

FINAL PROJECT - REALTIME AUDIO AND VIDEO

# MULTIVERSE

A REALTIME AUDIO VISUAL GENERATIVE ART

CS6301 – REALTIME AUDIO AND VIDEO

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*“Without the aid of a computer, it would not be possible to materialize quite so faithfully an image that previously existed only in the artist's mind. This may sound paradoxical, but the machine, which is thought to be cold and inhuman, can help to realize what is most subjective, unattainable, and profound in a human being.” ~ Vera Molnár*

## **Abstract**

This project demonstrates the importance and application of real-time audio visual art to induce or enhance psychedelic effects. Multiverse is a real-time audio visual generative art, that produce psychedelic visuals by altering various frequency levels and other parameters of music. It elaborates the concept that audio-visual reactive art, generated real-time has more effect on human brain known to follow after the ingestion of psychedelic drugs. The piece does not emphasis more on the psychedelic effects nor promote the usage of drugs to induce psychedelic effects, rather opens up a vast topic that studies generative audio-visual art. The project Multiverse focuses more on providing a stand-alone desktop application that has an interactive user interface which allows the user to adjust the video effects in real-time and personalise the visuals based on the users preferences. The paper explores on building an intuitive interactive user interface based application/patch that could be used extensively to understand and relish the psychedelic effects based on personal preferences. In this project, I am focusing more on building a patch that has instinctive interface to twiddle around and explore the various effects of psychedelic art.

## **Introduction**

The Generative Art is categorized into an artform, where the artist creates a piece of art with the help of a specific process which can be either autonomous or real-time generated. In this project I concentrate more on the real-time generation of visual art. The project also focuses on the application of the generative art to understand more about the various frequencies of sound. In Multiverse the visuals are generated real-time on the basis of the various parameters of the music. Being an interactive student, I have understood the true potential of providing an intuitive user interface to the user. An interactive real time audio-visual generative art integrated interface delivered to the user induce more psychedelic effect than a usual psychedelic video being played on a screen.

Art doesn't have a specific definition or explanation. Human mind tends to perceive art in different ways, an artwork might not be exactly same for two humans. It might even be contradicting with each other's perception of the different stimuli they are presented with. Art definitely creates a notion for human minds. Generative art has taken up a huge leap in the 21<sup>st</sup> century, people began to get fascinated by the possibilities and potentials that generative art began to provoke. The true potential is yet to be discovered by many, the possibilities are boundless. Over time, the boundary enclosing the art is being stretched to include various new forms of art. The scope and definition of art has been broadened to accommodate more artforms in an informal way. Over period of time, it has become really difficult to distinguish between art and good art, since art cannot be measured or valued.

The generative art thus diminishes or blurs the boundaries of the artforms creating new dimensions in the field of art. The project Multiverse is based on the generative art techniques, that makes use of visuals generated real-time to instigate psychedelic effect. In this paper, more priority is given to the understanding of the impact and impression on user when they are bestowed with multiverse final patch.

## **Real-time Audio Video**

In a movie, both audio as well as video plays an integral part in recognising the quality of the movie and both have equal priority and importance. A real-time audio visual creates an interest in human minds as they have a different approach on human intellects. Real-time generated audio visual are superior than the recorded visuals as they change in real-time and are mostly unpredictable, this creates an attentiveness in human minds and keep them immersed further.

The multiverse project has real-time visuals generated from the webcam feed, which creates more interest to the user and there are jitter objects on top of the webcam feed which react to the audio being played. The goal here is to present the user with visuals that are more pleasing and fascinating. The system also makes use of the audio being played live as well as sound picked from the mic, the jitter objects react to the sound altering the objects size, shape, position and rotation.

## **Psychedelic Art**

"Psychedelic art" can be defined as artwork manifested in the context of the ingestion of LSD-type drugs and related substances. There is a long history of such work dating back to ancient times (picturing mushrooms and other plants with psychedelic effects) as well as more recent anecdotal first-person accounts and various collections of psychological data resulting from experiments and interviews. One such collection includes the studies by Krippner of over 200 artists, writers, and musicians who referred to their artistic productions as "psychedelic" because they had some connection with their occasional or frequent use of these substances.

