Music Composition in the 21st Century: Exploring Concertgoers' Aesthetic Response to AI-generated Music

by

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Date: April 2021

SUPERVISOR'S STATEMENT

I hereby acknowledge that this dissertation has been submitted with my approval.

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Prof. Chatradari Devroop

Date: April 2021

DECLARATION

Submitted in fulfilment of the requirements for the degree of

Master of Music in the Cluster Performing Arts, School of Arts, College of Humanities at

University of KwaZulu-Natal, Durban, South Africa.

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01 December 2020

Mr Wessel Jacobus Jansen Van Rensburg (219095585)
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Dear Mr Jansen Van Rensburg,

Protocol reference number: HSSREC/00002128/2020
Project title: Music composition in the 21st century: exploring concertgoers aesthetic response to artificial intelligent generated music
Degree: Masters

Approval Notification – Expedited Application

This letter serves to notify you that your application received on 19 October 2020 in connection with the above, was reviewed by the Humanities and Social Sciences Research Ethics Committee (HSSREC) and the protocol has been granted **FULL APPROVAL** on the following condition:

Any alteration/s to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through the amendment/modification prior to its implementation. In case you have further queries, please quote the above reference number. PLEASE NOTE: Research data should be securely stored in the discipline/department for a period of 5 years.

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All research conducted during the COVID-19 period must adhere to the national and UKZN guidelines.

HSSREC is registered with the South African National Research Ethics Council (REC-040414-040).

Yours sincerely,

[redacted]

Professor Dipane Hlalele (Chair)

/dd

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Abstract

We live in the information age where digitisation and computational technology have become integral and indispensable to our daily activities. Artificial intelligence (AI), quantum computing, and other such technologies increasingly impact and disrupt our lives as we connect with our world. Within the arts, a field once dominated by human creation, we now experience a penetration of AI and deep learning technologies. The researcher, a practising musician, became interested in how our ubiquitous interaction with AI technology affects our decision-making and how it relates specifically to the field of music composition. The manifestation of AI's impact on music-making was met with the researcher's excitement and trepidation. Given the researcher's apprehension, he proposed investigating (1) the quality of AI creativity in the field of music composition and (2) how transparency of this AI creative employment affects aesthetic judgement. He designed his research using a mixed methods approach, comprising a quantitative phase in the form of an online questionnaire (based on the original AESTHEMOS instrument), followed by a qualitative phase of in-depth interviews. The researcher's objectives were twofold: (1) to establish if a sample of concertgoers could discern aesthetically between compositions generated by humans and AI and (2) how knowledge of AI use during the compositional process affects our aesthetic appreciation of the artefacts. The researcher partly hypothesised that participants could not discern aesthetically between human and AI-generated compositions because of current available AI technology (through machine and deep learning). However, when AI employment is disclosed, aesthetic responses to compositions yield a negative response. To test his hypothesis, the researcher engaged thirty concertgoers in Amsterdam, The Netherlands, to evaluate aesthetically five symphonic works via an online questionnaire. During the follow-up interview process, the AI generation of two of the five compositions was disclosed, and general attitudes toward AI creativity was probed. Using data analytic tools such as the Mann-Whitney U test, the researcher confirmed his hypothesis and concluded that participants interact aesthetically with AI-generated compositions if they appear to be human-composed. Transparency of AI involvement, however, affects the aesthetic value of AI-generated compositions. As AI weaves itself deeper into the human story, the familiarity of AI creativity will profoundly affect our notion of creativity, meaning and art creation of the future.

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ABBREVIATIONS AND ACRONYMS

AABS	Aural Activity-Based Study
AESTHEMOS	Aesthetic Emotions Scale
AI	Artificial Intelligence
AIVA	Artificial Intelligence Virtual Artist
DAW	Digital Audio Workstation
EDM	Electronic Dance Music
EMI	Experiments in Music Intelligence
GA	Genetic Algorithms
GEMS	Geneva Emotional Music Scales
ISC	International Science Council
MCAR	Missing Completely at Random
MP3	MPEG-1 Audio Layer III or MPEG-2 Audio Layer III
RIG	Research Information Gateway
SACEM	Société des Auteurs, Compositeurs et Éditeurs de Musique
SSL	Secure Sockets Layer
4IR	4th Industrial Revolution

CHAPTER 1: Introduction

It has now become a given that we are living in the information age where digital and computational technology has become integral to our daily activities and reached a point of indispensability. Our reliance on mobile technology to navigate from point A to B, access the latest news, monitor various health data and participate in the global digital community (social media) have become daily routine activities. We are at the beginning of a 4th industrial revolution (4IR) whereby the "boundaries between the physical, digital and biological worlds" are increasingly blurred and the use of artificial intelligence (AI), genetic engineering, quantum computing, and other technologies are disrupting our lives as we interact with our outer worlds (McGinnis, 2020).

As the researcher is conducting this study, we are in the midst a global pandemic of Covid-19 that has disrupted the global community resulting in great suffering, fear and anxiety. Technology, specifically artificial intelligence (AI) and machine learning, has aided with early diagnosis of Covid-19, tracking and development of potential therapies and vaccines. Vaccine development usually takes up to 10 to 15 years (*Vaccine Development, Testing, and Regulation | History of Vaccines*, n.d.). AI intervention employing deep learning technologies shortened the timeline for developing multiple Covid-19 vaccines to only one year. These deep learning algorithms, however, do not only sporadically impact our daily lives when we need them, but they are actually already running our lives (Du Sautoy, 2019, p. 40). As algorithms analyse and learn from the vast data we continuously generate through our digital interactions, they determine our likes and desires and influence our lifestyle choices such as movies, music, partners, politics and the like. Yuval Harari warns us of the power of AI:

> "A system that understands us better than we understand ourselves can predict our feelings and decisions, can manipulate our feelings and decisions, and can ultimately make decisions for us." (Harari, 2020)

Since AI pervades all aspects of our lives and we are witnessing its exponential growth, it is inevitable that AI will influence our decision-making as we increasingly interact with this technology. Even within the arts, a field once dominated by human creation, we now see a penetration of AI and deep learning (see Background, 1.1). Markus Buehler's *Viral Counterpoint to the Coronavirus Spike Protein (2019-nCoV)* (Buehler, 2020), in which he converted the SARS-CoV-2 Coronavirus protein data to music (ISC, 2020), is one such example bringing together of the disciplines of science and art using advanced data computational algorithms. Given that AI has become embedded in society, and thereby has caused

disruptive interventions in many spheres of life, including music and the performing arts, the researcher investigates our interaction with AI technology in the sub-field of music composition.

This chapter maps the way of this research which is about investigating the use of AI in music composition focusing on the quality of AI-generated compositions, the transparency of AI involvement (disclosure and non-disclosure) and the effect of AI employment on aesthetic value in general. This is relevant research, for we are on the brink of an explosion of AI technology which will dramatically impact how we consume and interact with art. As AI weaves itself deeper into the fabric of human life, will it ever truly communicate with humans through art? In the words of George Eliot:

> "Art is the nearest thing to life; it is a mode of amplifying experience and extending our contact with our fellow-men beyond the bounds of our personal lot" (quoted in Du Sautoy, 2019, p. 283)

1.1. Background

Since the Stone Age, humans have used technologies to give substance to their creative impulses. This natural urge to create, and the technologies that facilitate such creative output, exist "in a symbiotic, complex and continually evolving relationship" with each other (Agüera y Arcas, 2017, p.1). Consequently, as the nature of these technologies change through time, so too do the methods and output of our creative expression (Agüera y Arcas, 2017). As a composer and keyboardist, the researcher experienced this 'evolving relationship' between human creativity and technology through his initial engagement with synthesisers and drum computers in the late 1970s. Being accustomed to committing musical ideas with pencil and manuscript paper, his encounter with electronic technologies (analogue and digital) had a profound effect on his music creativity – it dramatically expanded his palette of artistic expression and infused novel methods and possibilities into his compositional processes.

Over the past decade, with the Atari and 486 computers assigned to a distant memory, the subsequent advancements of digital technology produced increasingly sophisticated tools for music creation. Its greater computational potential gave rise to advanced *Digital Audio Workstations* (DAWs) – software programmes and environments central to all aspects of music creation (composition, arranging and production). Contemporary musicians and composers rely on at least one of the many DAWs available as the software continues to influence and alter the landscape of music-making (DAWs – *Pro Tools*, *Logic X*, *Ableton Live 10*, *Presonus Studio One,* and the like). Other digital tools developed to assist musicians in the composition process include Avid's *Sibelius* notation software programme that assists

a user with orchestration and arranging, and software programmes such as *ORB Producer Suite*, *Melody Sauce* and *Chord Engine Genesis* that generate random melodies and harmonies (*Chord Engine Genesis 2.0 by ProduceRNB – Related Products*, n.d.; *Melody Sauce – Evabeat*, n.d.; *Music Notation Software – Sibelius – Avid*, n.d.; *ORB COMPOSER – AI for Music Composers*, n.d.). These algorithmic-based digital technology 'assistants' allow the creator/composer to focus on his/her musical narrative while the technology takes care of some or most of the technical demands. However, the decision on how the creative process finally unfolds ultimately remains fully under the composer's control. For the purpose of convenience the term composer, a defined role within the field of music, will be used generically to designate any creator or creatives within the music realm.

Recent advances in technology have brought the 'composer's prerogative' into question. In an age where humankind now every two days generates an amount of data which equals the sum of all the data we have generated from the beginning of civilisation until 2003, computer technology now has the advantage of 'deep-learning' on this vast amount of data through studying and training (Du Sautoy, 2019, p. 62). In 2016, for instance, a gaming computer programme, AlphaGo, defeated a 9-dan professional Go player for the first time by using deep learning capabilities (Deepmind, 2017). The software programme AIVA (Artificial Intelligence Virtual Artist) uses this same machine learning technology to create compositions through its deep analyses of the western musical canon (AIVA, 2020). In 2016, AIVA became the first artificially intelligent programme ever to be recognized by *SACEM* (*Société des Auteurs, Compositeurs et Éditeurs de Musique*) as an independent composer (AIVA, 2020). As our data output increases and technology becomes smarter, the use of AI in music creation becomes more ubiquitous. In 2018 Taryn Southern, an American musician, released her album 'I AM AI' to critical acclaim. All of the music on this album was composed by artificial intelligent software (Taryn Southern, n.d.). More artists are embracing AI technology (such as Holly Herndon, Ash Koosha and Dadabots), whereby the role of AI in music creation (assistant or independent creator), and the quality and nature of AI generated music, become interesting and necessary points of discussion (Musicians Are Using AI to Create Otherwise Impossible New Songs, n.d.).

Not only was AI's ability to drive creativity of interest to the researcher, but also the transparency surrounding the use of AI in the creative process. An important component of this study pivots around the disclosure and non-disclosure of AI involvement in the creation process and the effect it (knowledge of AI usage) has on aesthetic experience. The researcher's interest in the transparency of AI employment was sparked when he came across anecdotal evidence which suggests that human beings react differently to the output of AI creativity if the use of the technology has been disclosed.

One example of such an anecdotal episode involved a composition generated by a computer programme EMI, (Du Sautoy, 2019, p. 188). The computer-generated composition was included in the piano recital of lesser-known works by Johann Sebastian Bach. One music critic deemed this 'lesser known' algorithmic Bach composition as one of the "most beautiful pieces he'd heard in a long time", but after disclosure that it was generated by computer code changed his mind: it had "no emotion, no guts, no soul." (Du Sautoy, 2019, p. 189). Another recent example involves an exquisite painting painted in the style of Rembrandt by the computer programme The Next Rembrandt (Du Sautoy, 2019, p. 121). The AI-generated painting could easily be mistaken for an unknown original painting by Rembrandt van Rijn if the programmers were not transparent about the AI technology employed. One critic wrote: "[W]hat a horrible, tasteless, insensitive, and soulless travesty of all that is creative in human nature" (Du Sautoy, 2019, p. 121). The researcher wonders whether the critic would have been this harsh and vocal in his criticism if AI employment had not been revealed at all. Following the researcher's interest cited thus far, he plans to investigate a sample's response to the creative ability of AI in music creation and the effect of transparency of AI involvement on aesthetic judgement, thereby hoping to gain an understanding of society's attitude toward the ubiquitous use of AI in music creation of the 21st century.

Guiding his investigation, the researcher will consult literature on the themes of creativity, art and technology (specifically artificial intelligence) and their inter-relationship(s). Although this is an interdisciplinary study straddling music, computer science and cognitive science, the researcher's status as a musician (composer and pianist) leads him to an approach grounded in the music discipline. Furthermore, while he acknowledges that other traditions (African, Asian, etc.) make valid contributions to the field of music, his thinking and philosophy are rooted in the western tradition.

On the theme of creativity, three comprehensive texts on creativity were consulted – *The Cambridge Handbook of Creativity* (2010, 2019) by James C. Kaufman and Robert J. Sternberg, *The Philosophy of Creativity* (2014) by E.S. Paul, and Robert Paul Weiner's *Creativity and Beyond* (2000). The first two texts comprise a collection of essays by leading psychologists, researchers, philosophers and educators. From the literature, one observes firstly a shift from viewing creativity as an external force acting on or though human beings, to the perception of creativity as an internal mechanism part of our very nature as human beings. Secondly, our understanding of creativity is subject to change, just as the societies which grounded our thought on this topic are in a constant state of transformation. Thirdly, researchers concur that creativity, at the minimum, displays characteristics of novelty and usefulness, although what is meant by these terms remains ambiguous. And finally, the most objective lens through

which to understand the nature of creativity, specific to music composition, is to focus on the products (artefacts) of this creativity.

This brings us to the second theme in need of clarification, namely the product/artefact of creativity we call 'art'. The researcher references influential historical thinkers who laid the foundation for the 20th and 21st century's understanding of art, while simultaneously addressing the emergence of aesthetic judgment as indispensable to the nature of art debate. While Stephen David Ross's *Art and Its Significance: An Anthology of Aesthetic Theory* (Ross, 1984) and the compilation of essays in *The Routledge Companion to Aesthetics* edited by Berys Gaut and Dominic McIver Lopes (McIver & Gaut, 2002) form the researcher's foundation on the nature of art, it is the contribution of the Enlightenment philosopher Immanuel Kant, in his seminal work *Critique of Judgement,* that cements the researcher's understanding of the nature of art as an expression of aesthetic beauty (Kant, 1790 [1987]). This debate on the nature of art, however, is still ongoing as is evident in the researcher's review of the works of Arthur Danto (Danto, 1964), George Dickie (Dickie, 1969) and contemporaries such as Denis Dutton (Dutton, 2009), Stephen Davies (Davies, 2013), Annelies Monseré (Monseré, 2015) and Filippo Focosi (Focosi, 2016).

Lastly, the researcher explores the literature on artificial intelligence and its relationship to creativity. Aaron Hertzmann (2018), in his paper "Can computers create art?", attempts to answer this question with computational systems as his framework. Like Hertzmann (2018), Marcus du Sautoy (2019), Blaise Agüera y Arcas (2017), Simon Colton (2012), Margaret Boden (n.d.), Douglas Hofstadter (1999) and Michael F. Cohen explore this same question and revisit the debate on the nature of creativity and art. Margaret Boden concludes that AI can, in principle, exhibit transformational creativity, even though it has not achieved autonomous creativity yet (Boden, n.d., p. 13). The literature reveals that ultimately the programmer/coder acts as the original agent and that AI has not advanced (presently) enough to behave as such. Intelligent computers, however, do learn by mimicking human behaviour just as human beings, after all, receive genetic code from their parents, and through trial and error, internal and external influences, acquire new skills. These processes are evident in deep-learning AI software such as AlphaGo, but Margaret Boden "doubt[s] that AI will ever attain the full richness and subtlety of human thought and therefore human creativity. But it is not impossible in principle" (Boden, n.d., p. 11).

Although AI programmes can display varying levels of 'perceived creativity,' the literature still overwhelmingly considers human beings as the art creators. The researcher wonders, however, whether society in general even values this distinction between human and AI-generated art-creation at

all. We exist in an age of such technological integration where the individualistic aesthetics of the perceiver (consumer of art) is the central focus, and the question on the origin of the artwork is becoming of lesser importance. Given the positions presented thus far on creativity, art, and artificial intelligence, the researcher will attempt to test these perspectives through a mixed methods approach to ascertaining whether he agrees, disagrees, or finds limitations with the arguments presented in the literature.

1.2. Statement of Problem

The generality of computer technology in modern society is without dispute. Current global trends toward engaging with the 4th industrial revolution (4IR) give an indication that we are on an exponential curve regarding the prominence of technology, and that this is gaining momentum in all facets of our lives. Music and the performing arts have experienced highly disruptive interventions that have transformed the global music industry. Presently, AI's creative output dominates the digital landscape as never before. In music creation (see Background, 1.1.), AI is not only controlling more of the technical aspects of music production but is also actively increasing its role in the creative process itself. Where technology was historically viewed as a tool to aid the creator, the new technology of AI is morphing into becoming a creative partner and even advances toward being established as an autonomous, independent creator (Boden, 2004, p. 296). Furthermore, issues around the transparency of this AI employment in the creative process could impact how we meaningfully engage with art in the future. The researcher hopes that his focus on AI involvement in music creation will add to the growing literature on AI creativity and underscore the importance of investigating our inevitable, long-lasting interaction with this technology.

1.3. Purpose of the Study

Through this study the researcher explores the quality of AI's creative ability regarding its compositional output, and how the transparency (or lack thereof) of AI employment in music composition influences human aesthetic judgment. The study uses a mixed methodology drawing on both quantitative and qualitative research instruments. The researcher will engage a group of 30 concertgoing specialists in Amsterdam, The Netherlands, to aesthetically evaluate five symphonic compositions via a survey. After the AI nature of two of the compositions are revealed, he will conduct interviews to establish how this disclosed knowledge affects the research participants' aesthetic judgement. With this investigation, the researcher hopes to shed light on the quality, reception and understanding of musical composition in

light of AI creative intervention in western classical music of the twenty-first century. The researcher hopes that this research project can call for greater interest in AI-based composition, as well as create an interest in the relationship between AI and music as it manifests itself in other genres and between other cultures.

1.4. Importance of the Study

There has been a dramatic increase in our daily lives of interaction with AI technology. As we spend more time on the internet, AI algorithms are able to analyse our digital footprint and determine the nature of our political and religious persuasions, sexual orientations, habits, movie preferences and music tastes, not to mention having access to our most intimate health data. Every one of us has experienced how accurately Netflix and Google's YouTube algorithms can suggest the perfect next video to align with our tastes and worldviews. Marcus du Sautoy puts it succinctly in his book, *The Creativity Code* (2019):

> "If we want to retain a modicum of control over our lives, it is important that we understand how our emotions and political opinions are being pushed and pulled around by these algorithms, and how, given the same information, each will spin its own particular yarn, tailored to exploit our hang-ups and views" (Du Sautoy, 2019, p. 277)

Our interaction with AI, specific to its ability to reinforce our own beliefs and tastes, has profound influence on our perception of reality. We have witnessed an increased compartmentalisation of worldviews as it relates to, for example, politics (far-left vs. far-right) and health (vaccination vs. anti-vaccination) and the like. This increasing compartmentalisation of tastes also extends to our appreciation of art and music and has consequences for how we tell our stories, expand our horizons and understand our place in a diverse, complicated world. This study is important, for it confirms the inevitability and creative ability of AI, sheds light on our aesthetic interaction with AI creativity, and invites discussion of the implications of AI employment in our art creation of the future.

1.5. Theoretical Framework

Indispensable to this study are the notions of creativity, art, aesthetics and artificial intelligence as they are realised in the world of art. Creativity, art and aesthetics are particularly complex concepts to define and understand for two reasons; because they (1) exhibit a state of flux historically and (2) display an inter-disciplinary 'fluidity' as one moves through the fields of psychology, philosophy, cognitive science

and computational studies. While the evolution of these concepts (including artificial intelligence) is addressed in depth in Chapter 2, the researcher relied on three influential thinkers to structure his theoretical framework and help him solve his research problem. The researcher anchored his theoretical framework, by understanding the expansive themes of creativity, art, aesthetic and artificial intelligence through the works of the 18th-century philosopher Immanuel Kant (1724-1804), the mathematician Alan Turing (1912-1954), and the cognitive scientist Margaret A. Boden (1936).

Immanuel Kant, a philosopher of the Enlightenment, investigated how human beings relate to their outside world and constructed a philosophical system that explained a human being's relationship with his/her knowable universe. In his *Critique of Judgement* (1790),[1] Kant presented the perspective that a human being's relationship or interaction with the world of art (for this study, music composition) results in an aesthetic experience originating in the mind of the human or the perceiver (1790 [1987], p. 44). Kant's *Critique of Judgement* (1790) would become regarded as the "foundational treatise in modern philosophical aesthetics" (McIver & Gaut, 2002, p. 51), and yield a substantial influence on our modern theories on the nature of art. This statement is also true for this study, as Kant's view on the connection between the human mind and the object of art, and the ensuing subjective experience of beauty/aesthetics will serve as the philosophical underpinning in answering the research questions.

While Immanuel Kant addresses the nature of human beings' interactions with their outside world, both Alan Turing and Margaret A. Boden focus on the presence and use of artificial intelligence in our outside world and how we as human beings interact with this technology. Turing's essay *Computing Machinery and Intelligence* (1950), Boden's article *Creativity and Artificial Evolution* (Boden, n.d.), and her book *The Creative Mind: Myths and Mechanisms* (2004), are used to illuminate their thoughts and positions concerning AI, art and creativity. Alan Turing's importance to the study is his belief, already expressed in 1950, that computers could, and would in the future, imitate human beings. By creating his "imitation game", Turing anticipated the potential of artificial intelligence to match the human mind and to fool us into believing it is human: "[T]he reader must accept it as a fact that digital computers can be constructed, and indeed have been constructed … that [they] can in fact mimic the actions of a human computer very closely" (1950, p. 438). This ability of AI to mimic human creativity, and our interaction with this AI creativity, will be crucial in solving the research problem.

[1] Immanuel Kant's *Critique of Judgement* is not used in the original German-language but rather Werner S. Pluhar's translation (Kant, 1790 [1987]).

Lastly, the computer and cognitive scientist, Margaret A. Boden's understanding of machine creativity concludes the critical lens constructed from this triad of thinkers. She builds on the ideas of Alan Turing regarding AI capability and investigates the creative ability of artificial intelligence. Boden approaches her investigation of AI creativity through her curiosity about the nature of human creativity and how it functions, and comes to the conclusion that AIs are in principle, just like human beings, capable of the three kinds of creativity – combinational, exploratory and transformational (Boden, n.d, 2004). Therefore, Immanuel Kant's notion of aesthetics and art as a point of departure, combined with Turing and Boden's research into AI and computational systems, informs the researcher's understanding of this field. The researcher thus uses this lens to investigate how a concertgoing audience perceives art (musical composition) in our technologically integrated era.

1.6. Research Questions

In order to achieve the research objective of this study, a mixed methods approach is adopted. In a mixed methods research design, both the quantitative and qualitative research questions need to be advanced, in order to "narrow and focus the purpose statement" (Creswell & Creswell, 2018, p. 202). In this study, the primary and sub-research questions address a "mixing or integration of the quantitative and qualitative strands of the research" (Creswell & Creswell, 2018, p. 202).

The primary research question that underpins this is:

Within a portfolio of works, can a concertgoer discern aesthetically between compositions generated by humans and artificial intelligence?

This primary research question is built from the following research sub-questions:

1.1.1. Of what importance is the composer's intention in assimilating meaning from a composition?

1.1.2. What do contemporary concertgoers consider as essential aesthetic properties of a musical composition?

1.1.3. How do concertgoers view the involvement of AI in music composition (present-day/future)?

1.7. Methodology

Qualitative research constitutes an "approach for exploring and understanding the meaning that individuals or groups ascribe to a social or human problem", while a quantitative research approach focuses more on "numbered data" that can be "analy[s]ed using statistical procedures" (Creswell & Creswell, 2018, p. 41). This study's research problem involves the phenomenological concepts of aesthetics and art, that will be explored through a qualitative approach or lens due to the subjective nature of responses. However, the study will also comprise of a quantitative component to determine, by means of a survey, whether a purposive sample of concertgoers can discern aesthetically between human-composed and AI-generated compositions. Since this inquiry will involve the collection of both quantitative and qualitative data, this researcher combines both approaches by using a mixed methods approach (Creswell & Creswell, 2018, p. 41). The quantitative aspect is explored through an initial survey (the percentage – quantity) of concertgoers to determine aesthetic responses to human and AI compositions. This initial phase allows the researcher to probe different subjective reactions to the musical compositions in a subsequent qualitative aspect of the study.

The researcher brings a pragmatic paradigm to bear on his study, in which he focuses on the research problem and questions at hand by using "all the approaches available to understand the problem" (Creswell & Creswell, 2018, p. 48). The researcher partly makes use of a constructivist worldview, in the sense that "human beings construct meaning as they engage with the world they are interpreting" (Creswell & Creswell, 2018, p. 46). He also partly employs a postpositivist worldview, in that he believes that "numeric measure[s] of observation" in the study of the behaviour of individuals is possible (Creswell & Creswell, 2018, p. 45). This study centres around the phenomena of aesthetics and the nature of art, but also numeric observations of the phenomena in context of a purposive sample of concertgoers.

Research design:

This study focuses on how art is evaluated by a specialist segment of society using a mixed methods approach. This approach follows arts-based research, which combines a survey and focus group. Finlay defines arts-based research as a "… multimodal, cross-disciplinary, trans-disciplinary, and multidisciplinary methodology. … arts-based researchers are not limited by genre, and examples of arts-based research include music, drama and dance performances, visual arts…" (2018, p. 572). The survey, an instrument employed in quantitative studies, will be adapted to extrapolate qualitative

responses. According to Given, “[o]nline surveys and questionnaires provide an efficient way in which to document the views of large groups during a short period of time. The questions are posted on the web and include yes/no, all that apply, open-ended, and 5-point Likert-type scale questions” (2008, p.291).

The researcher refers to his approach as an Aural Activity-Based Study (AABS). Aural because it involves listening, activity because it requires active listening for the purpose of responding to a set of questions. He will construct his sample group based on the recommendations of Onwuegbuzie & Collins, who suggest a sample group of 21 participants for the quantitative component (questionnaire) and 3 to 10 participants for the qualitative part (interviews) as adequate to validate the study (Onwuegbuzie & Collins, 2007, pp. 288–289). In the survey component, a purposive sample of 30 symphonic concert-going specialists will be drawn from Amsterdam, The Netherlands. These specialists will be electronically sent five compositions in MP3 format to which they will be required to make value judgements on an online survey (see Appendix B). For the survey, the researcher designed his own questionnaire based on an instrument called AESTHEMOS designed by I. Schindler et al. (Schindler et al., 2017). The survey of Schindler et al. employs a Likert scale and probes aesthetic responses to aspects of creativity and music (Schindler et al., 2017, p. 18). The researchers used the Geneva Emotional Music Scales (GEMS) as a basis for their 24 aesthetic categories and divided them into four broader emotion groups, namely prototypical, epistemic, negative and self-forgetful emotions (Schindler et al., 2017, p. 16). The researcher of this study selected 12 aesthetic responses from these broader emotion groups, with the goal not to overburden and confuse the respondents with a too long and confusing questionnaire. The listener pack of the questionnaire consists of five compositions of which three compositions are human-composed and two compositions are generated by AI. The specialist sample will not be told of this distinction (juxtaposing AI with human-composed compositions). Results from this survey will be analysed using standard analytical tools including the non-parametric Mann-Whitney U test to compare the statistical differences between two groups (Nachar, 2008, p. 13).

The second focus group component phase of the research will follow the survey (see Appendix C). A qualitative interview involves “unstructured and generally open-ended questions that are few in number and intend(ed) to elicit views and opinions of the participants” (Creswell & Creswell, 2018, p. 263). This interview process focuses on capturing the participants’ meaning, opinions, and experiences and not the researcher’s views related to the topic (Creswell & Creswell, 2018, p. 258). The researcher’s focus group will comprise six participants selected from the specialist survey sample (Onwuegbuzie & Collins, 2007, pp. 288–289). Using interviews, the six participants will be approached to provide in-depth

descriptions to probe their survey responses to the AI and human compositions. At the commencement of this interview process, the participants will be told that two of the compositions in the survey phase were composed using artificial intelligence. The probing/questions (see Appendix C) that follow will be based on the artificially composed pieces to identify, qualitatively, whether the artificially composed works now alter their perception of the compositions and notions of aesthetics or whether it matters. This phase will be followed by thematic analysis of the responses to the interviews, to establish whether AI-generated creativity has now reached a point where its artefacts can be validated as art on par with human creativity and notions of aesthetics.

