**Creative Audio-Visual Coding Critical Commentary**

**Introduction**

In my project, using creative coding, I’ve built a system which has the functionality to generate an audio visualisation in the form of a piece of 3D visual art for a song. I’ve used the Galt MacDermot song ‘Cold Coffee’ from the 2000 album *Shapes of Rhythm/Woman Is Sweeter* as the base audio for the project, however I attempted to retain as much cross application between different songs as possible. This is a project which I undertook to ask the research question, what is the value of a creative coding approach to audio visualisation? In relation to the project, in this commentary I am going to explain its context, in terms of aesthetics and approach, answer the research question presented, using academic discourse on creative coding, and explain the methodology in my approach before conducting a final evaluation.

**Context**

Interestingly in this project I’ve been inspired by artists and art from a range of media. There is context within coding, music and film, or potentially anywhere where audio and visual media is combined. One of my biggest inspirations for the project actually came from film, the title sequences used in the James Bond film franchise. In most of these sequences there’s a section where the camera’s moving into the z axis past different graphics which react to the music, this can be seen in ‘Skyfall’ (Oddsun, 2013). However, this filmic example uses live film and animation so there’s an important distinction to be made between these techniques and those used to create my project. This style can also be seen in dance music videos. One example which is interesting is ‘Mr Traumatik - Psychedelic Ascension’ (MR TRAUMATIK, 2014). This is another example of an animation style of audio-visual art. The movement through the piece is in time with the music, an important goal of my project.

The largest basis of context for my project is however as expected the coded audio visualisation practice in itself. John Witney was particularly inspiring in this project. His focus on geometrical shapes and the composition of simple shapes to create complex structures evident in his 1972 piece ‘Matrix III’ (*crystalsculpture2*, 2008), are ideas fundamental to my piece. However, where our works differ is Whitney mostly used more ambient or orchestral slower music and I am applying some of his concepts using a more contemporary faster jazz style track which contains a lot of drums, something not common in the music for Witney’s projects. Due to this, I would argue ensuring timings are correct in my project is more important because the music is faster, and the beats are hyper emphasised by the drums.

**Research question**

In this section of the commentary, I am going to focus on my research question, what is the value of a creative coding approach to audio visualisation? To explore this objectively it’s important to first address some other approaches to audio visualisation. These include VJ software’s, such as Resolume (*Denon DJ*, 2019), VDMX and Modul8, typically used in live performance music events and visual/animation software such as Blender (*EMENDY Multimedia Institute*, 2019). The main difference between a creative coding approach or using one of these software’s is the type of medium used. Creative coders user programming languages such as JavaScript, Python ext., which are sets of ‘commands, instructions, and other [syntax](https://techterms.com/definition/syntax) use to create a software [program](https://techterms.com/definition/program) (*techterms*, 2011)’. These (VJ/animation) software’s described have been created by programming languages, therefore the different mediums occupy distinct computational levels.

In creating these languages developers create sets of tools for users, but in a creative coding approach a creator must create their own tools. This fact influences many of the advantages and disadvantages of creative coding. For example, as explored by Benedetti, Elli and Mauri (2020, p. 10) in a study on teaching creative coding this lack of premade tools and ‘immediate visual feedback’ presents new users with a ‘learning curve’. However, this can also be an advantage. Users using programming languages have a much larger degree of customisation and control over there system, as it is purpose built, and they are not constrained to the tools or specific workflows of pre-made software.

Another advantage of a creative coding approach to audio visualisation is the potential for improvisation largely facilitated by the capacity for mappings. Bergstrom and Lotto (2015, p. 28), although more focused on code bending, highlight how, using programming languages, data can be in a ‘rapid, playful manner … repurposed, encouraging an exploratory approach’ and ‘connections may be creatively re-arranged’. Functions in programming languages also facilitate this idea of improvisation as they allow the rapid recalling of code with the potential for slight or major differentiation through parameters. This can allow the high-speed building of complex structures and the potentially unforeseen transformations of formulated ideas.

**Methodology**

In this section of the commentary, I am going to discuss the process behind the creation of my audio-visual system, in particular its critical structural elements. Initially when I started the project, I had two major criteria. I needed to be able to work out and store specific times related to the audio, in order to be able to introduce different visual elements in time with the music. Also, due to the 3D movement of my piece, I needed a ‘space’ value to translate shapes by to ensure that they appeared full size at the correct position in the z plane. As each time would have a specific translation or space value, I used an associative array, a data structure that ‘associates values of one type with values of another type’ (Koenig, 1988, p. 1). The array ‘elements’ would then contain data (time and space) about the start of specific bars (e.g., bar 2).

To address the issue of timings initially I planned to calculate the length of a bar and then use this value to then calculate the starting time of all other bars. However, after conducting some tests, I realised that the length of different bars was not the same, because it is a live piece of music there is some slight variation. Therefore, I introduced a hybrid approach using the calculated timings when possible and bespoke systems using the ‘peakDetect’ object when necessary for specific bars.

