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Overview of Generative Processes in the work of Brian Eno

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Abstract. *Brian Eno is a famous a musician, producer and artist known for his endeavors in rock music who has devoted the latter part of his career to ambient and generative work. There are a few publications regarding his work (Albiez & Pattie, 2016; Sheppard, 2009; Tamm, 1988), but they do not focus exclusively on his generative processes. The only paper that details Eno's generative music only addresses the concepts of generative music and describes Eno's apps (Marshall & Loydell, 2017). The paper focuses more on his apps and it does not present a detailed correlation between his background/ influences to his work. This paper bridges that specific gap, by detailing Eno's school background, his influences, generative processes and how he moved on from traditional to more technological approaches.*

1. Introduction

This paper originated from research into Brian Eno's work and the lack of summarized information regarding his endeavors in the generative field. Whether he invented generative music or not, and we will see he did not, Eno might be considered the most popular name in the world of generative music. Due to his status, he popularized the term, and his work may serve as an introduction to the compositional method, so it is surprising that there are not many papers summarizing his generative work, in order to aid newcomers to the field.

This paper's main objective is to showcase some of Eno's work that introduces any kind of generative processes, detailing his early creations with more traditional methods and his most recent ones which feature more sophisticated and technological algorithms. The paper is composed of six sections. It will firstly introduce some historical background and concepts in generative music; secondly, it will present the theoretical and practical influences that led Eno to create music in such a manner; afterwards it will showcase Eno's most important generative work and processes, separating his early years from the most recent ones. It will then provide an overview of all the influences and techniques and lastly it will address the future work that this paper could incite.

2. Understanding Generative Music

In order to find the seeds for Eno's interest in generative music, one needs to understand its historical background and concept. Eno might have been the one that popularized the

term ‘generative music’, but he surely did not create it. He even acknowledges it in an interview. “I should stress that the idea of Generative Music is not original to me (though I think the name is). There have been many experiments towards it over the years” (Eno, 1996).

2.1. Historical background of generative music

The early instances of generative composition draws back to the mid XVIII century, with the dice musical games like Mozart’s The Musikalisches Wurfelspiel (Musical Dice Game) (Lorrain, 2003). These games “made it possible for the person ignorant of music to write minuets, marches, polonaises, contredances, waltzes and so forth by selecting bits of prefabricated music through the use of chance operations” (Hedges, 1978). With the technological advancements during the 1950s and 1960s computers started being utilized to generate musical compositions. The Illiac Suite by Lejaren Hiller, Leonard Isaacson and Robert Baker was one of the first computer generated compositions. It was achieved by “random selection constrained by lists of rules” and by “Markov chains, also random, in which the relative likelihood of each option was conditioned by one or more immediately preceding choices” (Ames, 1987). While still operating with the Illiac computer, Baker and Hiller created MUSICOMP (MUsic Simulator Interpreter for COMpositional Procedures), the first systems for automated composition. Throughout the rest of the century, other techniques and programs, like genetic algorithms, emerge providing more and sophisticated results (Alpern, 1995).

2.2. What is generative music?

So, what makes all these processes generative? As a broad definition any artwork that “is generated, at least in part, by some process that is not under the artist’s direct control” (Boden & Edmonds, 2009) can be considered generative art. The process can be achieved with various tools, just like a painting can be achieved with different brushes. What all these artworks have in common is that the artists determined beforehand a set of rules that allows a system to create a version of the artwork. This artwork can be created through simple algorithms, with the usage of randomness or stochastic processes, or with more complex advanced systems, that may include Markov Chains, genetic algorithms, L-systems, chaos, amongst others.

Throughout this section we have been referencing algorithms quite a few times. It is worth noting that there has been a significant correlation between generative music and algorithmic composition. According to Essl (2007) an algorithm is “a predetermined set of instructions for solving a specific problem in a limited number of steps.” Therefore, one can consider Mozart’s dice musical games an algorithm, and The Illiac Suite can be considered an algorithmic composition. When speaking about generative music one is almost always considering algorithmic composition. Going back to the preceding paragraph, generative art is achieved by the artists inability to have control over the artistic outcome. Claiming that The Illiac Suite is both an algorithmic composition and generative music is correct. One does not invalidate the other. Algorithms are a part of the process and a tool that artists use in order to create generative music.

