in visual design, to provide multi-element and multi-dimensional communication effects for visual projects.The author hopes that through the application of sound visualization in cultural and creative industries, we can deeply explore the multidimensional expression of cultural and creative product design in the perspective of sound visualization, in order to further promote the integration of digital technology and cultural and creative product design, and thus lead to a new path for digital design of cultural and creative products in future intelligent scenarios.

Research Objectives:

1. In order to make the sound more intuitively reflect human's processing of visual information, we can turn the intriguing, abstract and difficult-to-understand sound into more concise, intuitive and easy-to-understand images or dynamic posters, so as to help people better perceive and understand the sound.

2. Through the study of sound visualization design, it is found that adding some sound effects to the ordinary picture design can inspire the creators' inspiration, ideas, and provide a more novel and unique way of expression.

3. Through the study of sound visualization design, it is found that sound visualization can promote scientific research by converting certain sound data or experimental results into visual forms and comparing and analyzing them with other

data factors. So as to make people feel the change of data more intuitively.

The research subject (theme) is sound visualization design

The object (focus) of the research are Operation of Touchdesigner software,Poster Design ,Audio Visual Interaction Design,Interaction design.

Research methods.This work utilized the following theories and special research methods: analysis of literature sources and normative literature on the research topic, comparative analysis of sound visualization cases, systematic, comprehensive, and generalized methods for obtaining data, and use sound visualization technology and use Touch Designer visual programming software to achieve sound visualization conversion. The output visual sound images will be artistically processed and integrated into various types of cultural and creative product designs.

Elements of scientific novelty.TouchDesigner is a visualization software that can be used for interactive design through the creation of various types of components and effects of the "wiring".

Practical significance.The author hopes that through the application of sound visualization in cultural and creative industries, we can deeply explore the multidimensional expression of cultural and creative product design in the perspective of sound visualization, in order to further promote the integration of digital technology and cultural and creative product design, and thus lead to a new path for digital design of cultural and creative products in future intelligent scenarios.

Structure and volume of the thesis. The bachelor's thesis consists of an introduction, three chapters, conclusions to each chapter and general conclusions, a list of used sources of 30 items and appendices (8 pages). The work contains 18 drawings. The results of the research are presented on 54 pages.

Chapter I
TOPIC ANALYSIS

1.1 Research Objective

(1) Through the research of sound visualization design, it is found that human's visual ability is much stronger than the processing ability of auditory information. In order to make the sound more intuitively reflect human's processing of visual information, we can turn the intriguing, abstract and difficult-to-understand sound into more concise, intuitive and easy-to-understand images or dynamic posters, so as to help people better perceive and understand the sound.

(2) Through the study of sound visualization design, it is found that adding some sound effects to the ordinary picture design can inspire the creators' inspiration, ideas, and provide a more novel and unique way of expression. For example, in the post-production of a movie, by combining some scenes of the movie with specific sound effects captured, a highly realistic and immersive effect is created, which can add a lot of fun to the movie and give the audience a more immersive experience.

(3) Through the study of sound visualization design, it is found that sound visualization can promote scientific research by converting certain sound data or experimental results into visual forms and comparing and analyzing them with other data factors. So as to make people feel the change of data more intuitively.

Art creation has always been closely related to the development of technology. When technology is applied to human practical activities, humans have the ability to create artistic works. The creation of artistic works is directly related to the productivity level of human beings in different historical periods. Prehistoric art was inspired by the activities of tribes and totem worship, and was closely related to the survival of tribes; During the period of classical art, the revival of technology and the revival of literature and art promoted the development of art genres during the same period; Industrialization has accelerated the development of modern art, and cameras have almost overturned traditional painting models. As a result, more communicable images

have entered people's vision; With the popularization of computers and the development of information technology, new media art that subverts tradition has emerged. After the advent of the digital media era, artists are no longer satisfied with creating solely in a certain academic field or using a specific medium. Especially with the continuous development of technologies such as virtual reality and real-time rendering, the number of artistic works created using cross media concepts and combining software and hardware technologies is gradually increasing. The technology and creative media used by artists have changed, and programming technology is gradually being applied to art works, which has led to unique forms and languages in art works in the new media era, partially presenting the computability and construction characteristics of programming technology. Software and hardware technologies are influencing the way people view, experience, and transform works of art, providing new directions for thinking in the field of art.[1]

1.2 Research significance

At present, the visual design scene of many domestic brands, many of which are mainly based on static graphic design, seldom to dynamic poster design, digital art design, new media interactive design and other extended out of the skills to carry out the transmission of information; while in many foreign brands, especially in music products, will be through the extraction of sound, music, rhythm, auditory and other characteristics of the sound, some fleeting sound information Analyze and transform them into visual symbols and other elements to break the limitations of time and space, which is mesmerizing.

In visual visualization design, we make information visualization charts by utilizing the information conveying function of the brain and the human eye, so that the audience can get the information faster; in the static aspect, the static visual products are converted twice, so that they echo with the dynamic interactive applications, which can achieve the visual effect of extension and unification, and help the users to get the

sensory experience of multiple levels, so that their communication characteristics can be maximized. The communication features can be maximized.

In the process of brand design and communication, due to its unique dynamic visual characteristics and the "randomness" of program development, this style of logo is extremely dynamic and random, and presents a unique digital aesthetics. Its single-screen static image can be applied to the visual effect of product packaging, music product derivatives, paper posters and so on; at the same time, it can be dynamically delivered on digital media, giving the viewer a strong visual feeling.

In addition, vision can well help the sense of hearing to enhance perception, and music products themselves have the effect of emotional and psychological treatment and soothing. Sound visualization design can also provide value in terms of emotional health, focusing on the mapping between sound and the human mind, and human emotional response, using images and interactions as a means to make people feel music at a deeper level and gain emotional satisfaction from it. This project intends to integrate auditory visualization technology with visual technology to provide help for rehabilitation and psychological counseling for people with depression, anxiety and other emotional abnormalities.

Excellent cultural and creative product design and development should not only optimize the cultural elements it carries, but also make it have distinct regional cultural characteristics, and comprehensively enrich and innovate its display forms through modern design techniques that keep up with the times. If we use digital techniques to redesign cultural and creative products, extract local characteristic sound elements through sound visualization for visualization processing, redesign through artistic reshaping techniques, and express them in the form of cultural and creative products, making them more in line with the aesthetic preferences of young people today.

1.3 Research Status at Home and Abroad

Domestic:

(1) In the field of music and art, sound visualization combines music and image, allowing us to have a deeper understanding and appreciation of the beauty of music. Through the careful analysis of its spectrum and waveform, it can give a person an intuitive understanding of the structure and rhythm of music and the emotions it contains.

(2) In language analysis, sound visualization can better reflect the deep information in language. By analyzing the waveform of the speech signal, we can accurately identify the emotional state, speed and tone of the speech, which has a wide range of application prospects in speech recognition and emotion analysis.

(3)In acoustic applications, acoustic research is deeply influenced by the design of sound visualization. The aim of this project is to study the spatial distribution of sound waves and reveal the interaction mechanism of the acoustic environment through visualization methods.

In addition to the above mentioned, sound visualization technology has many other uses. For example, in the field of virtual vr and other areas, sound visualization technology can bring more immersive visual experience to the user; in teaching, this method can make students more direct and clearer understanding of the properties of sound and its changing characteristics.

Abroad:

(1) The United States, a leader in film, music and other industries, is also a world leader in sound visualization design. The sound effects and music design of American movies such as The Dark Knight and Titanic show an extremely high level of sound visualization design. The U.S. has also produced many outstanding sound visualizers, such as Walter Murch, Gary Ridgestem, Ben Burtt, etc., who have considerable attainments in film, television, music and other fields.

(2) The United Kingdom, a city at the center of the global music industry, has also shown its own characteristics in sound and visual design. The UK is more experimental and innovative in sound design, seeking a unique sound effect and expression in sound, bringing listeners an unprecedented visual and auditory feast. In addition, the United Kingdom has also produced many excellent sound designers, such as Peter Gabriel,

Brian Ennor and Philip Glass, whose works have won high praise in music and sound design.

(3) Japan, the Asian leader in the music and animation industry, has sound and visual design that is also an important part of the industry. Japan's sound design attaches great importance to the expression of individuality, and organically integrates sound effects with a variety of multimedia means, such as animation, film and television, and games, to form a special visual effect. At the same time, Japan also has many excellent sound designers, such as Kawai Kenji, Yokoyama Jing'er and Setagaya Masaki, etc., whose creations are very flexible and have high artistic value.