Considering various researches and experiments it is evident that psychedelic generative audio-visuals are a great source to induce the effect of psychedelic drugs in human brain. Psychedelic art works have different effects on different individuals. The hallucination or effects caused on individuals vary based on what they are concentrating in the psychedelic visual, here in the multiverse project I am persuading user to venture through the patch and alter the various parameter on screen to explore the various kinds of psychedelic effects that one could achieve from the psychedelic art visuals being displayed on the screen.

## **Intuitive Interaction Interface**

An Intuitive Interactive User interface lets the user interact with the system instinctively, without the need for conscious reasoning. A good interface design welcomes the user to interact with the system and explore the system without needing to explain the functionality. Recent study shows that people interact more with the system when they are provided with Graphical User Interfaces rather than the traditional way of writing codes or commands and users gets more immersed when fiddling with interactive graphical interface. Thus, the cognitive approach on such interactive system induces more effects on the users brain.

The main idea for giving the interactive interface is to let the user explore the artwork by themselves, the artworks are generated real-time, so varying the parameters creates different patterns and visual effects on the video being generated. The standalone application when installed on the system will have various controllers such as buttons, sliders, dropdowns to interact with the system. The Multiverse interface is built in the presentation mode of max software, the interfaces has a floating window on top which displays the generative visuals and other interactive controllers on the screen to perform the chore on the audio-visuals being displayed on the screen.

## Generative Art

Generative art has its own medium to represent the world of art. Generative art draws inspiration from Modern art and pop art, mostly using orderly geometric patterns and incorporates autonomous or self-governed system with randomness. You are likely to obtain a different, completely unique piece of art each time you run your program or patch. As a generative artist you can blend the code and special functions and often with unpredictable force, completely produce unique renders unlike anything else that exists. The approach of generative technique for creating art opens up a huge possibility to rediscover unthinkable human creativity achievement by depending on the computer tools. **Philip Galanter**, a practitioner and teacher of generative art, has given the following widely-used definition (Galanter 2003):

*“Generative art refers to any art practice where the artist uses a system, such as a set of natural language rules, a computer program, a machine, or other procedural invention, which is then set into motion with some degree of autonomy contributing to or resulting in a completed work of art.” ~ Philip Galanter.*

Although some generative art uses randomness, it cannot be implied that it is unorganised. The art really stands out when you arrange them and render to obtain an organised visual from the system. Although generative arts are dominated by computers, Galanter was careful not to mention art made with computers to restrict the field of generative art. Traditional theories of the art however did not consider artworks that were created with the help of machines. The generative art can contain music, visual arts, texts and much more. In order to create the generative art, by contrast the rules must be constructive. The art must imply a specific process that leads to some desired set of outcomes. The artist must handover a significant element to the computer for the decision making, then only the art can be considered to be at the core of art-making.

Computer art is usually tacitly classed as digital art, which includes not only artworks generated by computers but also include the ones that are digitally manipulated but human produced. Practically, computer “aid” could be necessary for art-making. In some cases it is impossible to create certain effect with the human knowledge. For Instance, humans cannot create some art with the help of acrylic colours on canvas, but the same could be achieved using powerful software like photoshop. Also bringing into consideration, the case of synthesized music generated with the help of computers are much more interesting than the usual instrumental music. They exploits and produces sounds that are never heard before, if the synthesizers were never developed. Thus, the computer generated art has much more precision than the human made, but would definitely lack the humans purposely made dramatic errors to create an interest in the music.

## Methodology

Multitude of sources were used to research for the project including google scholars and research gate. The university library was also used to expand the journals. Initially I started understand the various features of Max 8 software, explored more functionalities with the help of tutorials provided along with the max package. Invested more time on watching various tutorials available on YouTube to explore the possibilities, **The Amazing Max Stuff** was one of the channel that motivated me to create the patch. Began building the patch during the midterm and got fascinated by the endless functionalities available to use inside max. The sulis content and lecture videos has helped me a lot in the initial stages for building the patch. Once I was done with the initial patch, began to explore more functionalities to making the patch more interactive in the presentation mode and also tried to rectify the issues that I was facing during the initial stage. Struggled a lot in combining two videos and to overlay them one over the other to obtain the final desired output. Once the basic integrated patch was ready, I tried to integrate more controls over the patch to alter the various parameters to provide distinctive effects for the visuals. Finally, after various research's and seeking's, I ended up making a standalone application that could be distributed among the user to learn and study the effects and interactions they performed with the system, to enhance or evoke psychedelic effects on them.