3. Eno's Background and Influences

3.1. The school years

Brian Eno was born in 1948 in Suffolk, England and has a background in contemporary art studies at the Ipswich Art School (1964 – 1966) and received his Diploma in Fine Art from Winchester Art School in 1969 (Tamm, 1988). One can say that the basic artistic and educational foundation for Eno originated from painter Roy Ascott, head of the Ipswich Art School, who was an avid advocate of cybernetics, "the study of complex communication systems and their structures" (Sheppard, 2009). To Ascott the emphasis of modern art "is on behaviour, on what happens, on process and system, the dynamic interplay of random and ordered elements" (Ascott, 1968). With this approach in mind he created the Groundcourse at Ipswich, a course whose main philosophy "was to question preconceptions and established strategies of approaching art and creativity through the use of chance operations, games and exercises and behavioral psychology", highlighting the "process and not the product" (Albiez & Dockwray, 2016). Eno would later speak of cybernetic theorist Stafford Beer as a great influence to him (Eno, 2017a).

Initially Eno was interested in visual arts, but during his time in school, with the help of his teacher and painter Tom Phillips, he was introduced to John Cage, who presented similar conceptual ideas to what Roy Ascott taught at Art School. "For Cage, composition was partly a matter of chance; a process of circumscribing parameters within which any number of sonic events might be allowed to occur" and he also used diagrams and charts to write his scores (Sheppard, 2009), something Eno later used in the album sleeve of *Ambient 1: Music for Airports*.

Although Cage's conceptual ideas regarding composition were very important in Eno's development, one might say that the most essential outcome from discovering his work was the group of artist that were also inspired by Cage's philosophies (Albiez & Dockwray, 2016). Some of these artists gave lectures to Eno in school. Visits from Christian Wolff, Frederic Rzewski and Cornelius Cardew introduced Eno to music that were relatable to him because it did not require musical notation knowledge (Bangs, 1979). These artists produced pieces that were created by providing a set of rules and conditions that the performers needed to interpret. This type of compositions appealed to him because they were pieces of music he could produce (Sun, 2016).

3.2. Specific practical influences

Apart from introducing Eno to John Cage and the avant-garde music scene, Tom Phillips also encouraged Eno to exploit minimalistic compositions and tape recorders, using the work of La Monte Young, Terry Riley and Steve Reich as examples. (Sheppard, 2009) This section will present and describe three pieces of inspiration that had a profound impact in Eno's development has an artist.

As it has been established, John Cage is one of the most significant artists in Eno's career (Albiez & Pattie, 2016), so it might be safe to assume that the deck of cards *Oblique Strategies* (Eno & Schmidt, 1975), which will be addressed later, was inspired by the *I Ching* used by Cage. The *I Ching*, or Book of Changes (*I Ching, or Book of Changes: The Richard Wilhelm Translation Rendered into English by Cary F. Baynes*., 1967) is an ancient Chinese text that was given to Cage by Christian Wolff in 1949. Cage would use the text to make decisions and compose some his work. (Kostelanetz, 2003)

Another influential piece was Terry Riley's In C. (Riley, 1967) It is a generative composition where "the score consists of fifty-three notated melodic fragments, which the performers, who are variable in number, are to play one after the other, in synchronization with a steadily repeated "pulse" on the top two C's of the piano keyboard, repeating any given fragment an indeterminate number of times and pausing between fragments as they see fit. The piece ends after everyone reaches the fifty-third fragment." (Tamm, 1988) The composer sets a foundation of rules that the performers must follow, while still allowing the performer the creative freedom to repeat the fragments as many times he or she sees fit. Due to this individual choice imposed on the performers, the piece and its length it is always different. Robert Carl (Carl, 2009), who wrote a book about this piece, claims that "it is a piece that relies on the continued imagination and reinvention of its performers to survive" and that "in C is a piece of software. I define ''software'' as a series of rules and predefined relationships that execute a task; the user can then customize input and tweak aspects of the rules and relations to produce a product that is regarded as personal." This type of compositions, perhaps a bit difficult to duplicate, would reinforce Eno's appeal to music composed via a set of instructions and rules.