Touch Designer is a special effects interactive application software developed by foreign software companies, focusing on designing applications for visual programming. Unlike traditional code writing in visual programming design, TD achieves visual effects by connecting and adding relevant nodes, not only enabling real-time rendering and interactive product design, but also achieving artistic visual effects design. TD's control panel has rich functions, high degrees of freedom, and strong personalization. The control panels that can be freely set by different users are also different. It is currently one of the mainstream sound visualization conversion software at home and abroad.

The digital design of cultural and creative products needs to enter the new era field with the help of digital technology, and shape new models of cultural and creative products that adapt to the development of the times. The digitalization of cultural and creative products not only brings the distance between history and reality closer, but also makes cultural resources more dynamic due to the combination of creativity and technology. Sound visualization technology can further expand new methods and ideas for the digitalization of cultural and creative products. In this design, through the application of sound visualization technology, cultural creativity is invisibly developed with a wide range, diversity, and full copyright, bringing cold words and patterns to life and action.

Summary of the chapter I

1.Sound visualization technology can bring users more immersive visual experiences.

2.Software and hardware technologies are influencing the way people view, experience, and transform works of art, providing new directions for thinking in the field of art.

3.Sound visualization design helps people better perceive and understand sound.

4.If we use digital techniques to redesign cultural and creative products, extract local characteristic sound elements through sound visualization for visualization processing, redesign through artistic reshaping techniques, and express them in the form of cultural and creative products, making them more in line with the aesthetic preferences of young people today.

5.Sound visualization technology can further expand new methods and ideas for the digitalization of cultural and creative products. In this design, through the application of sound visualization technology, cultural creativity is invisibly developed with a wide range, diversity, and full copyright, bringing cold words and patterns to life and action.

6.sound visualization technology has many other uses. For example, in the field of virtual vr and other areas, sound visualization technology can bring more immersive visual experience to the user; in teaching, this method can make students more direct and clearer understanding of the properties of sound and its changing characteristics.

Chapter II
PRACTICE RESEARCH AND DESIGN CONCEPT

2.1 Practice Research

Practical research is the foundation of design and the key to solving practical problems. Without on-site investigation, it is difficult to make a plan in line with the actual situation. Visualization technology is an emerging method of graphic expression, its main purpose is to convert data into graphics, images and other forms, so as to enhance the readability of the data and improve the comprehension of researchers.Excel is a common office software, which has a graphic function is a direct manifestation of the visualization technology, which can be used in the form of pie charts, bar charts and other forms of data in a visualized way. It can use pie charts, bar charts and other forms to present data in a visualized way. With the advent of the big data era, the application of visualization has become more and more extensive, not only in the field of scientific research. In recent years, more and more artists apply visualization technology to their creations, and this transformation is especially prominent in multimedia video art, which plays an important role in promoting the innovation and development of art forms.

Sound visualization is a special mode of information dissemination on a large scale with sound as the medium, visual expression as the center, and new media dominating as the means of dissemination. In addition, sound visualization technology deepens the understanding and cognition of auditory content through visual elements such as images and pictures, and enhances the communication effect of hearing.[5]

In today's trend of science and technology, the rapid development of digitalization and information technology has brought infinite vitality to the research of sound visualization and opened up a new path of auditory art. In the rapid development of software technology today, experts in the audiovisual industry can be such as Processing, TouchDesigner and other advanced programming class multimedia effects

software, to easily carry out audio-visual intertwining, interactive interactive control of art works, greatly enriching the expression of sound art.

Currently, the emergence of sound visualization works is undoubtedly an accurate grasp of the trend of the times and business needs, and its application scenarios are extremely broad, which predicts a huge potential for development. From electronic music art activities to concerts to public art, sound visualization is everywhere. In exhibition venues or multimedia art spaces, it is possible to create immersive sensations with strong visual and tactile impacts, bringing unique feelings to the viewer. With computer programming, sound effects can also be projected in buildings, reproducing the scene and producing amazing image effects. At the same time, using different timbres, amplitudes and beats, sound visualization can also control public art forms such as musical fountains, providing a diverse range of art appreciation. From the design concept, performance form to content, each has its own characteristics, which is rich in academic value and shows high commercial value.

Compared to traditional painting works, works with interactivity in the new media era are more experiential and more likely to cause sensory impact on the audience. Media dissemination also makes such works exposed and popular. New media art works cover a wide range of applicable groups, and there is also a certain gap in capital market demand in public spaces such as shopping malls, making them more favored by the media and investors. Traditional software companies continuously improve and update the functional modules of image processing and image processing, add interactive plugins and hardware access modules, and introduce protocol interfaces and documents for communication between different software and devices. At the same time, some companies are keenly aware of the promising development prospects in this field, have established dedicated research teams, and developed multimedia interactive development engines such as vvv and TouchDesigner. In addition, some game engine developers are also targeting this market, such as Unity and Unreal Engine, where modules and plugins for interaction design are gradually emerging in their stores or warehouses. The joining of game engine developers has made real-time rendering technology applications in new media works more widespread. For low-cost art teams

or individual creators, using a large broadcasting station system is not practical, and due to the originality of art works, most existing system modules need to be customized according to the creator's intentions. The innovation of computer image processing technology has laid the foundation for the development of new media art. From the perspective of process analysis, the commonly used software and hardware technologies in existing new media art works are analyzed, and common software and hardware modules are organized. Creating new media art works requires a complex module integration process, with materials flowing between various software and hardware, without forming a complete system; Communication between mainstream software requires manual operation or writing of module communication protocols; For exhibitions, there is a lack of platforms that can be used simultaneously on both PC and mobile clients; There are various types of hardware, each with prominent functional modules, but there is some overlap between each functional module, and a unified industry process standard has not yet been formed..

Regarding the application direction of new media art interactive exhibitions, on the one hand, new media art works continue to appear in the application scenarios of traditional works, whether it is billboards, product display windows, or installations in art museums and public art areas. Interactive exhibition works attract the attention of audiences through the innovation of form and content. On the other hand, as new media art gradually enters the public eye, emerging industries such as exhibitions and audio-visual performances have emerged, mainly focused on generative and immersive art. To meet market demand, new media artists are also constantly exploring new exhibition solutions in interactive design engines. The application of new media interactive exhibition works can be roughly divided into two categories: one is to choose an interactive technology application in the mature art exhibition field to produce new interactive exhibition works. For example, Pan Changxue proposed the concept of integrating shadow puppetry art into interactive media design, installing sensors at finger joints or human joints to collect data on the main joints and transmit it to the shadow puppetry on the computer screen. The motion data of each joint corresponds to the motion data of multiple independent parts of the shadow puppetry,

controlling the new way of performing shadow puppetry. This not only preserves the cultural essence of folk shadow puppetry, but also combines new technologies to enhance the performance effect, promoting the inheritance and development of shadow puppetry; Wang Jianwei's work "Welcome to the Real Desert" designs theaters in the form of interactive media, providing new ideas for the development of contemporary drama, dance, and musicals. Another type of application approach is to start from a certain technological means and build a new interaction solution through different software and hardware, in order to change people's certain living and learning habits. Xiao Xiao achieved the recording of music materials for a single user and remote performance collaboration between two users by constructing an interactive scene of piano performance and projection. This work uses a screen and projection to create a new piano, where the player can record key data while playing and display it on the projection screen in front of the piano, displaying the position and force of the keys through images; Reproduce the performance scene through the recorded button sequence and automatically perform when no one is playing. The piano is also designed with a two person remote use mode. When two people play this piano at the same time, the projection screen can display the other person's half body and hands, creating a four handed accompaniment illusion. For the convenience of family use, Xiao Xiao has developed an iPad version of the exhibition and performance platform mobile end. This new type of human piano interaction method based on new media technology also has artistic and aesthetic functions, which can be applied to daily life and education fields.[12]

2.2 Design concept

This design is inspired by the sense of time and space and color in the communication of music, through the establishment of a specific rule of the scientific method, converting different keys of piano music, using our auditory organs to feel the sound in the

We utilize our auditory organs to feel the rhythm and law of sound changes in time and space, and thus express them in visual form to present different visual feelings to the audience. In my personal habit, every time I concentrate on doing something, I like to put on the headphones first to let myself empty. This kind of being wrapped in sound makes me feel a small world that only belongs to myself. This small world is very comfortable and soft, let me feel very safe, it may be the sonic vine like wrapping me, but also like a bay of clear water with some duckweed, lying quietly inside I will take my own feelings and emotions as a starting point to fantasize about the range of sound that we can not hear the human ear will be like? Thus, I created a spatial expression combining image and modeling. Thus, this design utilizes modern technology to skillfully transform the auditory sensation into a visual feast, realizing the integration of audiovisual art and creating a novel musical work of art. During the design process, we selected six classic piano pieces with different styles, and combined them with Touche Designer software to transform the melody, timbre and emotional state of each piece into dynamic posters with rich colors, different sizes and rhythms.

