AIMC 2023

The A in AIMC

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Published on: Aug 29, 2023

URL: https://aimc2023.pubpub.org/pub/axm86vsk

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ABSTRACT

This paper takes a playful constrained writing approach, focusing on cultural concepts and notions that emerge in the context of AIMC research, all of them starting with the letter “A”. Designing a creative AI system or performing on an intelligent instrument is a particular mode of operating, a unique approach of framing musical and interaction problems and solutions. The paper introduces the idea of constrained writing, gives a philosophical background to the paper and its methodology, and then announces an assemblage of analytical concepts that can be used to assess AIMC systems as we encounter them for study and evaluation. A constrained defining lexicon of A.

INTRODUCTION

This experimental and speculative paper, applying constrained writing techniques to generate a lexicon of theoretical concepts, aims at performing a particular intervention to the cultural context of our work, which is the theme of this year’s AIMC, or **intelligent performance systems**. It would be arduous to provide a general description of such a context, as there are multiple and diverse technical fields and cultures that constitute the AIMC community, with assorted aims and objectives. However, there is an increasing need for critical design, a critical understanding of the sociopolitics of AI in music, and thus an awareness of how critical theories can aid us in becoming more sensitive to the larger technocultural context. This is in tandem with a greater understanding of how contemporary technological design demands deeper ethical considerations.

The paper is partly algorithmic, applying a constrained writing technique. It operates in the spirit of the SIGBOVIK conference series [1] run by the Association for Computational Heresy: it is an intervention from extera, aiming to inject some cultural theory by brute force into the theoretical framework of the AIMC community. So we start with the letter “A,” where key concepts and keywords are presented in a form of an expository lexicon. Any letter could have chosen, and “E” would have been a good candidate with all its *embodied*, *embedded*, *enacted* and *extended* concepts [2], but the hope is that by providing a microscopic example of analytical tools to analyse and contextualise our work, it might serve as a template for similar studies or awareness. Let’s not err: the aim here is not to initiate a comprehensive lexicon of the full alphabet – this is not a “towards” paper and certainly not an *abecedarium* – but rather to present a specimen, an anatomical cut into the theoretical body available in contemporary theoretical and cultural analysis in the field of AIMC.

CONSTRAINED WRITING

Constrained writing is a literary technique where a text is written according to predefined rules. We are familiar with such constraints in poetry, with its meter and rhyme, but those are elements often said to serve as mnemotechnic devices in addition to providing the poetry with its musical beauty. Other more algorithmic

approaches have been taken, for example with the work of the *Oulipo group* (*Ouvroir de littérature potentielle*), formed as a subcommittee of the *Collège de 'Pataphysique*[3]. Oulipo's "potential literature" has taken various forms, including George Perec's lipogram novel *La Disparition*, a novel only containing words lacking the letter "e" (translated into English as *The Void* by Gilbert Adair). Another Oulipo technique is called S+7, where every noun in a text is replaced by the word that is seven entries behind it in a dictionary. Other constrained writing techniques include the well-known Japanese *haiku*; the minisaga, a text containing exactly 50 words, plus a title up to 15 characters; and the acrostic, where the first letter of every line forms a new text. The SuperCollider #sctweet is one form of constrained writing of musical composition, embracing the character limits of Twitter, and masterfully executed by composer Fredrik Olofsson.

This paper provides a constrained subjective lexicon for AIMC. One inspiration is Bataille's *Critical Dictionary* [4], which he published over time in the surrealist art magazine *Documents* during the years of 1929-30. Here, Bataille provides a free-association explication of terms such as aesthete, angel, architecture … metaphor, skyscraper and slaughterhouse. His aim was not to be encyclopaedic and provide a comprehensive account or a dictionary summary of what a term like architecture is, but rather to speculate on its connotations for him as a writer of a time and place. Another inspiration is Roland Barthes's *Mythologies* [5], a seemingly random series of commentaries on topics in popular culture that have become modern myths. What emerges in his book is a technical use of certain terms that are applied as instruments for cultural analysis. The value of Barthes's work was therefore not merely in his insights of the subject matters he wrote about, but also the methodological instruments he introduced.