These two pieces are indeed very significant to Eno because they established his mindset as an artist and also his approach to composing. But there is, however, another piece of work that is probably the most significant (Albiez & Pattie, 2016; Tannenbaum, 1985). In the famous *It's Gonna Rain* (Reich, 1965) by minimalist composer Steve Reich, he used a recording of African-American preacher, Brother Walker, saying the sentence *It's gonna rain*. Reich initially wanted to align the loops against each other, but the tapes slowly started to shift. "I had intended to make a specific relationship: "It's gonna" on one loop against "rain" on the other. Instead, the two machines happened to be lined up in unison and one of them gradually started to get ahead of the other" (Reich, 2002).

Eno recognizes the impact that the piece had on his career claiming that it is "probably the most important piece that I heard, in that it gave me an idea I've never ceased being fascinated with – how variety can be generated by very, very simple systems" (Tannenbaum, 1985). Even though the piece is based on the same sentence being repeated over and over again, Eno was fascinated by its outcome. "The amount of material there is extremely limited, but the amount of activity it triggers in you is very rich and complex" (Tamm, 1988). To him, this piece required the listener to have an active role in the composition. It required a new form of listening. According to Eno "the creative operation is listening. It isn't just a question of a presentation feeding into a passive audience" (Korner, 1986). Besides the conceptual impact on his artistic development, this piece also provided Eno a new method to composition, by using tapes and looping them out of phase with one another. This was the first technological implementation of the philosophy he learned in school and because it was a simple process, he was capable of duplicating it.

Eno would use these three pieces as inspiration, tailoring them to his specific artistic needs and using these improved techniques and approaches throughout his career.

4. Eno's Generative Processes

4.1. Oblique Strategies

Eno was familiar with the I Ching and he wanted to make something a bit more specific to certain situations. Still in school Eno would write down phrases/ instructions that would help him when he would feel lost in the artistic process. "The idea of Oblique Strategies was just to dislocate my vision for a while. By means of performing a task that might seem absurd in relation to the picture, one can suddenly come at it from a tangent and possibly reassess it". He would continue to write theses phrases down and place them in the studio when producing for Roxy Music. When he showed the phrases to Peter Schmidt, he also admitted to doing something similar and they decided to publish Oblique Strategies in 1975 (O'Brien, 1978). The deck included some phrases like: "Don't be afraid of things because they're easy to do." "Turn it upside down." "Do we need holes?" "Is it finished?" "Don't break the silence." "What are you really thinking about just now?" "Honor thy mistake as a hidden intention." Eno was notorious for using the deck in his production endeavors (Oblique Strategies was heavily used during the production of David Bowie's Heroes) and on a lot of his work during the mid to late 70s and possibly into the 80s (Tamm, 1988) and Eno has claimed to still using it. (*Brian Eno: Behind The Reflection*, 2017)

4.2. A Set of Instructions

Clearly influenced by the artists from the avant-garde movement, specifically Terry Riley's *In C*, Eno created some pieces based on a set on instructions. During the production of Another Green World (Eno, 1975a) Eno would give simple instructions to the musicians. "I tried all kinds of experiments, like seeing how few instructions you could give to the people in order to get something interesting to happen. For example, I had a stopwatch and said, 'Right, we'll now play a piece that lasts exactly ninety seconds and each of you has got to leave more spaces than you make noises', something like that, and seeing what happened from it" (Miles, 1976).