With "music visualization" as the core concept, we firstly transformed the piano music into the form of particle water waves, giving the music a vivid visual form. On the basis of in-depth research on the topic of "music visualization", we carefully selected six classical pieces, including the passionate "Croatian Rhapsody" (classical style), the gentle and romantic "Dream Wedding" (romantic style), and "The Wedding in the Dream" (romantic style). We have carefully selected six classic songs, including the stirring and unrestrained "Croatian Rhapsody" (classical style), the gentle and romantic "Dream Wedding" (romantic style), the deep and introspective "That True That You Leave" (modern style), and the energetic "Hit The Road Jack" (jazz style), The deep ethnic culture of "Liang Zhu" (ethnic style) and the tender "This Is What Sadness Feels Like" (light music style). These tracks are used as the theme of the poster design, fully demonstrating the perfect combination of music and visual art.

TouchDesigner is a powerful visualization tool that allows users to implement complex interaction designs through elaborate "links" between component effects. In our sound visualization practice, we first deeply analyze the themes conveyed by sound,

and explore the possible paths of its transformation into visual content. Then, on TouchDesigner, a visual programming platform, we imported musical elements and extracted their unique musical characteristics. Based on these features, we generated dynamic visualizations on pre-constructed graphic elements, where the dynamic parts were designed to provide a rich sound interactive experience, while the static parts were truncated and combined with the layout to form the main visual elements of the static posters, as well as the basis for the derivative visual posters. Such a design process not only builds a more complete visual picture for the sound visualization design, but also enhances the emotional interactive experience, further enriches the creative expression of the static visual work, promotes the diversification of the communication process, and deepens the audience's point of memory of the sound.

Based on the inherent components of TouchDesigner node based programming software and the requirements analysis in the previous text, the specific content of the interactive exhibition platform should be refined. The exhibition platform should have three main functional modules: interactive hardware module, operation module, and display hardware module. The operation module is divided into PC client and mobile client, used to control audio and video, interaction parameters, and preview display area conditions; The interactive hardware module is used to read participant data and control some parameters on the operating end; Display the hardware module connection preview area, responsible for outputting the specified screen. PC and mobile terminals can communicate through the OSC transmission protocol, and can adjust the relevant parameters of preview area display screen, audio, and interaction control.In the functions required for performance, there are often repeated references to components, parameters, or paths, such as playing the audio analysis node of the master tape, creating style information for repeated use in GUI effects, and repeatedly reading file resource paths when obtaining images and audio lists. Duplicate data content can be organized using custom components in node programming. The Base component of TouchDesigner is the foundation for users to create custom components, and by referencing globally defined operators, node redundancy can be greatly reduced. In addition, for components in the interaction control module that are similar in form and

have repetitive functions, the appropriate number of subclasses can be generated using replicator COMP, dynamically inheriting all methods and content from the parent class.

Summary of the chapter II

1.Sound visualization works are a precise grasp of the trend of the times and commercial needs, and their application scenarios are extremely wide.

2.TouchDesigner is a powerful software that allows users to achieve complex interaction designs through carefully designed "links" between component effectors.

3.In today's trend of science and technology, the rapid development of digitalization and information technology has brought infinite vitality to the research of sound visualization and opened up a new path of auditory art. In the rapid development of software technology today, experts in the audiovisual industry can be such as Processing, TouchDesigner and other advanced programming class multimedia effects software, to easily carry out audio-visual intertwining, interactive interactive control of art works, greatly enriching the expression of sound art.

4.Sound visualization is a special mode of information dissemination on a large scale with sound as the medium, visual expression as the center, and new media dominating as the means of dissemination. In addition, sound visualization technology deepens the understanding and cognition of auditory content through visual elements such as images and pictures, and enhances the communication effect of hearing.

5.The exhibition platform should have three main functional modules: interactive hardware module, operation module, and display hardware module.

6.This design utilizes modern technology to skillfully transform the auditory sensation into a visual feast, realizing the integration of audiovisual art and creating a novel musical work of art. During the design process, we selected six classic piano pieces with different styles, and combined them with Touche Designer software to transform the melody, timbre and emotional state of each piece into dynamic posters with rich colors, different sizes and rhythms.

Chapter III
DESIGN PROCESS AND RESULTS

3.1 Dynamic Interactive Poster Design

3.1.1Overview of TouchDesigner

TouchDesigner is a visualization platform based on node programming. Its programming logic realizes user needs by connecting components with different functions, abandoning the traditional way of manually writing text codes. It provides an intuitive visual programming environment that eliminates the need for developers to rely on text editors to write code line by line. In this environment, users can build and customize programs using the six basic categories of COMP (Figure 3.1), TOP (Figure 3.2), CHO (Figure 3.3), SOP (Figure 3.4), DAT (Figure 3.5), and MAT (Figure 3.6), in combination with the many effects contained therein.

Each node or OP component performs a specific, independent and tiny task, and the support of the Python programming language provides the user with a high degree of flexibility and customizability.TouchDesigner's significant advantage over other similar visual programming software is its low learning curve and high degree of node component integration. This eliminates the need for users to start with basic programming knowledge and enables them to quickly realize the desired effect directly with pre-built modules.

For designers, TouchDesigner's flexibility and efficiency also make it easy to seamlessly integrate artist-created visual elements with backend programs. This has been recognized internationally, with many renowned new media art studios utilizing TouchDesigner to complete eye-catching projects and present stunning visual feasts. (Figure3.7)

The visual application of music visualization in dynamic communication is studied through dynamic interaction, mainly through machine learning, continuously adjusting

parameters and effects. The process is as follows: The first step is to start the application and scan the music. The user opens the application and enters the scan music interface; Machine learning in Touchdesigner is applied by scanning and analyzing selected music. The second step is music analysis and image generation. Apply machine learning algorithms to recognize the features and patterns of music. After analysis, the application maps these music features to an image generation algorithm to generate an image related to music features. Step three, display the generated image. The generated image will be displayed to users in the application, and users can view this image. This image is related to the characteristics of the scanned music, and users mainly receive and use dynamic interaction through user scanning, image recognition, and finally music feedback. There are two types of interaction methods, and the specific paths are as follows:

1. Interaction Method 1

The first step is for the user to scan the image. The user aims the camera at the generated image, activates the scanning function, and the application captures the image through the phone camera, then performs image recognition. The second step is to recognize the image and restore the music. The application recognizes the features in the image and restores the relevant music. Music can be played through the built-in player of the application or provided to users in other suitable ways. In the process of interaction mode one, the key is to establish a reliable machine learning model that can map music features to images and restore corresponding music through image recognition when users scan images. At the same time, user experience is also important to ensure a user-friendly application interface and easy operation.

2. Interaction Method 2

Users draw patterns on the drawing board that they believe are relevant to the original image based on their own expression of music or emotional expression; After the user completes the painting, confirm and submit their work; The completed artwork will be compared to the original characteristics of music images and combined with TouchDesigner's point sensing and image recognition to ultimately restore the relevant music features. The restored music will be played or used in other ways

Provide the formula to users. In the process of interaction mode two, the audience attempts to express their understanding of music through painting, while The TouchDesigner application assists users in creating through machine learning technology and ultimately restores the drawing results to music. This interactive approach allows the audience to participate in the process of music generation.