1.8. Location of the Study

The current Covid-19 international lockdown measures for social distancing and restrictions on personal movement have resulted in the researcher refocusing critical aspects of data gathering for his study. A crucial aspect that impacts this study relates to the location. He resides temporarily in Amsterdam, The Netherlands, and it remains unclear as to when international or local travel restrictions will be eased. Given the current mobility restrictions, this study will be conducted among a sample extracted from the concert-going audience in The Netherlands. The population that will be used in this study will be drawn from the symphonic concert-going audience in and around Amsterdam.

1.9. Anticipated Problems/Limitations

The data will be collected online, and via semi-structured interviews, meaning that positions of power could constitute a limitation of this study. This will be mitigated, as far as possible, in discussions with the participants and in explaining that the researcher is interested in their honest responses rather than a reply that they might view as being preferential or pleasing to the interviewer. This will pose less of a limitation in the selection of participants from the Netherlands where they will/may know the researcher from afar as a musician, but will not have experienced the interviewer as a researcher.

Ethical issues in this study will be addressed by gaining the necessary ethical Humanities and Social Science Research and Ethics Committee clearance from University of KwaZulu-Natal (see Appendix N). All of the participants will be informed of the purpose of the study (Appendix E), will be asked to complete a consent form (Appendix D) and will be able to withdraw their participation at any time. As withdrawal also constitutes a possible problem in the data collection process of this study, more participants will be selected than necessary to mitigate against the eventual withdrawal of some.

Anonymity will be maintained by assigning self-selected pseudonyms to each of the participants. Personal information will be excluded in the study. All of the participants will be informed of their right to withdraw from the study at any stage. All of the data and interview recordings will be stored in the Cloud in a password-protected folder. The researcher has further assured all participants that he will make the results of his research available to all participants electronically.

1.10. Chapter Outline

After the introduction, background and overview of this thesis (Chapter 1), the researcher will proceed with the literature review (Chapter 2), where he will probe the literature on the concepts of creativity, the nature of art, aesthetics and artificial intelligence as it relates to creativity. The researcher will identify the importance of the product of creativity and the internal process of human beings as the primary assessment of art. He further investigates the literature on AI's creative ability and its dynamic role in the creation of art. In Chapter 3 the researcher will provide his theoretical framework, which is shaped by the views of three thinkers. The three thinkers' perspectives serve as the theoretical lens for the fundamental concepts of his study – aesthetics, art, creativity and artificial intelligence. He will show how aesthetic judgement of the perceiver (as explained by Immanuel Kant), the potential of AI to appear human (the contribution of Alan Turing), and the conclusion that AI can appear creative (research by Margaret A. Boden) will allow him to draw his conclusions in his research. Following his theoretical framework, the researcher will explain the methodology (Chapter 4) that he will employ in his research. In Chapter 4 he will lay out his mixed methods approach, the construction of his quantitative and qualitative instruments, and his choice of the Mann-Whitney U test for analysis. Chapter 5 (Data and Analysis) will unfold by presenting the data gathered during both phase 1 (quantitative) and phase 2 (qualitative). He will address issues on missing data, Likert scale analysis, and discuss the results of the Mann-Whitney U test in the quantitative component and the results of the interview process. Lastly, in Chapter 6 the researcher will present his conclusions and final thoughts. Here he supports his (quantitative) hypothesis that concertgoers cannot aesthetically discern between AI and human-generated compositions and qualitatively demonstrates that any knowledge of AI involvement will affect aesthetic judgement negatively.

CHAPTER 2: Literature Review

In this chapter, literature exploring the various dimensions of the research question and objectives of this study are reviewed. The notion of aesthetics as addressed in the research question, is complicated and difficult to uncouple from the related concepts of creativity and the nature of art. Thus, this chapter, though extensive, attempts to provide context to our present-day understanding of aesthetics. The themes covered are expansive and this therefore contributes to the unusual length of this chapter. This review commences with an overview of the concept of human creativity, as well as the historical development and the theoretical approaches of our present-day understanding of creativity. Thereafter the idea of art as the product of this creativity follows with a brief history of art, the emergence of aesthetics in our knowledge of art, and the various theories formulated in the 20th and 21st centuries to identify art. The review concludes with literature on the emergent technology of AI in art creation, its parallels with the technology of photography, examples of AI programmes in art creation and the question of whether AI can be creative at all. From this literature review, key themes, ideas and developments will be extracted that are used to shape the research design, theoretical framework and subsequently inform the research methodology and methods used in this study.

2.1. Creativity – a historical overview

The body of literature on the concept of creativity is vast and it would be premature to claim that a comprehensive overview of this literature is possible in such a study. Thus, the limitation on literature around creativity is explored from the perspective of an artist (musician). Some of the critical thinkers' views are examined to get a sense of the evolution of the concept and its relation to art, more especially its relevance to music. Three comprehensive texts on creativity are *The Cambridge Handbook of Creativity* (2010, 2019) by James C. Kaufman and Robert J. Sternberg, *The Philosophy of Creativity* (2014) by E.S. Paul, and Robert Paul Weiner's *Creativity and Beyond* (2000). The first two texts comprise a collection of essays by leading psychologists, researchers, philosophers and educators. The section below reviews their essential contributions.

In *Creativity: A Historical Perspective*, Glăveanu and Kaufman assert that creativity must be studied within the "social, scientific, technological, economic, and political context" of its time (Glăveanu & Kaufman, 2019, p. 9). They go on to add that any attempt to isolate creativity from its immediate historical connections would make its study impossible (2019, p. 9). Creativity is thus embedded within societies which have been continuously changing and evolving – they are in a state of flux and this

state of changeability is also mirrored by our dynamic understanding of creativity across time (2019, p. 9). Therefore, to explore creativity historically, one must be aware, firstly, that one's modern interpretation of creativity is different from that of earlier societies. Secondly, one must be cautious against superimposing one's modern concepts historically (2019, p. 9). Glăveanu and Kaufman thus conclude that due to our dynamic understanding of creativity throughout history, "there is no single, unitary, and final history of creativity to be told" (2019, p. 10).

Exploring recorded history highlights the contrast of the modern understanding of creativity and the historical perception of the concept. Creativity, in the first few centuries of recorded history, did not apply to creativity as a human activity at all, but was solely "associated with God and the generative powers of nature" (Kaufman & Sternberg, 2019, p. 10). Robert Weiner, in *Creativity and Beyond*, explains that in Genesis, the first book of the Hebrew bible, God is portrayed as the ultimate Creator who created heaven and earth ex nihilo (Weiner, 2000, p. 26). Human beings (made in God's image) on the other hand, could only take part in His creativity by obeying His commandment to be "fruitful and multiply" (Weiner, 2000, p. 26). Weiner indicates further limitations and "moral prohibitions on human creativity" by referencing the second commandment (Ex. 20:1-6): "Thou shalt not make unto thee a graven image, nor any manner of likeness of anything that is in heaven above, or that is in the earth beneath" (Weiner, 2000, p. 27). Human creativity was, in a sense, derivative and restricted by God's rules: "it is only because we are God's creatures that we can create anything at all, and all our creations simply rework the stuff of the original creation within the limits God has established" (Weiner, 2000, p. 26).[2]

Extending the discussion on divinity, Dean Simonton, in *The Philosophy of Creativity* (2014), expounds that even the early Greeks had a tempered and subordinate understanding of human creativity when compared to the creativity of the gods (Paul, 2014, p. 248). In Greek mythology, Zeus, the most powerful among the pantheon gods, fathered nine daughters who each, in turn, presided over the nine domains of creativity (poetry, music, dance, and the like). Each of the daughters was the Muse (guiding spirit) of her domain and a source of inspiration to human creativity (2014). In *The Philosophy of Creativity* (2014) Elliot S. Paul says: "Plato has Socrates say (in certain dialogues) that when poets produce truly great poetry, they do it not through knowledge or mastery, but rather by being divinely 'inspired' breathed into – by the Muses, in a state of possession that exhibits a kind of madness" (Paul, 2014, p. 3).

[2] Critique of Wiener's claims are beyond the scope of this dissertation.

During the Middle Ages, the notion of creativity as an external force and its association with the divine represented the dominant way of thinking. The idea of creativity relocated to being a human attribute with the rise of technology, specifically the invention of the printing press which "led to an unprecedented ability to transmit ideas and gain new knowledge" (Kaufman & Sternberg, 2019, p. 13). According to Weiner, new technological inventions, the discoveries of new worlds and an increasing interest in science was the driving force behind the eagerness for knowledge. The latter resulted in "earth and sun switch(ing) places: now interest can revolve around the worldly creators more than around their creations, the world, or even the divine. Now, in ways never attained before in the West, individual creators were recognized and revered" (Weiner, 2000, p. 63). The shift to a more heliocentric view of the universe combined with increasing world exploration and the diminishing power of the Catholic Church is also reflected in the art of the time: Leonardo da Vinci's technical drawings and Albrecht Dürer's realistic paintings are evidence of the changing subject matter and the movement away from the late Middle Ages (ca. 1250 – 1500) iconography of Jesus, Mary and the saints, to portraits of the rising bourgeoisie (Weiner, 2000, p. 63). The artist himself became the object of his paintings, and we notice the subsequent rising cult of the creative individual (Weiner, 2000, p. 63).

The Enlightenment (ca. 1715 – 1789) brought about a new, radical understanding of creativity with a belief in the power of human reason and our ability to transform the world through scientific and technological development, rather than placing creativity solely in the realm of religious doctrine (Kaufman & Sternberg, 2019, p. 13). Now, according to Weiner, "no stone would be left unturned, all realms would be open to investigation, to analysis, to experimentation, to reinterpretation, to discovery" (Weiner 2000, p. 70). In this regard, Charles Darwin's *On the Origin of Species* (published 1859) gained wide acceptance and "reinforced the theory of evolution and the increasing focus on historical change and individual creativity" (Weiner, 2000, p. 85). Weiner continues: "whether creativity was the doing of God, it seemed to be part of the natural process, and it was surely visible in human effort" (Weiner 2000, p. 85).

According to Weiner, research into creativity intensified after World War II, when the abstract noun "creativity" became included in standard dictionaries (Weiner, 2000, p. 89). He points out that "now attention could be directed to a phenomenon, capacity, or characteristic noticeable in many dimensions of human endeavor" (2000, p. 89). Paul, in *The Philosophy of Creativity* (2014), notes that research on creativity blossomed after J.P. Guilford's presidential address in 1950 at the American Psychological Association. This address called for research on 'creativity', resulting in a surge of popular writings on

this subject and a growing number of undergraduate and graduate courses devoted to the psychology of creativity (Paul, 2014, p. 5).

With this brief historical overview of creativity, the gradual shift of our understanding is apparent – creativity migrates as an activity attributed to external forces, namely, the gods, toward an internal, natural activity inherent to being human.

2.2. Creativity – some theoretical approaches

Kaufman and Sternberg et al., in their chapter "*The Neurobiological Foundation of Creative Cognition*", state that what "counts as 'creative' is not so easily defined" (Kaufman & Sternberg, 2010, p. 217). Gregory Feist, in *The Function of Personality in Creativity*, agrees and adds that "as a long-time creativity researcher, I often hear, especially from artists, that creativity is inherently unknowable, mysterious, and immeasurable" (Feist, 2010, p. 113). These perspectives lead to several competing theories as to what being "creative" means and what "creative" output should resemble. Among these competing theories, however, there is consensus that for creative thought or behaviour to be present, it "must be both novel/original and useful/adaptive" (Feist, 2010, p. 114). Thus, these multiple perspectives unpack the various forms of creativity possible – in architecture, music, poetry, drama, painting, coding, numerous ways of problem-solving (interpersonal to mathematics), everyday cleverness, business and product innovation, health research, and the like. Given the diversity of perspectives and the nature of the field explored in this research, the discussion is limited to the discipline of music, more specifically, music composition – composers composing music. In most societies the art of composing music is deemed a highly creative process – it involves an individual to express in abstract terms, using simple tools, complex cognitive processes and thought, resulting in a collection of sounds in the form of a composition.

In creativity research, Aaron Kozbelt et al. in *Theories of Creativity,* identify four aspects or facets of creativity and refer to them as the four P's; namely *process*, *product, person* (or personality) and *place* (Kozbelt et al., 2010, p. 24). Given the stated objectives of this research, only the first two aspects of creativity, namely *process* and *product* are deemed relevant. Focusing on the creative person or personality, although impressive, is not essential to the research problem investigated here, since the researcher is not looking at traits in groups of people to indicate creative potential. Theories, however, that focus on the creative *process* are more relevant to this study, since they aim "to understand the nature of the mental mechanisms that occur when a person is engaged in creative thinking or creative

activity" (Kozbelt et al., 2010, p. 24). Important issues addressed through this lens are the roles of the conscious versus unconscious and the "evaluative processes during the process of creation" (Kozbelt et al., 2010, p. 24).

Furthermore, in light of the research objectives of this study, the approach to understanding creativity also focuses on the products of creativity: musical compositions, works of art, publications, inventions, and the like. This latter approach, of defining creativity by focusing on the product or artefact, is referred to by Jonathan Plucker and Matthew Makel in *Assessment of Creativity,* as the "golden standard" of creativity assessment (Plucker & Makel, 2010, p. 59). Kozbelt emphasizes the quantitative objectivity of this approach for assessing creativity, since the objects are available for viewing or judging. Plucker and Makel agree and expound: "… a case can be made that the ability to measure a product's creativity is among the most important aspects of creativity assessment" (Plucker & Makel, 2010, p. 58). Seana Moran reinforces this idea in *The Roles of Creativity in Society*, by referencing L.S. Vygotsky – "creativity is the construction and synthesis of experience-based meanings and cognitive symbols embodied in cultural artifacts" (Moran, 2010, p. 84). Moran continues: "[T]he purpose or intention [of creativity] is to make meaning. The individual understands something in a personally significant way and shares that meaning through some type of product" (Moran, 2010, p. 82).[3]

From the above discussion on theoretical approaches to creativity, one observes, firstly, a move from a view of creativity as an external force acting on or through human beings, to the perception of creativity as an internal mechanism that is part of our very nature as human beings. Secondly, an understanding of creativity is subject to change just as our societies, which ground our thought on this topic, are in a constant state of transformation. Thirdly, researchers concur that creativity, at the minimum, displays characteristics of novelty and usefulness, although what is meant by these terms remains ambiguous. And finally, the most objective lens through which to understand the nature of creativity about music composition is to focus on the products (artefacts) of this creativity.

2.3. Art: The Product

Is this art? Standing in the Rijksmuseum in Amsterdam, admiring Rembrandt's *The Night Watch* (1642) painting or experiencing Mahler's *Symphony No.2 "Resurrection"* (1888 – 1894) at the Concertgebouw just a few hundred meters down the road, an answer to this question would probably be

[3] The issue of creativity is a broad discussion that has been explicated by various scholars in *The Cambridge Handbook of Creativity* (Kaufman & Sternberg, 2010, 2019). The researcher only engages with those aspects relevant to this study.

overwhelmingly uncontroversial and positive to a homogenous European concertgoing audience. What about stacked Coke cans, graffiti, a piece of driftwood, whale sounds or even paint doodles by zoo animals? Various theories on the nature of art have been formulated over time to address the question of what art is. What follows in the section below is an overview of essential theories espoused over the last century. The section commences with referencing influential historical thinkers who laid the foundation for the 20th and 21st century's understanding of art, while simultaneously addressing the emergence of aesthetic judgment as indispensable to the nature of art debate. Stephen David Ross's *Art and Its Significance: An Anthology of Aesthetic Theory* (Ross, 1984) and the compilation of essays in *The Routledge Companion to Aesthetics*, edited by Berys Gaut and Dominic McIver Lopes (McIver & Gaut, 2002), form the foundation for exploration of the nature of art. In order for one to get a clear understanding of what art is, is problematic today. The debate on art's definition is still ongoing. The latter becomes evident in the review of the works of Arthur Danto (Danto, 1964), George Dickie (Dickie, 1969) and contemporaries such as Denis Dutton (Dutton, 2009), Annelies Monseré (Monseré, 2015), Filippo Focosi (Focosi, 2016) and Stephen Davies (Davies, 2013, 2018). The ideas of the scholars stated thus far are explored to reflect on the nature of art and aesthetics in the section that follows.

2.4. The Emergence of Aesthetics: an overview

Christopher Janaway, in *Plato*, suggests that Plato's writings on art and aesthetics are "the earliest substantial contribution to the subject" (McIver & Gaut, 2002, p. 3). In Book X of *The Republic*, Plato associates art with the act of imitation (mimesis). Janaway explains that: "… mimesis is far removed from truth, though easy to mistake for the work of someone with knowledge, and (that) mimetic poetry appeals to an inferior part of the soul and thereby helps to subvert the rule of intellect and reason" (McIver & Gaut, 2002, p. 5). In *Art and Its Significance*, Ross agrees that by criticising art as 'mere' imitation, Plato warns of art's potential to undermine our capacity to know reality and gain actual knowledge (1984, p. 8). Ross expounds: "[I]n contemporary terms, this is the question of why we should waste our time with art when we can spend it pursuing knowledge of the world" (1984, p. 8). Aristotle's writings had a less harmful perspective on art as imitation. In his discussion of poetry, Aristotle acknowledges that imitation has inherent value (as good) and leads to what Ross interprets as the "emotional gratifications we receive from poetry" (1984, p. 68).

The perception of art through imitation was seen as being valuable and good, and continued through to the medieval period (ca. 467 – 1453). According to Joseph Margolis, in *Medieval Aesthetics*, medieval philosophy was overridden with "concern with the conceptual relationship between the Creator and

Creation" (McIver & Gaut, 2002, p. 27). St. Augustine, for example, was influenced by the Platonic idea of mimesis. Still, he saw human art as exceeding mimesis and being "symbolic of the higher meaning of God's art" (McIver & Gaut, 2002, p. 30). Margolis continues: "[I]t also provides the meaning of Augustine's question and answer, '[I]s a thing beautiful because it pleases or does it please because it is beautiful?' Clearly, '[I]t pleases because it is beautiful.'" (McIver & Gaut, 2002, p. 30). Margolis asserts that Thomas Aquinas, another Medieval philosopher, thought that "beauty and its perception and the pleasure taken in the thing perceived … are keyed to the formal essence of the things in question" (McIver & Gaut, 2002, p. 34). Aquinas, in his *Summa Theologiae* (First Part, Question 39, Article 8), states that "beauty demands the fulfilment of three conditions: the first is integrity, or perfection … the second is proper proportion or harmony … and the third is clarity – thus things which have glowing color are said to be beautiful" (cited in McIver & Gaut, 2002, p. 34).

The link between objects of art and their beauty has been present in early Western civilisation. James Shelley asserts, however, in *Empiricism*, that the concept of 'art' and 'aesthetics' (study of the nature of beauty) and their connection only came into its own in the 18th and 19th centuries (McIver & Gaut, 2002, p. 37). The British aesthetician, Francis Hutcheson, had the idea that we take pleasure in an object of beauty through our 'internal senses', since the source of the pleasure of beauty resides both in the object itself and within us as human beings (McIver & Gaut, 2002, p. 39). David Hume further emphasises the connection between items of art and our internal processes. He argues that in the evaluation of art, our taste (of what is beautiful) is primary (Ross, 1984, p. 81). Ross explains Hume by stating that there is "no authority beyond taste for the evaluation of works of art. A standard of taste, however, can be derived from the workings of the mind" (Ross, 1984, p. 81). With the arrival of Immanuel Kant's *Critique of Judgement,* the gradual transition from the importance of the external (the object) to the internal (the mind) in the contemplation of art becomes solidified (Kant, 1790 [1987]).

Immanuel Kant, a prominent thinker of the Enlightenment, expounds in his *Critique of Judgment*: "but if the question is whether something is beautiful … we judge it in our mere contemplation of it" (Kant, 1790 [1987], p. 45). For Kant, according to Donald Crawford in his essay "Kant", the judgment of taste is fundamentally a judgment of whether something is beautiful or not (Crawford, 2002, p. 52). The pleasure we experience from this beauty is merely 'contemplative' and "not based on any interest in the existence of an object" (Crawford, 2002, p. 53). Crawford further adds that this judgment of beauty is based on some human feeling or experience that, although it appears to be subjective, is actually a collective, universal experience (Crawford, 2002, p. 54). Ross explains this simultaneous subjective and universal character of the judgment of beauty by referring to Kant, who believed that, "although

subjective, judgments of beauty must be universal, shareable by everyone who possesses good taste" (quote by Ross, 1984, p. 98). Whether this subjective, internal process of assessing art is universal or not, thinkers following Kant, such as G.W.F. Hegel, understood art's purpose as developing the mind (McIver & Gaut, 2002, p. 67). Friedrich Nietzsche viewed art as disseminating the meaning of life (McIver & Gaut, 2002, p. 78), thereby emphasising internality by locating the judgment of art in the mind of the perceiver. Leo Tolstoy declares in *What is Art* that "[T]he activity of art is based on the fact that a man [is] receiving through his sense of hearing or sight another man's expressed feeling …" (Ross, 1984, p. 180).

As with the earlier overview of creativity, there seems to be, at least historically, a transition from the external (the object) to the internal (the mind) in our contemplation of art. This overview emphasises a shift in our understanding of art as external – an imitation/representation – to art as an internal process within the mind of the perceiver as he/she engages with the artefact. An attempt to counterbalance this subjective notion of aesthetics with more observable, objective and concrete criteria in contemplating art gave rise to the attempt to construct definitions of art in the last hundred years.

2.5. Towards a definition of Art in the 20th and 21st century

In attempting to define art, Clive Bell makes the following observation in his book *Art* (reprinted in part by S.D. Ross in *Art and Its Significance* (1984)): "[I]t must be replied that any system of aesthetics which pretends to be based on some objective truth is so palpably ridiculous as not to be worth discussing. We have no other means of recognizing a work of art than our feeling for it" (Ross, 1984, p. 189). Monseré agrees with Bell that a definition of art is elusive because of our aesthetics in engaging with art: "Usually, they [philosophers] try to formulate a definition of the concept of art. This methodology seems to imply that the concept of art is a shared concept that is implicitly known to us and, correspondingly, that we all have the same or highly similar intuitions on what is art and what is not … [S]ome philosophers perceive the disagreement so deep, that they consider the whole project to be pretty hopeless" (Monseré, 2015, pp. 159–160). Stephen Davies agrees with Bell and Monseré's misgivings about establishing a comprehensive definition of art, since defining art in terms of aesthetic properties is subjective – the aesthetic properties are "conceived as internal, perceptible, non-relational features" (Davies, 2013, p. 215). Davies, however, still believes in the possibility of a workable definition of art and in his essay "Definitions of Art", where he investigates the various proposed definitions of art of the 20th and 21st centuries (Davies, 2013). Davies identifies two broad categories of art definitions which he refers to as procedural and functional definitions of art (Davies, 2013, p. 215). Procedural

definitions emphasise relational properties concerning the process or formula of how the artwork came into being, while functionalist explanations focus on the aesthetic experience of the artwork (Davies, 2013, p. 215).

Arthur Danto, for example, leans more to a procedural approach in defining art when he declares, in *The Artworld*, "to see something as art requires something the eye cannot decry – an atmosphere of artistic theory, a knowledge of the history of art: an artworld" (Danto, 1964, p. 580). Danto tests the vigour of his definition by tackling unconventional and controversial art such as Andy Warhol's exhibition of Brillo cartons at the Stable Gallery in 1964 (Danto, 1964, p. 580). He asks the question of how one distinguishes Warhol's Brillo cartons as 'art' but the same Brillo boxes in the stockroom of a shop as not? He explains that: "[W]hat in the end makes the difference between a Brillo box and a work of art consisting of a Brillo Box is a certain theory of art. It is this theory that takes it up into the world of art and keeps it from collapsing into the real object which it is" (Danto, 1964, p. 581). George Dickie extends Danto's 'artworld definition' when he states "[A] work of art…is (1) an artifact (2) upon which some society or some sub-group of a society has conferred the status of candidate for appreciation" (Dickie, 1969, p. 254). Dickie cites Marcel Duchamp's urinal christened 'Fountain' and justifies it as an artwork, since "Duchamp's act [of creating the artwork and exhibiting it] took place within a certain institutional setting and that makes all the difference" (Dickie, 1969, p. 255). He uses this same criterion of "it all depends on the institutional setting" in explaining why the paintings of Betsy the chimpanzee from the Baltimore Zoo would not be considered art if it were displayed by the Natural History Museum in Chicago. Still, it probably would be appreciated as art if it were exhibited by the Chicago Art Institute (1969, p. 256).

Functionalist definitions of art, on the other hand, emphasise the aesthetic experience as the defining criteria in classifying an artefact as art (Davies, 2013, p. 215). Filippo Focosi, in *Another Artworld Is Possible* (2016), explains his functionalist approach in defining art. He elucidates how the formal aesthetic properties of artworks, especially ones that have "remarkable expressive qualities", can lead to an aesthetic experience, whereby the perceiver recognises and appreciates the realisation of these qualities (in an object) as beautiful (Focosi, 2016, p. 92). He goes on to suggest a definition that "an artifact (object or performance) is a work of art if and only if it possesses, by virtue of an intentional act on the part of a given agent, a sufficient degree of interpenetration of form and content, so that an experience with a marked aesthetic character is prompted in the sensitive perceiver" (2016, p. 93). Focosi continues that "we can assign an artistic merit to it (artefact) only if such an overarching experience proves to be aesthetically rewarding, that is, if it fully engages and promotes the

harmonious interaction of all our mental capacities" (Focosi, 2016, p. 93) and "sensuous perception, informed by cognition, enlarged by imagination and prompting emotional responses" (Alan Goldman's "The Broad View of Aesthetic Experience", cited in Focosi 2013, p. 233).

In *The Art Instinct: Beauty, Pleasure and Human Evolution* (2009), Denis Dutton seems to attempt an all-inclusive theory of art bridging the procedural and functional approaches to defining art, by proposing a 'cluster theory' of art consisting of twelve criteria focusing both on Danto's 'artworld' and (aesthetics) experiences of art (Dutton, 2009, p. 51). Dutton lists the twelve criteria as (1) direct pleasure, (2) skill and virtuosity, (3) style, (4) novelty and creativity, (5) criticism, (6) representation, (7) special focus, (8) expressive individuality, (9) emotional saturation, (10) intellectual challenge, (11) art traditions and institutions and (12) imaginative experience (Dutton, 2009, pp. 52–59). Of the twelve criteria, it is clear that the criteria of 'style,' 'criticism' and 'art traditions and institutions' emphasise a more procedural/artworld definition of art, while the criteria of 'direct pleasure,' intellectual challenge,' and 'imaginative experience' favour an aesthetic/functionalist approach to defining art. Dutton though does not specify how many of the criteria need to be present to justify an object as a work of art, and thereby seems (firstly) to undermine his attempt of a definition of art and (secondly) to demonstrate how elusive a comprehensive explanation of art turns out to be (2009, p. 61).

Given the discussion in the overview above, it is apparent that our attempts to define art are as fluid as art itself. Even art lovers, art critics and philosophers cannot agree on what classifies as art. If we favour a procedural approach to art, then it is crucial and also relevant to remind ourselves that we now live in a technological age. This is an epoch where the internet is our constant companion and a "virtual artworld" which continuously and relentlessly exposes us to new artefacts. The perceiver's interaction with artefacts is immediate (the mobile phone is one such example) and the perceiver's aesthetic experience is instant, primary and paramount. Immanuel Kant's notion of art as a subjective aesthetic experience (viewed as universal) would be an ideal point of departure – given the times we live in and the backdrop of this research. In fact, as the importance of an aesthetic experience in experiencing art is of primary concern, the various structured art theories or approaches (whether Danto's 'artworld', the cluster theory of Dutton, or even Focosi's formal aesthetic definition) are of little value in a highly technologised and technology-mediated world. George Dickie, in *Defining Art*, ends by saying: "[N]ow what I have been saying may sound like saying, 'a work of art is an object of which someone has said, 'I christen this object a work of art.' And I think it is rather like that" (Dickie, 1969, p. 256).