A collection of keywords can be helpful to understand the conceptual arsenal applied in the study of a subject, and examples include [6][7][8]. A relevant recent work is Matthew Fuller's *Software Studies*. Fuller applies the term lexicon for good reasons:

Rather than an encyclopedia, which is too universal, or a dictionary or glossary, which offer too short descriptions or readings of terms, a lexicon can be provisional and is scalable enough a form to adapt to any number of terms and lengths of text […] a lexicon can establish alliances between words, texts, and ideas without necessarily agglutinating them as a whole, thus effacing a more complex reality [9].

In his introduction, Fuller mentions Raymond Williams's influential 1976 book *Keywords: A Vocabulary of Culture and Society*, where Williams explores the modulations words have throughout history, presenting 109 keywords. Williams says:

This is not a neutral review of meanings. It is an exploration of the vocabulary of a crucial area of social and cultural discussion, which has been inherited within precise historical and social conditions and which has to be made at once conscious and critical – subject to change as well as to continuity [10].

It is important to note this rejection of neutrality or generality as this is not a dictionary, not a comprehensive overview of the terms' meaning, but rather a subjective perspective of their potential use within the AIMC context, and we invite others to write their own. A collection of such entries might even be put up in a dynamic database. This is a start.

A LEXICON OF A

Absurd. This is absurd. "This" referring to this paper, which is yet an attempt to launch an array of analytical tools in the research domain of AIMC. Amusing, perhaps, but the field might still benefit from such a toolset of concepts. Furthermore, designing an AI system for music is an absurd act, one that can be explained by the roots of the word itself: "ab" (away from) "surdus" (mute, silent), thus sounding, but also etymologically signifying out of tune or discordant. That is the origin of all AI systems: an out-of-tune assemblage of technical elements that, when attuned, get their agency and autonomy as unique expressive objects.

A. The first letter of the alphabet. The Greek alpha, from the Phoenician aleph, an ox. A stable in musical scales, the major sixth of the scale C, but an integer constant for tuning, where, in the scientific pitch notation, the cycles of A4 are 440Hz. The historical depth we have to engage with when creating AI musical systems, as part of organological history, can be exemplified by the lack of consensus as to what an A is. A might have the frequency 432Hz, or even 430.54Hz, which is the philosophical pitch (where C is 1Hz, or 256Hz in the fourth octave where A is 430.54Hz). To perform critical AI [11] also involves engaging with the technocultural genealogies of our technology.

Aerophone. One of the categories in Hornbostel-Sachs organological classification system [12], together with chordophone, membrano-phone, idiophone, and later electrophone. Any such classification is notoriously difficult in the area new musical instruments, as they rarely fit into one category [13]. We thus ask how AI becomes an integral quality of an instrument, like air, yielding the AI-ophone?

Artificial Intelligence. AI is becoming a key component in new musical instruments and discussed as such. Yet there is no consensus of what we mean by "artificial" here, as if there exists some true type of intelligence or a clear definition of what that might be [14]. The term "artificial" is not the only problem here, but also the term "intelligence": what kind of intelligence are we discussing? [15] When is a system intelligent and when is it not? AI is then typically defined as the simulation of human intelligence and its history shows how this has been optimistically put forward as one of the key goals of the research programme. Big-tech entrepreneurs project an optimistic future of AI as a solution to most problems, now setting the goal to "general" AI or GAI, a take that is easily refutable [16]. AI has informed cognitive science and yet there is increasing criticism of the neurological metaphors in its discourse and how these are visually represented [17]. For the design of intelligent instruments, there is a conflict in the public understanding of AI as simulation of human intelligence and the usage of it as part of instrument design, as many of the functions it is applied to do have nothing to do

with human intelligence, but rather should be seen as statistical methods aiding design, composition and performance.