TouchDesigner has many functional advantages, such as multi platform interoperability. TouchDesigner can customize according to different software and hardware settingsIntegrate TouchDesigner into any environment with backup, Hypertext Transfer Protocol, and global wide area network system matching operation options. For example: The professional sequencer Ableton Live released in 2013; MaxMSP, a visual programming language used for designing complex interactive programs; Visual programming software VVVV for prototype design and development; And over 95% of AAA game projects currently under development use 3D texture making software such as Substance Designer. Designers can use TouchDesigner to customize operators for different visual effects, presenting dynamic visual transformations such as shape conversion, jogging, depth of field, rough edges, noise, spiral paths, dynamic blur, flares, scattering, chaotic displacement, particle effects, and fixed layer rotation. TouchDesigner communicates with web servers through Transmission Control Protocol (TCP) and User Datagram Protocol (UDP) Web applications Interacting with social application programming interfaces such as Twitter and Instagram. In the creation of new media art, TouchDesigner can be seen as a platform for integrating and unifying media files in different formats, helping designers utilize the functionality of different software and hardware to create works of art that are closer to perfection. Whether it's graphic design tools like Photoshop or video editing tools like AE 3D rendering plugins such as C4D can be quickly integrated into TouchDesigner for secondary creation. Through TouchDesigner, designers can track C4D models through location and achieve real-time interactive effects such as audio control and time control. For media art creators and designers, it is relatively easy to learn and use TouchDesigner, while for programmers, TouchDsigner uses data flow methods and visual node structures to help them be more efficient in prototype design

and development. It can also easily help them integrate the visual part created by artists with the running part of the backend program, avoiding errors caused by the use of different software in different fields. At the same time, it facilitates communication, cooperation, and secondary debugging and modification between personnel from both sides, thus efficiently completing the landing of art projects and the precise deployment of design projects.[17]

Another advantage of it is real-time 3D rendering and high-resolution synthesis. In addition to basic 2D texture arrays and multi-layer textures, TouchDesigner combines real-time 3D rendering with high-resolution synthesis, providing designers with different types of material in a local material library. The online community also has official and personal sharing of available material textures, ambient lighting, and other file materials. In addition, TouchDesigner provides a variety of advanced video decoders to ensure video playback quality and maximize the potential of hardware devices. The hybrid encoding framework represented by HEVC (H.265), the HAP codec for Adobe CC applications, and the Gopro Cineform transcoder suitable for high-definition editing all provide more solutions for the input and output of high-performance HD and 4K videos in design projects. In the custom configuration of TouchDesigner, designers can output works of any combination to different displays simultaneously, achieving mixing and mutual triggering of multiple audio and video sources. They can also use synchronization operators and hardware frameworks to create a large multi machine networking infrastructure for art works.

3.1.2 Specific Applications of TouchDesigner

In the field of dynamic communication, the visual application of sound visualization is explored through strategic forms of dynamic interaction, and its core technology lies in machine learning, which achieves the best effect through continuous adjustment and optimization of parameters. The specific process is elaborated as follows:

The first step is to launch the application and scan the music files. After the user opens the application, it will enter the music scanning interface, at this time, Touchdesigner's built-in machine learning module will carry out detailed scanning and in-depth analysis of the music selected by the user.

The second step is to enter the music analysis and image generation phase. The application will apply advanced machine learning algorithms to accurately recognize key features and unique patterns in the music. These musical features are then accurately mapped to an image generation algorithm, which generates a visual image that is closely related to the musical characteristics.

In the third step, the generated image is displayed. The application will display the generated image of the music that the user is enjoying directly on the screen, so that the user can intuitively enjoy the visual presentation that is closely related to the music. Users scan the real-time response of operation, image recognition, and music feedback during the use of the application, thus obtaining a richer and deeper experience.

The common composition methods for sound visualization are waveform composition and spectrum composition. Based on different audio types and user selected sound elements, 3 to 6 composition templates are provided to enable intelligent systems to optimize composition. Assuming that the user only selects a single sound element, the system intelligently matches the composition of other elements or a single element based on the composition template selected by the user. For multi-element composition, it is necessary to establish its layout relationship, specify the position and range of theme sound elements, specify the position of peripheral elements and the arrangement relationship with the main elements, and mark it in the database.

In visual production, colors, heights, or other visual elements can be used to represent the dynamic changes in amplitude, emphasizing the continuity between notes. In terms of emotional expression, visual elements such as color and shape are used to express the emotions of the song. If there are lyrics, it can be considered to add them in the form of text or dynamic graphics to the visualization to increase the overall expressive power of the song. For background images and graphic effects, suitable background images can be selected based on the atmosphere of the song, and combined

with graphic effects to enhance the visual presentation of the song. The technical operation process of interactive mode utilizes deep learning to explore the composition rules of sound visualization in the machine learning process. The operating system adopts different composition methods according to different audio types. For example, popular music may use dynamic waveform composition, while classical music may use gradient spectrum composition. The emotional content of audio is usually expressed through changes in amplitude and frequency spectrum, similar to painting on a canvas. The composition of audio can extract salient regions and construct ratings Function, scoring based on changes in sound features.

Regarding the application of TouchDesigner in new media art, it is currently the most popular multimedia art programming creation in the world

As one of the tools, TouchDesigner is increasingly being chosen by artist teams and design studios, covering a wide range of fields.

Firstly, it can serve as an interactive projection device. In recent years, TouchDesigner is frequently used in various interactive projection projects, including performance projection installations, such as the visual arts production studio V Squared Labs in Los Angeles creating an audio-visual feast for Brazilian musician Amon Tobin's song ISAM; Interactive lighting devices, such as the on-site lighting show designed by Digital FUN, a studio from Shanghai, for the Audi A8L launch event. Unlike traditional pre rendered interactive experiences, this launch event uses a CNC ball real-time interactive control system and a power ball visual effects system; Interactive screen devices, such as the interactive screen wall produced by the design team Volvo Lab from New York for Microsoft Art Gallery Cinema; Outdoor screen projection, such as the large-scale dynamic digital sculpture called "150 Media Stream" designed and produced by Leviathan, a creative company dedicated to designing digital media and interaction; Multi dimensional spatial projection, such as the large-scale sound and image device "Orients" produced by Cao Yuxi Studio; Ball screen projection, such as the immersive view provided by Omnispace, which focuses on immersive ball screen projection, for the Seattle International Film Festival; Architectural projection, such as the multimedia studio Moment Factory from Montreal, which uses sound and light

elements to unveil the mysterious and solemn veil of the local Notre Dame Cathedral, giving this ancient church a new experience and spiritual outlook; Interactive art installations, such as the interactive installation project designed by the Japan No Lab team, revolves around the synesthesia between color and sound. Experients activate the sound system of the device through handheld devices and generate unpredictable color combinations. The essence of handheld devices is to adjust color wheels, with the horizontal dimension representing saturation and the vertical dimension representing brightness. Therefore, handheld devices will directly affect the visual effect of the device as the experiencer moves. Experients interact by obtaining spatial location information to generate sound and images, which can stimulate their senses to understand and remember synesthesia phenomena. TouchDesigner can communicate with lighting equipment, audio systems, input and output devices, and can use performance control components in various types of live performances. TouchDesigner converts data between different types, making it easy to program and control lighting devices such as LEDs using images or animated textures, achieving visual operations and previewing beam effects.[13]

It can also be used as a virtual reality experience. The various functions of TouchDesigner can be seamlessly integrated with VR tools and devices. With TouchDesigner and virtual reality, users can create and play panoramic surround movies. The Future of Music is an immersive surreal music space created by film director Greg Barth and Phenomena Labs studio. In this project, the design team used pre visualization functionality to analyze the internal three-dimensional space. They placed virtual cameras and virtual NPC characters inside the space to clarify the size of the space, the position of lights, and the size of props. The team will combine live captured videos with pre recorded videos in real-time, and the designer will use TouchDesigner to view the images captured by the panoramic camera in real time and make post production adjustments to create a comprehensive panoramic environment within the VR device. Meanwhile, this project showcases the disruptive changes and impacts of using VR as a creative medium on traditional art space forms.

TouchDesigner can also be used to create visual performances for many music venues and world-class music stages, VJ (Visual Jockey) provides real-time editing of visual elements such as images and animations, and adds effects to create an immersive real-time experience environment that combines music and visuals, bringing both visual and auditory enjoyment to the audience. In March 2019, musician Deadau5 completed a new stage upgrade in Miami - Cube V3. The team utilizes 3D printing technology to construct a stage model, with a hydraulic power system installed at the bottom of the stage. The tilt of the cubic stage is controlled through a built-in program. Deadmau5 builds a visual data system in Touch Designers and establishes connections with touch components inside the stage. The lighting effects, visual presentation, rotation angle, and other aspects of the stage can be achieved through this touch device.

3.1.3 Introduction to《 Sea Rhythm 》Works

Sea Rhythm" (Figure 3.8) is an interactive electronic music work combined with visual images, which is inspired by the image that came to my mind when I played the famous violin piece "Sea Rhythm" by chance. The waves of the sea are gently undulating under the breeze, and the violin plays undulating and reverberating, full of deep feelings. In this piece of music, along with the slightly undulating waves, the violin plays softly with a gentle melody, just like a song, and it seems to be whispered and sung, pouring out the heart. It profoundly expresses people's broad-mindedness and bold ideals, which are as boundless and open as the sea. Listening to this song, as if in the sea and sky, the vast and boundless seaside, feel from the depths of the "sea" emotion, let a person's heart surging. At the same time, the music is like the rising sea of the red sun, giving people unlimited confidence in the face of tomorrow and hope, inspiring people to go forward. In the whole piece, the author insists on a unique artistic concept, that is, committed to elevate daily life to the artistic level, so that the boundaries between life and art become blurred, and the two are closely connected and interpenetrate, together constituting a new form of artistic expression. This concept not

only deepens the artistic connotation of the works, but also gives more artistic meaning to life.