2.6. Artificial Intelligence and Art

The notion of art in the 20th and 21st centuries cannot be understood in isolation from the technical capabilities of the cultures who produce these art objects. What follows in the next section, is a brief historical overview of technology in art creation (specifically photography), culminating in an investigation of AI as the rising dominant technology in our creative processes of today.

2.6.1. Technology in Art

In the literature on artificial intelligence and art creation, the work of Blaise Agüera y Arcas (Agüera y Arcas, 2017) and Aaron Hertzmann (Hertzmann, 2018) are used for the overview of the earlier technology of photography. Following this overview are specific examples of the application of artificial intelligence in art creation by Harold Cohen (1995), David Cope (1989), François Pachet (2003), Simon Colton (2012), and Gaëtan Hadjeres (Hadjeres et al., 2017). In discussing artificial intelligence and its relation to art creation, the essays contained in *Computers and Creativity* edited by Jon McCormack and Mark d'Inverno (2012), Alan Turing (Turing, 1950), Douglas R. Hofstadter (Hofstadter, 1999), Margaret A. Boden (Boden, 2004) and Marcus du Sautoy (Du Sautoy, 2019) are used as the point of departure. One of the challenges in reviewing literature relating to artificial intelligence is the use of diverse terminology. Thus, terms such as "machine intelligence", "machine learning", "computer intelligence", "intelligent algorithms" and "intelligent programmes" refer, for the purposes of this composer-based inquiry, to the same thing/phenomenon.

Blaise Agüera y Arcas proclaims in *Art in the Age of Machine Intelligence* (2017) that "[A]rt has always existed in a complex, symbiotic and continually evolving relationship with the technological capabilities of a culture" (Agüera y Arcas, 2017, p. 1). Agüera y Arcas lists the invention of applied pigments, the printing press and photography as examples of technological capabilities that profoundly influenced art creation and reshaped our communities (2017, p.1). She goes on to predict that artificial intelligence will have a profound effect on how we create art in the future, and that it will "ultimately transform society in ways that are hard to imagine from today's vantage point" (Agüera y Arcas, 2017, p. 1).

In *Can Computers Create Art?* (2018), Aaron Hertzmann suggests that we look at the earlier innovation of photography(1839) and its subsequent impact on art creation, to gain a perspective on how artificial intelligence might transform art in the future (Hertzmann, 2018, p. 3). Before the invention of photography, artists focused on producing realistic images of the world, and these "technical skills of

realism were inseparable from other creative aspects" (Hertzmann, 2018, p. 4). Such skills for producing realistic portraits were in great demand among the wealthy and aristocrats, who, much like people today, enjoyed having portraits of themselves, their families and ancestors adorn the walls in their houses (Hertzmann, 2018). The skill of creating realistic portraits, however, was jeopardised by the arrival of two photographic processes invented in 1839, namely, the daguerreotype and the negative-positive process (Hertzmann, 2018). These inventions of photography would become the primary medium for producing realistic images, which led painter Paul Delaroche to declare: "[F]rom today, painting is dead!" (Hertzmann, 2018, p. 3). Henri Le Secq reinforces Delaroche's declaration that: "[O]ne knows that photography has harmed painting considerably, and killed portraiture especially, once the livelihood of the artist" (Hertzmann, 2018, p. 4).

While some artists rejected the new photography technology, others embraced it and with their good artistic eye and painting skills moved into the 'new world' of art photography (Agüera y Arcas, 2017, p. 3). Then there was a group of artists who, despite being confronted with photography, persisted as painters. They, however, abandoned figurative painting and attempted to discern new techniques of expression through painting (Agüera y Arcas, 2017, p. 3). Cubism is an example of such a new approach to painting. David Hockney explains that "[F]aced with the claim that photography had made figurative painting obsolete, the cubists performed an exquisite critique of photography; they showed that there were certain aspects of looking – basically the human reality of perception – that photography couldn't convey, and that you still needed the painter's hand and eye to convey them" (Hockney cited in Agüera y Arcas 2017, p. 3). Aaron Hertzmann concludes that "[I]t seems likely … that photography was one of the main catalysts of the Modern Art movement: its influence led to decades of vitality in the world of painting, as artists were both inspired by photographic images and pushed beyond realism" (Hertzmann, 2018, p. 6).

The history of photography and its impact on art creation is indicative of how artificial intelligence could affect art creation today and beyond (Hertzmann, 2018, p. 6). Just as photography, a mechanical process, vied for the attention of creative artists, so too does another mechanical process, artificial intelligence, as the relevant technology of today (Hertzmann, 2018, p. 6). While photography breathed life into the art of painting and pushed the art form into new directions, Hertzmann suspects that the same will happen with artificial intelligence: "[W]henever there is controversy in AI as an artistic tool, I predict the same trajectory (as photography). Eventually, new AI tools will be fully recognized as artistic tools; AI tools may stimulate traditional media as well, e.g., the New Aesthetic" (Hertzmann, 2018, p. 8).

2.6.2. Artificial Intelligence – Background

Douglas Hofstadter explains what artificial intelligence is by saying it is something that "c[ame] into existence at the moment when mechanical devices took over any task previously performable only by human minds" (Hofstadter, 1999, p. 601). In 1837 Charles Babbage invented the first of such mechanical devices, a sophisticated calculator named "the Analytical Engine" (Du Sautoy, 2019, p. 2). At the time, an English mathematician, Ada Lovelace, said of this machine that it can only do what we tell it to do and therefore "[T]he Analytical Machine has no pretensions whatever to originate anything" (Du Sautoy, 2019, p. 2). This notion of Lovelace's that one can order a machine to perform certain functions with a set of instructions is one of the earliest conceptions of computer coding, and this would go on to ignite a quest to create intelligent machines that could display human intelligence (2019, p. 2).

The arrival of the digital computer, approximately a hundred years after Charles Babbage's "Analytical Engine", led Alan Turing to ask: "Can machines think?" Turing proposed a test called the "imitation game" to evaluate whether computer intelligence could perhaps be mistaken for human intelligence (Turing, 1950, p. 433). Unlike Lovelace, Turing asserted that computers could do more than what we order them to do. He went on to proclaim that "[M]ost of the programmes which we can put into the machine will result in its doing something that we cannot make sense of at all, or which we regard as completely random behaviour" (Turing, 1950, p. 459). This observation of Turing's, together with his "imitation test", underpins the potential that he saw in AI – machine versus human, with the success of artificially intelligent machines being calculated by AI's ability to be mistaken for being human (Du Sautoy, 2019, p. 6). It is Turing's questions that are mirrored and underpin the current study on the notions of the intelligence of humans and that of machines.

For Turing, the race was on when he expressed the hope "that machines will eventually compete with men in all purely intellectual fields". He suggested an abstract activity such as the game of chess to test whether this was possible at all (Turing, 1950, p. 460). We know from history that Turing's hypothesis was proven after his death, when the IBM chess computer, Deep Blue, defeated chess grandmaster Gary Kasparov in 1997. Twenty years later (2017) AlphaGo Master became the first computer programme to be crowned Go world champion (Du Sautoy, 2019, p. 27). It is now apparent that artificial intelligence programmes could match and better the most remarkable human minds in the games of chess and Go, and that AI's prowess will eventually be showcased across the spectrum of problem-solving human endeavours. The question of the advancement of AI leads us to the question of what

happens when AI is applied to a human activity that is not problem-solving in nature, such as art and music creation? The perspectives around the latter question are dealt with in the section that follows.

2.6.3. Artificial Intelligence Programmes in Fine Arts and Music

In *The Further Exploits of AARON, Painter*, Harold Cohen, a successful artist and computer programmer, documented his attempt to design a computer programme that could create works of art (Cohen, 1995). By the time of his death in 2016, Cohen had written thousands of lines of code for AARON and stated that "AARON exists; it generates objects that hold their own … It does these things, moreover, without my own (*sic*) intervention"; but Cohen then continued to say: "I do not believe that AARON constitutes an existence proof of the power of machines to think … it constitutes an existence proof of the power of machines to do some of the things we had assumed required thought …" (Cohen, 1995, p. 18). Simon Colton, another programmer/artist says of Cohen's AARON program that it is a programme developed over a forty-year time span, to generate figurative art using Cohen's uniqueness as the basis in guiding AARON's creative and aesthetic choices (Colton, 2012, p. 5). He continues that it would, however, be an oversimplification to claim that AARON paints like Cohen, but what remains clear is that "AARON has not been developed to be independent of Cohen" (Colton, 2012, p. 5).

Simon Colton, following on Cohen several years later, developed *The Painting Fool*, an automated painter that most closely resembles Harold Cohen's AARON program (Colton, 2012, p. 5). Colton gives *The Painting Fool* a persona, and on its website he states the following:

> "[I]'m The Painting Fool: a computer program, and an aspiring painter. The aim of this project is for me to be taken seriously one day as a creative artist in my own right. I have been built to exhibit behaviours that might be deemed as skilful, appreciative and imaginative" (The Painting Fool – A Computer Artist, n.d.).

For Colton, *The Painting Fool* is "very much a work in progress, and we are not claiming that it should be taken seriously as an independent creative artist yet", but "more as a creative collaborator" (Colton, 2012, p. 8 & p. 30). Apart from AI's use in the visual arts, its application in the field of music creation would also deliver exciting and promising results.

David Cope is a composer, who with deadlines looming and a lack of inspiration, turned to computer programming to aid him with his compositional work (Cope, 1989; Du Sautoy, 2019, p. 183). He wrote a computer programme *EMI (Experiments in Musical Intelligence)* that could analyse the compositional

output of various composers such as Bach, Mozart, Chopin, Gershwin and many more. Following the analysis, *EMI* would construct a database of patterns to be used in Cope's own music compositions (Cope, 1996, p. 25; Du Sautoy, 2019, p. 184). Cope explains that "[T]he genius of great composers … lies not in inventing previously unimagined music but in their ability to effectively reorder and refine what already exists" (Cope, 1996, p. 1). Patrício da Silva, in *David Cope and Experiments in Musical Intelligence* (2003), says that "*EMI*'s algorithms can't operate miracles, though sometimes a surprised user may believe so. One must keep in mind that any information outputted by *EMI* derives directly from previously existing data as stored in the database" (da Silva, 2003, p. 19). Douglas Hofstadter, however, after hearing a pianist perform an à la Bach two-part invention outputted by *EMI*, said he found himself 'baffled and troubled' with the *EMI* version, and that he only felt consoled by the fact that "EMI doesn't generate style on its own" and depended on "mimicking prior composers". But he still felt a degree of dis-ease (Du Sautoy, 2019, p. 188).

In the same vein, Gaëtan Hadjeres developed *DeepBach*. This algorithm analysed the 389 chorales by J.S. Bach and "after being trained on the chorale harmonizations" his model was "capable of generating highly convincing chorales in the style of Bach" (Hadjeres et al., 2017, p. 1). Unlike previous algorithms, *DeepBach* uses deep learning to compose chorales that are more "structurally coherent than those created by the algorithms that sent the music meandering forward without really knowing where it is heading …" (Du Sautoy, 2019, p. 197). According to Hadjeres "DeepBach is able to generate coherent musical phrases" and can generate diverse "reharmonizations of melodies without plagiarism" (Hadjeres et al., 2017, p. 2). When volunteers were asked to listen to *DeepBach* chorales alongside those composed by J.S. Bach himself, fifty percent of the volunteers thought *DeepBach's* compositions were composed by J.S. Bach (Du Sautoy, 2019). Students in music composition did slightly better with forty-five percent attributing the *DeepBac*h output to Bach himself (Du Sautoy, 2019). It is this bridging of human-machine creative convergence that informs this research.

Another algorithm which generates real-time compositions was developed by François Pachet, who explains: "*The Continuator* [his programme] is able to learn and generate music in any style, either in standalone mode, as continuations of musician's input, or as interactive improvisation back up" (Pachet, 2003, p. 1). The algorithm, called *The Continuator*, employs a call and response compositional technique when interacting with live musicians. It analyses the live input of the improviser and generates a response. When the live musician stops performing, the algorithm "continues in the style of the person feeding it the training data" (Du Sautoy, 2019, p. 205). When confronted with the output of the musician and *The Continuator*, two jazz critics found it challenging to distinguish between the

performer and machine composer. They went on to conclude that "*the Continuator* was more likely to be the human jazz musician …" (Du Sautoy, 2019, p. 206). Similarly, *Live Algorithms*, an algorithm developed by a research network *LAM (Live Algorithms for Music*), headed by Tim Blackwell and Michael Young, attempts to "take part in improvised, collaborative performance, sharing the same modes of communication and expression as its partners" (Blackwell, 2009, p. 1). Blackwell continues: "Autonomous rather than automated or controlled, the device enjoys the same constraints and freedoms as its human associates" (Blackwell, 2009, p. 1). Blackwell et al. state in their essay *Live Algorithms: Towards Autonomous Computer Improvisors* that *Live Algorithms* is "an autonomous machine that interacts with musicians in an improvised setting … the Live Algorithm listens, reflects, imagines and articulates its musical thought as sound in a continuous process" (McCormack & D'Inverno, 2012, p. 218).

All the earlier cited examples of AI programmes are but a few of the multitude of AI programmes used in the field of human creativity. They all have one thing in common, in that they are judged by their failures and successes on how anthropomorphically they behave. Again, Alan Turing's "imitation test" resurfaces: would one mistake artificial intelligence for human intelligence? In the field of art and music creation, when confronted with the question of artificial intelligent creativity versus human creativity, one needs to ask whether AI can be creative at all, and, if so, whether it is creative enough to act as an autonomous free agent, or a human being?

2.6.4. Artificial Intelligence Programmes: Collaborator or Autonomous Creator?

Marcus Du Sautoy, in *The Creativity Code*, proposes a test to assess how creative artificial intelligent machines/programmes can be (Du Sautoy, 2019, p. 6). He calls it the Lovelace Test, named after Ada Lovelace, who believed that intelligent machines are limited in that one cannot get more out of the machine than one puts in (2019, p. 2). Du Sautoy explains: "[T]o pass the Lovelace Test, an algorithm has to produce something that is truly creative. The process has to be repeatable … and the programmer has to be unable to explain how the algorithm produced its output. We [du Sautoy and other computer programmers] are challenging the machines to come up with things that are new, surprising, and of value. For a machine to be deemed truly creative, its contribution has to be more than an expression of the creativity of its coder or the person who built its data set" (2019, p. 6).

Margaret A. Boden, a cognitive scientist and AI expert, addresses the issue of creativity in computational systems and asks: "Can computers be creative? Or rather, can they at least appear to

be creative?" (Boden, 2004, p. 7). According to Boden, creativity is "the ability to come up with ideas or artefacts that are new, surprising and valuable" (Boden, 2004, p. 1). Ideas include concepts, musical compositions, theories, jokes and the like, while artefacts represent physical objects such as paintings, sculptures, pottery and much more (Boden, 2004). Boden identifies three types of creativity in human beings: combinational, exploratory and transformational creativity, and she attempts to establish whether any of these creativities are present in computational systems (Boden, 2004, p. 4). The first type of creativity, combinational, "involves making unfamiliar combinations of familiar ideas" (Boden, 2004, p. 3). Du Sautoy cites (in the arts) Philip Glass taking ideas from his working with Ravi Shankar and using it to "create the additive process that is the heart of his minimalist music" (Du Sautoy, 2019, p. 9). He then expounds: "There are interesting hints that this sort of creativity might also be perfect for the world of AI. Take an algorithm that plays the blues and combine it with the music of Boulez and you will end up with a strange hybrid composition that might just create a new sound world" (Du Sautoy, 2019, p. 9).

Exploratory creativity, on the other hand, involves exploring a conceptual space that already exists, for example, a style of painting or a specific style in creating music (Boden, 2004, p. 4). A conceptual space is a "structured style of thought", and anyone who comes up with a novel idea within this thinking style/conceptual space is deemed to be creative (Boden, 2004, p. 4). Rules define each style or conceptual place. Du Sautoy gives the example of J.S. Bach fully exploring the style of Baroque music – while Bach obeyed the rules of the Baroque style, he still managed to compose awesome music as he explored the limits of counterpoint (Du Sautoy, 2019, p. 8). According to Boden, *EMI* (David Cope's algorithm) is an excellent example of exploratory creativity in an AI algorithm, since it explores the music styles of, for example, Beethoven or Mozart, and then continues to compose new music in that particular style (Boden, 2004, p. 311).

The last form of creativity identified by Boden is transformational creativity, which occurs when the style or conceptual space itself is transformed (Boden, n.d., p. 1). Du Sautoy explains: "transformational creativity is behind those rare moments that are complete game-changers. Every art form has these gear shifts. Think of Picasso and cubism; Schoenberg and atonality or Joyce and modernism" (Du Sautoy, 2019, p. 9). Boden searches for transformational creativity in AI systems and points to 'evolutionary' AI programs based on genetic algorithms (GA's) as *prima facie* candidates (Boden, n.d., p. 3). These GA-programmes are based on biological evolution and can "transform their own rules so that structures can be produced in the later generation which could not have occurred before. In short, a form of transformational creativity sometimes occurs in artificial systems" (Boden, n.d., p. 3). Paul

Hodgson, though, who developed exploratory and GA-based algorithms that can improvise in the style of Charlie Parker, argues that the deep stylistic change, which Parker himself achieved, lies beyond the reach of any GA-programme of the current type (Boden, n.d., p. 7). Other musicians, such as Andrew Gartland-Jones and Peter Copley, who developed GA-based computer programmes, conclude that transformational creativity, as we experience it in biology and human thought, is not presently possible to achieve with algorithms (Boden, n.d., p. 7).

Today, there are algorithms capable of continuous learning. The algorithm will alter its approach if the result falls short of its objective – feedback is built into the system to help it avoid making the same mistake again (Du Sautoy, 2019, p. 63). This new deep learning through neural networks (a bottom-up approach of machine learning developed in 1950s) mimics the way the brain works as opposed to the conventional top-down method employed by most computer programmes (of accessing information at specific locations). To succeed, these algorithms need lots of data on which to train (Du Sautoy, 2019, pp. 62, 71). A large amount of available data fuels the new AI revolution. Du Sautoy explains that "90 percent of the world's data has been created in the last five years", and this resource of data is the "main catalyst for the new age of machine learning" (Du Sautoy, 2019, p. 62). It is evident from the literature that artificial intelligent programmes can exhibit combinational and exploratory creativity and, sometimes, transformational creativity. Algorithms of the future will furthermore, as they become increasingly sophisticated, shrink this division between human and machine capabilities.

As algorithms develop in the future, the question remains: who is the creator – the computer programmer/coder or the artificially intelligent machine independent of the programmer? Can the computer pass the Lovelace test proposed by Marcus du Sautoy (Du Sautoy, 2019, p. 9)? Hofstadter, in *Gödel, Escher, Bach: an Eternal Golden Braid,* states that: "The answer, it seems to me, is that we look for a sentient being to attach authorship to … the driving force behind such pieces (compositions) is a human intellect, and the computer has been employed, with more or less ingenuity, as a tool for realizing an idea devised by the human" (Hofstadter, 1999, pp. 608–609). Du Sautoy agrees: "At the moment, all creativity in machines is being initiated and driven by the human code. We are not seeing machines compelled to express themselves" (Du Sautoy, 2019, p. 281). And here, according to Du Sautoy, we reach the crux of the matter: "We cannot understand why we create without the concept of consciousness" (Du Sautoy, 2019, p. 283). Du Sautoy continues: "[F]or humans, the realization of one's inner world brought with it the desire to know oneself and share it with others" (Du Sautoy, 2019, p. 283). Du Sautoy is of the view that creativity is linked to mortality. He adds that "[B]eing aware of our mortality is one of the costs of consciousness … [U]ntil a machine has become conscious; it cannot be

more than a tool for extending human creativity" (Du Sautoy, 2019, p. 285). Boden agrees that "[C]omputers are not automatic members of the human community, in the way that members of the biological species homo sapiens are … If they are not members of our community, then they have none of our rights" (Boden, 2004, p. 297). It seems, however, that this perception of AI computer programmes is evolving. In 2016, the algorithm AIVA (Artificially Intelligent Virtual Artist) became the first intelligent machine to be awarded with the title of 'composer' by SACEM, the French professional association administering artists' rights (AIVA – The AI Composing Emotional Soundtrack Music, n.d.; Du Sautoy, 2019, p. 215).

2.7. Conclusions

The purpose of this study is to investigate how a concertgoing audience reacts to music composed by artificially intelligent machines. It was therefore vital to explore how humans create music and then investigate the equivalent activity (if present at all) by artificial intelligence machines, the latter being one of our biggest challenges in the 21st Century. This review commenced by probing what human creativity is – how we (humans) define it. In this brief review, it became apparent that our understanding of creativity gradually shifted from being an activity attributed to external forces, the gods, to being, as we understand it today, a natural human activity that originates as an internal process within the human mind. Even though this modern understanding of creativity might evolve in the future, researchers cited in this review agree that, for the activity of creativity to be present, the characteristics of novelty and usefulness need to be present. However, what is meant by these terms remains ambiguous. Furthermore, in identifying creativity, researchers acknowledge that focusing on the product of creativity is the most objective approach. If the latter is the case, this research on creativity focuses on the artefact of music compositions (hereafter referred to as compositions), which is the product of music creation, rather than the process of composing itself.

As in the case with the historical overview of creativity, the same gradual shift occurs when one explores how our understanding of art evolved. If historical events are to be used as the point of departure in deciding the nature of art, then it is apparent that there is a movement away from external artefact towards an emphasis on the internal workings of the mind of the perceiver. This shift to the internal human process in identifying art simultaneously gave rise to a concept of aesthetics (the notion of beauty) as primary in our assessment of art. This emphasis on the subjective assessment of art, however, led to disagreement and confusion, resulting in attempts to construct definitions of art consisting of observable, objective and concrete criteria (a debate still prevalent today). It became

apparent that the definitions reviewed, especially in hindsight of our technological age, fail to establish objective universally agreed on criteria in judging art. Given the diversity of views on what art is and furthermore in light of its subjectivity, the researcher aligns himself with Immanuel Kant's notion of art (although Kant assessed it to be a universal experience) as an aesthetic experience of the perceiver.

The increasing significance of technology (driven mainly by modernism) and its use by humans led the review toward the role of technology, specifically artificial intelligence, in the process of creating art. The literature suggests that it is difficult to objectively evaluate AI while our culture is developing so rapidly. The discussion of technology commenced with the invention of photography and its impact on art creation. This discussion provided a glimpse of how AI might influence our culture and art in the future. Scholars agree that the invention of photography is seen as one of the significant disruptors to art, and some scholars predict that AI will follow the same trajectory as that of photography – confronting human beings to find novel means of expressing themselves artistically. Just as new forms or styles in art creation surfaced with the invention of photography, so too new techniques of art creation, not possible in the past, could become the norm for the future with the use of AI. Various examples of AI programmes are presently utilised in art creation, and this review highlighted the debate around the abilities of these algorithms. It became apparent in the discussion that AI can display creativity on the level of human beings, allowing it to function as a creative tool or even, in some instances, as a creative collaborator or partner. Whether these programmes can act independently of their human programmers is, for now, at least doubtful. The question about the presence of autonomous action by intelligent machines raised the question of consciousness and whether these intelligent machines have an intent or even desire to create. The literature agrees that machines do not presently display any desire to create, to communicate – they do not feel and they are not conscious. Still, Margaret Boden does not rule out this possibility altogether by suggesting that "future tin-cans" may have feelings and sensations as well (Boden, 2004, p. 296).

The literature review concludes with the question about consciousness in AI. Although it is a pertinent question to explore, what interests the researcher more, rather, is the impact of the ubiquitous presence of AI in our everyday lives. We think we make decisions on what to watch on Netflix or YouTube for our enjoyment, but remain unaware that AI is making the suggestions for us. The same happens with music streaming services such as Spotify, Apple Music and the like. Life is becoming tailored around our tastes and interests, and AI is mostly responsible for shaping these choices. AI is assisting in creating a 'personalised subjective world' designed around our impulses and desires. As we become bombarded with even more information (including art), the question of who or what created the product becomes of

less importance. Therefore, the question of the level of AI's involvement in art creation is becoming irrelevant. What matters most is our response to the product – the decoding that takes place in the human mind. Our subjective aesthetic response to art is paramount and primary. Douglas Hofstadter echoes in the dialogue between the crab and Achilles: "[T]he sense of Beauty is the exclusive domain of Conscious Minds, minds which through the experience of living have gained a depth that transcends explanation by any mere set of rules" (Hofstadter, 1999, p. 555). The themes and ideas generated in this literature review will be used in the next section to guide and shape the theoretical framework of this study.

CHAPTER 3: Theoretical Framework and Methodology

This chapter draws on key aspects identified in the literature review that underpin the research question(s) and objectives of this study. The themes identified in the literature (creativity, aesthetics, art, and artificial intelligence) are examined through three influential thinkers, namely the 18th-century philosopher Immanuel Kant (1724-1804), the mathematician Alan Turing (1912-1954), and the cognitive scientist Margaret A. Boden (1936). While Kant addresses the nature of the interaction of human beings with their outside world, both Turing and Boden focus on the interaction of human beings with the outside world of artificial intelligence. My lens will focus on human interaction with AI as it relates to art and the creation of art. As a basis for exploring this interaction, *Kant's Critique of Judgement* (1790), Turing's essay *Computing Machinery and Intelligence* (1950), Boden's article *Creativity and Artificial Evolution* (Boden, n.d.), and the text *The Creative Mind: Myths and Mechanisms* (2004) will be used to illuminate their thought processes and positions regarding the themes mentioned earlier. Kant's *Critique* is not used in the original German, but rather Werner S. Pluhar's translation of his *Critique of Judgement* (Kant, 1790 [1987]).

3.1 Immanuel Kant (1724-1804)

Kant's investigation of the interaction between the human mind and its outside world is the primary framework for my understanding of the relationship between the human mind and objects of art (music composition, painting, poetry and the like). As a philosopher of the Enlightenment, Kant constructed a philosophical system that attempted to explain a human being's relationship with their knowable universe. In his first treatise, *Critique of Pure Reason* (1781), Kant investigated whether our minds (cognitive powers) can know truths about the world (consisting of objects in space and time) a priori, that is, knowable independent of experience (Pluhar cited in Kant, 1790 [1987], xxx). After addressing our ability to know metaphysical truths (i.e. independent of experience), Kant continued in his second critique, the *Critique of Practical Reason* (1788), to examine our cognitive powers again, only this time concerning action, namely, as practical reason (Pluhar cited in Kant, 1790 [1987], xxxix). Here Kant concerns himself with the mind's connection with free will and morality. He examines the mind's (or cognitive power's) ability to make moral laws and obey or disobey them independent of nature (Pluhar cited in Kant, 1790 [1987], xliv). It is, however, his last treatise, the *Critique of Judgment*, that is of significance to this study, since it explores whether our minds can perform a judgement of beauty/taste (aesthetic judgement) at all. In his essay "Kant", Donald Crawford, regards Kant's *Critique of*

Judgement (1790) as the "foundational treatise in modern philosophical aesthetics" (Crawford, 2002, p. 51), a work that would turn out to have a substantial influence on modern theories of art.

In his *Critique of Judgement*, Kant explains that the judgement of taste/beauty originates in the mind as an aesthetic judgement, and not a cognitive or logical appraisal. Since it is an aesthetic judgment (judgement of beauty), it is by definition a subjective judgement (1790 [1987], p. 44). He goes on to explain that, although the judgement of taste is a subjective one, it is also at the same time universal. The latter is affirmed by his statement that "in a judgment of taste about beauty we always require others to agree" (1790 [1987], p. 57). So, in short, when one refers to a musical composition or a painting as beautiful, Kant sees this as a subjective judgement. At the same time, given that the judgement is universal, everyone else will also judge the musical composition or painting as beautiful.

Kant further deals with the problem of subjectivity by making a distinction between liking something (finding something agreeable) and judging something to be beautiful. Both these cognitive functions are subjective. If one likes something, then it is one's own taste and not universal. If one finds something beautiful, then it becomes a universal judgment which everyone will agree upon:

> "[H]ence about the agreeable the following principle holds: Everyone has his own taste (of sense). It is quite different (exactly the other way around) with the beautiful. It would be ridiculous if someone who prided himself on his taste tried to justify [it] by saying: This object (the building we are looking at, the garment that the man is wearing, the concert we as listening to, the poem put up to be judged) is beautiful for me. For he must not call it beautiful if [he means] only [that] he likes it. Many things may be charming and agreeable to him; no one cares about that. But if he proclaims something to be beautiful, then he requires the same liking from others; he then judges not just for himself but for everyone, and speaks of beauty as if it were a property of things. That is why he says: the thing is beautiful, and it does not count on other people to agree with this judgment of liking on the ground that he has repeatedly found them agreeing with him; rather, he demands that they agree" (1790 [1987], pp. 55–56).