Agency. This word is highly problematic, yet it cannot be avoided. The richness of the term stems from the differing definitions as to what agency means, ranging from actor-network theory definitions of inanimate and non-human objects having agency (e.g. Latour [18]), through theoretical biologists discussing the agency of primitive life forms (e.g. Barandiaran, Di Paolo and Rohde [19]), to analytical philosophers who might define agency as a property of a conscious, ethical, autonomous human being (e.g. Anscombe [20]). On such a continuum we might ask how we define agency in AI research? We are clearly not talking about our instruments as ethical beings (not yet at least), but arguably they are objects of thing-agency, where instruments with AI contain a form of music theory, a view of music that shapes the expressive potential of the performer. Here Latour's actants mix with Barad's intra-action and we could talk about intra-actants, i.e. where agency emerges from the relationship between something and someone [21]. Bio-agency is another matter, and with the use of AI and ALife, our instruments might take on some agency that is defined by their aims, goals, memory of past events, learning and adaptation, problem-solving, separation from the environment, searching for equilibrium or new states, in short, a dynamical movement from one state to another, often prompted by user or environmental input with some purpose. Questions of artificial life emerge. We might also talk about semiotic agency, where, for example, I pick up a flower and give it to someone. That act itself is a semiotic act, transforming the being of the flower into a semiotic agent [22].

Actor. Something that acts. In actor-network theory, an actor is not confined to a human, but could extend to human networks, and non-human entities [23]. An actor acts. It performs some work, *ergon*, thus we can talk about the ergonomy of a musical instrument, or the general expressive scope that goes beyond subject-object distinctions. What are the ergonomic and *ergodynamical* [24] features of an instrument with AI? Since actors are always constituted of actor-networks, we are entangled up in a social, cultural, technical and political structures, and, as such, the actor is never localised in one particular place. It is an assemblage. The genealogical origins of music are practically infinite and with machine learning they are non-traceable. The origins of an intelligent actor are interdependent, emerging, arising [25].

Assemblage. Instrument designers assemble into their design a set of technical elements that become the instrument. This involves elements from a wide range of engineering or computing, and other fields such as gaming, sports, military, etc. Involved are arrays of hardware, software and protocols, as well as cultures of use. Deleuze and Guattari [26] define the assemblage as something that is not a fixed, static entity but rather one in a state of becoming, being transformed in new techno-cultural contexts. When assembled, an instrument is an object that has a particular purpose in a particular time and place, yet is likely to disappear and be forgotten rather quickly (what happens to our current systems? How do they sustain into the future?). This nature of instruments as technical assemblages yield the difficulty of fitting them into hierarchical classifications, as I explore in a recent article on digital organology [27].

Adaptive. A term used in the context of evolutionary biological systems. Adaptation is seen as a core quality of living systems, perhaps recently augmented with the notion of *enaction* [28]. With AI in music creativity, we gain technologies that are capable of adapting to our behaviour, for example instruments that adapt to the performer's playing. We also have machine learning models that we can train ourselves, such that they become personalised and unique through tuning and personalisation [29]. This is in contrast to views stating that machine learning in music will yield the most common denominator and produce only mediocre summative results.

Authorship. Applying instruments with intelligence in a musical performance is a constant negotiation with the designer of the system in a different manner of how we appreciate acoustic instruments. The question of authorship emerges, asking where the boundary between the designer and the performer lies, and where the music actually "sits" in this situation. If a model is trained on a canon of musical works (e.g. Sturm [30], Shepardson [31] etc.) where does authorship lie, what is the curatorial role of the instrument designer and the compositional or performative role of the musician who plays the instrument? Yet, it is precisely here through the relationships and dependencies represented by the elements of the assemblage, that the notion of the author is recast as a dispersed entity. The AI designer is not a monad, unit or singularity that designs systems, writes music, or generally expresses themselves from an "original" standpoint, but rather an actor that is intrinsically interconnected to other actors that themselves represent networks (cf. Barthes [32]). Furthermore, the choices of data sets and training applied to the system become aesthetic choices that will colour the potential scope of the instrument's future music.