3.1.4 Form of expression of 《 Sea Rhythm 》works

In the interactive electronic music work "Sea Rhythm", the author used TouchDesigner software as the visual interaction software. In the processing of the music part, the author samples the real sound of waves, takes the sound of waves as the sound prototype, and uses various effects to refine the musical attributes in the noise language of the waves, giving it the function of instrumental performance, enriching the ability of the sound sample of waves to express and change in the music. In terms of visual control interaction, the author uses TouchDesigner software to create dynamic images of simulated ocean waves, by connecting the camera to read people's dynamic information, and adding various components in the software to process the acquired dynamic information, which is finally converted into image data, so that the dynamic images presented change according to people's actions and behavior, thus achieving the effect of interactivity and showing more innovative materials, and enriching the ability of expression and change of the sound sample of ocean waves in music. Innovative material, improve the audience's visual perception, increase the audience's sense of participation, thus prompting the work can produce a stronger psychological resonance with the audience. Interaction and sampling technology, TouchDesigner, as a programmable multimedia effects software, can be well connected with audio, midi controller and video content to achieve the final effect of sound visualization and visual interaction.

The entire electronic music work of Sea Rhythm consists of four paragraphs, using an alternating music structure of loose and fast boards. The visual structure is also interconnected with the music, which makes the entire work relaxed and moderate. The first part is the scattered board section, where the main sound material is untreated water droplet sound, and the visual part corresponds to the music part. The author uses a midi controller to connect the pusher of the midi controller with parameters in TOP type

components such as Noise and Level, transforming the work from a color screen at the beginning to a black and white screen as music progresses. In addition, the "Sphere SOP" was used to model the shape of water droplets, and sound spectrum analysis techniques were used, that is, the "Audio Spectrum" in the CHOP component was used to analyze the music spectrum, so that raindrops can be associated with the sound of water droplets in the audio, emphasizing the effect of sound visual interaction.

The second part is the fast board, where the music and visual imagery are compared and echoed with the first part, not only achieving the simultaneous development of visual and audio, but also,It also adds dynamic contrast, converting black and white images back into color images. The working principle of this section is to use the MIDI controller to reintroduce the previous background while adding "Noise TOP". Noise TOP is a data noise element that can generate irregular or random waveform data. It can also select different waveforms or adjust their parameters such as period, amplitude, and harmonics. The author adjusted its parameters and added time data to its variation parameters, so that it can continuously change with the flow of music.

In the third part, the author used the previously formed images as the basis for development, not only adding "Noise TOP" to make the visual effect more complex, but also using "Feedback TOP" and "Display TOP". These two effectors are a combination of changing graphic effects. One can repeatedly process the generated image and then stack the effects layer by layer; Another option is to distort or move the generated image. On this basis, the author connected more knobs on the midi controller to the parameters in the "Display TOP" to achieve real-time control of visual images. In this section, the video is still connected to the audio, and the visual flow is linked to the phase changes in the audio, achieving interactive control of the performer over the video.

The visual effect of the fourth part is still set against the background of the third part, with a more impactful sound and visual interaction added. The principle still utilizes sound spectrum analysis and processing, combining striking sound and droplet shapes, but based on this, a "Circle SOP" effector is used, changing the shape of the first part of the droplet and adding a new effector - the "Phong Mat" effector. This is an

effector that can create modeling materials, which means it can add different effects such as textures, reflections, and bumps on top of the model. The author used "Phong Mat" to change the material of the newly modeled water droplets, making the overall visual effect look more rich and full.

3.2 Sound Poster Design

3.2.1 Poster Design

Sound visualization is a subjective interpretation and judgment of sound expression, aimed at understanding, analyzing, and comparing the expressive power and internal structure of sound A presentation technique provided. Sound visualization is essentially a branch of data visualization, where data comes from the sound itself. It is an intuitive visual presentation technology that can be implemented in many ways. It can translate sound information into visual language through flat language, or use new media technology to present sound information in the form of images.

By combining relevant sound materials and artistic associations of classic scenes, analyzing the motion patterns of objects in sound materials, extracting and determining visual elements, and finally abstracting them to form new visual images. By using code to generate abstract and processed new visual images, combined with computer language and object motion characteristics, further clarify the trajectory of various sounds and the details of the orientation and size of different elements. Color selection should be in line with the actual theme selection, while focusing on the designer's creative inspiration and sensory experience. Different elements of color should be selected and exchanged to achieve a harmonious and creative overall visual effect.

Poster design is a combination of six different styles of classic piano music and touche designer software, according to the low, medium and high piano tunes and musical moods to present different colors, different sizes and rhythms of the dynamic posters. The poster design is based on the theme of "sound visualization", combining the piano music into a dynamic poster design in the form of particles of water waves,

through the research on the subject of "sound visualization", the "classical" was selected. Piano: Croatian Rhapsody", "Romantic Piano: Dream Wedding", "Modern Piano: that true that you leave", "Jazz", "Piano: hit the road jack", "Piano: the road", "Piano: the road", "Piano: the road", "Piano: the road". Piano: hit the road jack", "Ethnic Piano: Liang Zhu", "Light Music Piano: this is what sadness feels like" are the six classic piano pieces, as the theme of the poster. Piano music, as the theme of the poster design.[19]

3.2.2 Design Conceptualization

Firstly, we analyze the theme conveyed by the sound and explore the construction of its transformation into visual content; secondly, we import the music elements and extract their musical characteristics in TouchDesigner software, and generate a dynamic visualization effect on the constructed basic graphic elements, with the dynamic part as the sound interactive experience, and the static part processed by frame-cutting and combined with the layout as the main visual of the static posters as well as the visual of the derivative posters to be interpreted. The static part is interpreted as the main visual of the static poster and the derivative visual poster after frame-cutting and layout processing, which constitutes a more complete visual picture and emotional interactive experience in the sound visualization design, and enriches the creative expression of the static visual work, the diversity of the communication process, and the sound memory points.

3.2.3 Finalized Design

(1)The first "sound visualization" poster design is based on a classical piano piece: "Croatian Rhapsody", whose melody is unique and charming, full of excitement and deep emotion. Its opening part, in the form of a solo piano performance, has a concise but tense melody, just like the smoke of war filling the air, foreshadowing the story that is about to unfold. As the music advances, the melody gradually becomes complex and rich, as if the Croatian people in the war through the trials and hardships. Between the

notes jumps the unyielding fighting spirit and firm belief, as if they saw their firm figure in the ruins above the rebuilding of their homes. In the climax of the piano piece, the melody reaches its peak, and the impassioned notes burst out like an explosion, full of power and passion. This is not only a depiction of the war, but also a tribute to the indomitable and courageous spirit of the Croatian people. And at the end of the piece, the melody returns to calm and deep. The piano solo resounds again, as if telling of the silence and reflection after the war. The desire for peace and the longing for the future flow between the notes, making people feel a deep shock and resonance in deep thought. The melody of Croatian Rhapsody is full of power and emotion, which is not only a fond remembrance of the history of Croatia, but also a tribute to the resilience and courage of mankind. With its unique musical charm, this track has deeply touched the hearts of countless people.