But the piece that most embodies In C method is present on the second half of Discreet Music (Eno, 1975b), where Eno's "interest in self-regulating and self-generating systems is exemplified in the 3 variations on the Pachebel Canon" (Eno, 1975c). In this composition a group of performers, the Cockpit Ensemble conducted by Gavin Bryars, obey a set on instructions (Tamm, 1988). "Each variation takes a small section of the score (two or four bars) as its starting point, and permutates the players' parts such that they overlay each other in ways not suggested by the original score. "In "Fullness of Wind" each player's tempo is decreased, the rate of decrease governed by the pitch of his instrument (bass=slow). "French Catalogues" groups together sets of notes and melodies with time directions gathered from other parts of the score. In "Brutal Ardour" each player has a sequence of notes related to those of the other players, but the sequences are of different lengths so that the original relationships quickly break down" (Eno, 1975c).

Eno would later admit to not liking the piece, considering it not very successful (Sheppard, 2009) and it is probably due to the input material since it is possible that it had too many notes and "the randomness here created cacophony" (Tamm, 1988).

4.3. The Tape Loop System

As previously mentioned, Eno claims that *It's Gonna Rain* is probably the most important piece he had ever heard (Albiez & Pattie, 2016; Tannenbaum, 1985) and he would be right. Eno would go on and use the tape loop system throughout his career. The earliest account of the usage of the tape loop system is in his collaboration with Robert Fripp on the album *No Pussyfooting* (Fripp & Eno, 1973) and later on the first side of *Discreet Music* (Tamm, 1988) but the most prominent evolution from Steve Reich's two tape loop system is used in *Ambient 1: Music for Airport*s. (Eno, 1978a) The second track on the first side, or "*2/1*" as it is called, is created out of very little material, like most tape loop compositions. It is composed of 7 loops of "taped female voices singing single pitches with an absolutely unwavering tone production, on the syllable "ah," for about five seconds per pitch." (Tamm, 1988) The length of the tape was somewhat arbitrary, because Eno just "wanted silence at least twice as long as the sound" and "It wasn't measured." (Tannenbaum, 1985) So the timing of the cycles ensures that the odds of the piece repeating itself would be very low, and because it does not provide a lot of structure, the listener does not have anything to hold on to. He/ she pays as much attention as he/ she pleases. This was, after all, Eno's intent with ambient music. "Ambient Music must be able to accommodate many levels of listening attention without enforcing one in particular; it must be as ignorable as it is interesting." (Eno, 1978b) For Eno, ambient music revolves around the idea that the music is part of the environment, even comparing it to paintings. "I'd like people to have the expectations of music that they presently have of painting. If a painting is hanging on a wall where we live, we don't feel that we're missing something by not paying attention to it. (…) It's a sort of continuous part of the environment." (Korner, 1986) Unlike a painting however, which is a static work of art, by using the tape loop system in his ambient music, he allows the listener to hear an ever-changing composition that never repeats itself but still introduces familiar elements, leaving the listener in a state of limbo between acknowledging the music or not.

Unfortunately, one of the issues or inconveniences in utilizing this system, is that what the listener is hearing is a sample of what the system can produce. He/ She cannot experience the actual system in action, playing something different every time that it is played. Eno would have to wait nearly 20 years to finally publish the generative system as it is and not the result of one.

5. Eno's Computer Generated Music

In 1994, a company named SSEYO that developed 'algorithmic music-generating software' released the SSEYO Koan Plus (Cole & Cole, 2021b). In Buddhism, koans are brief sayings, dialogues, or anecdotes that can be used as a mean to find enlightenment in particular situations. "Koans frequently comprise elements that render them difficult to understand at first glance" and some even "defy logic or common sense." (Foulk, 2000).