The question still remains: how does one differentiate between liking something and deeming something to be beautiful?

Kant answers the above question by explaining the difference through referring to the object being contemplated upon. He adds that if the pleasure experienced is directly caused by the physical object being contemplated, then it is only agreeable and a purely subjective taste. However, on the other hand, if the pleasure is the result of a priori principles of taste (universal principles) "which underlies the judgement of taste as its subjective condition … its pleasure in the object must be its consequence" (1790 [1987], p. 61). Therefore, if one experiences pleasure directly from an object, it is not a universal

experience but purely a personal one. However, if one experiences pleasure from a priori established principles before contemplating the object, one will experience its beauty, and this will constitute the universal judgement of beauty (aesthetic judgement). Although Kant attempts to present a structured judgement of beauty (aesthetic judgement), he never really explains what these a priori (universal) principles of beauty/taste consist of, because they are subjective.

Kant moves the focus away from the object and emphasises the subjective workings of the mind to explain taste/beauty. The latter is apparent when he says that "… to play the judge in matters of taste, we must not be in the least biased in favor of the thing's existence but must be wholly indifferent about it" (1790 [1987], p. 46). And since we now have no real interest in the physical object itself, and are free from sensations related to the object, we can have a judgement of the beautiful which is disinterested and free because of our contemplation or reflection of it. He states that

> "…if the question is whether something is beautiful, what we want to know is not whether we or anyone cares, or so much as care, in any way, about the thing's existence, but rather how we judge it in our mere contemplation of it (intuition and reflection)" (1790 [1987], p. 45).

Whether Kant successfully establishes universal aesthetic criteria in his judgement of objects (art) is not of importance to the central premise in this research. What is invaluable, however, is Kant's emphasis on the perceiver's mind as it judges or understands an artefact (musical composition, poetry, sculpture and the like). The decoding of meaning which leads a person to experience an artefact as art does take place wholly within the human mind. Whether this cognitive process is a universal process, with each person having the same outcome (thus the same opinion about art), is highly unlikely. However, regarding the nature of art, Kant's emphasis on the activity of the mind as it (mind) connects with the art object itself, is a critical lens which frames the investigation in this study.

In the 18th century Kant constructed his philosophical system explaining human beings' interaction with the outside world. He could not have known that this outside world would one day also consist of ubiquitous artificially intelligent machines. Could this new technology disrupt our conventional ideas about being human in this world, specifically as it relates to this study of creativity and art creation? This sort of inquiry has led researchers to one of the great thinkers on artificial intelligence, Alan M. Turing. Turing, like Kant, focused on the human mind and its relationship with the outside world as a point of emphasis (in explaining the universe). In Turing's case, however, this includes the technology of artificially intelligent machines (hereafter simply referred to collectively as artificial intelligence or AI).

3.2. Alan Turing (1912-1954)

In 1950, Alan Turing wrote an article for the journal *Mind*, entitled "Computing Machines and Intelligence" (Turing, 1950). He started his article by positing the question "Can machines think?" (1950, p. 433). Turing then attempted to answer this question by constructing what he called his "imitation game" (1950, p. 433). This "game" consisted of two players (in one variant of the game) – an interrogator in one room and a computer/machine in the other room. Furthermore, these parties did not have any visual contact and could only communicate through typed messages. The aim of this game was for the computer to behave as such (by answering various questions from the interrogator) that the interrogator thought the computer to be a human being. By formulating the "imitation game", Turing already anticipated the potential of artificial intelligence to match the human mind and to fool us into believing it is human: "[T]he reader must accept it as a fact that digital computers can be constructed, and indeed have been constructed … that [they] can in fact mimic the actions of a human computer very closely" (1950, p. 438).

Turing then went on to predict that "in about fifty years' time it will be possible to programme computers…to make them play the imitation game so well that an average interrogator will not have more than 70 percent chance of making the right identification after five minutes of questioning" (1950, p. 442). He continued to defend this prediction by addressing a variant of Ada Lovelace's objection that machines can "never do anything really new" (Lovelace cited in Turing, 1950, p. 450). Lovelace argued that machines only do what we tell them to do (Turing, 1950, p. 450). Turing negates this position, by claiming that "[M]ost of the programmes which we can put into a machine will result in its doing something that we cannot make sense of at all, or which we regard as completely random behaviour" (1950, p. 459). He supported the validity of his claim by addressing the future notion of machine learning with the following: "[I]nstead of trying to produce a programme to simulate the adult mind, why not rather try to produce one that simulates the child's?" (1950, p. 456). Turing envisioned computer programmes that could learn just like a child-brain does – accepting instructions/teachings on a clean slate, resulting in surprising mutations over time. The latter is evidenced in his statement that "[A]n important feature of a learning machine is that its teacher will often be very largely ignorant what is going on inside, although he may still be able to some extent to predict his pupil's behaviour" (1950, p. 456).

Turing's belief in the potential of intelligent machines to simulate human beings, combined with his vision of machine learning in the future, sets the framework for this investigation into the use of artificial

intelligence in music composition. In this research, the researcher 'tests' (explores) if concertgoers are able to recognise whether a music composition was created by artificial intelligence or a human being. This endeavour is fundamentally a Turing imitation test, by probing whether artificial intelligence can fool us into believing that it is human. Not only did Turing foresee the potential of artificial intelligence then, but he also foresaw how this intelligence, by means of machine learning, could match (and one day even surpass) human intelligence.

Intelligent machines (some of them are music composition software programmes) learn from analysing data. Humans are at the threshold of generating enormous amounts of data (referred to as 'big data') every day. According to Eric Schmidt, the amount of data generated every two days is equal to the sum of data generated from the dawn of civilisation to 2003 (Siegler, 2010). The quantity of generated data will only increase in the foreseeable future, resulting in the continuation of the revolution of artificial intelligent programmes we experience today, and this includes the field of music composition. While Alan Turing is viewed by scientists today as the visionary and prophetic voice who foresaw the potential of artificial intelligence and bridging human imagination with machine intelligence, Margaret A. Boden extends Turing research. Boden does so by exploring the notion of creativity in the age of artificial intelligence. Her study on the creativity (and boundaries thereof) of artificial intelligent machines is the final critical lens in this framework.

3.3. Margaret A. Boden (1936)

Margaret Boden arrives at her investigation of the notion of AI creativity through her curiosity about the nature of human creativity and how it functions. In *The Creative Mind: Myths and Mechanisms* (2004), Boden explains that creativity (in human beings) is "seemingly a mystery, for there is something paradoxical about it" and she arrives at the conclusion that explaining creativity from the perspective of psychology "is in principle unachievable" (2004, pp. 11–12). Boden then turns to computer science, specifically artificial intelligence, as the vehicle that could unlock the 'mysteries' of human creativity. She explains that, since artificial intelligence is the study of how to construct computers to emulate the human mind, AI can be used to study the mind by providing "many ideas about possible psychological processes, and so has given rise to a new approach in studying the mind: 'computational' psychology" (Boden, 2004, p. 15).

Although Boden defines creativity as "the ability to come up with ideas or artefacts that are new, surprising and valuable" (2004, p.1), her broader framework of creativity is informed by computer

science, in that she connects creativity with some kind of interaction with conceptual spaces (see "structures styles of thought" in 2004, p. 4). Computer programmes are written with specific goals in mind and are designed to operate within structured conceptual spaces, whether these be the analysis of specific data, the tracking of weather patterns, or playing chess, and the like. Boden cites examples of conceptual spaces (in humans) to include "ways of writing prose or poetry; styles of sculpture, painting or music; theories in chemistry of biology; fashion in couture or choreography, nouvelle cuisine and good old meat and two veg – in short, any disciplined way of thinking that is familiar to (and valued by) a certain social group" (2004, p. 4). Her connection of creativity with conceptual spaces led her to identify three kinds (levels) of creativity – combinational, exploratory and transformational creativity (2004, pp. 4–7). These forms of creativity and how they manifest in AI have been discussed in detail in the literature review (see Literature Review 2.6.4.). Thus, this theoretical framework addresses a broader view of Boden's understanding of AI creativity.

In *The Creative Mind* (2004), Boden initiates her investigation into the potential creativity of artificial intelligence, by referring to Ada Lovelace's declaration that a computer can only do what it is programmed to do (2004, p. 16). Like Turing, when confronted with Lovelace's statement, she adds that AI possesses more potential than is acknowledged. Thus, her study of creativity in AI begins by formulating four new "Lovelace questions", namely,

1. Can computational ideas help us understand how human creativity is possible?
2. Can computers ever do things that at least appear to be creative?
3. Could computers ever appear to recognise creativity?
4. Can computers themselves ever really be creative (independent of the programmer)? (2004, pp. 16–17)

The first question is beyond the scope of this study, since the identification of creativity (by a perceiver) is paramount in addressing this research problem and understanding the process of human creativity is not under investigation. Question three, on whether computers can appear to recognize creativity, has no bearing on this research, because this study's concern is whether human beings perceive computers to be creative and not the other way around. Questions two and four, however, are central to the exploration conducted in this present research.

The way that Boden structures the second question is reminiscent of how Turing thought about artificial intelligence. Boden does not ask whether computers are creative, but whether they appear to be

creative; i.e., will they pass Turing's imitation test and be mistaken for being human creators? The exploration of Boden's second question is adequate for this research, because the research question does not concern itself with the nature of the AI creativity (apparent or independent). This research, however, includes Boden's fourth question because it provides insight into her view on the potential of AI, and also addresses some concerns and objections about AI technology in general.

Boden explores the question whether computers can at least appear to be creative by investigating AI's ability to display any of the three kinds of creativity – combinational, exploratory and transformational creativity. In her essay *Creativity and Artificial Evolution* (n.d.) she explains that, while computers can display combinational creativity, the problem with combinational creativity in computers is that producing mere combinations is not a problem, but producing valuable (funny, ironic, apt and the like) combinations is rare (but possible) (Boden, n.d., p. 2, 2004, p. 1). Boden suggests, in the following quotation, that exploratory creativity is more suited to intelligent programmes:

> "[Well, what must] a program be like, to appear creative? Given that we are considering exploratory (as opposed to combinational) creativity, it must inhabit, and explore, a conceptual space rich enough to yield indefinitely many surprises. Ideally, it should extend this space – or perhaps even break out of it, and construct another one … The results must often be individually unpredictable, although they may all possess a recognizable conceptual style. They must be generated by the program acting alone, relying on its own computational resources rather than constant input from a human operator …" (2004, p. 163).

Boden goes on to cite Harold Cohen's *AARON* programme, which paints in the style of the programmer, and David Cope's music composition programme *EMI*, which can compose music generated from a database of analysed compositions, as examples of exploratory creativity (2004, p. 320). Even transformational creativity, which transforms the conceptual space altogether, can be possible with artificial intelligence – some programmes can even transform their conceptual space by using genetic algorithms (GA) – especially algorithms employed in the field of evolutionary programming (2004, p. 318). Boden concludes that computer programmes can indeed appear to be creative in all three kinds of creativity (2004, p. 17). Her evidence that computers can appear to be creative allows her to define the role of artificial intelligence in art creation as much more than just another tool (such as paintbrushes and pencils) used by artists. She expounds in her foreword of *Computers and Creativity* (McCormack & D'Inverno, 2012) that:

> "Sometimes, as is Harold Cohen's work, the program [*AARON*] runs entirely by itself. The artworks that result are literally untouched by human hand – and, occasionally, untouched even by post hoc human choices, or selection. At other times, although the code 'runs itself' in the

> sense that it's not altered by human beings during the running process, what it actually produces depends partly on the various sorts of interactions between the program (sic) and the human artist and/or observer … One thing, however, is agreed: the computer, here, is being used by the human artist not as a mere tool, but as a partner (or perhaps a quasi-partner) in the creative endeavour" (McCormack & D'Inverno, 2012, p. 6).

The status of artificial intelligence, as laid out by Boden, to be that of a creative assistant or even collaborator, is of sufficient significance for the purpose of this study, since the researcher is investigating the appearance of AI creativity in this study, not autonomous AI creativity. The answer to the fourth question (re independent creative AI) has more interest with regard to the objection to AI in general and AI of the future.

With regard to the question whether AI can ever be really creative, that is, acting autonomously and independent of the programmer, Boden is guarded and states in *Creativity and Artificial Intelligence* (Boden, n.d.) that she doubts "that AI will ever attain the full richness and subtlety of human thought and therefore of human creativity. But it is not impossible in principle" (n.d., p. 11). With this statement, Boden aligns herself with thinkers such as Douglas Hofstadter and Marcus du Sautoy, who contend that computers do not (yet) possess consciousness and therefore cannot presently be seen as autonomous, independent creators (Du Sautoy, 2019, p. 283; Hofstadter, 1999, p. 686). Boden lists the arguments usually presented against real AI creativity as follows:

> "Several different arguments are commonly used in support of that conclusion [that computers cannot be creative in themselves]. For instance, it's the programmer's creativity that's at work here, not the machine's. The machine isn't conscious, and has no desires, preferences or values, so it can't appreciate or judge what it's doing. A work of art is an expression of human experience and/or a communication between human beings, so machines simply don't count" (2004, p. 7)

Boden, however, is optimistic of the potential of a truly creative AI. For this perspective, she shifts to a nuanced argument in discussing the future of AI and creativity. She mentions the brain-stuff argument against an independent AI, which relies on "a factual hypothesis: that whereas neuroprotein is a kind of stuff which can support intelligence, metal and silicon are not" (2004, p. 287). She explains that it is equally impossible to "see" how 'real' intelligence is supported by neuroprotein (the grey matter in our skulls) as it is with metal and silicon: "[I]n sum, the brain-stuff argument is inconclusive. It reminds us that computers made of non-biological materials may be incapable of real creativity. But it gives us no reason whatever to believe that this is actually so" (2004, p. 289). As for the problem of consciousness, Boden asks: "So why shouldn't some future tin-can have feelings and sensations too? Why shouldn't

there be something which it is like to be that computer, just as there is something which it is like to be you or me" (2004, p. 296).

3.4. Summary

The theoretical framework in this section brings together three thinkers whose views serve as the theoretical lens for fundamental concepts and themes of this study, namely that of creativity, aesthetics, art, and artificial intelligence. Kant's perspective that judging and recognising art (in this case music composition) as an aesthetic judgement taking place solely in the perceiver's mind, is an important perspective for this study. He focuses our notion of art and the meaning of art on being located within the perceiver's mind, irrespective of the origin of the creation. Kant's emphasis on the perceiver's mind resonates with Alan Turing's thinking, which manifests as his "imitation game" that tests whether the perceiver's mind can be fooled into believing computers to be human (or appear to be human) and to be able to display human-like qualities such as creativity (or appear to do so). Boden's ideas on machine creativity conclude the critical lens in this triad of thinkers. She does so by reflecting on Turing's belief that artificial intelligence can (one day) successfully emulate human beings (i.e. appear to be human). After investigating the creativity in artificial intelligence, she concludes that artificial intelligence can appear to be creative. These three standpoints on the aesthetic judgement of the perceiver (Kant), the potential of AI to appear human (Turing) and the conclusion that AI can appear creative (Boden) form the theoretical framework for this study. It is this lens that will be applied to explore how a concertgoing audience reacts to music composed by artificially intelligent machines.

CHAPTER 4: Research Methodology

This chapter describes the research methodology used in this study to answer the primary research question: Within a portfolio of works, can a concertgoer distinguish aesthetically between compositions generated by humans and artificial intelligence? According to research methodology literature (Kara 2020, Farooq 2019, Creswell 2018, Denzin & Lincoln 2018), scholars agree that research methodology refers to "a systematic way to solve a problem … a science of studying how research is to be carried out" – dealing with the theoretical/philosophical positioning of a study while research methods deal with the "various procedures, schemes, steps and algorithms used in research" (Farooq 2019) – the actual 'doing' part of the study. Thus, this chapter will first address the issues around methodology and encase the precise methods adopted in this research, illustrating how it was undertaken.

In Chapter 3, Theoretical Framework, the aspects of theory and the philosophical underpinning of this thesis were discussed. Leading on from this discussion on research methodology, Helen Kara reminds us that doing research is an everyday human activity, requiring researchers to collect and analyse data as they live their lives and connect to the external world (Kara, 2020, Chapter 1, p. 14).[4] When researchers engage in the activity of research in a formal and structured way, it has historically been viewed as "a process in which experiments were conducted in conditions where all confounding variables had been eliminated and the researcher was a neutral agent who did not influence the findings" (Kara, 2020, Chapter 1, p. 11). This historical view of research, however, was challenged when researchers realised that in some contexts, objectivity was not possible to attain at all, for example, research into social phenomena and the arts (Kara, 2020, Chapter 1, p. 16).

Researchers generally bring their biases and prejudices (not to mention language and meaning) to the table as they conduct experiments, interviews, do fieldwork and the like, with the consequence that true objectivity is not always achievable or even desirable (Kara, 2020, Chapter 1, p. 14). Today, our view of research is diverse and nuanced compared to the earlier paragraph's historical picture. This diverse and nuanced approach to research is reflective of the vast literature on research methodology, and it is for this reason that the researcher frames his discussion on the methodology for this study within a few primary current sources, namely, *Creative Research Methods* (Kara, 2020), *Research Design:*

[4] At the time of publishing this thesis, the second edition of Helen Kara's *Creative Research Methods* was still in print. With her kind permission the researcher used the final draft version of this book. In the latter version the page numbers were not chronological but rather indicated, correlating the chapter and page numbers. Thus, each new Chapter commenced with page 1. For ease of citation the researcher cites only this text together with its corresponding chapter.

Qualitative, Quantitative, and Mixed Method Approaches (Creswell & Creswell 2018), *The Sage Handbook of Qualitative Research* (Denzin & Lincoln 2018), and *Measuring Aesthetic Emotions: A review of the literature and a new assessment tool* (Schindler et al. 2017). Although having read widely and assessed several sources on the subject, the researcher concluded that most discussions around methodology become thematically cyclical and repetitive. Only in cases where there are exceptions outside these primary sources are the authors' views cited and engaged with in the text of this research.

4.1. The Research Approach

Creswell and Creswell define approaches (framework) to research as "plans and (the) procedures for research that span the steps from broad assumptions to detailed methods of data collection, analysis, and interpretation" (Creswell & Creswell, 2018, p. 40). They identify three broad research approaches used in research today: quantitative, qualitative and mixed methods (a combination of qualitative and quantitative approaches) (Creswell & Creswell, 2018, p. 41). Interestingly, Kara (2020, Chapter 1, p. 1) revises the mixed methods approach by referring to it as multi-modal. When comparing the earlier version of her text *Creative Research Methods in the Social Sciences: A Practical Guide* (Kara, 2017) to the current 2020 edition, she makes the case for the usage of "multi-modal approach" instead of mixed methods (Kara 2000, Chapter 1, p. 1).

Qualitative research is an "approach for exploring and understanding the meaning that individuals or groups ascribe to a social or human problem", while quantitative research approaches focus more on "numbered data" that can be "analy[s]ed using statistical procedures" (Creswell & Creswell, 2018, p. 41). This study, which probes whether concertgoers can discern aesthetically between compositions generated by humans and artificial intelligence, uses "an approach to inquiry involving collecting both quantitative and qualitative data" (Creswell & Creswell, 2018, p. 41) – rendering it a mixed methods study. The quantitative aspect is explored through an initial survey (the percentage – quantity) of concertgoers to determine general music composition responses that comprise human and artificial intelligent compositions. This initial phase allows the researcher to probe different subjective reactions to the musical compositions in a subsequent stage, lending itself to a quantitative approach.

4.2. The Research Paradigm

Choices about a research approach depend on the philosophical worldview or paradigm of the researcher himself (Creswell & Creswell, 2018, p. 40). Creswell and Creswell define a paradigm/philosophical worldview as "a general philosophical orientation about the world and the nature of research that a researcher brings to a study" (Creswell & Creswell, 2018, p. 44). Researchers develop worldviews based on their particular fields of interest, the research communities they engage with, opinions of advisors or colleagues and the like. Creswell and Creswell (2018) provide a concise overview of the different worldviews. In short, this research is underpinned by both a positivist and interpretivist approach. Postpositivists work with the belief that knowledge is gained through "careful observation and measurement of the objective reality that exists 'out there' in the world". Such an approach favours quantitative methods to research (Creswell & Creswell, 2018, p. 44). Within the interpretivist worldview, "individuals seek understanding of the world in which they live and work" and "individuals develop subjective meanings of their experiences". This approach is suited to a qualitative research approach (Creswell & Creswell, 2018, p. 46). A combination of the elements of both postpositivist and constructivist/interpretivist paradigms favours a mixed-methods approach to research (Creswell & Creswell, 2018, p. 47). The authors label this paradigm or worldview as "pragmatic" (Creswell & Creswell, 2018, p. 47).

The pragmatic paradigm "arises out of actions, situations, and consequences rather than antecedent conditions (as in postpositivism)" (Creswell & Creswell, 2018, p. 48). This paradigm furthermore focuses on the research problem and questions at hand and uses "all the approaches available to understand the problem" (Creswell & Creswell, 2018, p. 48). Pragmatists do not believe in any one system of philosophy or reality and acknowledge that research always occurs within social, historical and political contexts. Pragmatists believe in an external world independent of the mind but also in an inner world within one's mind (Creswell & Creswell, 2018, p. 48). In this study, the researcher displays an interpretivist worldview, in the sense that "human beings construct meaning as they engage with the world they are interpreting" (Creswell & Creswell, 2018, p. 46). The researcher also presents a postpositivist worldview, in that he believes that "numeric measure[s] of observation" in the study of the behaviour of individuals is possible (Creswell & Creswell, 2018, p. 45). The worldview is thus pragmatic; it is dependent on the research problem. The research problem centres around aesthetics and the nature of art, concepts identified by the individual participants' subjective meaning; hence, the pragmatic worldview contains a vital interpretivist element. Denzin and Lincoln furthermore remind us

that “all research is interpretive: guided by a set of beliefs and feelings about the world and how it should be understood and studied” (Denzin & Lincoln, 2018, p. 56).

This research adopts the pragmatic paradigm, which guides the researcher to embrace a mixed-methods approach in solving the research problem. A mixed-methods approach suggests combining quantitative and qualitative research designs (Creswell & Creswell, 2018, p. 49). Helen Kara, by contrast, refers to this research design as “multi-modal research because it involves combining different methods of data gathering and/or analysis, different types of recruitment or sampling, different theoretical and/or disciplinary perspectives, and so on” (Kara, 2020, Chapter 2, p. 3). She further adds that the “point of combining qualitative and quantitative methods is that they offer us different ways to understand the world. Quantitative methods show us how much, which, when and where, based on a theory of normality and difference: is this within the curve, or outside?” (Kara, 2020, Chapter 2, p. 11). This is followed in this research’s case with subjective probing of a select group of participants that make up the qualitative component. Finally, the research in this study involves the field of music composition – Susan Finley purports that “[A]rts-based research is a multi-modal, cross-disciplinary, trans-disciplinary, and multidisciplinary methodology … examples of arts-based research include music, drama and dance performances, visual arts …” (Denzin & Lincoln, 2018, p. 988). This mixed-methods or multi-modal approach is appropriate for this research, which is needed to draw on a sample to participate in the study and explore subjective content about aesthetics and the arts.

4.3. The Research method

With the research design established, the researcher chose the specific research instruments and the order in which these instruments would be utilised to gather the data. The mixed methods/multi-modal research design (hereafter simply referred to as mixed methods design) commonly uses a combination of qualitative and quantitative instruments to gather data (Kara, 2020, Chapter 7, p. 10). Quantitative data in this study were collected through tools, such as questionnaires which were closed-ended, designed to provide a numeric description of trends (Creswell & Creswell, 2018, p. 50-51). The qualitative data were collected through open-ended interviews and probed participants’ experiences regarding the research phenomenon (Creswell & Creswell, 2018, p. 50-51). In this study, the researcher used the explanatory sequential mixed methods design, which involved a two-phase data collection process; the researcher collected quantitative data (phase 1) and then used the results of this initial phase to plan (or build on to) the qualitative phase (phase 2) (Creswell & Creswell, 2018, p. 304). This design used the qualitative data to explain the quantitative results, thereby connecting the

quantitative results to the qualitative data. Creswell and Creswell affirms that "[A] typical procedure might involve collecting survey data in the first phase, analysing the data, and then following up with the qualitative interviews to help explain confusing, contradictory, or unusual survey responses" (Creswell & Creswell, 2018, p. 304).

Before getting into a detailed discussion around research methodology and components, the researcher offers a few disclaimers. The research was conducted during the Covid-19 (2020-2021) pandemic in Amsterdam, The Netherlands. The national (The Netherlands) lockdown and safety protocols complicated recruiting participants for the online questionnaire. Furthermore, it became apparent in the data collection that in-person interviews and participants' responses were altered to accommodate the awkwardness of an online process; the latter made the overall process challenging. The overall atmosphere of anxiety and uncertainty around the pandemic made it difficult for participants to relax and generally stay focused. Participants expressed reluctance to being subjected to prolonged and free-flowing interviews. Participants were withdrawn, and some even articulated that the idea of AI in art creation seemed less urgent and relevant against the backdrop of existential Covid-19 existence. Although the average Hollander is fully bilingual (especially in a cosmopolitan city like Amsterdam), the possibility of a language barrier did exist. Thus, the researcher did his best to overcome this limitation by allowing the interviewees to express themselves in Dutch. A Dutch translation of the English online questionnaire was available to all the participants (See Appendix L).

4.3.1. Phase 1: The quantitative component

In attempting to answer the primary research question, the first quantitative phase of this research involved identifying the participants for this research. Once participants were identified, a research instrument(s) was needed to explore whether the participants could make aesthetic judgements about symphonic music compositions. This phase's concluding aspect comprised a set of compositions composed by a human interspersed with those 'created' by artificially intelligent machines.

Given that symphonic music is a western cultural artefact, the researcher chose participants from a homogenous population of concertgoers, namely symphonic concertgoing specialists from Amsterdam, The Netherlands.[5] This population lived in The Netherlands and subscribed to a worldview reflective of the Enlightenment's western tradition. According to Denzin and Lincoln, researchers "seek out groups,

[5] The term "symphonic concertgoing specialists" refers to a group of people who regularly attend performances at the Concertgebouw in Amsterdam.

settings, and individuals where (and for whom) the processes being studied are most likely to occur" (Denzin & Lincoln, 2018, p. 553). Onwuegbuzie and Collins (2007) concur with Denzin and Lincoln by pointing out that one of the sampling schemes available for a mixed methods research design is a homogeneous sampling scheme, that is, "choosing settings, groups, and/or individuals based on similar or specific characteristics" (Onwuegbuzie & Collins, 2007, p. 285). The participants for this study were therefore purposively selected – a specialised group of people who attend symphonic concerts in Amsterdam regularly. The researcher consequently contacted the Concertgebouw, who agreed to publish the researcher's request for participants on its notice board (Appendix E). Individuals who were interested in participating in the study contacted the researcher. This sample gathering took place during the Covid-19 outbreak and, with no available concerts for months, had the consequence that not enough potential participants were exposed to the pinned request. The rest of the specialised group of participants joined the study through word of mouth, either from colleagues, friends or the researcher himself. Only participants who indicated that they had an interest in orchestral music were selected. Once the participants were identified, the researcher emailed a consent form, reminding the participants of their rights, obligations (Appendix D) and guarantees of anonymity. After receiving the participants' email confirmation and consent, the researcher emailed a link to the online questionnaire (which he designed) hosted on www.wufoo.com. The researcher, also a professional musician, believed that participants had adequate, specialised knowledge of symphonic music and composition.