Thus, in the poster design of "Sound Visualization", the theme is "Croatian Rhapsody", and the charm of music is vividly presented through abstract art form. The poster presents a modern and futuristic abstract art image, reflecting the perfect combination of sound and vision. The poster uses blue and purple as the main colors, which gives the image a deep and mysterious sense of future technology. The image uses various geometric shapes and symbols to express the emotion and rhythm of the music, aiming to simulate the mountains and rivers in the battlefield. Sharp triangles, rounded circles and irregular polygons are intertwined, and hidden among the many shapes are musical symbols such as musical notes and pentatonic scores, which are interspersed between the geometric shapes like musical notes jumping and flying in the air, demonstrating the rhythm and rhyme of the music as well as adding a sense of dynamism and vigor to the image. These notes and geometric shapes echo each other, together forming a marvelous world full of music and art. These elements are skillfully integrated into the overall picture, reminding people of the melody and harmony of music, and feeling the flow and change of music. The whole poster shows the musical charm of "Croatian Rhapsody" through abstract art form, which makes people feel as if they can hear the stirring melody and deep notes. This poster is a perfect fusion of

music and visual art, bringing people a unique aesthetic experience and spiritual feelings. (Figure 9)

(2)The second "sound visualization" poster design is based on a romantic piano piece: "Dream Wedding". The piano piece "Dream Wedding" has a rich and deep melody, just like the sweetness and bitterness of love intertwined together. In the climax of the piano piece, the melody is stirring and surging, as if a grand and romantic wedding is taking place. The notes blossom like ceremonial flowers in all their splendor, transmitting happiness and joy to every listener. At this moment, people seem to be able to feel the shyness and happiness of the bride, the firmness and persistence of the groom, as well as the blessings and laughter of friends and relatives. After the climax of the melody, it gradually returns to calm. As after the wedding, the newlyweds step into the marriage hall hand in hand and start their new life. Although the melody is soft, it is full of power and hope, as if telling people that although love is full of unknowns and challenges, as long as there is love in our hearts, we can walk through every difficulty together. The melody of the whole song is full of emotion and power, and it brings people into a romantic and dreamy world. Whether it is joy, sadness, happiness or hope, they are all perfectly interpreted in the melody. This is not only a piano song, but also a story about love and dream.

This poster with the theme of "Dream Wedding" is a perfect blend of music and visual art, showing the unique charm of sound visualization. The huge circular stage in the center of the image seems to be a time-traveling wedding scene, both ancient and futuristic. The arch structure on the stage is like a door to the dream world, leading people into the world of "Dream Wedding". The purple background symbolizes mystery and romance, complementing the theme of the wedding. The geometric shapes and lines scattered on the background not only add a sense of dynamism to the picture, but also seem to be musical notes jumping and intertwining in the space, visualizing the melody and rhythm of the music. The changes of these shapes and lines are just like the ebb and flow of the music, giving people a sense of the deep emotion and tenderness conveyed by "Dream Wedding". (Figure 3.10)

(3)The third "sound visualization" poster design is based on a modern piano piece: "that true that you leave", which can feel the protagonist's deep attachment and reluctance to the person who left. It expresses his hope and expectation for the future. The melody of the whole song is very moving, so people can't help but be immersed in it and feel the pain and helplessness of parting.

In the poster, various music symbols such as notes, rests and decorative patterns are intertwined to form a unique visual composition. These symbols are presented in the form of smooth lines, and the line colors include black and orange, which contrast with the colors of the background and accentuate the sound visualization even more. (Figure 3.11)

(4)The fourth "sound visualization" poster design is based on the jazz piano song "hit the road jack", which describes a battle of words between a husband and wife, with a rhythmic melody and emotional depth. In the piano version, the song may have been given a more elegant and lyrical expression. The melody may still retain its original vigor and dynamism, but through the piano interpretation, a more delicate and deeper emotion may be presented. The tone of the piano is able to better interpret the emotional changes in the song, from excitement to calmness, from conflict to reconciliation, all of which can be fully demonstrated through the piano performance. At the same time, the piano version may pay more attention to the smoothness and harmony of the melody, making the whole song sound more pleasant. In terms of playing techniques, various piano techniques such as chords and arpeggios may be utilized to enrich the expression of the song.

In the poster, multiple music symbols can be seen, such as notes and pentatonic. These music symbols are distributed on the image in different sizes and directions, and they echo with the abstract patterns in the background to form a harmonious visual effect. The smooth and dynamic lines of the background contrast with the static beauty of the music symbols, and this contrast enhances the visual effect of the poster. With its unique artistic style and visual effect, the whole poster combines music with abstract art, reflecting the effect of sound visualization. (Figure 3.12)

(5)The fifth "Sound Visualization" poster design is based on the theme of the

national piano piece: "Liang Zhu", which combines many musical elements with Chinese characteristics. Melodically, it adopts many traditional Chinese scales and tones, such as Guqin scales and Bayu tones, making the piece full of unique oriental flavor. In addition, the piece also quotes some solo techniques of traditional Chinese instruments, such as the vibrato of the erhu and the glissando of the pipa, etc. Together, these elements form the unique flavor of the piece. The piano piece consists of several movements, each of which depicts the bumpy experiences of Liang Shanbo and Zhu Yingtai on the road to love. The first movement depicts their joy and infatuation when they first meet, the second movement presents their separation and enduring the pain of longing, the third movement depicts their reunion, recognition, and deep love for each other, while the fourth movement shows their eventual separation and eternal farewell. This chapter structure not only reflects the ups and downs of the story, but also makes the whole piece more layered.

The colors of the entire poster are bright and contrasting, with the main colors of purple and blue creating a romantic and mysterious atmosphere that complements the love story of "Liang Zhu". The figures of the birds in the picture are like musical notes jumping and flying in the air, visualizing the melody and rhythm of the music, making it seem as if one can hear the beautiful melody echoing in the air. (Figure 3.13)

(6)The sixth poster, "Sound Visualization", is based on the theme of a light piano piece, "this is what sadness feels like", and shows the sadness in the music through the form of visual art, with all kinds of shapes and lines scattered in the picture, which are like melodies and rhythms in the music, intertwining together to form a dynamic and dynamic image. The shapes and lines scattered in the picture are intertwined like the melody and rhythm of the music, forming a dynamic and rhythmic visual effect. The variety and change of these shapes and lines reflect the complexity and richness of the music and symbolize the sadness.

In the center of the poster, a thin black line runs through the whole picture, which is like the melodic line of the music, guiding the viewer's eyes and allowing people to feel the emotional fluctuations in the music more deeply. In addition, there are some smaller round objects distributed in different positions in the poster, their colors vary

from dark blue to light purple, these round objects are like notes in the music, dotted in the picture, increasing the sense of hierarchy in the picture and enriching the expression of emotions. The jumps and changes of these notes are like the rhythm and melody in music, which make people's emotions rise and fall and change. Through the form of abstract art, the poster shows the sad emotion in the piano song "This Is What Sadness Feels Like", so that people can also feel the charm of music and the power of emotion visually. (Figure 3.14)

3.3 Graphic Element Design

Graphics are a visual symbol that has certain characteristics and shapes. Many graphic designers use graphic elements in their designs, and some even only use graphics to add joy to the entire design. In addition, graphics have another meaning, that is, graphics are a carrier of various concepts, such as time, space, information, etc., can be transmitted through graphics. The visual communication characteristics of graphics are vivid, accurate, and intuitive, making them the most spiritual and visually infectious way of information transmission in mass media. Compared to text, the biggest and most obvious advantage of graphics is that it can replace a lengthy paragraph with a simple identifier, and its dissemination effect is better than that of text. Therefore, graphics have been widely used in various fields. Graphics are an important component of design, and their form in graphic design is not singular. They can exist in a single form or be combined with multiple elements. The roles played by graphics vary when they appear in different forms, such as in the graphic design of advertisements, books, outdoor billboards, and greeting cards.

By combining different abstract geometric shapes, we visualize the "sound" in a different way. The graphic design is mainly in blue and purple, echoing the elements in the poster, symbolizing the freedom of music and creativity. (Figures 3.15、3.16、3.17、3.18)

Summary of the chapter III

1. TouchDesigner is a visualization platform based on node programming. Its programming logic realizes user needs by connecting components with different functions, abandoning the traditional way of manually writing text codes. It provides an intuitive visual programming environment that eliminates the need for developers to rely on text editors to write code line by line.

2. Sound visualization is a subjective interpretation and judgment of sound expression, aimed at understanding, analyzing, and comparing the expressive power and internal structure of sound A presentation technique provided. Sound visualization is essentially a branch of data visualization, where data comes from the sound itself. It is an intuitive visual presentation technology that can be implemented in many ways. It can translate sound information into visual language through flat language, or use new media technology to present sound information in the form of images.

3. Many graphic designers use graphic elements in their designs, and some even only use graphics to add joy to the entire design. In addition, graphics have another meaning, that is, graphics are a carrier of various concepts, such as time, space, information, etc., can be transmitted through graphics. The visual communication characteristics of graphics are vivid, accurate, and intuitive, making them the most spiritual and visually infectious way of information transmission in mass media. Compared to text, the biggest and most obvious advantage of graphics is that it can replace a lengthy paragraph with a simple identifier, and its dissemination effect is better than that of text.

CONCLUSIONS

This graduation design focuses on the theme of sound visualization, and discusses its significance, current situation, application areas and other contents in depth. Through theoretical analysis and case studies, we have been able to understand more comprehensively the intrinsic value of "sound visualization" as a digital art design and its impact on modern society. Through the study of sound visualization design, it is found that human's visual ability is much stronger than the ability to process auditory information. Adding some sound effects to ordinary screen design can inspire creators' ideas and provide more innovative and unique ways of expression.