While they were preparing for the release of Koan Pro in 1995, they were capable of bringing it to Eno's attention and in 1996 Eno released Generative Music 1 with SSEYO Koan Software on a floppy disk (Cole & Cole, 2021a). The software worked "by inputting basic guiding parameters, or 'seeds', the software could 'grow' unique musical developments – none of which would ever repeat in exactly the same configuration" (Sheppard, 2009) and it allowed Eno "to allocate any of around a hundred and fifty

different conditions, each operating within its own probability range, to any given voice or instrument" (Mills, 1996). Eno saw this as an opportunity to initiate a new era of music. "From now on there are three alternatives: live music, recorded music and generative music. Generative music enjoys some of the benefits of both its ancestors. Like live music, it is always different. Like recorded music, it is free of time-and-place limitations - you can hear it when you want and where you want" (Eno, 1996) and he finally could deliver the compositions as he wished, but the medium still wasn't the best.

At the same time as Eno was working on Generative Music 1, Peter Chilvers, a musician and software designer, was working on a series of videogames called Creatures and for the soundtrack he had to resort to generative ambient music. "We needed something that hung in the air like a presence; something that gave color to the environment. That led me to generative music and ambient music" (Crane, 2020). Due to the clear common interest, a mutual friend put Eno and Chilvers in contact and in 2006 Chilvers helped Eno on a generative soundtrack he was developing for a videogame called Spore. From that experience they created a prototype for Bloom (Eno & Chilvers, 2008), that ran in Flash using a Wacom tablet (Chilvers, 2016) which required a stylus. They thought that a lot of people did not have this kind of stylus tablets so they just shelved the project for a while, until the first iPhone was announced in 2007. (Cohen, 2007; Crane, 2020) Chilvers and Eno recognize that it was difficult to offer the proper experience for generative music and iPhone provided the best platform. "The difficulty developers have faced with generative music to date has been the platform. Generative music typically requires a computer, and it is just not that enjoyable to sit at a computer and listen to music. The iPhone changed that - it was portable, powerful and designed to play music" (Milani, 2009). For Eno, it finally allowed the people to "own the process rather than the results of the process." (Dredge, 2012)

Bloom is an app that offers two modes to the user: "Listen, which plays an interactive generative composition, and Create, in which you create each note that plays in real time" (Buskirk, 2008). The user can compose by tapping the screen and circles appear with each tap. "The sounds are pitched low to high from the bottom to the top of the screen, with the software including 12 'moods' which alter the color palette of the ink blots, and subtly change the characteristic of the sounds, their relationship with one another and the length of sustain. Additional functions allow for the adjustment of delay, and the sounds themselves – offering either a higher attack in 'impact', a hollower 'bowl' sound, and 'blend', which combines the two (Marshall & Loydell, 2017). According to Chilvers, it "is sample based. Brian has a huge library of sounds he's created, which I was curating while we were working on the Spore soundtrack and other projects" (Milani, 2009).

Since Bloom, Eno and Chilvers developed other generative music apps, like Trope (Eno & Chilvers, 2009), Scape (Eno & Chilvers, 2012), Reflection (Eno, 2017b). The main difference between them is the visual elements, interaction and composition method. For example, in Trope the user draws shapes "using five differently shaped cursors" and can choose between 12 moods and, although hidden, can adjust "delay and the interval between notes", whereas in Scape "the user selects shapes whose placing and interrelationships change the sounds and development of the piece, while the different colours and patterns of the backgrounds add a further layer to the music production" (Marshall & Loydell, 2017). Of all of them the one that might stand out the most is Reflection, because unlike Bloom or Trope, the listener has a more passive role. With this

app, Eno regained control of the composition. The only control that the listener has is "pause playback, set a sleep timer and allow streaming to Apple TV via Airplay" (Marshall & Loydell, 2017). The app is based on randomization scripts that Chilvers would create and Eno would use them in Logic Pro (Sherburne, 2017). Some of the examples of the scripts can be seen during a piece that BBC did on Eno upon the release of Reflection. On a specific track Eno says that he has three rules (which are scripts): "one is that a random 14% of these notes are going to be pitched down by 3 semi-tones; the second is that 41% of them are going to go an octave down; the other is a corrector, so if any notes are produced that I don't want there, I can correct it with this" (*Brian Eno: Behind The Reflection*, 2017). It appears that Eno has a MIDI track with notes and because of the scripts on the track, it changes the notes every time that it is played. On this specific track Eno says that there is not any change in the position of the note, but there are other tracks where a script will shift the position of the notes. Other scripts include: Markov chain; bouncing ball delay; damp velocity above a certain pitch; different randomizers; among others.