Now that I had the associative array implemented, I began to introduce shapes at different times using conditional if statements. For example, if run time is larger than ‘elements. bar1.time’ draw a line. I used the ‘getEnergy’ object between specific frequency ranges (60-250, 8000-20000) and assigned them to ‘bass’ and ‘treb’ variables. For the ‘bass’ variable

I used it to control the rotation speed of the more central lines and for the ‘treb’ variable I used the data to trigger movement(translation) in the outer perpendicular lines. For the ‘treb’ movement I could have achieved the same effect using ‘peakDetect’ however I didn’t because I required a high level of control, something I felt was convoluted within the ‘peakDetect’ object.

To add colour in my system, I used a for loop system coupled with the ‘analyze’ object. At any instance in the song the for loop searched through the bins of the ‘spectrum’ object each one representing a frequency range. Due to the conditional within the if statement the largest bin is identified and assigned to the ‘i\_val’ object. I then used this in conjunction with two functions ‘calling\_colours’ and ‘calling\_colours(delay)’ to change the colour of the shape compositions. The functions allow me to efficiently and cohesively apply adjustments to a variety of shapes. In terms of the actual colour considerations, I calculated the mid-point frequency of specific bins and researched their closest musical note. I then, as explored by Goldsmith (no date), used Dominic De Clario’s musical note to colour assignment. However, I conducted a slight variation moving the colour wheel a twelfth clockwise, this was an aesthetic decision and is acceptable because the music colour scheme is subjective and to some degree ‘arbitrary’ (Goldsmith, no date).

**Evaluation**

In evaluation of my project, I’ve achieved my aim of creating an engaging 3D audio visualisation. Through the project I’ve learnt much, in particular about mappings and generating and moving through 3D spaces. My project has put me in an excellent position to further explore the idea of audio-visualisation due to its base structures such as the ‘time’ and ‘space’ associative array and colour changing functionalities. In the future I would like to further develop this project’s ideas by employing ideas of randomness, introducing individuality between audio visualisations, and make the system more cross compatible between song, currently it is not due to the bespoke peak detect timing system.

A creative coding approach in this project, and the discussed improvisatory element intrinsic to it, has allowed me to surpass my creative expectations. For example, the mapping for bass amplitude to the rotation of the central lines was an experiment and formed the basis of the whole second generation of my project. Leading on from this point the accessible functionality of mappings has allowed me dynamically and creatively explore new concepts, something which would not have been possible in the same capacity in pre-made software. Moreover, a creative coding approach has allowed me to create a highly customised unique system through the large degree of organisational control it allows users. This would not have been the case if I used other, e.g., VJ, software. Therefore, to answer my research question, despite the learning curve and the potential for syntax errors slowing creative flow, the value of a creative coding approach to audio visualisation, and I think artistic practice in general, is massive. Finally, I think my project is a great example of the future possibilities of creative coding to ‘help designers to discover new possibilities of expressions, to test assumptions and to envision new ideas’ (Benedetti, Elli and Mauri, 2020 p. 2).

**Bibliography**

* Benedetti, A. Elli, T. Mauri, M. (2020) ‘“DRAWING WITH CODE": THE EXPERIENCE OF TEACHING CREATIVE CODING AS A SKILL FOR COMMUNICATION DESIGNERS’. Available at: https://www.researchgate.net/publication/343418771\_DRAWING\_WITH\_CODE\_THE\_EXPERIENCE\_OF\_TEACHING\_CREATIVE\_CODING\_AS\_A\_SKILL\_FOR\_COMMUNICATION\_DESIGNERS (Accessed: 11 May 2021). pp. 2-28.
* Bergstrom, I. Lotto, R. (2015) ‘Code Bending: A New Creative Coding Practice’, *Leonardo*, 48, pp. 25-31. Available at: https://direct.mit.edu/leon/article/48/1/25/45842/Code-Bending-A-New-Creative-Coding-Practice (Accessed: 11 May 2021). p. 28.
* crystalsculpture2 (2008) *John whitney-matrix III (1972)*. Available at: https://www.youtube.com/watch?v=ZrKgyY5aDvA (Accessed: 1 May 2021).
* Denon DJ (2019) *Denon dj & resolume av demonstration*. Available at: https://www.youtube.com/watch?v=70QmuVPYKAw (Accessed: 4 May 2021).
* EMENDY Multimedia Institute (2019) *Creating animated visuals for your music*. Available at: https://www.youtube.com/watch?v=b2-d1hzHm54 (Accessed: 4 May 2021).
* Goldsmith, J. (no date) *An investigation into the relationship between sound and color*. Available at: http://www.people.vcu.edu/~djbromle/color-theory/color01/Relationship-color-sound-joe\_goldsmith.html (Accessed: 10 May 2021).
* Koenig, A. (1988) ‘Associative arrays in C++’. Available at: http://www.softwarepreservation.com/projects/c\_plus\_plus/library/att/koenig-assoc.pdf (Accessed: 11 May 2021). p. 1.
* Mr Traumatik (2014) *Mr traumatik - psychedelic ascension*. Available at: https://www.youtube.com/watch?v=uvntuZzXcAM (Accessed: 4 May 2021).
* Odd Sun (2013) *Skyfall opening credits (hd)*. Available at: https://www.youtube.com/watch?v=\_4gdhsVKTcs (Accessed: 19 April 2021).
* *techterms* (2011) Available at: https://techterms.com/definition/programming\_language (Accessed: 4 May 2021).

**Discography**

* MacDermot Galt. *Shapes of Rhythm/Woman Is Sweeter*. Kilmarnock, 2000. Spotify streaming.