Authenticity. Authenticity is problematic word in cultural studies and art [33]. Problems include essentialism as if some traditions or elements therein are inherently authentic; colonialism and the history of "world music;" commercialisation of "authentic" products as part of lifestyle; and as a tool of exclusion where some actors do not fit the prescription of the authentic. There are largely differing opinions as to what is authentic, and qualities that might be defined as such appear in various assemblages. The question of authenticity is particularly interesting in the context of AIMC, where the systems designed are typically seen as inauthentic not grounded in living musical tradition, context or musical culture. Or what? Is the work of AI composers perhaps an extension of that particular culture? And is AIMC itself not an authentic musical culture on its own? However that is answered, many of our musical references are not deeply rooted in one specific cultural tradition, but more typically fusing a range of musical cultures with an array of technical cultures, where technical elements assembled typically have centuries or decades old traditions.

Appropriation. Cultural appropriation [34]. The problems arise when a dominant culture (of which tech cultures have traditionally been part of) appropriates elements from a marginalised culture without properly acknowledging the source. This topic is problematised with the concept of *hybridity* by Homi Bhabha [35]. Music has always transgressed cultural boundaries easily and it is hard to find examples of it not happening. Suffice it to mention Debussy and gamelan music, Miles Davis and Spanish music, 1960s British rock and

American blues, punk and reggae, and perhaps the success of hiphop as an international genre that takes unique roots in local cultural contexts. This is typically seen as a question of engagement and respect for what is being incorporated, whether that involves musical styles, instruments, performance methods or perhaps less identifiable elements, such as alternative tunings. Across Western music departments there is much talk of decolonialisation, a noble attempt to acknowledge the cultural situatedness of our musical canon and to broaden its scope, but the other side of that coin might result in cultural appropriation. The issue of appropriation is currently strongly debated amongst artists who complain about their work being used in the training of models (e.g. [36]) but at present these are mostly privileged voices, not from marginalised cultures, although this also exists [37]. The notion of appropriation is included in this lexicon as a reminder that bringing elements from other musical cultures into our instruments and practice has to be done with care, respect, understanding and acknowledgement of the source culture.

Autonomy. AI systems can display various forms of autonomy, and we often perceive them as having agency. Sherry Turkle demonstrates how humans tend to attribute intentionality and intelligence to inanimate objects [38]. Autonomous agents are omnipresent in computer science and software, and they are used increasingly in creative applications where they might entangle with each other or human users. In digital systems, and to some extent in acoustic instruments too, we delegate agency to the instrument, adapting our expression to its expressive functionality. This delegation ranges from being reactive responses to fully autonomous [39]. The past proceedings of AIMC could also be placed on a continuum between the autonomous and the instrumental.

Automation. Autonomous agents are now used for musical tasks of composition, assisted composition, interpretation, improvisation, accompaniment, melody, rhythm, and harmony generation, continuation, style imitation, arrangement, curation [40]. Automation can help novices to express themselves musically as well as inspire or save time for expert musicians. Modern humans do not enjoy digging holes with their hands, and the history of technology exemplifies the iterative solutions to that problem. Automation in music is similar, except we have more protective and divergent ideas of art and creativity than we have of hole digging. However, in the current cultural landscape of automation anxiety [41] the topics of automation and its inroads into creative work will continue to be a topic of academic and artistic discussion for years to come. Furthermore, in future AIMC research we are bound to explore how it makes sense to automate all kind of processes in a musical performance, but hardly the musical performance itself, except perhaps in robotic performances of music.

Aura. On the uniqueness of an artistic work or an instrument. Walter Benjamin’s articulation of how the unique aura of artworks disappears in the age of mechanical reproduction is well known. For Benjamin this was no bad thing: it democratised art and made public engagement easier, a view his colleague Adorno did not share. Today the idea of aura has dispersed into multiple functions, for example where an original Roland TB-303 drum machine has a unique aura for those who own it, cherishing the bespoke sound that is not easily attainable by the multiple simulators and recreations of the device. The same can be said with original first release of vinyl albums. But what is emerging too is the new type of loss-of-aura that we witness in generative

AI systems: there are infinite potential versions of a piece or a performance and none is more authentic than another [42]. However that develops, we can rest assured that aura is a sub-cultural notion, applicable in infinite contexts on all kinds of objects, depending on the aesthetics of bespoke value systems and a notion that we won't be able to throw away anytime soon.