Another variable for the album is the time of day. "The rules themselves could change with the time of day. The harmony is brighter in the morning, transitioning gradually over the afternoon to reach the original key by evening. As the early hours draw in, newly introduced conditions thin the notes out and slow everything down" (Chilvers, 2017). This showcases that external variables, that the composer cannot control, can be used to provide another layer of rules to change the outcome.

Eno and Chilvers continue to release generative work, the most recent being Bloom: 10 Worlds (Eno & Chilvers, 2018), in celebration of the 10 year anniversary of the original Bloom. It presents 10 different worlds with different sounds and different rules. Unfortunately, like many of the apps, the difference between these rules is not explicitly known.

6. Conclusion

Knowing now Eno's background and influences, it seems logical that he would contribute to the field of generative music. Ever since the beginning of his academic career Eno was introduced to the conceptual ideas of systems, rules and chance, so a significant part of his theoretical framework was established very early on. Nevertheless, by studying the artists and composers from the avant-garde movement, not only did he deepen his theoretical knowledge, but he also adopted and improved some of the generative techniques that they used.

Eno was also extremely lucky with the timing of the technological advancements. In parallel with his time in school, the first developments in computer generated compositions were being accomplished. As Eno's career progressed, so did computer generated music and eventually the two would meet. There are two instances where Eno was introduced to new technology that allowed him to create generative music: one was with the SSEYO Koan program and the other was when the first iPhone was released. Given these two instances one can speculate that without these products, Eno would not have reached the full potential of generative music.

While technology is allowing Eno to fully explore generative music, there are

contrivances with the usage of software as opposed to more traditional and less technological means. There is a possibility that the software may become obsolete and Eno's work could be lost, and it may happen sooner rather than later. Generative Music 1 was released on a floppy disk, which are currently not in use and the system also required a specific soundcard to hear the sounds as Eno wished (Cole & Cole, 2021b), not only making it difficult to listen now, but also in the near future. Concerning the apps developed with Chilvers, there is also potential that some component in smartphones, either hardware or software, changes and impedes the apps from being used. The same cannot be said about the more traditional techniques, like the dice games from the XVIII century. They can still be used today. Although speculating, a possible solution to this issue could be presented by the authors and artists. They would have to allow the code to be open-access or publish instructions to reverse engineer the code. But the desire and will power to provide future proof access needs to come from them. They would need to be willing to release that information to ensure that their creations can be reconstructed or analyzed when technological advancements prevent their work from being seen or heard.

From an academic perspective, another problem that computer generative compositions present is the accessibility to the actual code making it difficult to understand the underlying rules and techniques that were imposed. It is surprising however, although admittedly challenging to achieve, that a musical and software analysis has not been done. For instance, it would be interesting to know what techniques are used in each app; why use one in favor of another; why use one in a specific app but not on another; if they use certain techniques for specific moods; why allow control over certain parameters, amongst others.

Even though Eno is a technological oriented artist he is not a programmer and as much as he enjoys talking about the process behind his work, there is not a lot of information regarding the specific generative techniques used in the apps. While this article tried to provide some information in this matter, there is a need for further investigation. It is safe to assume that in order to know about these techniques and how the software behaves one needs to talk to Peter Chilvers and Peter and Tim Cole from Intermorphic (previously known as SSEYO), who are the main software designers behind Eno's most technological work. And even with a possible interview with said software designers, we still may not find out relevant information. Unfortunately, the specific techniques used in their products are subject to proprietary restrictions for as long as the apps are in commercial use, therefore the techniques are not available for an in-depth analysis.