## **Project Implementation, Functioning and Explanation**

Multiverse comprises of two different layer of visuals, the underlying layer generates a reactive 3D mesh pattern from the webcam and reacts to the audio captured from the external mic attached to the system. The overlying layer is generated by manipulating the various frequencies bands from a piece of music being played. The various Frequency bands of the music are exploited to create various parameters for generating the overlying layer. The bass or low frequency is used to control the scaling of the generated objects, midrange covers the rotation of the object and the treble or high frequency to alter the shapes of the objects. Thus, achieving a unique visual altogether.

The visuals are generated in a specific pattern to keep the human mind engaged in finding the different effects of various frequencies and parameters of the music. A music file is fed into the system and it is converted and split into the various frequency band, separating them into low(bass), mid(midrange) and high(treble). These levels of frequencies are used as parameters to control the visual. The overlaying visual layers is designed in a way to react based on these levels of frequencies. Human hearing range varies roughly between 20Hz and all the way up to 20kHz. Though, for individuals the range may vary between these two extremes. In musical sense, we broadly categories them into base, midrange and treble sections. Roughly speaking, bass accounts for frequencies ranging between 20Hz and 300Hz, mid varies between 300Hz to 4kHz whereas trebles counts to as mostly anything above 4kHz.

At First, the low level frequencies or the bass in a track is mapped to the scaling of the objects in the visual, which means multiplying every linear dimension of the object with the same factor. Basically, scaling changes the size of the object and not its shape. A linear transformation of the object, that enlarges or shrinks the object by a specific scale factor. The separated bass from the track is the scaling factor for the multiverse project, which in turn scales the objects in max visuals. Then, the mid-level frequencies or the midranges of the track are plotted over the rotation of the objects. In the visual, the object is rotated over an angle and every point of the object is rotated by the same angle. The three dimensional rotation of object based on the rotational factor of frequency(midrange), and these 3D Jitter objects from the Max 8 are revamped to provide the ideal visual. Finally, high level frequencies or the treble from the track depicts the motion of the 3D jitter objects, the high-level frequencies are used to alter the movement of the objects. The project is setup in such a way that when a track or music is supplemented into the system, the system converts the frequencies in the track into bass, midrange and treble and these parameters are then used to alter the visual with the help of 3D jitter objects from max.

The underlying layer in the visual is created using the 3D Facetime (Webcam) Mesh from max and it fluctuates or varies based on the video from the webcam as well as the audio obtained through the microphone attached to the system, thus altering the visual with the help of real-time audio video entities fed into the system at any given point of time. The 3D mesh visual reacts to the sound and creates a unique visual pattern. The video from the webcam can be even plotted on the three dimensional plane, altering the plane over x, y and z axis, providing more randomness and uniqueness to the visual each time they are rendered inside the system. The underlying and the overlying layers when clubbed together to visualise a unique art it focuses on making a psychedelic effect on the human who are viewing the visual in real-time..

The generated artwork is also an example for the interaction, the user has to interact with the webcam and microphone connected to the system to obtain the overlying video presentation. The interaction alters the effect on the underlying 3D mesh video. The more intense the sound, input through the webcam the more saturated the colours of the mesh would be. Similarly, the soundtrack being played clearly distinguishes the various levels of frequencies and the jitter objects will more intuitive react to the audio chosen to play.

## Purpose for Multiverse Project

The term “Multiverse” is a conceptual science fiction, where it is believed that there is a hypothetical group of multiple universe. The literal meaning of universe is ‘all that exists’, the longer we have studied about universe, the larger the universe have become. The Multiverse concept explains that there could be other universes besides our own, where all the choices that you made in your life played out in surrogate realities. This concept in most commonly known as ‘Parallel Universe’, which is a facet of astronomical multiverse theory. The Multiverse theory has an inclination towards proving that there is multiple universes, exploring the undefined. Similarly, the multiverse audio visual project generates psychedelic visual based on multiple parameters that interplay with the each other to produce a unique visual which has multiple dimensions in it. The generated visuals are undefined and the visual varies each time you run the application. The main purpose of the project is to create a standalone application that acts as an audio visual medium to induce psychedelic effects on user, while they individually interacting with the application to take it up a notch.