In addition, the study of sound visualization can promote scientific research, through the conversion of certain sound data or experimental results into a visual form, and compared with other data factors for analysis, which helps people better understand the relationship between the data and the indicators.

Sound visualization not only can quickly get the feeling of visual effect, but also provides a rich source of inspiration for creators, provides a graphical operation platform for art creators, and will also promote the process of massification of new media art.

The software features of TouchDesigner not only provide a quick way to obtain visual effects, but also provide creators with rich sources of inspiration. On this basis, the author attempted various connection methods and parameter changes of the effector to achieve visual richness, interactivity, and the creation of the entire work, such as changing the parameters of "Noise TOP" and adding time data code to meet the requirements of generating rich image effects; Add "Feedback TOP" and "Display TOP" between images to achieve visual image movement and stacking; Mapping MIDI promoters to the parameter values of various effectors enables the author to control visual image effects in real-time. In summary, TouchDesigner provides a graphical operating platform for art creators and will also promote the popularization of new media art.Due to the domestic market situation, TouchDesigner has not yet been widely used in China. But with the upgrading of communication experience and the significant

improvement of the public's aesthetic level of media art in the future, creative tools like TouchDesigner will generate huge design and commercial value. Therefore, the author hopes that this article can attract the attention and importance of TouchDesigner among domestic design practitioners.