Since Eno is an artist that evolves with the technological advancements it would be interesting to know what kind of work, he could produce with the new technologies available (such as neural networks). And because of the adaptability of his generative approach, it seems fair and plausible to claim that, with the right help, Eno could be, just like generative music, an artist that can create new work that never repeats himself but still is familiar. The only thing that changes is how the rules are created.

7. References

Albiez, S., & Dockwray, R. (2016). Before and After Eno: Situating 'The Recording

Studio as Compositional Tool'. Em S. Albiez & D. Pattie (Eds.), *Brian Eno: Oblique Music*. Bloomsburry.

Albiez, S., & Pattie, D. (Eds.). (2016). *Brian Eno: Oblique Music* (Vol. 53, Número 9). Bloomsbury. https://doi.org/10.1017/CBO9781107415324.004

Alpern, A. (1995). *Techniques for algorithmic composition of music*.

Ames, C. (1987). Automated Composition in Retrospect: 1956-1986. *Leonardo*, *20*(2), 169–185.

Ascott, R. (1968). The cybernetic stance: My process and purpose. *Leonardo*, *1*(2), 105–112. https://doi.org/10.1162/leon.2007.40.2.189

Bangs, L. (1979). *Brian Eno: A Sandbox In Alphaville*. Perfect Sound Forever. http://www.furious.com/perfect/bangseno.html

Boden, M. A., & Edmonds, E. A. (2009). What is generative art? *Digital Creativity*, *20*(1–2), 21–46. https://doi.org/10.1080/14626260902867915

Brian Eno: Behind The Reflection. (2017, Abril 5). BBC Click - YouTube. https://www.youtube.com/watch?v=cv7epY75Wa0

Buskirk, E. Van. (2008, Outubro 9). *Eno and Chilvers Release Sweet Music App for iPhone* . WIRED. https://www.wired.com/2008/10/review-brian-en/

Carl, R. (2009). Terry Riley's In C. Em *Studies In Musical Genesis , Structure, and Interpretation*. Oxford University Press. https://doi.org/10.1017/CBO9781107415324.004

Chilvers, P. (2016, Novembro 10). *Ten years working with Brian Eno*. peterchilvers.com. http://www.peterchilvers.com/?p=134

Chilvers, P. (2017, Janeiro 1). *Brian Eno: Reflection*. peterchilvers.com. http://www.peterchilvers.com/?p=137

Cohen, P. (2007, Janeiro 9). *Macworld Expo Keynote Live Update: Introducing the iPhone*. Macworld. https://www.macworld.com/article/1054764/liveupdate.html

Cole, T., & Cole, P. (2021a). *Eno's «Generative Music 1» (1996)*. intermorphic.com. https://intermorphic.com/sseyo/koan/generativemusic1/index.html#gm1

Cole, T., & Cole, P. (2021b). *Koan*. intermorphic.com. https://intermorphic.com/sseyo/koan/

Crane, L. (2020). *Peter Chilvers: Fun with Generative Music*. Tape Op Magazine. https://tapeop.com/interviews/137/peter-chilvers/

Dredge, S. (2012, Setembro 26). *Brian Eno and Peter Chilvers talk Scape, iPad apps and generative music* . The Guardian. https://www.theguardian.com/music/appsblog/2012/sep/26/brian-eno-scape-ipad-apps

Eno, B. (1975a). *Another Green World*. Island Records.

Eno, B. (1975b). *Discreet Music*. EG.

Eno, B. (1975c, Setembro). *Discreet Music Liner Notes*. Discreet Music. http://www.eno-web.co.uk/discreet-txt.html

Eno, B. (1978a). *Ambient 1: Music for Airports*. Polydor Records.

Eno, B. (1978b). Music for Airports Liner Notes. Em *Ambient 1: Music For Airports*.

Eno, B. (1996, Março 1). Music of the Future. *The Independent*.

Eno, B. (2017a). Generating and Organizing Variety in the Arts. Em C. Cox & D. Warner (Eds.), *Audio Culture, Revised Edition: Readings in Modern Music*. Bloomsburry.