Concerning the sample size used in a mixed methods study, Onwuegbuzie and Collins explain that the two essential criteria are the "time orientation (i.e., concurrent vs sequential) and the relationship of the qualitative and quantitative samples" (Onwuegbuzie & Collins, 2007, p. 292). In this study, the mixed methods research design employed is the explanatory sequential method, in the form of a "nested relationship", whereby "sample members selected for the one phase of the study represent a subset of those participants chosen for the other facet of the investigation" (Onwuegbuzie & Collins, 2007, p. 292). Onwuegbuzie and Collins further suggest a sample group of 21 participants for the quantitative component (questionnaire) and three to ten participants for the qualitative part (interviews) to be a recommended sample size to validate the study (Onwuegbuzie & Collins, 2007, pp. 288–289). This study employed a sample size of 30 participants for the quantitative component, and this was subsequently followed by six participants for the qualitative 2nd phase of the research.

4.3.1.1. The Instrument

The research instrument (questionnaire) used in this initial phase of the study was based on an instrument called AESTHEMOS (see Appendix A) that was designed by Ines Schindler et al (Schindler et al., 2017). This research instrument presented in *Measuring aesthetic emotions: A review of the literature and the new assessment tool* (2017) explains that in philosophical aesthetics there exists a substantive tradition that the notion of aesthetic appeal is more felt than known:

> "[E]motions accompany and inform our experiences of art, literature, music, nature, or appealing sights, sounds, and trains of thought more generally. Consequently, empathetic and affective responses play a central role in accounts of how visual art [1–3], music [4, 5], literature [6, 7], film and television [8–10], art in general [11–15]…are processed" (Schindler et al., 2017, pp. 1–2).

In deciding the emotions that can be classified as aesthetic emotions, Schindler et al. lay out four features:

1. Emotions are aesthetic if the emotions are felt by the recipient rather than being "emotions that are represented, expressed, or alluded to in the respective stimuli" (Schindler et al., 2017, p. 2)
2. Aesthetic emotions are emotions that are triggered by objects themselves (stimuli), rather than outcomes – "subjective experience and savouring of aesthetic emotions take precedence over the emotions' signalling value for preparing goal-directed actions" (Schindler et al., 2017, p. 2)
3. Aesthetic emotions are "elicited through vision, hearing, and cognitive processes in response to such input (perceptual input)" (Schindler et al., 2017, p. 3)
4. Aesthetic emotions and aesthetic judgement are intertwined: "… aesthetic emotions play an epistemic role in aesthetic judgement … a person's felt appreciation of a stimulus serves as an indicator of its perceived aesthetic appeal" (Schindler et al., 2017, p. 3).

With this framework, Schindler et al. investigated those emotions that could be classified as aesthetic. To achieve this, they used the Geneva measures of musical emotions, also known as the Geneva Emotional Musical Scale (GEMS), as a starting point. The GEMS include nine emotion factors, namely 'wonder', 'transcendence', 'tenderness', 'nostalgia', 'peacefulness', 'power' (triumphant), 'joyful activation', 'tension' and 'sadness' (Schindler et al., 2017, p. 5). Accepting these emotions as aesthetic emotions, the authors extended their search for aesthetic emotions beyond the music domain (by

including the other arts) and eventually domains beyond the arts (Schindler et al., 2017, p. 16). A list of 24 aesthetic emotions was arrived at as a means of "an integration of theoretical ideas and empirical findings on the range of aesthetic emotions" (Schindler et al., 2017, p. 16). Schindler et al. broadly group these emotions into four categories of aesthetic emotions (prototypical, pleasing, negative, self-forgetful):

> "The *prototypical aesthetic* emotions are (1) feeling of beauty, (2) liking/attraction, (3) captivation, (4) being moved, (5) awe, (6) enchantment/wonder, and (7) nostalgia/longing; the *pleasing emotions* are (8) joy, (9) humour (*sic*), (10) vitality/arousal, (11) energy, and (12) relaxation; the epistemic emotions are: (13) surprise, (14) interest, (15) intellectual challenge, and (16) insight; the *negative emotions* are: (17) feeling of ugliness, (18) disliking/displeasure, (19) boredom, (20) confusion, (21) anger, (22) uneasiness/fear, and (23) sadness; and the single *self-forgetful emotion* is: (24) flow/absorption". (Schindler et al., 2017, p. 16)

Following this list of emotions, the authors developed a questionnaire called the Aesthetic Emotions Scale *(*AESTHEMOS – see Appendix A) to gauge aesthetic, emotional responses to stimuli. The questionnaire uses a 5-point Likert scale to rate aesthetic, emotional responses (Schindler et al., 2017, p. 18). In the Likert scale (also called the satisfaction scale), measurements range from one extreme to another. Also included in such scales are moderate to neutral options. Harpe reminds us that rating scales (such as the Likert scale) have specifically been developed to allow researchers "to derive quantitative measures of non-physical phenomena by combining a set of items asking an individual to make a series of qualitative assessments" (Harpe, 2015, p. 838). These Likert scales are summated/aggregated rating scales, since they are based "on the idea that some underlying phenomenon can be measured by aggregating an individual's rating of his/her feelings, attitudes, or perceptions related to a series of individual statements or items" (Harpe, 2015, p. 839). The researcher furthermore performed the non-parametric Mann-Whitney U test to analyse the quantitative data (see 4.3.1.3). This statistical test allows the researcher to compare two independent groups of data consisting of ordinal data (such as generated by the Likert scale questionnaire of this study) (Nachar, 2008, p. 13).

Given that the original AESTHEMOS questionnaire (See Appendix A) was comprehensive, the researcher used those aspects of the questionnaire that explicitly addressed assessing music aesthetics (see Appendix B for the questionnaire). The researcher however ensured that the original AESTHEMOS questionnaire elements were present, but that the number of the emotional responses

was reduced from 42 to 12. In this study these aesthetic emotion responses are referred to as the 12 aesthetic items in the questionnaire. The Likert scale from 1 to 5 was left unchanged. The rationale for the reduction of emotional responses was threefold: firstly, some of the aesthetic emotions listed by Schindler et al., were semantically difficult to distinguish from one another (most participants are Dutch-speaking, and this instrument was in English), such as “calm me” (no. 4) and “relax me” (no. 20). The same can be said of “invigorate me” (no. 9), “energized me” (no.16) and “motivated me to act” (no. 41) (see Appendix A). Secondly, the participants had to list their emotional responses to five MP3 recordings – the listing of 42 aesthetic emotions for each MP3 recording would have been too demanding and time-consuming, and could result in participants losing interest and supplying potentially inaccurate data. Lastly, although functioning quantitatively, this questionnaire served as a vehicle to initiate in-depth interviews with the participants in phase 2, using the phenomena of aesthetics and art as prominent themes. The interpretivist viewpoint is paramount in this study. Deviating from the original instrument of Schindler et al. did not impact the experimental phase as such – it opened up the possibility for the researcher to use the questionnaire as a reflective tool in initiating in-depth interviews with participants.

4.3.1.2. Piloting of the survey instrument

Once the instrument was finalised, ten participants (not part of the sample of 30) were identified to pilot this instrument to identify potential problems in following the research procedure.[6] The pilot was administered to assess the feasibility of a (full-scale) study, for assessing the success of the proposed recruitment process, for identification of survey method, to assess the suitability of language, for collection of preliminary data in ensuring that the responses correlate to the purpose and intention of the instrument and finally to provide possibilities for a qualitative follow-up. Responses garnered from the piloted participants yielded a positive response. The pilot indicated no potential challenges regarding online access, language and understandability issues, and furthermore indicated possibilities of further probing. There was no need to make any changes to the research instrument, administer the online instrument, capture data, and protect participants' anonymity.

[6] The participants to the pilot were people who attended symphonic concerts on a regular basis and were known to researcher.

4.3.1.3. Administering the survey instrument

The questionnaire (see Appendix B) was used to elicit aesthetic responses to five individual recordings of compositions that were emailed to the participants in this study, together with the questionnaire. Of the five recorded compositions unknown to the sample, three compositions were composed by a human being. Two compositions were generated by artificially intelligent machines (hereafter referred to as AI). To control the music parameters (loudness, length and conformity of sound), the researcher searched for five recorded compositions consisting of the same genre and sound representation (as far as this was possible). The researcher found five recordings of symphonic film music (mainly from YouTube searches), all of which were recorded by the same symphony orchestra, The CMG Music Recording Orchestra of Hollywood, and also recorded at the same recording location, namely the Barbara Streisand Scoring Stage at Sony Pictures in Los Angeles, USA. Two of these recordings were of compositions generated by *AIVA* (*Artificial Intelligence Virtual Artist*), and three recordings were of the compositions composed by a human composer, George Shaw. Following the identification of the recordings fit for purpose, the researcher acquired permission from *AIVA* (Appendix G and H) and the human composer, George Shaw (Appendix J and K), to use these recordings as part of this research.

Following the permissions mentioned above, the researcher then imported the audio recordings into his Digital Audio Workstation (DAW) Presonus *Studio One*, using the computer programme *Loopback.* He then compared the five recordings and normalised the recordings, so that they all had approximately the same loudness (decibel) level. The researcher then shortened the recordings to 2 minutes, 9 seconds each and created a five-second fade-out at the end of each recording. He then exported the individual audio files in the form of MP3s (sample rate of 44.1 kHz and a bit-rate of 64 kbps) and uploaded the recordings to his Google Drive labelled Composition A, Composition B, Composition C, Composition D, and Composition E. Following the audio processing component, the researcher uploaded his questionnaire to www.wufoo.com and created an online questionnaire linked to each of these recordings on his Google Drive. The researcher then sent out an email containing the consent form to the 30 selected participants, reminding them of their rights and obligations (Appendix D). After the participants' consent was confirmed, they received an email link to the online questionnaire hosted on www.wufoo.com. The participants did not know the identity of the composers, a mix of human and AI. They were simply required to give Likert aesthetic, emotional responses to these recordings by

listening to them on a right (consumer level) set of headphones. The 30 participants' data to this questionnaire were then collected via email and analysed using quantitative instruments.

Regarding the data analysis, Helen Kara reminds us that not much room exists for creative interpretation in quantitative data analysis. The statistical technique chosen should be the right one for the question you attempt to answer (Kara, 2020, Chapter 8, p. 4). The researcher utilised statistical techniques such as charts, graphs and spreadsheets supplied by wufoo.com and Excel to organize and analyse the data. The questionnaire's purpose was to gain insight into the phenomena of art and aesthetics by capturing subjective impressions (or attitudes) to specific music compositions, and it did not serve as a rigorous psychological quantitative instrument. Data generated in this quantitative phase 1 were used as the point of departure for the qualitative phase 2 of the research.

4.3.1.4. Quantitative data analysis: Mann-Whitney U Test

Given the diverse research analytical tools available, the researcher found that the non-parametric Mann-Whitney U test was an appropriate test to analyse the quantitative data. It is one of the most common nonparametric tests used in behavioural sciences and is suited for small sample sizes (Nachar, 2008, pp. 13–14) – such as the sample size in this study. Nadim Nachar reminds us in *The Mann-Whitney U: A Test for Assessing Whether Two Independent Samples Come from the Same Distribution* (2008), that the Mann-Whitney U test is used "to answer the questions of the researcher concerning the differences between his groups" (Nachar, 2008, p. 13). In this study's quantitative phase, the researcher's two groups that were compared were: Group 1 (human compositions) and Group 2 (AI-generated compositions). This test was used explicitly as a non-parametric test because the sample was small, the measurement ordinal, and the data recorded were not on a precise scale (Nachar, 2008, p. 13). The Mann-Whitney U test hypothesis stipulates that a null hypothesis (H_0) indicates that the two groups come from the same population. Therefore, the two independent groups are "homogeneous and have the same distribution … and stochastically equal" (Nachar, 2008, p. 14). In this study, the researcher wanted to establish whether the data of Group 1 (Human) and Group 2 (AI) revealed any statistical differences (despite the summed response values); i.e., whether the responses to Group 1 (human) were different to those of Group 2 (AI).

The sample, to verify the hypothesis, must consist of: 1) a purposive sample drawn from a target population; 2) each measurement has to correspond to a different participant; 3) the data measured

must be ordinal (Nachar, 2008, p. 15). The Mann-Whitney U test initially calculates a U statistic for each group:

Mann-Whitney U Test Formula: $U_1 = n1 * n2 + n1(n1 + 1)/2 - R1$

$$U_2 = n1 * n2 + n2(n2 + 1)/2 - R2$$

with n_1 representing the number of observations in Group 1 and n_2 the number of observations in Group 2 respectively. Both groups had 12 observations (12 aesthetic items) (see Figure 3). R_1 represents the sum of the ranks of Group 1, and R_2 represents the sum of ranks assigned to Group B (see Figure 3).

The U statistic for each group was calculated according to the U test formula:

U_1 of Group 1 (human compositions)
U_2 of Group 2 (AI-generated compositions)

According to the test, the lowest U statistic (irrespective of which group it belongs to) is seen as the p-value. Following the U statistic calculation (U_1 and U_2) the appropriate statistical threshold (α) is determined by consulting the Mann-Whitney Critical values table (see Appendix M). The U critical threshold (α) is established by intersecting the number for n_1 and n_2 (both are 12).

According to the Mann-Whitney U test, the null hypothesis is rejected or accepted depending on the relationship between the p-value and α-value (statistical threshold) (Nachar, 2008, p. 16). If the $p < \alpha$ threshold, then H_0 (null hypothesis) is rejected, the samples do not come from the same population and are not statistically similar. If the p-value is more significant than the statistical threshold ($p > \alpha$), then the two groups are statistically similar and come from the same population.

4.3.2. Phase 2: The qualitative component

The second phase of the study used a qualitative instrument (in-depth interviews) with a purposive sample of respondents drawn from the initial group of participants in phase 1. A qualitative interview involves “unstructured and generally open-ended questions that are few in number and intend(ed) to elicit views and opinions of the participants” (Creswell & Creswell, 2018, p. 263). This interview process focuses on capturing the participants’ meaning, opinions, and experiences and not the researcher’s views related to the topic (Creswell & Creswell, 2018, p. 258). Qualitative instruments, however, are

interpretive by nature, and the researcher needs to be aware of his/her role in conducting his/her study (Creswell & Creswell, 2018, p. 260). The researcher's viewpoint influences the strategic and ethical processes of qualitative research. It requires researchers to "explicitly identify reflexively their biases, values, and personal backgrounds, such as gender, history, culture, and socioeconomic status (SES) that shape their interpretations formed during a study" (Creswell & Creswell, 2018, p. 260). In some instances, the influence of the researcher on the inquiry process is unavoidable, such as the role of this researcher in the quantitative component of this study when the researcher decided the compositions and aesthetic emotions to be included in the questionnaire, the order of compositions to be presented, and even where the fade-outs of the various MP3 audio would be placed.

Although this researcher was guided during the conversations in the qualitative phase of this study by formulated open-ended questions, it is "critical for the interviewer to suspend his or her assumptions about how people will answer the questions" (Given, 2008, p. 22). However, the researcher was aware of his own biases regarding worldview, aesthetics, and musical experience and consciously attempted to minimise his influence during the interview process.

The in-depth interviews in this phase 2 sequentially followed the questionnaire (phase 1) component. The researcher chose six participants from a sample of participants (purposive), who initially agreed to the second phase of the study. These participants were contacted by email, and dates for the interviews were established. Since this study was conducted during a peak outbreak of the Covid-19 virus in Amsterdam, only three in-person interviews were conducted. The remainder of the interviews were undertaken online, recorded on a mobile phone or Zoom, and stored on the researcher's secure Dropbox account.

The researcher captured the audio recordings and transcribed them using the online service of Microsoft 365. Transcriptions of the interviews were also stored on his secure Dropbox account as a back-up. The interview component sought to reveal additional information about the participants' responses. The researcher commenced the interviews by informing the participants that two of the survey compositions (phase 1) were generated by artificial intelligence and not composed by a human composer. Through loosely structured questions, he gained insight into how (or not) this new knowledge affected their original aesthetic assessment of the compositions and whether it mattered at all. The researcher then guided the conversation towards the use of artificial intelligence in music composition in general. He probed participants' feelings and experiences about the presence of artificial intelligence in music. The questions were left as open-ended as possible, allowing the participants to

express their views without interruption freely. The researcher used a set of sample questions as a guide to orientate and aide him and the participants and to initiate the conversations. A list of the interview questions asked is found in Appendix C.

4.4. Data Analysis Procedure

Data garnered for this research were two-fold in nature, firstly via the survey instrument and subsequent follow-up interviews. The survey data were analysed by using statistical techniques such as charts, graphs and spreadsheets supplied by wufoo.com and Excel. For purposes of this analysis the Mann-Whitney U Test was used (explained in Chapter 4.3.1.4 above). The ordinal Likert data generated (12 aesthetic items) by each of the 30 participants were composited according to responses to the human compositions and AI-generated compositions respectively. These composited responses (of the 30 participants) were then aggregated into two groups, namely Group 1 (human compositions) and Group 2 (AI-generated compositions). The researcher compared the distribution of data between the two groups and applied the Mann-Whitney U test to establish whether the data of the two groups were statistically similar or not.

The data collected through the interviews were first transcribed using the online Microsoft Word software and then analysed through qualitative data analysis. In qualitative research, the researcher can be more creative by using a thematic -, narrative - and conversation analyses to comprehensively understand the collective meanings and experiences expounded by the interviewees (Kara, 2020, Chapter 8, p. 4). The researcher initially organised the interview data according to his five interview questions. He then extracted and isolated concepts formulated by the interviewees, such as their understanding of aesthetic beauty (which in turn revealed an isolated concept such as ‘storytelling,’ ‘melodies,’ ‘structure,’ and ‘motifs’), utility or functional music, the value of live performance, and the role of the composer’s intent. He then cross-coordinated the extracted data/concepts with his literature research of Chapter 2 and the lens of his theoretical framework of Chapter 3 to reach his conclusions.

4.5. Cross-coordination of data

Convergent validation of data sources forms an integral component of mixed methods research. Generally, mixed methods research offers the depth of qualitative understanding with the reach of quantitative understanding. Convergent validation using different methods is achieved by looking at similar questions, themes, and attempting to answer these using interviews with finally seeking to blend

both the methods. The three nodes of data in this research are the quantitative, the qualitative and the theoretical framework. Themes and variables identified in the theoretical framework are corroborated with the quantitative instrument and participants' subsequent responses. Secondly, these themes and variables are pursued in the qualitative interview phase. Cross-coordination confirms the findings in establishing their validity and reliability.

In this study the researcher constructed a theoretical framework that focussed on the contributions of three important thinkers, namely, the relationship between mind and artefact in aesthetic appraisal (Immanuel Kant), the ability of AI to mimic human behaviour (Alan Turing), and the creativity of AI (Margaret A. Boden). The data from the quantitative component (phase 1) were cross-coordinated and corroborated by the contributions of the three thinkers and served as the foundation to initiate the qualitative component (phase 2).

4.6. Ethics

The study was conducted in full accordance with the University of KwaZulu-Natal's ethical guidelines. Given that human subjects formed the critical participants during two phases of this research, namely the quantitative and qualitative, the survey instrument's data also required permissions from the participants, creators of AIVA (Artificial Intelligence Virtual Artist) and George Shaw (the composer of the human compositions). Participants were explicitly informed about the tasks they were expected to perform. The anonymity of the data collected through the various research tasks, the voluntary nature of participation, and participant's right to withdraw from the study at any time were all established upfront. Following the clarity of the research process outlined to all participants, the latter gave their informed consent in writing (by email). The researcher stored the informed consent in the Cloud and backed up on a hard drive.

With the questionnaire being hosted on the wufoo.com online platform, it was impossible, due to anonymity, to match the consent forms with questionnaires. Thus, the stored questionnaire data are anonymous. The interview data (audio and interview transcriptions) were stored anonymously alongside the questionnaire data.

With regard to the use of the five compositions used in this study, written requests were conveyed to the creators of AIVA and to George Shaw, whereby they were informed of the nature of the study.

Every effort was made to ensure that the artistic integrity of compositions (both human and artificial intelligent) was maintained. The researcher ensured the anonymity of the composers and compositions and also emphasised their right to withdraw from the study at any time. After receiving AIVA's creators' and George Shaw's written permissions (Appendices G, H, J and K), they were notified that the results of the study would be made available to them at their request.

4.7. Summary

In this methodology, the researcher laid out his choice of research design employed (mixed-methods design), detailed the structure of the two instruments utilised (questionnaire and interview), explained the methods of analysis, cross-coordination of data and the issues of ethics that underpin this research. The researcher acquired the sample of specialist concertgoers in Amsterdam, partly by contacting the Concertgebouw, who agreed to publish the researcher's request for participants on its notice board (Appendix E). Interested persons were requested to contact the researcher by email. Being a musician active in Amsterdam's music world, the researcher also knew some concertgoers who were interested. He also received requests from potential participants who heard about this project through other musicians and participants.

Once the participants were selected, the researcher sent out an email containing the consent form, whereby the participants were reminded of their rights and obligations (Appendix D). After receiving the participants' email confirmation and consent, they received an email link to the online questionnaire, hosted on www.wufoo.com. The participants completed the survey (over two weeks), and www.wufoo.com collected, stored and encrypted all the online data securely with 256-Bit SSL Encryption. Only the researcher himself could access the data by means of a username and passcode. The researcher then utilized the Mann-Whitney U test and statistical techniques such as charts, graphs and spreadsheets generated by Wufoo.com and Microsoft Excel to organize and analyse the data. These findings were then exported from wufoo.com and stored securely on his private Dropbox account. After phase 1 of the research was completed, the researcher moved on to phase 2 of his study, the in-person interviews. The researcher interviewed six participants from a sample of participants (purposive), who initially agreed to the second phase of the study. After the interviews were conducted, they were transcribed and securely stored and analysed through qualitative data analysis methods.

The researcher cross-coordinated the data from the questionnaire with the ideas, themes and concepts presented in his theoretical framework. He further used the findings as the foundation for gathering data for the interview component. The researcher then collated the quantitative and qualitative data with the theoretical framework and understood the present-day human perspective on the use of artificial intelligence in music composing and music creation in general, as experienced by a specialist concertgoing audience. Following this methodology, the actual data are presented and analysed in the next chapter.

CHAPTER 5: Data and Analysis

This study explores whether symphonic concertgoers in Amsterdam can make aesthetic judgements in distinguishing between music compositions generated by humans and artificial intelligence. The researcher uses a mixed methods approach (Chapter 4), which comprises a quantitative component followed by a qualitative, interview-based process. This chapter presents the data gathered in both research phases, commencing firstly with the quantitative and then followed by the qualitative.

In the first quantitative phase, data were gathered using an online questionnaire administered to a sample of thirty symphonic concertgoers. Following a review of the initial phase responses, the second phase of the research process of in-person and online interviews with six purposively selected participants was undertaken. The Covid-19 lockdown restrictions presented specific logistical challenges with data gathering and impacted the responses in the interview section. Both the limitations and impact on reactions are discussed in Chapter 4.

This chapter unfolds by presenting the data gathered during both phase 1 (quantitative) and phase 2 (qualitative). The data from the first questionnaire survey phase 1 are presented, followed by an analysis of the data. These sections are then followed by presenting and analysing data from phase 2, the interview phase. Data garnered from both stages are then correlated and synthesised in the summary of the data.

5.1. Questionnaire

Using any research instrument presents particular challenges. In this study, the questionnaire used in phase 1 of the study showed one such challenge related to data that could not be accounted for, labelled ‘missing data’.

5.1.1. Missing Data

The thirty participants in the quantitative phase completed the online questionnaire (structured around the original AESTHEMOS questionnaire). This questionnaire comprised twelve questions requiring the Likert scale (from 1 – never to 5 – very often) responses. Five music compositions were used, which comprised of three that were human-composed and two composed by AI. These compositions were interspersed, with the participants not knowing the nature of the ‘composer’. Each of the five

compositions had to be rated using twelve identical questions – thus, each participant completed 60 questions overall (5 compositions x 12 questions (aesthetic items) = 60 responses).

The purposive sample comprised 30 participants for this phase of the research. Thus, the total of data entries would have been 1800 entries (5 compositions x 12 responses x 30 participants = 1800 total responses). However, the online survey only yielded 1751 data entries, with 49 'missing' data entries. According to Dong and Peng, missing data in quantitative research is the rule rather than the exception. They cite Craig K. Enders's article, "Using the Expectation-Maximization Algorithm to Estimate Coefficient Alpha for Scales with Item-Level Missing Data" (2003), wherein Enders claims that the missing rate of data of 15% to 20% is expected in educational and psychological studies (Dong & Peng, 2013, p. 1; Enders, 2003). All researchers concur with Joseph Schafer (1999, p.7) that a missing rate of 5% or less is inconsequential about the statistical inferences (Dong & Peng, 2013, p. 2).

In the online questionnaire used for this research, the percentage of 'missing' data amounted to only 2,7%. This percentage is negligible to the outcome of the statistical inferences reached in this research. The nature of the 'missing' data (non-responses), though, according to Maurizio Carpita and Marica Manisera (2011, p.145), is essential when one decides on how to deal with the non-responses/missing data. They add that "[I]t is *ignorable* [their emphasis] when the differences between respondents and non-respondents are not systematic (Missing Completely At Random or MCAR)" (Carpita & Manisera, 2011, p. 145). With this questionnaire, the missing data were MCAR – (the missing entries were not related to specific questions on the survey). They presented themselves randomly throughout the survey (over all the questions), with the result that these non-responses were not systematic and could be ignored. To diminish the possibility of distorted/biased results, the researcher in this study still decided to address the missing data by using imputation procedures. In the latter approach, "the missing values in the data are filled in with plausible values to create a completed data set that can be analysed with standard techniques" (Carpita & Manisera, 2011, p. 144). While there are various complex imputation procedures available, the researcher opted for the "item mean substitution", whereby the average of the responses for a specific question (item) is used to replicate the missing data of that question item (Carpita & Manisera, 2011, p. 145).

5.1.2. Likert scale and Reverse scoring

With ordinal Likert scale analysis, Harpe suggests that to come to an overall psychometric evaluation of the responses as a whole (group), the Likert items should be "grouped" together (Harpe, 2015, p. 845).

The researcher, therefore, created two groups consisting of responses to human-created compositions (Group 1) and responses to AI-generated compositions (Group 2). The participants' Likert item composite for Group 1 and Group 2 was done by "taking the arithmetic mean" of each participant's response values for the 12 aesthetic items of Group 1 and Group 2 respectively (Harpe, 2015, p. 841). Finally, within each of the two groups, the 12 aesthetic items consisted of the summation of the 30 participants' composite responses per aesthetic item to Group 1 (human) and Group 2 (AI) (see Sum of Frequencies Figure. 1 and Figure. 2). As suggested by Harpe, the researcher then conducted a comparative analysis of the summed responses between Group 1 and Group 2 to identify differences in overall aesthetic emotion responses between the two groups (Harpe, 2015, p. 845). Using the Mann-Whitney U test (non-parametric test to compare mean distribution in ordinal [non-continuous] data sets), the researcher set about to establish whether the two groups displayed statistic differences or not. Lastly, he compared the data distribution of the individual Likert items of the two groups (human and AI) to identify differences in shape and level between Group 1 and Group 2 (Landry, 2017).

It is important to note, though, that the twelve data items of this Likert scale consisted of positive and negative emotional response items – nine positive aesthetic items and only three negative aesthetic items, namely "I found it ugly" (item 3), "Bored me" (item 5) and "Felt indifferent" (item 12). To aggregate the overall aesthetic emotions response to a specific composition, the Likert analysis and scoring of the negative aesthetic items had to be addressed. Suppose a participant scores a "1" on the negative aesthetic item, "I found it ugly". In that case, it follows that a low rating on the Likert scale, in this case, translates into a positive aesthetic experience of that particular emotion. Therefore, to determine an overall aesthetic emotion response to a specific composition, one can calculate the overall result by reverse scoring the negative aesthetic items to reflect the implied positive value, for example, achieving a "1" for item 3 ("I found it ugly") suggests a low negative experience of the composition and therefore equates to a high positive experience of the composition (value "5"). The Likert scale data for all these negative aesthetic items were reversed and reinterpreted, namely, 1=5, 2=4, 3=3, 4=2, 5=1 (Grace-Martin, K, *An Easy Way to Reverse Code Scale Items*, 2012). The three negative aesthetic items were rephrased to facilitate the graphical representation:

Item 3 "I found it ugly" becomes "I did not find it ugly."
Item 5 "Bored me" becomes "Did not bore me."
Item 12 "Felt Indifferent" becomes "Did not feel indifferent."

