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Use of Computers and Algorithms in Music Composition

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The Use of Computers and Algorithms in Music Composition

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Fundamentals of Computational Intelligence

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Abstract

Do you believe a computer could create an emotionally moving and easily accessible piece of music? Or the complete opposite? Algorithms have always provided a framework for the construction of a musical work, but modern technologies have allowed computers to generate their own pieces with as little effort as desired by the human composer.

1. Introduction

Music has always been an imperative medium for human creativity. It is celebrated in every culture as an authentic expression of emotion, and as a genuine form of entertainment (Raglio & Vico, 2017).

Composers have created pieces of music throughout the ages that have accurately captured the collective human experience of the time. Technological advancements in the past century have accelerated to unforeseeable realities in every aspect of life. This bares the question: could a non-human compose a piece of music deemed important or especially emotionally intelligent by a large human population?

2. History

Creative endeavours are often considered to be a product of the right hemisphere of the brain, whereas analytical and processed thinking may be understood as the processes of the left hemisphere. However, this dichotomy is not mutually exclusive. In fact, many universally appreciated pieces of art are a conglomeration of both sides. They follow structure and technique and cease to exist without their foundations. They are intentionally constructed and follow formulas to achieve their desired result. Tool's seminal work *Lateralus* (2001) explores the division in detail and uses the Fibonacci sequence in rhythmic and syllabic form to boldly illustrate how mathematics underlies art. Twentieth-century composers including Stockhausen and Stravinsky have used algorithms in widely celebrated suites (Fernandez & Vico, 2013). Avant-garde composer John Cage notably constructed a piece based around multiple phases of Mandelbrot's fractals. We can even understand that Western pop music itself follows strict algorithms albeit to please the largest demographic to produce the highest revenue possible. If we can conclude that all works of music must embody a certain structure, we must question if a computer could produce a similar, if not greater result. Furthermore, could computer algorithms progress the future of music, or would they produce a cold, systematic piece of music?

3. Contemporary use of algorithms

Since the turn of the century, the computer has become the most popular instrument. Endless performers have found major success through a digital product. However, in most cases, the composers of these songs are still humans making conscious decisions using Digital Audio Workstations ("DAWs"). Conversely, there are a number of experimental artists who have utilised the new medium in intuitive ways. Richard D. James, known pseudonymously as Aphex Twin, has constructed an expansive amount of music through custom-built software. The software allows James to input custom parameters and generates melodies and percussion based on

his instructions (Nierhaus, 2009). The results can be extremely varied and depend on the level of control he possesses over the algorithm. His deliberate interference creates a symbiotic relationship with his computer (Pitman, 2015; Nierhaus et al., 2015). James' piece "4" features a series of disorienting polyrhythms impossible for a human to physically perform, which juxtaposes strongly with the expressive yet simple melody. The work is cohesive and humanistic.

James' fellow *Warp Records* label-mates Autechre remove the human element altogether and create abstract, highly rhythmic music with very minimal acoustic input. They use commercial programs including Max/MSP and SuperCollider to compose and write unique mathematical algorithms for each piece (Fernandez & Vico, 2013). Nierhaus et al. (2015) discusses the use of Markov chains assisted in making this interconnect. Highly acclaimed producer Brian Eno (Oldfield, 1996) refers to the use of computer languages in compositions as *generative music*, essentially describing them as tools to reach a distinct sound. It is important to understand that *generative music* is not used to simplify the writing process, or to serve a lazy songwriter. Instead, it should be considered an alternate route to achieve otherwise impossible feats as an analytical approach for building a textured work. It should add a new dimension (Oldfield, 1996).

4. Artistic integrity

Is it deemed artistically inauthentic to use algorithms to produce music? To what extent? If highly complex FM synthesizers are accepted by large populations as 'human', why can't the framework of the song be? Humans can have as much or as little freedom in the parameters they assign the 'AI', meaning there is different degrees of autonomy on the computers' side (Bigo & Andreatta, 2019). Furthermore, it is not uncommon for composers to use algorithms to find inspiration and then build upon the output with their own creative minds (Meredith, 2016).

Music has always played an active role in societies. Throughout history, barriers have been defied and experimentation has lead to new standards in music. In comparison to the eons that precede it, the twentieth century saw radical progression in the sociological understanding of what music is and what purpose it serves. This was caused directly by the composers 'breaking the rules': creating atonal music, pioneering new technologies including the ondes Martenot, an early synthesiser and ultimately pioneering new technologies. It is undeniable that composers in previous eras would have made use of computer languages if they had the appropriate equipment.

5. Conclusion

Technology plays a pivotal role in our understanding of the world around us. Artistic mediums have only become more experimental and progressive as time has passed, and therefore modern composers utilise the correct methods to communicate the emotion they wish to express. It is simply a case of using the right tools for the right job. Using algorithms should not be considered inferior or insincere if the project calls for it. Human bias interferes with the process of algorithmic music as it is: composers set parameters that can and cannot be crossed, and it is within these confines that the music is generated. Musicians will continue to break new boundaries as technology progresses. Modern composers will continue to use their creative and analytical thought processes in unison to produce quality and meaningful work that is both emotionally and mathematically stimulating.

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