## Motivation and Supporting Evidence for the project

The underlying principle behind creation of the multiverse project is the impact of generative art that bloomed really quick during the 21st century. The factor that drive me to create an interactive interface for visualising psychedelic art came from the artworks done by **Ernest Edmonds**, who is also a pioneer working in the field of Computer interactions and Computer generated artworks. Ernest's art was already computer based before 1970, and his future vision was to transform user participation with interactive and distributed works. From that time he began a quest to transform user interface design to an adaptive and iterative process and by 1973 he had made HCI at Leicester Polytechnic a priority research area.

**Federico Foderaro** is an audio-visual composer, teacher and designer for interactive multimedia installations. Graduated in Electroacoustic Musical Composition at the Licinio Refice Conservatory in Frosinone cum laude, he has lived and worked in Berlin since 2016. His main interest is the creation of audio-visual works and fragments, where the technical research is deeply linked with the artistic output. The main tool used in his production is the software Max/MSP from Cycling74, which allows for real-time programming and execution of both audio and video and represents a perfect mix between problem-solving and artistic expression. Beside his artistic work, Federico teaches the software Max/MSP, both online and in workshops in different venues. The creation of commercial audio-visual interactive installations is also a big part of his work life, having led in the years to satisfactory collaborations and professional achievements.

Most of Federico Foderaro works are visuals based on generative art projects such as **ALBA**, **BLAMM!**, **Anthropocene** where he makes use of Max patch to generate visuals when connected with Ableton Live during his live performances. These idea gave me proposals for creating a patch which can be used during live performance, and numerous possibilities of connecting this standalone application to midi controllers or Ableton Live to bring out psychedelic visuals on large screens. I aim to build my patch as a standalone application that can run on a big screen in museum or in parties where people can interact with the system and explore psychedelic visuals that are generated.



## Results Achieved from the Project

The result achieved from the Multiverse: Realtime audio visual generative art is quite interesting. The project not only creates an audio-visual generative art, rather it helps the user to induce and exploit psychedelic effects when they are exposed to the application. The project, Multiverse: Realtime audio visual generative art also helped me cover my area of research in the master's program for Interaction Design. The interactive graphical user interface system, can be considered as an application that helps the user to intuitively interact with the system and explore the various effects created in the psychedelic audio-visual. Since, we can specify rules and data to respond to the external stimuli, it can also be seen to put behaviours into effect by controlling output devices. The artwork clearly covers the interactive part of my research, by allowing the users to interact with the system to manipulate the visuals in different desired ways.

## Future Scope for Multiverse

To emphasize the further scope of the multiverse project, I would like to mention few idea that still needs to be explored further. The standalone application can be given more features to connect multiple midi and audio sources to make use of it during a live performance. The output can be displayed on multiple screens having webcams connected to them and provide an opportunity for users to change the different parameters on a physical device build with the help of Arduino and other electronic components.

The project can also be extended in current situation where social distancing is practiced strictly, user can just install the application on any machine and create a virtual psychedelic party from the comfort of their home. Multiverse can also be implemented as an API plugin for various online streaming services, such as Spotify or YouTube to have a connected psychedelic party.

## Conclusion for Multiverse Project

*“The design process strikes a balance between the expected and the unexpected, between control and relinquishment. While the processes are deterministic, the results are not foreseeable. The computer acquires the power to surprise us.”~ Michael Hansmeyer*

In a nutshell to conclude, the main objective behind the Multiverse: Realtime audio visual generative art project was for providing a cognitive intuitive interaction to users to play around and explore the psychedelic effects that can be induced with the visuals. I have achieved to build a standalone application that creates psychedelic effect. Referring the above quote by Michael Hansmeyer, I have built a system, the results and the effects that users experience are not foreseeable. But I Strongly believe my patch will definitely achieve psychedelic effects for the users.

The project Multiverse: Realtime audio visual generative art achieves both interactive qualities for the user as well as provide real-time audio-visual generation, thus helping me to understand a clear concepts of both interactive design media as well as more about the module real-time audio video. The Project also helped me in understanding and practicing deeper on Cycling74's Max 8 Software. Playing around with the patches and other objects, providing an integral value in taking up the course for the first semester.



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