5.1.3. Results

The Likert scale options ranged from a minimum value of “1” to a maximum value of “5”, with the median being “3”. Harpe reminds us that the analysis of Likert scales should remain at the aggregated level (group) and that item-by-item analysis should be avoided unless a subgroup (of items) could be identified and be used for comparison (Harpe, 2015, p. 857). Although the analysis for this survey remained at the aggregate level, the researcher did identify a subgroup of items that performed consistently across the two groups and made for interesting observation. Four aesthetic items, namely 1 (“I found it beautiful”), 3 (“I did not find it ugly”), 5 (“It did not bore me”), and 12 (“I did not feel indifferent”) stood out to be indicators of participants’ overall broad aesthetic response to the compositions. In hindsight, these four items most likely represented a broadly emotional response that appealed to the participants (making it more transparent and more comfortable for them to navigate the survey). Other items (such as item 2, 4, 6, 7, 8, 9, 10 and 11) of the survey addressed aesthetic emotions responses in more detail. They could have resulted in participants overthinking their responses and being more circumspect with their responses; i.e., items 6 (“I felt awe”), 11 (“I was surprised”) and 8 (“I was deeply moved”). It is, therefore, possible that the participants emphasised the aesthetic items which seemed the broadest and most transparent to them (items 1, 3, 5 and 12). So, although the researcher did not conduct an item-by-item analysis (it remained a group level – summed response), he did refer to the subgroup as a matter of interest. Furthermore, it is important to note that the numerical points (the summed responses) do not resemble an exact numerical representation of the summed individual aesthetic responses to the compositions (which is not possible in a study of the phenomenon of aesthetic judgement), but as ordinal data only serve as a broad indication of how participants responded to the compositions aesthetically.

Furthermore, the researcher declared the limitations of his instrument upfront, in that it contains a new combination of aesthetic items, and no psychometric evaluation had been conducted. The psychometric properties of the instrument at this point are unknown. According to Harpe, a newly developed instrument can have “unknown psychometric properties”, but this “can raise the question of reliability and validity of the instruments” (Harpe, 2015, p. 856).

FIGURE 1: A Composite of Aesthetic Survey Items distribution of responses to the human compositions. (Group 1: human)

	Group 1_HUMAN COMPOSITIONS_FREQUENCY OF RESPONSES												CENTRAL TENDENCY		
	1= Never		2= Rarely		3= Sometimes		4= Often		5= Very often		TOTAL		MODE (most frequently occurring score)	MEDIAN (middle score)	Sum of Frequencies (SoF)
Aesthetic Items	n	%	n	%	n	%	n	%	n	%	n	%			
1. I found it beautiful	1	3%	10	33%	9	30%	9	30%	1	3%	30	100%	4	3	89
2. It challenged me intellectually	11	37%	13	43%	5	17%	0	0%	1	3%	30	100%	1	2	57
3. I did not find it ugly	0	0%	0	0%	6	20%	16	53%	8	27%	30	100%	4	4	122
4. It touched me	6	20%	12	40%	7	23%	5	17%	0	0%	30	100%	2	2	73
5. It did not bore me	0	0%	1	3%	5	17%	18	60%	6	20%	30	100%	4	4	119
6. I felt awe	12	40%	8	27%	8	27%	1	3%	1	3%	30	100%	1	2	61
7. It made me curious	5	17%	14	47%	8	27%	3	10%	0	0%	30	100%	2	2	69
8. I was deeply moved	11	37%	14	47%	3	10%	2	7%	0	0%	30	100%	1	2	57
9. It made me feel nostalgic	8	27%	10	33%	5	17%	6	20%	1	3%	30	100%	1	2	70
10. I felt relaxed	3	10%	9	30%	14	47%	4	13%	0	0%	30	100%	2	3	79
11. I was surprised	6	20%	15	50%	7	23%	2	7%	0	0%	30	100%	1	2	63
12. I did not feel indifferent	0	0%	4	13%	8	27%	10	33%	8	27%	30	100%	4	4	112

In Figure 1 (above), n indicates the number of participants (out of 30) who responded to a specific aesthetic survey item with a value of "1" to "5". The 30 participants' breakdown of responses to aesthetic survey item 1 ("I found it beautiful"), for example, reads as follows: 1 out of 30 participants scoring the item a "1" (3% of participants), 10 out of 30 participants scoring the item a "2" (33% of participants), and so on. The "Mode" indicated the most frequently scored value and the "Median" indicates the middle score of all the summed responses. All the responses for that particular aesthetic item are summed and displayed as the Sum of Frequencies (SoF) in the last column. In the case of aesthetic survey item 1, "I found it beautiful", the Sum of Frequencies (SoF) = 89. A Likert scale consists of ordinal data, and the values indicate tendencies and not exact numerical representations. The SoF values are therefore indications of trends which can be analysed. A neutral response is indicated by Likert value "3" ("sometimes"), while Likert scale "1" ("never") and "2" ("rarely") indicate infrequent or negative responses. Likert scale items "4" ("often") and "5" ("very often") on the other hand indicate frequent and positive responses. Therefore, a SoF value of 90 ("3" x 30 participants) would indicate a neutral response:

SoF = 90 show sometimes (neither frequent nor infrequent)

SoF > 90 shows tendency from sometimes towards often (+frequent)

SoF < 90 shows tendency from sometimes towards never (-infrequent)

A summation of results from listening to music composed by humans (see Figure 1.) yielded that more than 60% of the respondents reported the emotions they frequently experienced were that the music was not ugly (n=24, 80%), that it did not bore them (n=24, 80%) and that the music did not generate feelings of indifference (n=18, 60%). On the other hand, the human compositions were *infrequently* reported as generating aesthetic responses of being intellectually challenging (n=24, 80%), awe-inspiring (n=20, 67%), touching (n=18, 60%), moving (n=25, 83%), awakening curiosity (n=19, 63%), nostalgia (n=18, 60%), and surprise (n=21, 70%). Item 1 ("I found it beautiful") is the only item that generated a near-neutral response (infrequent n=11, 37%; frequent n=10, 33%).

The results suggest that three of the subgroup aesthetic items (3, 5 and 12) generated the highest aesthetic emotion responses by most participants. In contrast, aesthetic item 1 of the subgroup generated a near-neutral response. The rest of the items generated low aesthetic responses by the majority of the participants. Given that Group 1 consisted of the human-created compositions, and keeping in mind the caveats mentioned (caution against Likert item analysis), such variety in responses are expected, depending on the complexity and appeal of a composition. The variety in responses favoured the subgroup of aesthetic items 1, 3, 5 and 12, which could be (as explained before) the result of participants navigating these subgroup items as broadly defined aesthetic responses (beautiful, not beautiful; boring, not boring, and the like) resulting in a more robust response. Lastly, the highest computed aesthetic response value that could have been recorded for the human compositions is 1800 (30 participants x 12 questions x 5 (very often)). The summed SoF value for the human compositions is 971:

971(SoF)*100/1800(Max value of the SoF) = 53.94%.

This data reveals that the distribution is positively skewed.

FIGURE 2: A Composite of Aesthetic Survey Item distribution of responses to the AI compositions. (Group 2 – AI)

	Group 2_AI COMPOSITIONS_FREQUENCY OF RESPONSES												CENTRAL TENDENCY		
	1= Never		2= Rarely		3= Sometimes		4= Often		5= Very often		TOTAL		MODE	MEDIAN	Sum of Frequencies (SoF)
Aesthetic Items	n	%	n	%	n	%	n	%	n	%	n	%			
1. I found it beautiful	5	16,67%	4	13%	15	50%	4	13%	2	7%	30	100%	3	3	79
2. It challenged me intellectually	11	36,67%	14	47%	3	10%	1	3%	1	3%	30	100%	2	2	51
3. I did not find it ugly	0	0,00%	0	0%	4	13%	11	37%	15	50%	30	100%	5	4	127
4. It touched me	8	26,67%	13	43%	7	23%	1	3%	1	3%	30	100%	1	2	58
5. It did not bore me	1	3,33%	4	13%	7	23%	9	30%	9	30%	30	100%	5	3	104
6. I felt awe	17	56,67%	6	20%	5	17%	1	3%	1	3%	30	100%	1	2	51
7. It made me curious	9	30,00%	8	27%	9	30%	4	13%	0	0%	30	100%	3	2	62
8. I was deeply moved	17	56,67%	9	30%	3	10%	1	3%	0	0%	30	100%	1	2	46
9. It made me feel nostalgic	9	30,00%	11	37%	8	27%	1	3%	1	3%	30	100%	2	2	58
10. I felt relaxed	5	16,67%	7	23%	15	50%	3	10%	0	0%	30	100%	3	2	70
11. I was surprised	9	30,00%	13	43%	8	27%	0	0%	0	0%	30	100%	2	2	54
12. I did not feel indifferent	1	3,33%	6	20%	4	13%	11	37%	8	27%	30	100%	4	3	102

When listening to music composed by AI (see Figure 2. overleaf), 60% (and above) of the respondents reported that the emotions they frequently experienced were that the music was not ugly (n=26, 87%), did not bore them (n=18, 86%) and that the music did not generate feelings of indifference (n=19, 63%). On the other hand, the AI compositions were *infrequently* reported as generating aesthetic responses of being intellectually challenging (n=25, 83%); awe-inspiring (n=23, 76%); touching (n=21, 70%); moving (n=26, 87%); awakening curiosity (n=17, 57%); nostalgia (n=20, 67%) and surprise (n=22, 73%). Item 1 (I found it beautiful) is the only item that generated close to a neutral response (infrequent n=9, 30%; frequent n=6, 20%).

The results show that three of the subgroup aesthetic items (3, 5 and 12) generated the highest aesthetic emotion response from most participants. In contrast, Likert item 1 of the subgroup generated closest to near a neutral reply. The rest of the items (2, 4, 6, 7, 8, 9 and 11) generated low aesthetic responses from most participants. Although the individual response values generated (except for item 3) are lower than that of Group 1, the distribution of the individual item responses mirrors that of Group 1, possibly suggesting that participants (just as with Group 1) interacted meaningfully with the AI-generated compositions, generating a variety of reactions but favouring the subgroup of aesthetic items (1, 3, 5 and 12). The summed total of SOF of Group 2 generated a value of 862:

862(SoF)*100/1800(Max value of SoF) = 47.89%.

This data show that the distribution is negatively skewed.

5.1.3.1. The Mann-Whitney U Test

Using the Mann-Whitney U test (Chapter 4, 4.3.1.4.), the researcher compared the data of Group 1 (human) and Group 2 (AI) to reveal if there were any statistical differences between the two groups. A null hypothesis (H_0) of the Mann-Whitney test indicates that the two groups come from the same population and are therefore homogeneous, and the two independent groups are, therefore, "homogeneous and stochastically equal" (Nachar, 2008, p. 14).

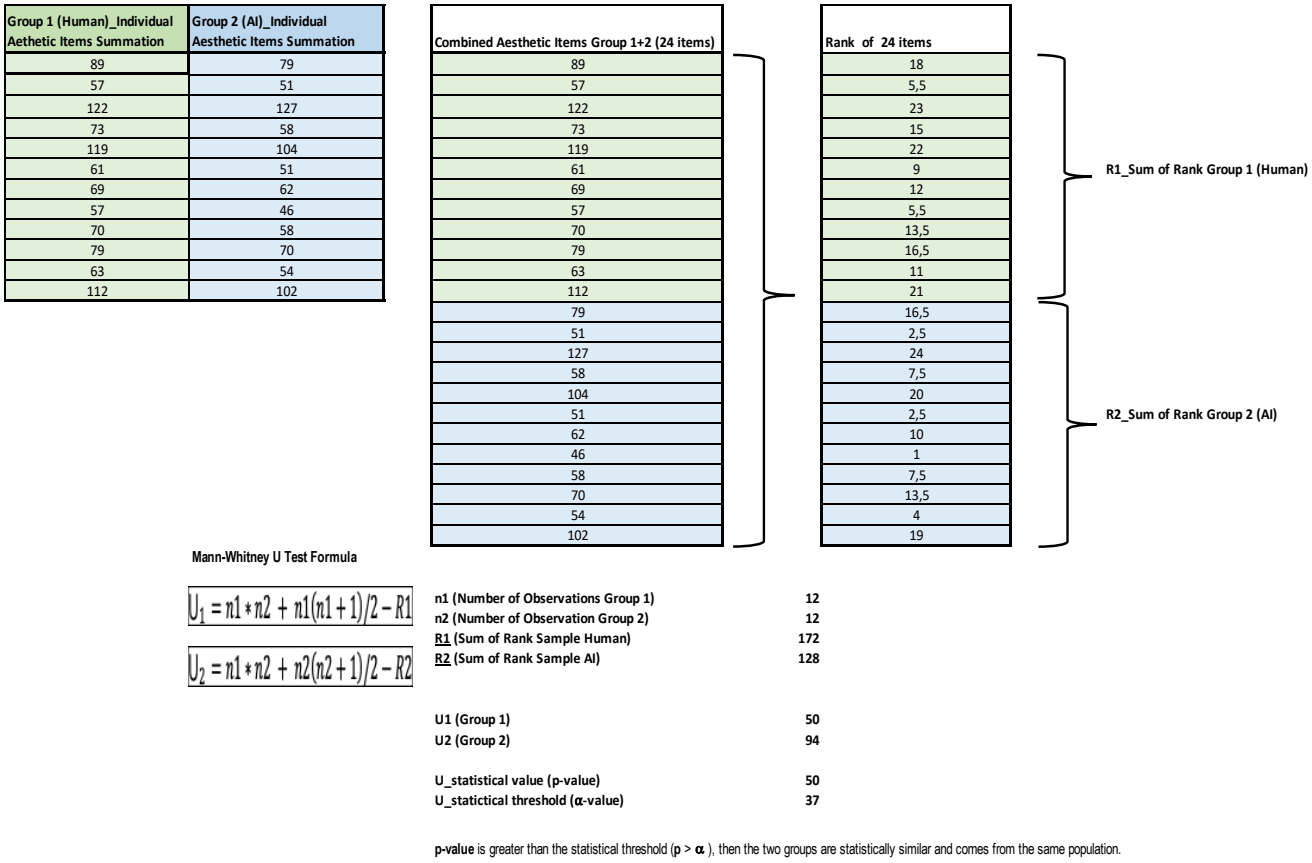
The U statistic for each group was calculated according to the U test formula (Figure 3):

The **U** statistic for Group 1 = 50
The **U** statistic for Group 2 = 94

The lowest U statistic is viewed as the p-value, which for this study is the U statistic for Group 1, which is 50. The appropriate statistical threshold (α) was determined by consulting the Mann-Whitney Critical values table (see Appendix M). The U critical threshold (α) was calculated to be a value of α **=** 37 (see Appendix M).

The null hypothesis is rejected or accepted depending on the relationship between the p-value and α-value (statistical threshold) (Nachar, 2008, p. 16). If the p-value is greater than the statistical threshold ($p > \alpha$), then the two groups are statistically similar and come from the same population. If $p < \alpha$, then one rejects the null hypothesis (H_0) and the two groups are not statistically similar. In this case, the p (50) > α (37) and we accept the null hypothesis (H_0) – Group 1 and Group 2's variables are stochastically equal. Therefore, although the two groups generated different summed aesthetic response values, there are no significant statistical differences between them.

FIGURE 3: Mann-Whitney test data



Group 1 (Human)_Individual Aethetic Items Summation	Group 2 (AI)_Individual Aesthetic Items Summation
89	79
57	51
122	127
73	58
119	104
61	51
69	62
57	46
70	58
79	70
63	54
112	102

Combined Aesthetic Items Group 1+2 (24 items)	Rank of 24 items
89	18
57	5,5
122	23
73	15
119	22
61	9
69	12
57	5,5
70	13,5
79	16,5
63	11
112	21
79	16,5
51	2,5
127	24
58	7,5
104	20
51	2,5
62	10
46	1
58	7,5
70	13,5
54	4
102	19

R1_Sum of Rank Group 1 (Human)

R2_Sum of Rank Group 2 (AI)

Mann-Whitney U Test Formula

$$U_1 = n1 * n2 + n1(n1+1)/2 - R1$$

$$U_2 = n1 * n2 + n2(n2+1)/2 - R2$$

n1 (Number of Observations Group 1)	12
n2 (Number of Observation Group 2)	12
R1 (Sum of Rank Sample Human)	172
R2 (Sum of Rank Sample AI)	128
U1 (Group 1)	50
U2 (Group 2)	94
U_statistical value (p-value)	50
U_statictical threshold (α-value)	37

p-value is greater than the statistical threshold (**p** > **α**), then the two groups are statistically similar and comes from the same population.

In Figure 3, the SoF (Sum of Frequencies) for each of the 12 aesthetic items of Group 1 (green) and Group 2 (blue) are displayed. The 'n' (number of observations) for each of the two groups is 12. In order to apply the Mann-Whitney U test (to compare the observations of two groups), (1) the data of both groups must be combined (see Figure 3, middle column), (2) ranked within the combined group of 24 observations and (3) the sum of the ranks of each group calculated separately (see Figure 3, last column). The Mann-Whitney U test is performed on both Group 1 and 2 and the lowest U of the two groups determines the statistical value of the test (p-value), in this case p = 50. The U critical threshold (α) was calculated to be a value of α **=** 37 by consulting the Mann-Whitney Critical values table (see Appendix M).

5.2. Interviews

The Covid-19 lockdown restrictions impacted data gathering for phase 2 of this research. Only three of the six interviews were conducted face-to-face. The researcher observed a general unease exacerbated by social distancing protocol and uncertainty, resulting in shorter interviews than

anticipated. The remainder of the interviews were conducted during stricter Covid-19 measures when participants were confined to their residences. Even under these conditions, the interview process was challenging. Interviewees were less comfortable with lengthy online interviews. The interviewees felt that engaging with a computer screen that had minimal interactivity was uninteresting. Thus, their prolonged participation created diminishing returns in terms of their responses to complex questions around aesthetics. Understandably, most participants felt their primary focus was on their health. The eagerness to get the interview done resulted in limited and, at times, curt answers to the researcher's questions.

Despite the challenges alluded to above, the researcher was satisfied with the interview process and grateful to the participants for their willingness to participate in the research process. The interviews were loosely structured (semi-structured) around five questions (see Appendix C for the Interview Questions). At the outset, the researcher made all interviewees aware that the five compositions they responded to in the survey (phase 1) were symphonic works and that this repertoire of works consisted of three compositions created by humans and two generated by artificially intelligent machines. All five of the works were performed by an orchestra comprising 'live' musicians. All interviewees were asked the five questions (Appendix C) and were prompted to talk about their understanding and experience of artificial intelligence in general. The researcher concluded that the subject matter of AI was not familiar to all the participants. Some of the interviewees needed more guidance and input/explanation than others in eliciting their responses. Through listening, compiling and analysing their answers, opinions and narratives, the researcher sought to shed light on his main research question (whether concertgoers can aesthetically distinguish between human and AI-generated compositions), and at the same time to provide answers, context and background to his research sub-questions, namely:

- Of what importance is the composer's intention in assimilating meaning from a composition?
- What do contemporary concertgoers consider as essential aesthetic properties of a musical composition?
- How do concertgoers view the involvement of AI in music composition (present-day/future)?

For this particular study, the researcher grouped the participants' responses according to the five questions posed during the interview process. The researcher briefly comments on the data (findings) for continuity and context. The primary analyses and cross-coordination of the data with the theoretical framework (Chapter 3) and research questions (main and sub-) are undertaken in Chapter 6. The six participants were assigned pseudonyms for anonymity: participant 1 to 6 (P1 to P6). All participants

were Caucasian, five male and one female. It was not possible to get a gender balance with the interviewees due to the nature of the data responses received in the survey (phase 1) coupled with participants' willingness to engage in phase 2 of the study.

5.2.1. Interview Results

The qualitative part of the study was conducted by means of interviews (both online and face-to-face), with six of the participants selected from the first part of the study. All six participants were subjected to the questions listed below and their synthesised responses are recorded in sections 5.2.1.1. through to 5.2.1.5.

5.2.1.1. Question 1: If I tell you that two of the recordings (from the online questionnaire) were composed/generated by artificial intelligence (AI), do you find this surprising? Does this knowledge change your overall value of these compositions?

Two interviewees (P1, P6) were not surprised that the online questionnaire included some artificial intelligence generated compositions. P1 enjoyed some of the compositions but felt that the music, in general, did not engage him. This contrasted his experience when he attended music performances at the Concertgebouw. With the recorded compositions, he kept on losing his concentration, which always demanded his attention. He regarded the online questionnaire's music as a kind of "utility" music that functioned either as background music or music to enhance a film. Since he perceived these compositions as music serving a secondary purpose rather than compositions to be appreciated for their worth, the use of artificial intelligence in generating some of these compositions came as no surprise to him at all.

P6, on the other hand, guessed that AI was used in some of the survey compositions. He somehow (maybe through interaction with other participants) became aware of the researcher's study of AI in music composition. This information, however, did not affect his survey responses or, in any way, change his mind/response. The compositions themselves were paramount, and how the compositions came into existence did not interest him. He judged them using the same criteria for all music compositions, namely production value, sound palette, arrangement, and form.

The remaining four interviewees (P2, P3, P4 and P5) were genuinely surprised when they learnt that AI generated two questionnaire compositions. P2 believed it was impossible to establish which of the

compositions were generated by a computer and which were composed by a human being. P2 was eager to inquire which of the compositions were AI-generated to compare whether he scored them (AI compositions) differently from the human-composed ones. P2 furthermore indicated that if he had been given advance knowledge of any AI involvement in the compositional process, this information would have been on his mind throughout and would have influenced his listening experience. P3 found the revelation of AI involvement surprising and intriguing and queried the researcher to the AI-generated compositions' identities, to establish whether those were the compositions P3 rated the highest. P3 lastly indicated that any previous knowledge about AI involvement would have influenced her response positively: "I might like it even more."

P4 was also surprised to learn about AI involvement in the compositional process. Just as P1, P4 felt that the compositions were not "high end" art, but a kind of "utility" music that functioned as a background score for film or games – the type of music to which he would not purposefully listen. P5 was surprised by the AI revelation, but thought that the same person composed all of these compositions. Prior information about AI involvement would not have influenced P5's questionnaire responses, in that he judged the compositions on their merit alone.

It is apparent from the responses to question 5.2.1.1. that four participants (P2, P3, P4 and P5) were surprised to learn of AI involvement in generating some of the compositions. Although P1 and P4 questioned the quality of all the compositions in general (viewing these compositions as some sort of utility or incidental music), all participants judged the compositions solely on their merit. Participants were divided on whether prior knowledge of AI involvement would influence their aesthetic judgment of the compositions. However, the researcher concluded that participants perceived and interacted with all the compositions (AI and human) as artefacts (products of creativity) irrespective of their origin and were generally surprised by the AI involvement in the creative process.

5.2.1.2. Question 2: What is the likelihood of you attending a concert where all the compositions are composed by AI (and advertised as such) and performed by live musicians?

P1 and P2 indicated that they would not attend a concert comprising of AI-generated music. P1 thought he would be prejudiced if he knew in advance that artificial intelligence generated the compositions for the concert. The fact that a "machine" composed the music would negatively colour his judgement; i.e., the music would not be 'artistic' or 'creative' enough. P2 said that even knowing that these AI

compositions would be performed by human beings, the compositional creativity did not originate from human beings, and therefore he would not attend.

P5's position was slightly different, in that he indicated that if a concert of AI-generated music were advertised before he took part in this study, he would not have attended. However, because of his new awareness of AI (through his interview with the researcher), he might consider going to such an event. He did not, however, have confidence in the quality of such a concert.

By contrast, P3, P4 and P6 were optimistic, curious and definitely would attend such a concert. P3 loves music and has a background in machine learning. Perhaps the latter accounts for her interest in attending a performance of AI-generated music. She expressed doubt, however, about the possible aesthetic quality of the concert in general. P4 shared P3's concerns regarding the aesthetic quality of a concert of AI-generated music. P4 perceived music as a human activity of storytelling: "I think it's hard for [a computer]." P6, indicated that although he would attend the concert, the latter would be for reasons of his interest in new technologies. He doubted whether the concert would result in a satisfying aesthetic experience. He also believed that AI could not yet "come up with something original or interesting."

In short, most participants would attend a concert performance of AI-generated music, even if attending only out of curiosity regarding AI technology. All participants agreed that they expected the concert to be of low aesthetic value. It is apparent from participants' responses that information about the origin of the compositions as AI-generated negatively influenced them. As with question 1, doubts were raised about the AI compositions' aesthetic quality, but the artefact status of the compositions themselves was not questioned.

5.2.1.3. Question 3: In listening to music, what is more important in judging its beauty – is it the performance, the composition, both or anything else?

P1 and P3 mainly focused on the composition itself when judging its beauty. P1 saw the beauty of the composition as a puzzle to unravel. The composition would be of "high value" aesthetically if it had a good structure, consisting of themes and motifs that developed and repeated. He emphasised the "organic-ness" of a composition, which he explained as the composition's potential to grow in various directions. Concerning the performance of the composition, this did not matter to him. He only used the performance as a kind of map to guide him through the composition. If, for example, a Beethoven or

Brahms performance was not well executed (performed), he would imagine how it would sound if well executed, since he is familiar with the repertoire. If, however, a composition is not well constructed (not aesthetically pleasing, in his opinion), the performance would play a more critical role. P3 focused her listening experience on the composition itself, concentrating on the melody lines of a composition, which she felt was an essential element for engaging meaningfully with a composition.

P2, P4, P5 and P6 favoured neither the composition nor performance. P2 judged the beauty of the composition by treating the performance or composition as equally important – a "combination of seeing the performance as well as hearing it". P4 explained that he engaged with the music on different levels: a technical level (the use of dynamics, melodic structure, and production value) and on a purely emotional level. He listened to the composition and how the composition was performed. For P4, the composition and performance worked together to present a beautiful piece of music. P5 explained that there were two parts to his listening experience: "the composition for sure and then you have the execution – the performance." Some compositions are so good that one just likes them, especially if they contain strong melodies. However, the composition's execution contributes to his aesthetic enjoyment of music. He listens holistically "with pleasure, you know, not analysing. (I) (J)just like it; it makes me feel good." P6 also listened to the composition and the performance as a whole: "…I just listen to music. My first impression is I can like it or not."

Two of the participants focused primarily on the composition in their aesthetic judgment. However, the majority of participants had a more holistic approach and regarded both the composition and the performance as necessary in their aesthetic experience of the music. As with previous questions 5.2.1.1. and 5.2.1.2., the artefact status of AI-generated compositions was not questioned.

5.2.1.4. Question 4: Is the reason a composition is created or, for that matter, the mindset/intent of the composer important in your overall aesthetic judgment of it?

P3 and P4 agreed that the reason for the composition's existence and the composer's intention are essential. P3 viewed herself as someone who listened to music intuitively and wanted to analyse *why* she felt this way. She explained that this additional information on intent and context would enhance her musical experience. P4 felt that further information added context to the composition and improved his enjoyment of the music. He cited the composition "Tears in Heaven" by Eric Clapton as an example: "I didn't like this song so much until I heard that it was written for his son who died. You know, then it gives (for) me an extra dimension to it (composition). It explains the choices (of the composer) more or

less …". He also cited Piet Mondriaan (the Dutch painter) as an example where additional information would enhance one's aesthetic experience – research into Mondriaan's painting style would add depth to one's appreciation of his work, giving context to his later style of straight lines and primary colours.

P1, P2, P5 and P6 believed that intent and context were not essential to their aesthetic experience of the music. The additional information about the compositions, however, can still be valuable. P1 cited Arnold Schoenberg and Anton Webern, who talked about their worldviews and ideas, whereby P1 became interested in how these worldviews and beliefs manifested themselves in their compositions. P1, however, insisted that the composer's intention was not essential – he listened to the music from his perspective and found meaning that way. P2 prioritised the composition itself and added that, for him, it was all about emotion and feeling and much less about the intellectual side of things. Additional information surrounding the composition could enhance his enjoyment of the music.

P5 had no interest in knowing who composed the music or the reason for its creation. So much music has no specific author and was borne out of folklore music. He was more interested in who performed the composition and adds that "I think I'm more/always concerned, like who is playing this, like who's executing (it), and I don't look at the composer".

P6 explained that he purposefully did not seek more information about the music he listens to. He made judgements about the music based on what he heard and what it meant to him. On the other hand, if someone recommended music to him or read an article about a particular composer, this additional information would influence his judgement. Still, it was not essential to his appreciation of the music.