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ANNEX

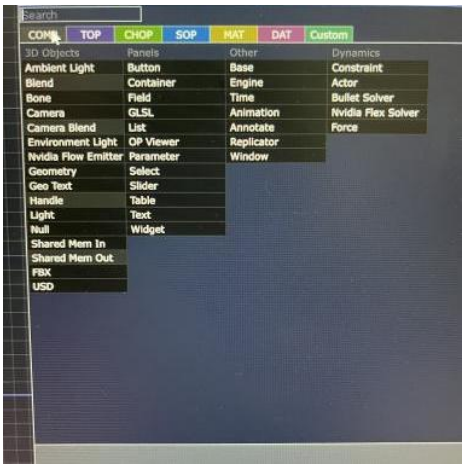


Fig. 3.1. COMP

Fig.3.2. TOP

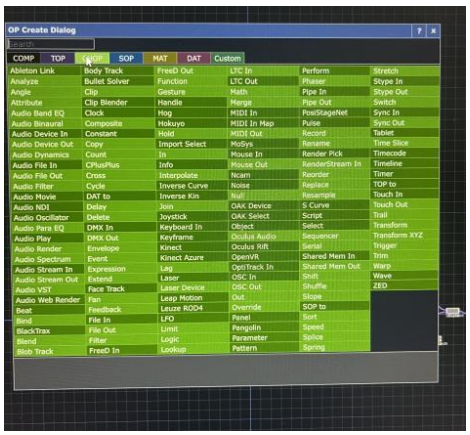


Fig. 3.3.CHO

Fig. 3.4.SOP

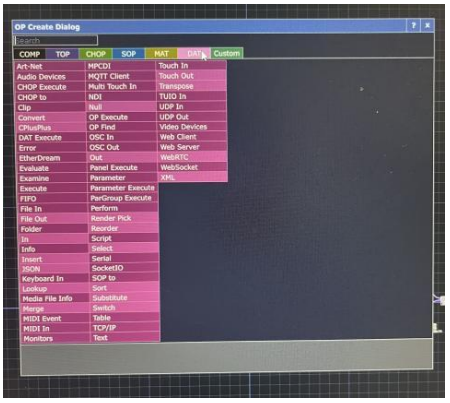


Fig. 3.5.DAT

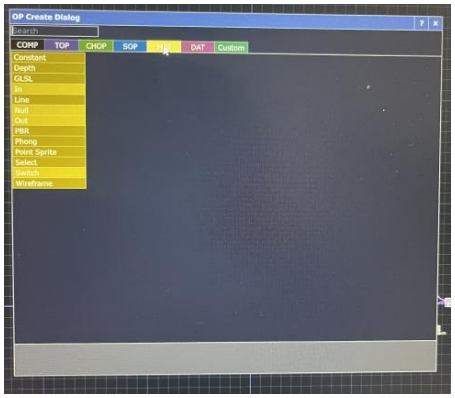


Fig. 3.6. MAT

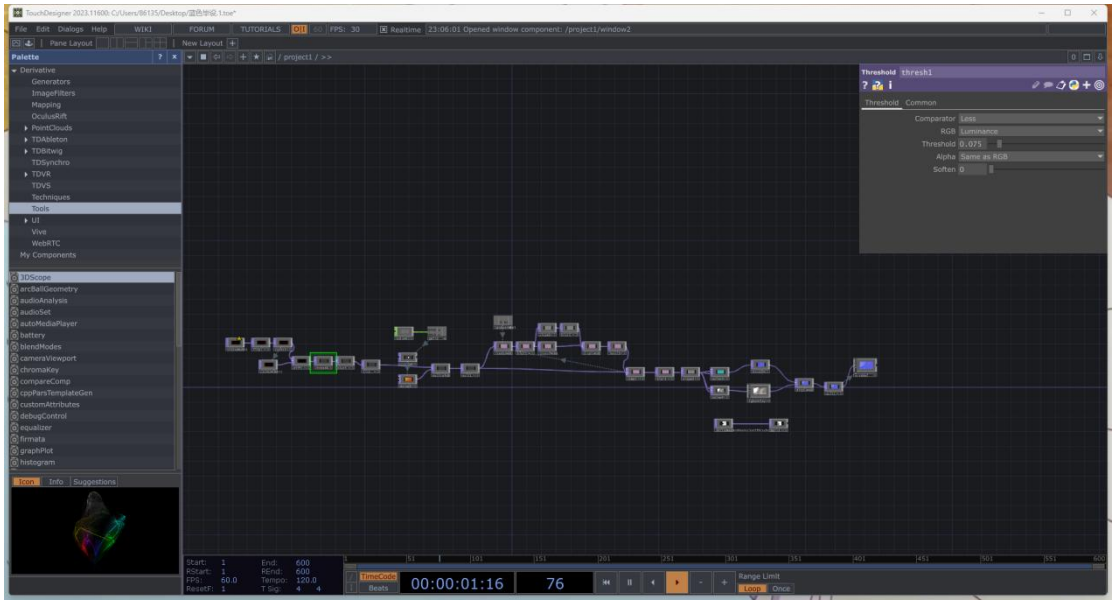


Fig.3. 7.Works created by TouchDesigner software

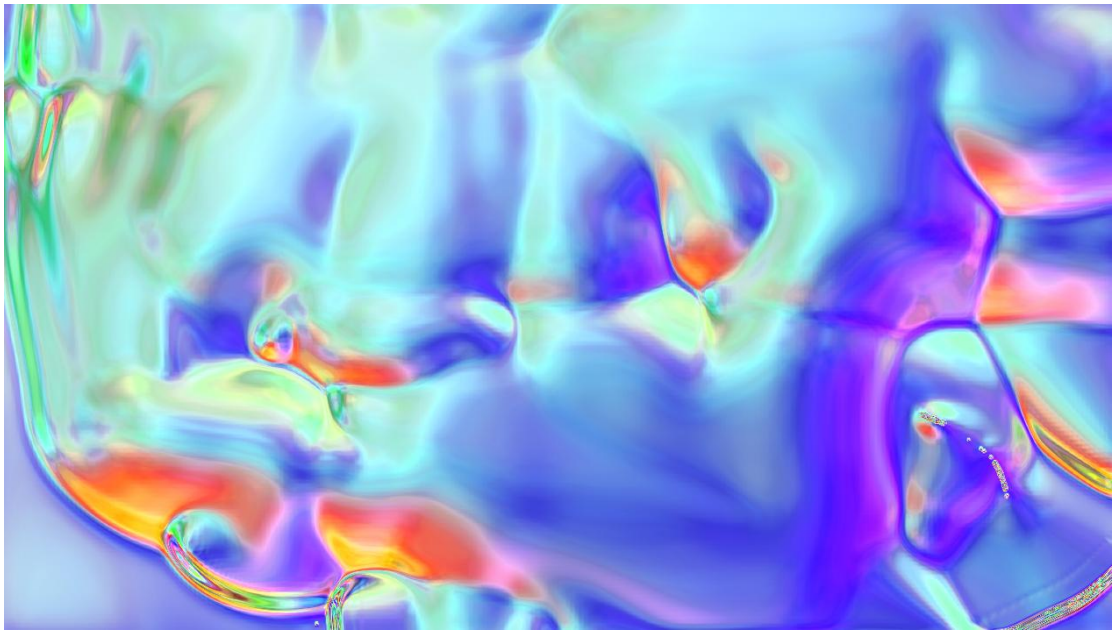


Fig. 3.8.《 Sea Rhythm 》work

Fig. 3.9.Croatian Rhapsody Poster

Fig. 3.10.Dream Wedding Poster

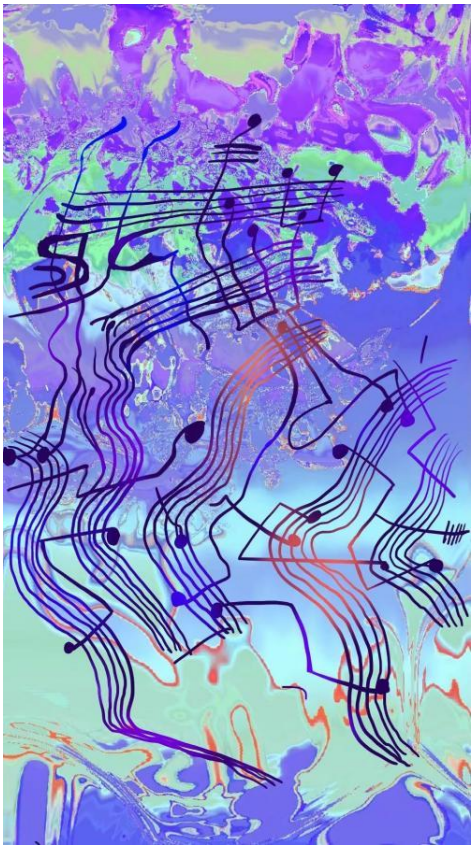


Fig. 3.11.That True That You Leave Poster

Fig. 3.12.Hit the Road Jack Poster

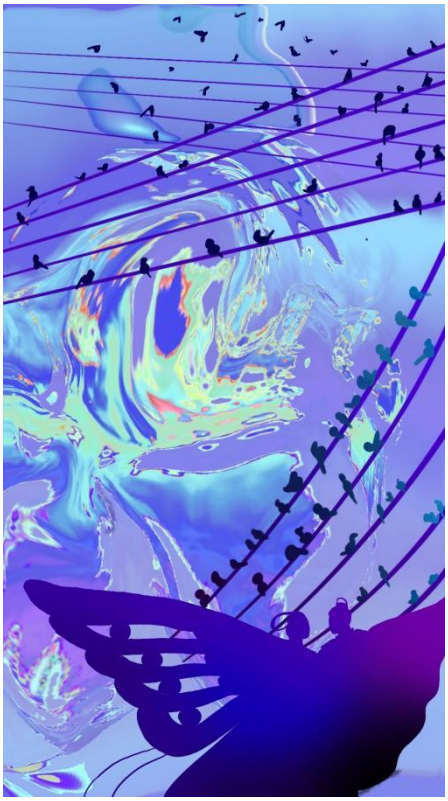


Fig.3. 13.Liang Zhu Poster

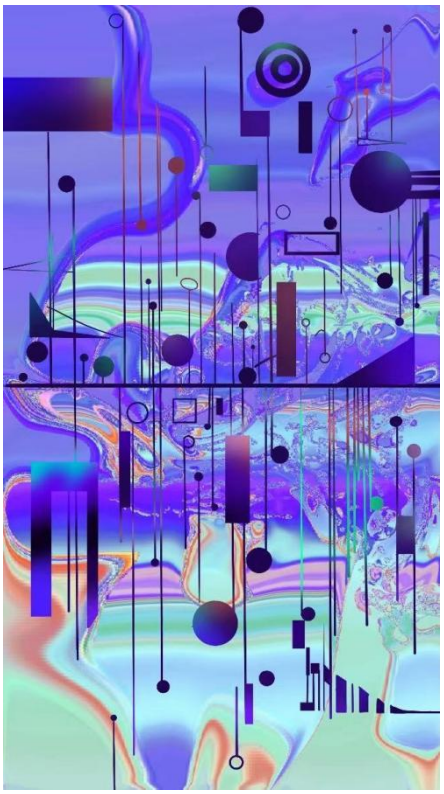


Fig.3. 14.This is What Sadness Feels Like Poster

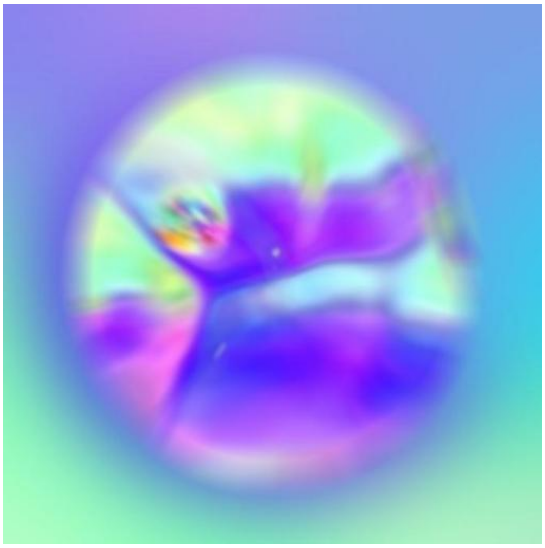


Fig.3. 15 graphic design

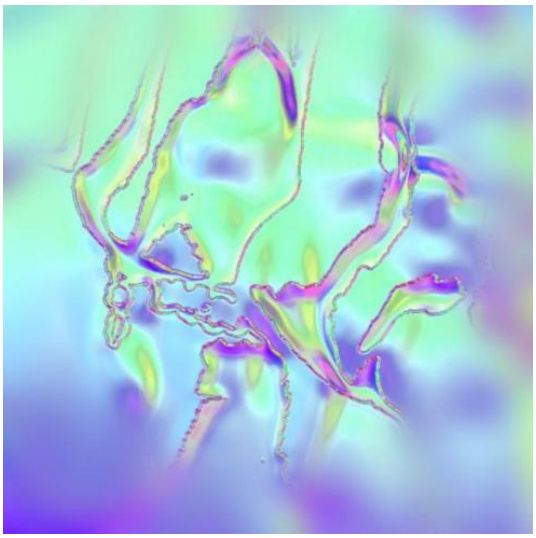
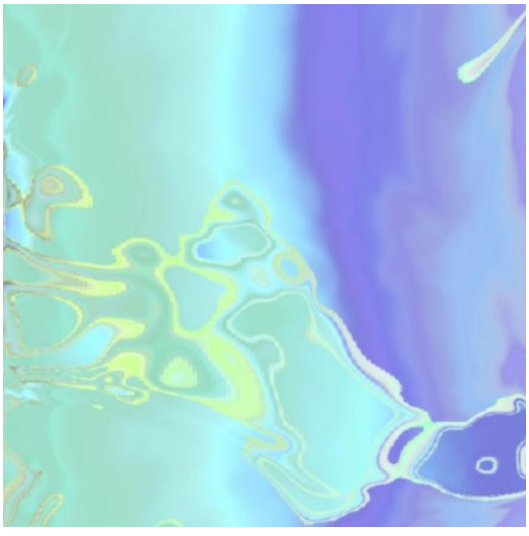


Fig. 3.16.graphic design



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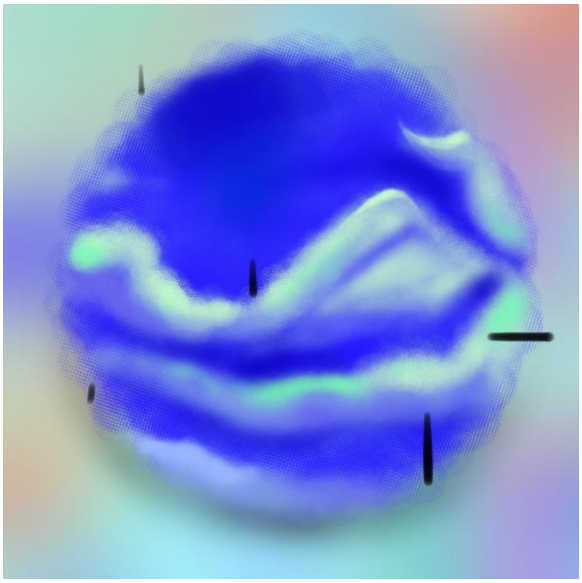

Fig. 3.18.graphic design