Affect. Research methods in AIMC often seek to be scientific, objective, and analytic, based on user studies and evaluation. Musical expression and ideas are squashed into formal methods of surveys and interviews, and answers interpreted "objectively." Or such is the culture researchers, paper writers, peer reviewers and meta-reviewers adhere to, many somewhat grudgingly. Findings in embodied cognition demonstrate how thinking happens in a situated body where the whole system, and some point especially to the guts affecting our thinking [43]. Emotion is taken as an example of being ostracised from scientific thinking, yet it makes no sense to maintain this dichotomy between emotion and reason, as Nietzsche stressed and has now become commonly acknowledged [44]. Affect theory acknowledges the role of emotion, but focusses on how affect emerges as an encounter with the world, or as Sarah Ahmed articulates it: "Affect is what sticks, or what sustains or preserves the connection between ideas, values, and objects" [45]. A field of computer science exploring this is called Affective Computing [46]. Yet, in AIMC, even if the scientific methods might need to consider the role of affect in formal studies, the lack of affect is not the case when we design, perform or informally evaluate the outcome of our work. Here affective methodologies can add benefit as they investigate affective processes that emerge in empirical studies [47].

Algorithm. An algorithm is a formal definition of a process, a step-by-step instruction of how to achieve a task. When formalised thus, it can be repeated, for example by a machine. An algorithm requires an abstraction of the world, where the fluid mess of the world is turned into discrete forms. A good example is whether it is raining or not: a condition we are extremely familiar with, yet there are situations of drizzle where we have problems answering the question. Formal algorithms enable us to write our music theory or musical work rules, and traditional notation is one such algorithm. This is not the case in machine learning where we set up an algorithmic system that learns, such that we cannot follow its decision making, nor understand so easily how the input (data) yielded the output (music). This is the black box of ML, a box that has become integral feature of composition systems and some musical instruments. Algorithms thus become actors in our music making that need investigation. They are transformers or functions that shape thoughts and sounds. We need to study them critically, their role in culture and their sociomaterial agency, and for that we have algorithm studies [48].

Anthropomorphism. The act of attributing human characteristics to an object, plant or animal. Our intelligent agential instruments might have "goals" or "seek" some kind of a state, have memories of past states, and they might even be "tense," "frustrated," "angry," "wild," or "happy." The AI system might have been in a low mood when it made that sad music. We thus project our imaginary onto a system that might not have any capacity for those states, and certainly not a human sentience for experiencing them. In anthropomorphic HCI,

for example in online services or robotics, users often trust or put belief in a system that otherwise would not warrant it [49]. Recently, however, the idea of anthropomorphism has been criticised from an unexpected direction by biologist Michael Levin whose research involves exploring the potential for mind in any complex system. He states that “there is no such thing as ‘anthropomorphizing’ because human beings have no unique essential property which can be inappropriately attributed to agents that have none of it” [50].

Anthropocentrism. The idea that the human being is the centre unit with which to measure intelligence, emotions, mind, consciousness and personhood. The danger of this idea, largely originating from the large monotheistic religious traditions, is to set the human against all non-humans, ostensibly because a profound lack of understanding of other beings, primed by a religious dogma of human exceptionalism. Anthropocentrism blinds us to the diversity of non-human minds and the possibility of understanding non-human like consciousness [51]. We do not have the path to insight into the intelligence of animals, plants or larger ecological systems, or at least science has been largely primitive in that approach. Only recently have we begun to acknowledge the importance of studying the rich mental life of some non-human beings and their communication [52]. Bogost, in his speculative realism, goes as far as proposing an alien phenomenology albeit acknowledging its impossibility [53]. The diverse field of posthumanism [54] acknowledges the anthropocentric mindset of past centuries and try to open our minds (however difficult or practically impossible) to the minds of non-humans. Again, AI is helping us to reflect upon ourselves and we might ponder how machine learning can not only help us to detect patterns in non-human cognition and communication, but also apply the methods of “explainable AI” to other systems of intelligence.