The majority of participants expressed the opinion that the composer's identity and the context surrounding the composition's creation had no bearing on their aesthetic judgement of a composition. Two participants believed that the additional information about the composer and context would alter their aesthetic experience. This finding contradicts the participants' responses to question 5.2.1.2., where all the participants indicated that knowledge of AI involvement would lower their aesthetic experience of the compositions. Regarding question 5.2.1.2., however, this additional information surrounding the compositions was advertised and known publicly, thereby creating perceptions in the participants' minds. In question 5.2.1.4., participants were asked if the additional information was essential for their aesthetic enjoyment, and the majority of participants expressed the view that the artefact's existence was the primary requirement for aesthetic experience – regardless of any intentions of the composer or any additional contexts.

5.2.1.5. Question 5: Given the presence of technology in the music creation process today, what are your views on where music is going in the future?

All participants, sometimes with caveats in place, viewed AI technology in music production as a positive development. P1 was hopeful and optimistic and stated that if a computer could produce music he enjoyed, that was good enough for him. He emphasised the relationship between the perceiver and the artefact, by saying "the most important thing is that people find their attitude or relationship with music." P2 accepted the future value of AI in art creation, despite its shortcomings. Music is a shared experience between human beings and involves human feelings, which artificial intelligence do not have: "so it (AI) can't be communicating actual feelings. But the fact that it's copying (the) real feelings and music that arises from them to me means you can get the same result."

P3 was optimistic about future AI use in art creation: "I have no objection to AI being used to generate music. I think it's interesting as an intellectual challenge … The thing is, there's something about bringing beauty into the world. There's so much grief, there's so much pain, there's so much ugliness, and as artists, we can bring meaning and beauty into this, and if AI helps, fine."

P4 anticipated that AI could play an essential role in producing utility music (music for workout, study, yoga and the like). He believed that, as AI usage in music became more ubiquitous, human beings will increasingly yearn for a unique experience, which they would satisfy by attending more live music concerts: "you know they (audience) wanna be like 1, 2, 3, 4 … (the band is counted in), and there we go – you want to have this moment, go in it all together with the musicians, share the energy and then you know and have that experience – it is a different experience than listening to Spotify, and this becomes like a unique experience." He had, however, a caveat about the involvement of AI in music creation – AI is not an active member of our society and cannot translate our experiences through music the same way that human beings can: "There's one thing the computer will never, never, never experience, and this is the reproduction of life – like you have a child. The miracle, that's it. So those are two like (fundamental) emotions which have to do a lot with the music of course – they (computers) will never be able to experience it."

P5 felt that, although AI technology usage in music creation of the future will increase, analogue instruments and musicians will be in demand forever and won't be replaced. P6 viewed the use of AI technology, specifically relating to music education, as a positive development. Due to technology, entry into music production has become more affordable, because music-making is more accessible for

everyone. He agreed that AI involvement in music would increase the popularity of live music events and hopefully get people excited to learn an acoustic instrument.

All participants were generally positive about AI involvement in music creation and accepted that AI usage would only increase shortly. Some participants expressed that increasing AI involvement would lead to a reactionary boost of live performances and an increasing interest in playing acoustic instruments. One participant raised the caution that AI was perceived to be a machine and not a human agent (and therefore not conscious), thereby lowering the aesthetic experience of AI-generated music. This caution is mirrored in question 5.2.1.2. and the general participant belief (throughout the interview process) that the knowledge of AI involvement would result in a lower aesthetic experience. It is important to note that knowledge of AI involvement, which is usually not readily available, is a pre-requisite needed (according to participants) to lower the expected enjoyment of a piece of music.

5.2.2. Essential Aesthetic Properties of Compositions

During the online survey process, the participants evaluated the compositions aesthetically, according to 12 aesthetic emotion items. The six interviewees who agreed to participate in the interview process, however, were not bound by the online questionnaire breakdown of aesthetic standards. Each interviewee had his/her individual, subjective opinion on what constitutes an excellent aesthetic composition. The researcher was left with the overall impression that the interviewees' aesthetic interaction with music was not a detailed or mainly thought through process. P1, P2, P4, P5 and P6, for example, expressed the notion that they just interact with or listen to the composition/artefact in a non-detailed manner. Their initial reaction is a sort of global emotional response to the artefact, informing whether they like it or not.

> Participant 1: "I **felt**" and "[I]t **feels** like..."
> Participant 2: "music is so much **emotion** and **feeling** for me anyway; it's much less about the intellectual side of things."
> Participant 4: "can also listen in a sort of (fundamental) kind of **emotional** vibe…"
> Participant 5: "Or like (listening) you know, but with pleasure, you know, not like analysing. Just **like** it, it makes me feel good."
> Participant 6: "Another thing for me is I just listen to music. My first impression is I can **like** it or not."

Reflecting on their aesthetic choices, all the interviewees used terminology such as 'imagination', 'storytelling,' 'melodies,' 'structure,' and 'motifs' to substantiate their concepts of aesthetics:

> Participant 2: "I just listen to the music" and "**imagined**" while being transported to imaginary scenery.
> Participant 3: "… here is something about certain **melody** lines. Just the **melody** itself, where the **melody** feels like something profound is going on."
> Participant 4: "beautiful **melodies**" as a component of an excellent aesthetic composition.
> Participant 5: (on the importance of beautiful melodies): "I'm just attracted to it (melodies), and it sticks a little bit."
> Participant 6: "I listen to it; (it) becomes boring without the **story**."

When it came to explaining their aesthetic responses rationally, participants listed various elements: the importance of structure and motifs, melody lines and the presence of storytelling. These elements contributed to the aesthetic value perceivers derived from the artefacts when they reflected on their aesthetic judgement. The data indicates, however, that the initial aesthetic responses (by most participants) to the music compositions were more intuitive than rational. When pressed, the identification of various aesthetic elements served as a validation of their initial intuitive aesthetic choices.

5.2.3. Summary

The data generated by the quantitative and qualitative instruments were analysed independently. In the case of the survey instrument, participants were not informed that AI was used to generate two of the five compositions used in the questionnaire. The latter process mitigated a bias towards "liking" the human compositions more than the AI-generated ones. It is clear from the data that Group 1 (human compositions) generated a higher aesthetic response value than Group 2 (AI-generated compositions). However, the results of the Mann-Whitney U test, showed that the two groups did not display any significant statistical differences and that the two independent groups were homogeneous and stochastically equal. Therefore, it is reasonable to assume that the discrepancy between all the groups' aesthetic response values resulted from expressions of personal aesthetic tastes. It was not indicative of an 'intuitive' aesthetic negation of compositions based on their origin, be it human or AI-generated. Differences in aesthetic response values between groups are consistent with human beings making aesthetic judgments of artefacts – human assessment of beauty is subjective and not reflective of zero-sum outcomes.

During the interview process (phase 2), the interviewees indicated that they could not identify the AI involvement in the creation process. They agreed (or tacitly assumed) that AI can produce artefacts but expressed their doubt over the quality of AI's creative output. The interview participants indicated that knowledge of AI employment would influence their aesthetic evaluation of the artefacts (AI-generated) in general. Although interviewees accepted the inevitability of increasing AI participation in art creation, they doubted whether AI creations could ever match human beings' creative output, because of AI's non-acceptance (for now) as an active member of human society. The interviewees, however, expressed the belief that AI, as technologies preceding it, will become pervasive in art creation of the future and will continuously be refining and bettering its abilities.

In closing, the survey and interview data showed that the AI-generated compositions in themselves were sufficient to establish interaction and meaning with the perceiver/participant. Furthermore, the researcher's hypothesis that concertgoers would not be able to differentiate between compositions composed by human beings or generated by artificial intelligence is validated by the data results of the survey and interviews, and will be supported with concepts and ideas formulated by Immanuel Kant, Alan Turing and Margaret A. Boden. The theoretical lens formulated with Kant, Turing and Boden and their relevance to the data and subsequent analysis will be elaborated upon in the conclusions section of Chapter 6.

CHAPTER 6: Conclusions and Recommendations

This final chapter provides the conclusions that have emerged as a result of answering the research questions. Recommendations relating to these finding are suggested, together with suggestions for further research and a final comment.

6.1. Findings

The answer to the main research question, which follows, has emerged as a result of the answers to the three research sub-questions below in sections 6.1.2., 6.1.3. and 6.1.4. respectively:

6.1.1. Main research question: Within a portfolio of works can a concertgoer discern aesthetically between compositions generated by humans and artificial intelligence?

Inferred from the answers given in the three sub-questions (Chapter 6, 6.1.2., 6.1.3. and 6.1.4.), it becomes evident in this mixed methods approach that the main research question will be answered in the negative. The conclusions drawn from the sub-questions do not proceed chronologically but are seen as individual parts of a whole. Based on the conclusion to sub-research question 6.1.3., it can be inferred that participants interacted with the compositions in a broad, global 'intuitive' aesthetic rather than engaging with them cognitively and reflectively. It is also true from the answer to sub-research question 6.1.2., that in this aesthetic engagement with an art object, the existence of the art object (compositions) alone is sufficient to establish meaningful, aesthetic interactions. The conclusion to sub-research question 6.1.4. suggests that participants were doubtful about the creative ability of AI, since it lacks human agency. Therefore, the disclosure or non-disclosure of AI use in the creative process plays an essential role in participants' aesthetic evaluation of compositions. Given that participants to the questionnaire were not informed of AI's involvement in the compositional process, combined with the finding that compositions themselves are sufficient for aesthetic interaction, the researcher infers that participants were unable to discern between works composed by a human and artificial intelligence. With this preliminary context to the three sub-research questions, the researcher will proceed to answer the central research question in detail.

Thirty participants engaged with the online compositions during the quantitative phase and, using 12 aesthetic criteria, judged each composition's aesthetic beauty. While the summed aesthetic responses

of Group 1 were more positively skewed towards the human compositions (at 53,94%) than those of the AI-generated compositions (47,89%), a subgroup of broad aesthetic items (1 – "I found it beautiful", 3 – "I did not find it ugly", 5 – "It did not bore me", 12 – "I did not feel indifferent") reveals a robust response in both Group 1 (human) and Group 2 (AI) (see Chapter 5, 5.1.3.). Aesthetic items 3, 5 and 12 indicate that most participants (60% +) responded positively to both human and AI-generated compositions. The negatively skewed distribution of participants' response values across the rest of the aesthetic items (2, 4, 6, 7, 8, 9, 10 and 11) suggests that when comparing the results of the two groups, these aesthetic items' distribution for each group are mirrored (Chapter 5., 5.1.3. – Figure 1 and 2). Probing further into the value differences between the two groups, the researcher conducted the nonparametric Mann-Whitney U test to compare the statistical differences between two data sets. Following this test, results indicate that the two groups do not statistically differ significantly from each other. Both groups are stochastically equal, and the mean difference between Group 1 and 2 is not significant (see Chapter 5, 5.1.3.1.). Therefore, because (1) the summed response values between the groups are not remarkable (53,94% and 47,89%), and (2) the data distribution between the two groups are similar (sub-groups and rest of items), combined with (3) the results of the Mann-Whitney U test, suggest that aesthetic judgement of participants are consistent with human beings making subjective decisions of beauty, and not proof of an intuitive negation of the AI-generated compositions.

The thirty questionnaire participants furthermore engaged and judged the compositions *without* any prior knowledge of the compositions' source. Participants in all likelihood assumed that all compositions were created by human beings and engaged with the artefacts as such. In fact, the majority of the interviewees in the qualitative phase of the study were surprised to learn of the AI involvement in the compositional process (Chapter 5, 5.2.1.1.). Even when the interviewees were questioned about attending a concert of all AI-generated compositions, they expressed their doubt over the aesthetic experience's quality. Still, they never questioned the validity of the compositions as genuine artefacts (Chapter 5, 5.2.1.2.). Both the participants to the questionnaire and the interviews engaged with all the compositions as if they were artefacts, even though the interview participants indicated that knowledge of AI involvement would lower their aesthetic experience of the artefact (see Chapter 5, 5.2.1.1., 5.2.1.2., 5.2.1.4. and 5.2.1.5.).

In formulating the primary research question, the researcher hypothesised from his theoretical framework and the available literature that concertgoers would not differentiate between compositions created by human beings or those generated by artificial intelligence. The hypothesis was used as the basis for the quantitative part of this study. This hypothesis was supported by essential concepts and

ideas formulated in the theoretical framework via philosopher Immanuel Kant, mathematician Alan Turing and cognitive scientist Margaret A. Boden.

Immanuel Kant refined our understanding of aesthetic beauty and its relationship to art (artefacts) when he expounded "but if the question is whether something is beautiful … we judge it in our mere contemplation of it" (Kant, 1790 [1987], p. 45). He solidified this relationship between the perceiver's mind and the object of art and placed this experience of beauty within the perceiver's subjective mind (Kant, 1790 [1987], p. 61). Whether one agrees with Kant that this aesthetic experience of beauty was an a priori, universal beauty, decided upon by everyone, is not relevant to this study (Kant, 1790 [1987], p. 57). Of importance, however, is the Kantian notion of the connection between the mind and the object in experiencing aesthetic beauty. Data from the online questionnaire (see Chapter 5, 5.1.3.) and the interview process (see Chapter 5, 5.2.1.1.) show that this interaction between the participants' minds and the artefacts or compositions transpired. The participants engaged with the compositions as artefacts and expressed their subjective experiences of the compositions' aesthetic beauty as aesthetic judgement.

The researcher established that both the questionnaire and interview participants engaged with the compositions *without* any prior knowledge of AI involvement in generating some compositions. Human beings performed these compositions and led to participants' assumptions that all compositions were human created. Alan Turing (1950, p.438) expounded on AI's ability to fool humans into believing it to be human when he said: "[T]he reader must accept it as fact that digital computers can be constructed, and indeed have been constructed … that [they] can mimic the actions of a human computer very closely" (Turing, 1950, p. 438) (Chapter 3). This AI ability to mimic human behaviour (in this case to compose a piece of music), as illustrated by Turing's "imitation game", was sufficient for human beings to interact with computers as if the computers were indeed human (1950, p. 442). Margaret A. Boden agrees with Alan Turing about AI's ability to emulate human beings, when she expounds in *The Creative Mind: Myths and Mechanisms* (2004) that AI can display any of the three kinds of creativity – combinational, exploratory and transformational (2004, p. 17). As indicated in Chapter 5 (5.1.3. and 5.2.1.1.), the creative ability of AI in this study was sufficient to fool the online participants (and most of the interviewees) into interacting with the AI compositions, since the compositions *appeared* to be composed by humans. The participants in the study accepted the compositions as human-composed and judged them aesthetically accordingly. The aesthetic response values to Group 1 (human) and Group 2 (AI) did not display significant statistical differences and were stochastically equal, indicating

that the participants could not intuitively detect AI involvement in the compositional process (see Chapter 5, 5.1.3.1., Figure 3).

Based on the following three aspects, (1) the research participants' lack of knowledge regarding AI's involvement in the creation process (Chapter 5, 5.2.1.1), (2) AI's ability to mimic human creative behaviour (Chapter 3, 3.2., 3.3.) and (3) the results and findings of the quantitative instrument (questionnaire) (see Chapter 5, 5.1.3.1.), the researcher concludes that a concertgoing sample of participants could not discern aesthetically between compositions created by AI and human beings. Therefore, the aesthetic differences computed are not the result of an 'intuitive' negation of the AI-generated compositions, but rather the participants' regular aesthetic interaction resulting in subjective, individual aesthetic judgment.

6.1.2. Sub-question 1: Of what importance is the composer's intention in assimilating meaning from a composition?

Participants in the quantitative component of the study were presented with five online compositions. They were not privy to the composer(s) or their intentions for creating these compositions – the "why" and "because" (reason and context) these artefacts came into existence were not divulged. The 30 participants only had the artefacts to engage with and exercised their aesthetic judgement solely on the artefacts (compositions). The aesthetic response data collected from the questionnaire phase suggest that despite the lack of additional information, such as the composer's intent, the participants engaged aesthetically and meaningfully with the compositions (53,94% positive aesthetic response to Group 1 vs. a 47,89% response to Group 2) (see Figure 1 and 2, Chapter 5, 5.1.3.). Participants to the qualitative component of the study were explicitly asked if additional information such as the composer's intent (reason and context) for creating a composition would influence their aesthetic evaluation (Chapter 5, 5.2.1.4.). The majority of interview participants felt that the additional information (why and because) would be interesting but would not influence or alter their aesthetic experience of the artefact (two participants deemed additional information essential) (Chapter 5, 5.2.1.4.). However, when participants were asked about attending an advertised concert of only AI generated compositions, they had varied responses to attending, but they all agreed that the knowledge of AI involvement would negatively affect their aesthetic experience of the compositions (see Chapter 5, 5.2.1.2.). Thus, the researcher deduced that additional information about the purpose and reason for the artefact's existence (such as AI involvement), if publicly available, will affect a participant's aesthetic interaction with an artefact.

In the literature review, Seana Moran explains that when we create, we share our creativity and meaning "through some type of product" (Kaufman & Sternberg, 2010, p. 82) (see Chapter 2, 2.2.). In his explication of concept of creativity, the researcher showed the importance of the artefact in judging creativity – the literature on creativity views the product of creativity (the artefact) as a "golden standard" of creativity assessment (Kaufman & Sternberg, 2010, p. 84) (see Chapter 2, 2.2.). The British philosopher Francis Hutcheson believed that when this creative object connects with the perceiver's mind, aesthetic judgement is possible because the source of the pleasure of beauty resides in both the object itself and within us as human beings (McIver & Gaut, 2002, p. 39) (see Chapter 2, 2.4.). For Hutcheson, the emphasis in experiencing beauty is in the connection between the perceiver's mind and the object of art. It is all about the item and the person interacting with it. Immanuel Kant solidified our modern understanding of the human aesthetic experience as an experience that happens because the perceiver's mind and the art object connect. In his *Critique of Judgement* (1790), Kant locates the judgement of the beauty/aesthetics of an artefact (in this case, a composition) within the mind of the perceiver (1790 [1987], p. 45). Kant goes so far as to prioritise the internal experience over the art object's existence in the case of universal beauty (aesthetic beauty) (1790 [1987], p. 45) (see Chapter 3, 3.1.). Kant's claims of the universality of beauty, however, is beyond the scope of this study. What Kant contributes to this study, is his notion that the connection between the perceiver's mind and the object of art is a prerequisite for having an aesthetic experience of the artefact. If nothing else about the art object is known, the perceiver would still have a meaningful aesthetic experience. This view of Kant's is consistent with our 21st century understanding of the nature of art, whereby the perceiver's subjective aesthetic experience of an artefact is becoming central to our definition of art (see Focosi in *Another Artworld Is Possible* (2016), Chapter 2, 2.5.). The intent of the composer and the reason for the object's existence is of secondary importance. If, however, additional information were readily available and revealed to the perceiver (such as AI involvement), it would change the perceiver's perception of the object and affect the perceiver's aesthetic experience.

The researcher concludes that the art object's existence (compositions) is sufficient to establish meaningful, aesthetic interactions. The composer's intention and additional information are of secondary importance as the perceiver interacts aesthetically with the art object.

6.1.3. Sub-question 2: What do contemporary concertgoers consider as essential aesthetic properties of a musical composition?

The researcher attempted to identify the reasons for participants' particular aesthetic experience of the compositions. The questionnaire participants were bound by 12 aesthetic items to judge the beauty of five compositions (see Chapter 5, 5.1.3.). When the distribution of the data of the12 aesthetic items was analysed, it became clear that a subgroup of four aesthetic items (items 1 [I found it beautiful], 3 [I did not find it ugly], 5 [It did not bore me], and 12 [I did not feel indifferent]) elicited the most robust response. It seems that participants favoured the four broader aesthetic items of the subgroup because of their 'global' nature in the description of aesthetic beauty, thereby allowing a more effortless initial aesthetic response. The rest of the aesthetic items required more introspection, and these items all generated lower aesthetic response values in both Group 1 (human) and Group 2 (AI) (see Chapter 5, 5.1.3.). These specific 12 aesthetic items did not bind the interviewees in phase 2 of the study. They freely expressed their subjective reasons for a favourable aesthetic experience of a composition (see Chapter 5, 5.2.2.). Here, the researcher observed the same affinity to 'global' responses as he deduced from the questionnaire participants. Mirroring the questionnaire participants' responses, the interviewees favoured a broad 'global' aesthetic response – they either liked the compositions or not. How they 'felt' about them and how the compositions affected them emotionally triggered their initial reactions (see Chapter 5, 5.2.2.). Clive Bell makes a similar observation in his book *Art* (section reprinted by S.D. Ross in *Art and Its Significance* (1984)): "[W]e have no other means of recognizing a work of art than our feeling for it" (Ross, 1984, p. 189) (see Chapter 2, 2.5.) The majority of interview participants displayed an analogous view when they explained that their aesthetic response to the compositions includes the performance as well (see Chapter 5, 5.2.1.3.). Human beings react emotionally to music as the sound engages our senses – it is therefore not surprising that the first initial aesthetic responses to artefacts would be broad and visceral, rather than detailed and cognitive. However, when interviewees had to think and reflect on what makes a composition aesthetically pleasing, they identified diverse elements of structure and motifs, melody lines and the presence of storytelling as essential components for a favourable aesthetic experience (see Chapter 5, 5.2.2.). Their analysis functioned as a subsidiary justification for their primary responsibility of 'liking' or 'disliking'. The data shows that participants of both the questionnaire and interview process favoured 'global' aesthetic responses (like and dislike). A dissection of essential aesthetic properties is secondary and serves as justification for their initial aesthetic response.

In this study's literature review, references to similar 'global' experiences of beauty are evident (see Chapter 2, 2.4.). St. Augustine's response to the beauty of an object was, ''[I]t pleases because it is beautiful.'" (McIver & Gaut, 2002, p. 30). Thomas Aquinas, another Medieval philosopher, talked about "beauty and its perception and the pleasure taken in the thing perceived" (McIver & Gaut, 2002, p. 34). But Immanuel Kant's view on aesthetic beauty is inescapable: 'but if the question is whether something is beautiful … we judge it in our mere contemplation of it" (Kant, 1790 [1987], p. 45) (see Chapter 3). What is essential here is Kant's notion of experiencing beauty within the mind by 'mere contemplation'. This idea suggests an effortless, instant or immediate experience of beauty rather than a probing cognitive activity. It is as if a global aesthetic acceptance (of liking/not liking; beautiful/ugly) is primary and effortless. The reasons for preference by reflection serve as justification for the initial emotional response uttered. The researcher therefore concludes that perceivers react to art objects with a broad emotional aesthetic response (aesthetic acceptance or rejection). A cognitive analysis (breakdown) of aesthetic elements is of secondary importance.

In answering this research sub-question, it should be noted that the properties (or elements) of an aesthetic, pleasing composition, is not initially defined, but reflected upon for justification of the universal global aesthetic response of acceptance or rejection – boring/not boring, liking/disliking and beautiful/ugly. However, on reflection, participants listed elements of structure, motifs, melody lines and the presence of storytelling as essential components to an aesthetic, pleasing composition (see Chapter 5, 5.2.2.).

6.1.4. Sub-question 3: How do concertgoers view the involvement of AI in music composition (present-day/future)?

The researcher, with this research sub-question, wanted to probe general attitudes towards AI involvement in music composition (present-day and future). This probing targeted the interviewees' views of phase 2 of the study specifically (see Chapter 5, 5.2.1.5.). Many interviewees were not interested in AI in general and were unaware of its wide-spread use in music creation. By engaging with interviewees about AI's use in music, two available opinions emerged, namely (1) the certainty of AI employment in music creation and (2) a general pessimism about the quality of AI creative output (see Chapter 5, 5.2.1.2. and 5.2.1.5.). Although most participants were initially surprised to learn about AI involvement in this field (music creation), they were aware through media reports of ubiquitous AI employment in society and concluded that AI involvement in the creative area will be inevitable. Most interviewees, however, believed that AI's creative ability is only sufficient to create 'lower art' – utility or

commercial music for advertising, fitness, games, films and the like. When AI creativity moves beyond 'utility' and attempts to create, for lack of a better term, 'high art', participants were sceptical whether AI will ever succeed. Their main objection centred around their perception view of AI as non-human and therefore its lack of human agency. Participant 4 talked about AI's inability to experience the fundamental story of being a human being – the miracle of birth (see Chapter 5, 5.2.1.5.). Despite the overwhelming presence of AI in most facets of our daily lives, AI is not accepted (yet) as a member of the human community. Its interaction with the humanity still lacks credibility.

AI's lack of credibility is emphasised when AI is juxtaposed against Marcus du Sautoy's view on what it means to be a human being: "[O]utpouring of creative art, music, and literature are the media to expose what it means to be a conscious, emotional human being" (Du Sautoy, 2019, p. 283) (see Chapter 2, 2.6.4. and Chapter 3). He continues: "Surely human creativity and consciousness are inextricably linked. We cannot understand why we create without the concept of consciousness … For humans, the realization of one's inner world brought with it the desire to know oneself and share it with others…" (Du Sautoy, 2019, p. 283). The problem of AI's lack of human consciousness seems to be at the heart of its limited success in communicating meaningfully through art. Margaret Boden, however, responds differently to the question of consciousness: "So why shouldn't some future tin-can have feelings and sensations too?" (2004, p. 296). But the irony is that, as Alan Turing and Margaret Boden argue, AI only has to a*ppear* to be human (Boden, 2004, p. 17; Turing, 1950, p. 438). If AI creativity mimics love, joy or pain or loss, AI will be seen as human and accepted as such. The interaction with AI-created artefacts is mostly hidden or unintentionally undisclosed, whereby we interact with them in a Kantian aesthetic meaningful manner.

The researcher concludes that although participants accept the inevitability of AI involvement in future music creation, they have reservations about the quality of AI's creative output. The participants main objection pivots around AI's lack of human agency.

6.2. Conclusions

With regard to the main research question and the three sub-questions posed at the outset of this study, the following conclusions are drawn:

The researcher set out to investigate AI's compositional creativity by surveying whether a purposive sample of concertgoers could detect AI use. He also investigated how transparency of AI employment

affected participants' aesthetic judgement. He concluded that perceivers of today's art primarily interact aesthetically with art objects without seeking additional information and that this interaction is more intuitive than reflective. Furthermore, if AI involvement in the creative process is known or disclosed, the exchange will result in a lower aesthetic experience.

6.3. Recommendations

This study was conducted under minimal circumstances using a limited sample of concertgoers in Amsterdam, the Netherlands. A survey of a much broader audience in different locations will help to reinforce/reject some of the findings in this study or show up its limitations.

6.3.1. The quantitative instrument

The researcher set out to investigate the creative ability of AI as it relates to the aesthetic experience of the perceiver. Through his surveying of the literature, the researcher became aware of a quantitative instrument designed by Schindler et al. that could measure aesthetic emotions (Schindler et al., 2017). As explained in the methodology, he constructed his instrument based on the AESTHEMOS questionnaire, which contained fewer aesthetic items and was not psychometrically tested. He understands the limitations of his findings reached with his instrument design, but still wonders whether it is possible to investigate subjective aesthetic opinions with a quantitative instrument. The researcher hopes to apply the original AESTHEMOS instrument in future research and concentrate on quantitative analysis alone (see Further Research 6.2.4).

6.3.2. Population sample

The researcher used a purposive sample of a concertgoing audience in Amsterdam, The Netherlands. His sample selection was purely due to his location at the time of the study. Although Amsterdam is multicultural and cosmopolitan, most of the participants in his research were Caucasian Europeans. The researcher would like to investigate how the use and perception of AI creativity would differ among different cultural orientations. In this regard, his own country of South Africa would be a good departure point. Indigenous South Africans have a visceral connection with music and storytelling. It would be interesting to investigate how the perception of AI-involvement in art influences South African indigenous communities' aesthetic experiences. Furthermore, given South Africa's partial connection to

the western art tradition (for a minority segment of the population), it would be interesting to ascertain the response for a South African concertgoing audience who occasionally attend symphonic concerts.

6.3.3. Composition versus Performance

When the researcher commenced his investigation of the aesthetic experience of compositions, he was aware that it would be nearly impossible to separate the composition from its performance. The researcher focused on composition because AI (to date) is very poor at performance, and the study would yield no surprising data in that regard. AI could, however, perform compositional creativity exceptionally well and therefore this phenomenon made the second component to his research possible – the disclosure and non-disclosure of AI employment and its implications for aesthetic interaction. The researcher hopes for further research on how transparency of AI use in the creativity fields affects our creative processes as artists and, consequently, our perception and meaning of the art of the future. The voluminous creative output of AI, the ability of AI to align creative output with individual data on gender, politics, religion, and health can profoundly influence how we interact with the art of the future.