Eno, B. (2017b). *Reflection*. Opal Limited.

Eno, B., & Chilvers, P. (2008). *Bloom*. Opal Limited. https://apps.apple.com/gb/app/bloom/id292792586

Eno, B., & Chilvers, P. (2009). *Trope*. Opal Limited.

Eno, B., & Chilvers, P. (2012). *Scape*. Opal Limited.

Eno, B., & Chilvers, P. (2018). *Bloom: 10 Worlds*. Opal Limited.

Eno, B., & Schmidt, P. (1975). *Oblique Strategies*.

Essl, K. (2007). Algorithmic Composition. Em N. Collins & J. D'Escriván (Eds.), *The Cambridge Companion to Electronic Music* (pp. 104–122). Cambridge University Press.

Foulk, T. G. (2000). The Form and Function of Koan Literature. Em S. Heine & D. S. Wright (Eds.), *The Koan: Texts and Contexts in Zen Buddhism*. Oxford University Press.

Fripp, R., & Eno, B. (1973). *No Pussyfooting*. Island Records.

Hedges, S. A. (1978). Dice Music in the Eighteenth Century. *Music & Letters*, *59*(2), 180–187.

I Ching, or Book of Changes: The Richard Wilhelm Translation Rendered into English by Cary F. Baynes. (R. Wilhelm & C. F. Baynes, Trads.; 3rd ed.). (1967). Princeton University Press. https://doi.org/10.2307/597234

Korner, A. (1986). *Aurora Musicalis*. Artforum. http://music.hyperreal.org/artists/brian_eno/interviews/artfor86.html

Kostelanetz, R. (2003). *Conversing with Cage* (2nd ed.). Routledge.

Lorrain, D. (2003). Realization of 18th century musical games: Mozart & Stadler. *Computer Music Multidisciplinary Research 2003*.

Marshall, K., & Loydell, R. (2017). Sound Mirrros: Brian Eno & Touchscreen Generative Music. *Music on Screen: From Cinema Screens to Touchscreens Musicology Research Journal*, *53*(9), 1689–1699. https://doi.org/10.1017/CBO9781107415324.004

Milani, M. (2009, Setembro 19). *Generative Music: An interview with Peter Chilvers*. Unidentified Sound Object. https://usoproject.blogspot.com/2009/09/generative-music-interview-with-peter_19.html

Miles. (1976, Novembro 27). *«ZING!» GO THE STRINGS OF MY ART...* New Musical Express. http://www.moredarkthanshark.org/eno_int_nme-nov76.html

Mills, R. (1996, Julho). *My Ever Changing Moogs*. Q. http://www.moredarkthanshark.org/eno_int_q-jul96.html

O'Brien, G. (1978). Eno at the Edge of Rock. *Andy Warhol's Interview 8*, *III*(6).

Reich, S. (1965). *It's Gonna Rain*. Columbia Records.

Reich, S. (2002). *Writings on music, 1965-2000* (P. Hillier, Ed.). Oxford University Press.

Riley, T. (1967). *In C*. Columbia Records.

Sheppard, D. (2009). *On Some Faraway Beach: The Life and Times of Brian Eno*. Chicago Review Press.

Sherburne, P. (2017, Fevereiro 16). *A Conversation With Brian Eno About Ambient Music*. Pitchfork. https://pitchfork.com/features/interview/10023-a-conversation-with-brian-eno-about-ambient-music/

Sun, C. (2016). Brian Eno, non-musicianship and the experimental tradition. Em S. Albiez & D. Pattie (Eds.), *Brian Eno: Oblique Music*. Bloomsbury.

Tamm, E. (1988). *Brian Eno: His Music and the Vertical Colour of Sound*.

Tannenbaum, R. (1985, Setembro). *More Dark Than Shark*. A Meeting of Sound Minds: John Cage + Brian Eno. https://www.moredarkthanshark.org/eno_int_musician-sep85.html