Autopoesis. Self-creation. For Maturana and Varela this concept defines the nature of life: as something that is self-producing, has metabolism and separates itself from the world through some form of a membrane [55]. The nature of a membrane or a boundary is of different degree of porousness. Our skin emits and incorporates molecules constantly throughout the day, for example. Autopoesis can be applied to non-biological structures too, and Luhmann has applied the concept to describe society [56]. We might apply it in describing a research lab. What is the matter that goes in and what goes out? Where is the boundary of the lab, and how does it extend into the wider world? In AIMC instrument design, autopoiesis can be applied as a concept to mimic the self-sustaining behaviour of living systems in sound synthesis, for example with feedback loops, self-regulation, adaptation and homeostasis.

Apparatus. Apparatus is tools or implements that are assembled with a bespoke means to an end. Yet, the apparatus colours and shapes the activity and the outcome of what is studied. In the agential realism of Barad, we learn how the apparatus produces the phenomena it investigates [57]. Apparatus is more than simply the physical tools that are applied in the study of the world or the creation of music, but also the context in which they are used, for example in a laboratory or studio setting. Through apparatus, the material agency of the world emerges, the instruments not neutral probes [58]. We need to consider how the AIMC system is an apparatus in that shapes our world view, defines our experiments and colours our interpretations of data. An

old philosophy of technology joke states that “if the only tool you have is a hammer, every problem looks like a nail,” pointing to how our technology shapes our thinking and worldview.

ALife. Artificial Life. Or life-as-it-could-be, according to Christopher Langton, one of the proponents of Alife [59]. ALife has inspired musicians from the beginning, Brian Eno’s enlightenment when he saw Conway’s Game of Life for the first time has become a famous tale. For many, to have a ‘living’ part of the instrument or the system can mean that they delegate to it some of the playing and focus on its agency and autonomy. From previous research [60] it is clear that people embrace precisely the contribution of a ‘living’ system as a way to get out of one’s own thought processes and established habitual patterns. This development relates to aesthetic movements in posthumanism, where the previous focus on the expressive self is shifted to the ideas of cyborgs, systems theory, distributed selves, and community. Since Eno was mentioned in this entry, his argument that we are moving from the ‘genius’ to the ‘scenious’ is relevant in this context, i.e., we have shifted from the modernist conception of the human to a posthuman notion, where non-humans become partly elements of the distributed self.

Augmentation. Augmenting existing instruments with digital technologies has proven beneficial for many reasons: there is already craft in making highly sophisticated instruments, there is existing skill in musicians who can play those instruments well, and there are cultural traditions around the instruments [61]. We currently explore how performance systems can be augmented with AI. Questions of skill leverage come in here [62] and how trained performance can be augmented with AI.

Animism. Instruments become animated through play, but typically they are in-animate when not played. With feedback, artificial intelligence and artificial life, the instruments take on different forms of life-like qualities. The feeling performers have, when playing the instruments, is reportedly one where the instrument exhibits a form of agency [63], a non-linear behaviour that is not to be controlled but to be played with, as in a dance. A term related to animistic design is empathy, where users feel some kind of affect with the animate object, as we might perceive it has some form of autonomy and inner life [64].

Art. In a broad and original sense art is craft and artists are people who practice their craft. We thus know of the art of medicine, art of warfare, art of painting, art of cooking, art of thinking. To discuss art as a bespoke Western phenomenon with its elaborated institutions and practices is a reduction of the human being’s technicity and skill into what seems like a microscopic practice in the big picture of human activities. Art is everywhere and to be found in all cultures, but definitions of it vary together with notions of what constitutes creativity, itself being a word that has diverse cultural meanings. Creating an AI system is an art, where ideas, aesthetics, skills, craft, innovation and critical thinking come together, and the system itself can produce art of varied quality, just like humans do [65].

Anthropology. The study of humans, their societies, cultures and sub-cultures. As a sub-culture within a larger musical and technical culture, it is time for an anthropological study of AIMC. If AI is an extension of the

human, and in creative AI, imitator of human creativity, we need an anthropology of machines, as paradoxical as that sounds (some seeds are growing [66][67]). Such an anthropology would study not only the behavioural patterns in selecting and curating datasets, designing and training models, evaluating and selecting musical outputs, but also the attributions, affect, and ideas given to the system through conscious and unconscious anthropomorphism. This anthropology of machines would study how technology is adopted into musical context, the discourse that emerges around that use, how creative AI systems are produced, maintained and used, their dissemination and innovation, and the impact this work has on the larger musical culture, education, industry and society in general.