6.3.4. Further Research

The researcher would like to use this research as a basis for further investigation. Through this thesis process, the researcher would design the study's quantitative phase more transparently and comprehensively. He would possibly use the AESTEHMOS quantitative instrument for further research and increase the number of participants ("n") from 30 to at least 100. The number of compositions used in the test set would be increased to several dozen. Furthermore, AI and human compositions would match numerically and stylistically. He would generate an AI equivalent for every human composition and predict that the matching pairs of human and AI compositions would result in a more reliable study. Lastly, he would divide his participants into two groups of musically sophisticated and naïve listeners and observe any differences in their aesthetic responses.

The researcher could also possibly pilot such a study to non-symphonic music, particularly the genre of popular music and specifically EDM (electronic dance music). Since these genres already employ AI extensively (due to the genres' patterned and repetitive nature), it could be interesting to compare only AI-generated (and performed) music and establish how (and why) perceivers respond aesthetically to various AI creations. As a jazz musician, another interesting research project could be to investigate

how audiences respond aesthetically between improvisations of humans versus improvisations by François Pachet's *Continuator* (Du Sautoy, 2019, p. 204).

As a more qualitatively oriented study, it can be valuable to investigate how our increasing familiarity with AI creativity could influence our perception of aesthetic beauty and meaning in the future. Perhaps AI's capability for technical perfection becomes celebrated as an overwhelmingly, important aesthetic element of human creativity. It is certainly true that our own capabilities increase as we become more aware of computers' creative prowess. The opposite could also happen, whereby human beings, in response to seemingly AI cerebral creativity, increase the value of creativity rooted in imperfections, human emotion and storytelling. Which aspects of AI and human creativity will be celebrated, and which aspects diminished? As a final thought, the output capabilities of AI are endless and commercially viable. AI can effortlessly create a symphonic score within minutes where human beings would toil months to do the same. Just from a time management and energy management perspective, human beings cannot compete with AI. What effect could a continuous and relentless AI output have on our aesthetic values as we interact with endless art? A study of the nature of art morphing from expressions of aesthetic meaning to products of utility and the subsequent effect on our aesthetic values could also be interesting. Will AI creativity result in accentuating or blurring the divide between 'high art' and 'low-art'?

6.4. Final Thought

As human beings we desire to explore the unknown, in order to make sense of this world we inhabit. The researcher embarked on this study not because AI and its remarkable prowess are unknown – AI is progressively championed and celebrated in all facets of our lives – but because of its exponential potential it is a mystery that could dramatically disrupt our understanding and interaction with our outside world. As seen in this study, AI is already remarkable in mimicking human beings and its creative prowess is thus vindicated. The story of AI and our relationship with it, however, is still unfolding. In the introduction to this study, the researcher referenced the 4th industrial revolution where the "boundaries between the physical, digital and biological worlds" are increasingly blurred (McGinnis, 2020). As we engage with AI through our mobile devices, and accept it as an indispensable feature of our lives, at what point will the boundaries between AI technology and biology blur even more? Could AI finally evolve and be accepted as a human agent with feelings, purpose, and meaning, or will we meet technology halfway and incorporate it within our own biology? Whatever the outcome, our engagement with AI has indelibly altered our perception of art, reality and meaning of this new world.

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APPENDICES

Appendix A – AESTHEMOS Questionnaire

The Aesthetic Emotions Scale (AESTHEMOS)

The AESTHEMOS can be used to assess either the intensity of aesthetic emotions (e.g., for studying momentary aesthetic experience or the experience of a specific stimulus, such as a picture, poem, piece of music, or film scene) or the frequency of experiencing aesthetic emotions during a more prolonged aesthetic experience (e.g., for studying an event as a whole, such as an entire art exhibition, theater performance, or a walk through nature). An example of the AESTHEMOS assessing intensity is shown below.

For the frequency version, the following modifications need to be made.

Rating instruction: How often did you feel this emotion?

Rating scale: From 1 *never* to 5 *very often*

Instruction:

Which emotional effect did _____ have on you?

For each emotion listed below, please mark the response category that best matches your personal experience. Please only indicate how **you** actually felt. Do not characterize the emotions expressed in _____ if you did not feel them yourself.

	How intensely did you feel this emotion?				
Emotional feeling	**1 not at all**	**2**	**3**	**4**	**5 very**
1 I found it beautiful	☐1	☐2	☐3	☐4	☐5
2 Challenged me intellectually	☐1	☐2	☐3	☐4	☐5
3 Delighted me	☐1	☐2	☐3	☐4	☐5
4 Calmed me	☐1	☐2	☐3	☐4	☐5
5 Made me curious	☐1	☐2	☐3	☐4	☐5
6 Liked it	☐1	☐2	☐3	☐4	☐5
7 Fascinated me	☐1	☐2	☐3	☐4	☐5
8 Felt something wonderful	☐1	☐2	☐3	☐4	☐5
9 Invigorated me	☐1	☐2	☐3	☐4	☐5
10 Was mentally engaged	☐1	☐2	☐3	☐4	☐5
11 Baffled me	☐1	☐2	☐3	☐4	☐5
12 I found it ugly	☐1	☐2	☐3	☐4	☐5
13 Sensed a deeper meaning	☐1	☐2	☐3	☐4	☐5
	How intensely did you feel this emotion?				

Emotional feeling	1 not at all	2	3	4	5 very
14 Felt deeply moved	☐1	☐2	☐3	☐4	☐5
15 Made me feel melancholic	☐1	☐2	☐3	☐4	☐5
16 Energized me	☐1	☐2	☐3	☐4	☐5
17 Made me angry	☐1	☐2	☐3	☐4	☐5
18 Was enchanted	☐1	☐2	☐3	☐4	☐5
19 Bored me	☐1	☐2	☐3	☐4	☐5
20 Relaxed me	☐1	☐2	☐3	☐4	☐5
21 Felt a sudden insight	☐1	☐2	☐3	☐4	☐5
22 Amused me	☐1	☐2	☐3	☐4	☐5
23 Made me sad	☐1	☐2	☐3	☐4	☐5
24 Felt confused	☐1	☐2	☐3	☐4	☐5
25 Made me aggressive	☐1	☐2	☐3	☐4	☐5
26 Made me feel sentimental	☐1	☐2	☐3	☐4	☐5
27 Worried me	☐1	☐2	☐3	☐4	☐5
28 Made me feel nostalgic	☐1	☐2	☐3	☐4	☐5
29 Surprised me	☐1	☐2	☐3	☐4	☐5
30 Felt oppressive	☐1	☐2	☐3	☐4	☐5
31 I found it sublime	☐1	☐2	☐3	☐4	☐5
32 Spurred me on	☐1	☐2	☐3	☐4	☐5
33 Felt indifferent	☐1	☐2	☐3	☐4	☐5
34 Was impressed	☐1	☐2	☐3	☐4	☐5
35 I found it distasteful	☐1	☐2	☐3	☐4	☐5
36 Touched me	☐1	☐2	☐3	☐4	☐5
37 Was unsettling to me	☐1	☐2	☐3	☐4	☐5
38 Sparked my interest	☐1	☐2	☐3	☐4	☐5
39 Made me happy	☐1	☐2	☐3	☐4	☐5
40 Felt awe	☐1	☐2	☐3	☐4	☐5
41 Motivated me to act	☐1	☐2	☐3	☐4	☐5
42 Was funny to me	☐1	☐2	☐3	☐4	☐5

Appendix B – Questionnaire

The Aesthetic Emotions Questionnaire - Adapted from AESTHEMOS

The AESTHEMOS was used to assess the intensity of aesthetic emotions (e.g., for a piece of music, or film scene). This survey is an adaptation of the AESTHEMOS assessing intensity for purposes of this study as shown below:

Rating scale: From 1 never to 5 very often

Instruction:

Which emotional effect did _____ have on you?

For each emotion listed below, please mark the response category that best matches your personal experience. Please only indicate how you actually felt.

	How intensely did you feel this emotion?				
Emotional feeling	1 not at all	2 rarely	3 sometimes	4 often	5 Very often
1 I found it beautiful	☐1	☐2	☐3	☐4	☐5
2 Challenged me intellectually	☐1	☐2	☐3	☐4	☐5
3 I found it ugly	☐1	☐2	☐3	☐4	☐5
4 Touched me	☐1	☐2	☐3	☐4	☐5
5 Bored me	☐1	☐2	☐3	☐4	☐5
6 Felt awe	☐1	☐2	☐3	☐4	☐5
7 Made me curious	☐1	☐2	☐3	☐4	☐5
8 Felt deeply moved	☐1	☐2	☐3	☐4	☐5
9 Made me feel nostalgic	☐1	☐2	☐3	☐4	☐5
10 Relaxed me	☐1	☐2	☐3	☐4	☐5
11 Surprised me	☐1	☐2	☐3	☐4	☐5
12 Felt indifferent	☐1	☐2	☐3	☐4	☐5

These criteria will all be used for each of the five compositions.

Appendix C – Interview Questions

Interview questions

The following questions will be used for the second phase of my research to probe subjective responses to the two AIVA compositions. Six participants will be selected from the initial sample to undergo in-depth interview. These participants will be notified ahead of time that various composers were involved in the compositions they evaluated and that I would appreciate a short interview. The following questions, without their prior knowledge of it, will be part of the interview and will be recorded live.

1. If I tell you that two of the recordings (from the online questionnaire) were composed/generated by artificial intelligence (AI), do you find this surprising and does this knowledge change your overall value of these compositions?

2. What is the likelihood of you attending a concert where all the compositions are composed by AI (and advertised as such) and performed by live musicians?

3. In listening to music, what is more important in judging its beauty - the performance, the composition, or both or anything else?

4. Is the reason a composition is created or for that matter the mindset of the composer important in your overall aesthetic judgment of it?

5. Given the presence of technology in the music creation process today, what are your views on where music is going in the future? Are you anxious or hopeful?

Appendix D – Consent – Participants

I _____ understand the contents of this document and consent to participate in the study entitled **Exploring Aesthetic Response to Music Composition in the 21st Century**. I understand that my participation in this research is entirely voluntary, that I may freely withdraw from the study at any time without any disadvantage, and that my input will remain confidential and anonymous throughout the research. I also understand that the findings of this study will be presented in the form of an academic presentation and/or publication.

Insert a cross (X) in the correct option indicating your consent to participate in each stage of the research as stated below:

	Yes	No
My questionnaire/interview responses may be utilised in this study		
Would you like to be considered for the second phase (interviews) of this study? (If you answered NO to this question, please proceed to sign the consent form. If you answered yes, proceed to the questions below)		
I agreed to be interviewed		
I agree to be audio taped during the interview		
I understand that any recordings will only be used for this research.		
I am aware that I can withdraw from this study at any stage.		
I am aware that my anonymity will be protected		

Signature_____

Date: _____

HSSREC Research Office contact details: HSSREC Research Office, Tel. 03 1260 8350/4557/2587, Email: hssrec@ukzn.ac.za

Appendix E – Letter to Participants

Dear Participants,

My name is Wessel Jansen van Rensburg and I am a freelance musician.

I am studying towards a Master's Degree in Music at the University of KwaZulu-Natal (UKZN). The title of the research study is **Exploring Aesthetic Response to Music Composition in the 21st Century.** This study is looking at how we experience music composition as an art form in the twenty first century. I would like to invite you, a concert goer from October to November 2020, to voluntarily participate in this research study.

Should you be willing to participate in this research, I request your permission to analyse your questionnaire and interview responses. The research is made up of two parts, the first of which is a questionnaire based on five short symphonic pieces that I will need you to listen to and respond to a set of questions. The second phase of my research will be in the form of interviews in which I plan to ask you questions about your answers in the questionnaire. If you do not wish your responses to be included for research purposes, please indicate this on the consent form. Participation in the first phase should take you about 20 to 30 minutes, and the second phase of interviews approximately 30 minutes. Each of the interviews will be audio recorded. Please indicate on the consent form if you are happy to be included in the second phase of data collection.

You will not be disadvantaged in any way by participating in this research. You can refuse to answer any question, discontinue the interview or observation or withdraw your permission from participating in the research at any time, without any penalty. There are no foreseeable risks in participating in this research. You will not be paid for your participation in this study.

Your name and any other characteristics that may personally identify you will be kept confidential at all times and pseudonyms will be used in the written study and in all published and written data resulting from the study. All information generated will be anonymous and your individual privacy will be safeguarded throughout. All raw research data will be stored safely throughout and after the research process in a password protected computer and virtual file. The data will be destroyed 5 years after the completion of the study.

Please let me know if you require any further information and I will gladly assist.
I look forward to your participation. Thank you very much for your help.

Yours sincerely,

Wessel Jansen van Rensburg (Master's Student) Date
University of KwaZulu-Natal Student Number: 219095585
Email: wjvanrensburg@icloud.com
Phone: +31 (0)62 367 2255

Supervisor contact details:
Professor Chats Devroop
Academic Leader Research: School of Arts
University of KwaZulu-Natal
Email: devroopc@ukzn.ac.za
Tel: (+27)(0) 31 260 1349 /(+27)(0) 82 331 5048

Appendix F – Gatekeeper's letter – AIVA

Dear Rights holders for AIVA,

I am a Master's candidate at the University of KwaZulu-Natal (UKZN) and I am writing to request permission to use two compositions generated by AVIVA to conduct my Master's research. The proposed title of my thesis is **Exploring Music Composition in the 21st Century: An Investigation into Artificially Intelligent Music Composition.** In this study I will be looking at how a contemporary symphonic concert going audience draws certain conclusions about music, art and creativity. The study will comprise two phases a questionnaire phase in which participants will be required to answer questions around five compositions, two of which will be composed by AIVA and three by a human composer. Thereafter the second interview phase will be conducted with a selected group of participants in which I probe in detail their responses particular to the AIVA compositions. I assure you that the AIVA compositions will only be used for study purposes exclusively. On completion of the study I will make available to you the findings of my research in published form.

If you require any further information, please contact myself, or Prof Chats Devroop my supervisor. Our contact details are below.

I look forward to your favourable response.

Yours Faithfully

Wessel Jansen van Rensburg
Masters of Music Degree Student (Student Number: [redacted]
University of KwaZulu-Natal
Email: w[redacted]
Tel: +31 (0)[redacted] 2255
d[redacted]

Prof. C. Devroop
Academic Leader Research
School of Arts
University of KwaZulu-Natal
Email:
Tel: [redacted]

Appendix G – AIVA Confirmation of Approval

From: Ashkhen Zakharyan [redacted]>
Date: 29 May 2020 at 09:51:58 CEST
To: [redacted]
Cc: contact <contact@aiva.ai>
Subject: Re: Contact request sent by Wessel Jansen van Rensburg

Hi Wessel,

Thank you for your email and for your interest in AIVA.

I approve that you can use AIVA's composition called "Caretaker" for your university thesis - research that you mentioned.

Please let me know what is the second track that you want to use so that I can approve that too.

I wish you the best of luck with your thesis.

Kind regards,

Wessel Jansen van Rensburg

Best,

AIVA Team

--
Ashkhen Zakharyan
www.aiva.ai

Appendix H – AIVA Approval 2

Re: MMUS Research in AI and composition

21 September

2020 at 15:36

From Ashkhen

Zakharyan

Hi Wessel,

Thank you for your reply!

I confirm that you can use AIVA's composition called "Symphonic Fantasy in A min, Op31" for your thesis that we discussed!

Please feel free to share your findings once you are done!

I wish you the best of luck with your research.

Kind regards,

On Fri, Sep 18, 2020 at 4:10 PM Wessel Jansen van Rensburg <[redacted]> wrote:

> Yes - it the same thesis - AI and composition: Aesthetic response to AI generated compositions. I will probably get to to the practical side of the thesis next month. COVID 19 has slowed down my research a bit, but My thesis should be finished by end December 2020. I will of course share my findings with you if you are interested - I truly think that AIVA as a AI composer is quite remarkable and hope my research will back it up. In any case, it is all anonymously done and the compositions (titles and composers) are never revealed to the participants. Kind regards
>
> Wessel
>
> Sent from my iPhone
>
> On 18 Sep 2020, at 15:47, Ashkhen Zakharyan <[redacted]> wrote:
>
> > Hi Wessel,
> >
> > Thank you for your email!
> >
> > And is that the same research (the research for master thesis) that you would like to use the track for?
> >
> > Kind regards,

On Fri, Sep 18, 2020 at 2:54 PM Wessel Jansen van Rensburg <[redacted]> wrote:

Dear Sir,

The second track I would like to use for my research is "Symphonic Fantasy in A min, Op31." I must say, that so far, nobody in the experimental phase of the research could tell

the difference between the AI generated and human generated compositions (as I suspected).

AIVA is really good.

All the best

Wessel

From: Ashkhen Zakharyan <[redacted]>
Date: 29 May 2020 at 09 :51:58 CEST
To: [redacted]
Cc: contact <[redacted]>
Subject: Re: Contact request sent by Wessel Jansen van Rensburg

Hi Wessel,

Thank you for your email and for your interest in AIVA.

I approve that you can use AIVA's composition called "Caretaker" for your university thesis - research that you mentioned.

Please let me know what is the second track that you want to use so that I can approve that too.

I wish you the best of luck with your thesis.

Kind regards,

Wessel Jansen van Rensburg
Wessel Jansen van Rensburg
Mobile: [redacted]

--
Ashkhen Zakharyan
[redacted]

Appendix I – Gatekeeper's letter – George Shaw

Dear Mr. George Shaw,

I am a Master's candidate at the University of KwaZulu-Natal (UKZN) and I am writing to request permission to use two compositions to conduct my Master's research. The proposed title of my thesis is **Exploring Music Composition in the 21st Century: An Investigation into Artificially Intelligent Music Composition.** In this study I will be looking at how a contemporary symphonic concert going audience draws certain conclusions about music, art and creativity. The study will comprise two phases a questionnaire phase in which participants will be required to answer questions around five compositions, two of which will be composed by AI and three by a human composer. I assure you that the compositions will only be used for study purposes exclusively. On completion of the study I will make available to you the findings of my research in published form.

If you require any further information, please contact myself, or Prof Chats Devroop my supervisor. Our contact details are below.

I look forward to your favourable response.

Yours Faithfully

Wessel Jansen van Rensburg

Masters of Music Degree Student (Student Number: [redacted])
Email: [redacted]
Tel: +31 (0) 62 367 2255

Academic Leader Research Prof. C. Devroop
University of KwaZulu-Natal School of Arts
University of KwaZulu-Natal
Email: [redacted]
Tel: (+27)(0)31 260 1349

Appendix J – George Shaw Approval

Re: New message via your website, from wjvanrensburg@icloud.com

29 July 2020 at 4:10

From George Shaw

To Wessel Jansen van Rensburg

Wessel,
Sure, I give you permission to use my compositions "Wielding a Saber" and "Battle for Light and Dark" in this research. Love to see what the results are when you have them!
Warm Regards, George
On Tue, Jul 28, 2020 at 2:11 AM Wessel Jansen van Rensburg [redacted] wrote:

> Dear Mr. Shaw,
> This is so fantastic! I just need your permission to play sections (approximately 2'30) of those two recordings to 30 participants of my focus group. Altogether the participants will listen to 5 recordings (which will not be named) of which two compositions are be composed by AI (and they do not know that AI is included as a composer). They will then give aesthetic feedback on the music they listen to. It all happens anonymously, and is only heard by the 30 participants in this experiment. I will generate mp3's of the recording of your compositions as performed by orchestra on youtube and will use it only for this propose. The university has a strict ethical code and to start my research I have to get clearance from the composer that I can use his/her music. I will include a letter from my supervisor, but I just need an email from you saying that you give me the permission to use your compositions "Wielding a Saber" and "Battle for Light and Dark" in this research. And if you would be interested in the results of the experiment at all, I will of course make it available to you. In any case, I just find your compositions so beautiful and was so fortunate to stumble on them while searching youtube for appropriate content. Kind regards
>
> Wessel
>
> Wessel Jansen van
> Rensburg Mobile:
> 062 367 2255
> On 28 July 2020 at 8:59, George Shaw <[redacted]> wrote:
>
> > Hi Wessel,
> > Happy to help and your research sounds interesting. What exactly do you need from me?
> >
> > Warm Regards, George

Appendix K – George Shaw Approval 2

Re: New message via your website, from [redacted]

22 September 2020 at 1:29 From George Shaw

Go for it!

On Fri, Sep 18, 2020 at 5:46 AM Wessel Jansen van Rensburg [redacted] wrote:

> Dear George,
>
> I am getting closer to do the research now and want to know if I can add your composition "Join the Battle" to my research in addition to "Wielding a Sabre" and "Battle for Light and Dark." I am sure you would be fine with it, but I have to ask as part of my ethical clearance as directed by the university. kind regards
>
> Wessel
>
> Wessel Jansen van Rensburg
> Mobile: 062 367 2255
>
> On 29 July 2020 at 4:10, George Shaw <[redacted]> wrote:
>
> > Wessel,
> > Sure, I give you permission to use my compositions "Wielding a Saber" and "Battle for Light and Dark" in this research. Love to see what the results are when you have them!
> >
> > Warm Regards, George
> >
> > On Tue, Jul 28, 2020 at 2:11 AM Wessel Jansen van Rensburg [redacted] wrote:
> >
> > Dear Mr. Shaw,
> >
> > > This is so fantastic! I just need your permission to play sections (approximately 2'30) of those two recordings to 30 participants of my focus group. Altogether the participants will listen to 5 recordings (which will not be named) of which two compositions are be composed by AI (and they do not know that AI is included as a composer). They will then give aesthetic feedback on the music they listen to. It all happens anonymously, and is only heard by the 30 participants in this experiment. I will generate mp3's of the recording of your compositions as performed by orchestra on youtube and will use it only for this propose. The university has a strict ethical code and to start my research I have to get clearance from the composer that I can use his/her music. I will include a letter from my supervisor, but I just need an email from you saying that

you give me the permission to use your compositions "Wielding a Saber" and "Battle for Light and Dark" in this research. And if you would be interested in the results of the experiment at all, I will of course make it available to you. In any case, I just find your compositions so beautiful and was so fortunate to stumble on them while searching youtube for appropriate content. Kind regards

Wessel

Wessel Jansen van
Rensburg Mobile: 062 367
2255

On 28 July 2020 at 8:59, George Shaw [redacted] > wrote:

Hi Wessel,
Happy to help and your research sounds interesting. What exactly do you need from me?

Warm Regards, George

On Thu, Jul 2, 2020 at 7:47 AM [redacted] > wrote:

T

Appendix L – Questionnaire Translation

1. I found it beautiful - Ik vind het mooi
2. Challenged me intellectually - Daagde me intellectueel uit
3. I found it ugly - Ik vond het lelijk
4. Touched me - Raakte me aan
5. Bored me - Verveelde mij
6. Felt awe - Voelde ontzag
7. Made me curious - Maakte me nieuwsgierig
8. Felt deeply moved - Voelde me diep ontroerd
9. Made me feel nostalgic - Ik voelde me nostalgisch
10. Relaxed me - Ontspannen me
11. Surprised me -Verras me
12. Felt indifferent - Voelde me onverschillig

Appendix M – Table of Critical Values for the Mann-Whitney U Test

Critical Values of the Mann-Whitney U
(Two-Tailed Testing)

n_2	α	n_1																	
		3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
3	05	--	0	0	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8
	01	--	0	0	0	0	0	0	0	0	1	1	1	2	2	2	2	3	3
4	05	--	0	1	2	3	4	4	5	6	7	8	9	10	11	11	12	13	14
	01	--	--	0	0	0	1	1	2	2	3	3	4	5	5	6	6	7	8
5	05	0	1	2	3	5	6	7	8	9	11	12	13	14	15	17	18	19	20
	01	--	--	0	1	1	2	3	4	5	6	7	7	8	9	10	11	12	13
6	05	1	2	3	5	6	8	10	11	13	14	16	17	19	21	22	24	25	27
	01	--	0	1	2	3	4	5	6	7	9	10	11	12	13	15	16	17	18
7	05	1	3	5	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34
	01	--	0	1	3	4	6	7	9	10	12	13	15	16	18	19	21	22	24
8	05	2	4	6	8	10	13	15	17	19	22	24	26	29	31	34	36	38	41
	01	--	1	2	4	6	7	9	11	13	15	17	18	20	22	24	26	28	30
9	05	2	4	7	10	12	15	17	20	23	26	28	31	34	37	39	42	45	48
	01	0	1	3	5	7	9	11	13	16	18	20	22	24	27	29	31	33	36
10	05	3	5	8	11	14	17	20	23	26	29	33	36	39	42	45	48	52	55
	01	0	2	4	6	9	11	13	16	18	21	24	26	29	31	34	37	39	42
11	05	3	6	9	13	16	19	23	26	30	33	37	40	44	47	51	55	58	62
	01	0	2	5	7	10	13	16	18	21	24	27	30	33	36	39	42	45	48
12	05	4	7	11	14	18	22	26	29	33	37	41	45	49	53	57	61	65	69
	01	1	3	6	9	12	15	18	21	24	27	31	34	37	41	44	47	51	54
13	05	4	8	12	16	20	24	28	33	37	41	45	50	54	59	63	67	72	76
	01	1	3	7	10	13	17	20	24	27	31	34	38	42	45	49	53	56	60
14	05	5	9	13	17	22	26	31	36	40	45	50	55	59	64	67	74	78	83
	01	1	4	7	11	15	18	22	26	30	34	38	42	46	50	54	58	63	67
15	05	5	10	14	19	24	29	34	39	44	49	54	59	64	70	75	80	85	90
	01	2	5	8	12	16	20	24	29	33	37	42	46	51	55	60	64	69	73
16	05	6	11	15	21	26	31	37	42	47	53	59	64	70	75	81	86	92	98
	01	2	5	9	13	18	22	27	31	36	41	45	50	55	60	65	70	74	79
17	05	6	11	17	22	28	34	39	45	51	57	63	67	75	81	87	93	99	105
	01	2	6	10	15	19	24	29	34	39	44	49	54	60	65	70	75	81	86
18	05	7	12	18	24	30	36	42	48	55	61	67	74	80	86	93	99	106	112
	01	2	6	11	16	21	26	31	37	42	47	53	58	64	70	75	81	87	92
19	05	7	13	19	25	32	38	45	52	58	65	72	78	85	92	99	106	113	119
	01	3	7	12	17	22	28	33	39	45	51	56	63	69	74	81	87	93	99
20	05	8	14	20	27	34	41	48	55	62	69	76	83	90	98	105	112	119	127
	01	3	8	13	18	24	30	36	42	48	54	60	67	73	79	86	92	99	105

Appendix N – Ethics Approval Notification

UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI

01 December 2020

Mr Wessel Jacobus Jansen Van Rensburg (219095585)
School Of Arts
Howard College

Dear Mr Jansen Van Rensburg,

Protocol reference number: HSSREC/00002128/2020
Project title: Music composition in the 21st century: exploring concertgoers aesthetic response to artificial intelligent generated music
Degree: Masters

Approval Notification – Expedited Application

This letter serves to notify you that your application received on 19 October 2020 in connection with the above, was reviewed by the Humanities and Social Sciences Research Ethics Committee (HSSREC) and the protocol has been granted **FULL APPROVAL** on the following condition:

Any alteration/s to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through the amendment/modification prior to its implementation. In case you have further queries, please quote the above reference number. PLEASE NOTE: Research data should be securely stored in the discipline/department for a period of 5 years.

This approval is valid until 01 December 2021.
To ensure uninterrupted approval of this study beyond the approval expiry date, a progress report must be submitted to the Research Office on the appropriate form 2 - 3 months before the expiry date. A close-out report to be submitted when study is finished.

All research conducted during the COVID-19 period must adhere to the national and UKZN guidelines.

HSSREC is registered with the South African National Research Ethics Council (REC-040414-040).

Yours sincerely,

[redacted]

Professor Dipane Hlalele (Chair)

/dd

Humanities and Social Sciences Research Ethics Committee
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Telephone: +27 (0)31 260 8350/4557/3587 **Email:** hssrec@ukzn.ac.za **Website:** http://research.ukzn.ac.za/Research-Ethics
Founding Campuses: Edgewood Howard College Medical School Pietermaritzburg Westville