Attention. When an object or a work of art presents itself in a novel way, we pay attention. In this encounter something stands out or what Bergson defined as a suspension of normal motor activity, or, as we might say today, a break in our predictive processing cognitive structures. Yet, as Sullivan points out, we tend to see only what we are interested in, what we have already seen [68]. Here art becomes a crucial tool to break the motor pattern of our perception, of generating an aesthetic experience that at the same time is novel for our ears and more general affective perception. How do we attend to AI generated music? Is it predictable and dulling our attention or does it raise our interest? Repeated identical patterns dull the senses, but what attracts our attention makes perception more intense [69]. A question is how this differs from attention in machine learning! [70]

Aesthetics. A term typically used to signify the underlying principles of an artist's work, but could equally be about genres, styles or movements. Contemporary usage of the word derives from the 18th century, developed by philosopher Alexander Baumgarten, to refer to the perception of beauty. Immanuel Kant criticised this usage in his Critique of Pure Reason and sought to refer to its original meaning in Greek, namely that which concerns perception, sensation and that which is of the senses. Aesthesis is the sensation of touch, whilst we might argue for a study of micro-scale perception of musical instruments [71], we should also consider how the perception of sound touches us [72]. To explore the overall look, feel and expressive scope might be called aesthetics of instruments, but considering the strong and historical usage of the term as that of the study of beauty, the term ergodynamics has been proposed [73]. That expressive scope might be shaped by the aesthetics of a trained AI model. The data set, curation and tunability of that model becomes and aesthetic question.

Analogue. A high level and performer focussed reticulation of musical instruments might divide them into acoustic, analogue and digital instruments. The analogue is where the medium form is analogous with the output, for example where the groves on a vinyl record are isomorphic to the sound waves in the air. This is not the case with digital instruments, and in a different mode with acoustic instruments either as they are the actual producers of the sound, often where interface and sound generation are the same technical element. Yet, when moving across the strata of our technical devices we find the analogue and acoustic in digital instruments and the digital in acoustic. The world is not as easily categorisable as we might think. With machine learning we can explore how analogy appears in the signal that goes into the dataset and the signal that comes out.

Acoustic. Acoustic instruments are typically defined as those that are not powered by electric or electronic means. In short, all instruments before the advent of electricity. In the new music technologies today we find very few new acoustic instruments, which is a matter of curiosity. Currently, in the field of AIMC the acoustic has a particular place and purpose, as machine generated music tends to sound much better when played by people on acoustic instruments, as opposed to machine rendered MIDI files. This need not be so necessarily when our models have been trained on instrument sounds and the expressive quirks of human performers. What is ultimately the hard problem of musical expression in AI will be to have the machine understanding the music, and that's analogous to the hard problem of consciousness [74].

A DISCUSSION

AIMC is a young field that combines innovative musical and technological practice. True to its nature deriving from those practices, the literature has been largely musicological and technological in nature, but there are important developments emerging in addressing the ethics and aesthetics that present themselves with this type of work [75]. What the field needs now is a stronger engagement from fields such as media studies, software studies, cultural studies, science and technology studies, material anthropology, sociology of technology, and philosophy in general. Agre's critical technical practice [76] is a good departure for our developments, but it would only represent a starting point. The question is how we can philosophise with artificial intelligence; how AI becomes an instrument for philosophical thought. Other methods needed are musicological approaches into the experience of practicing music with AI, historical analysis of the dependencies, conditions and emergence of these technologies, and sociological studies of how the technology is applied in musical context and its reception by other musicians, the industry and the general public.

Anthropology and aesthetics can study how the animism of ALife and AI is expressed in the cultural imaginary. Through algorithms on the embedded computer, an assemblage emerges that demonstrates a particular aesthetic, one that is defined by the behaviour of the AI and the ALife. These systems might feel alive, yet there is no point in talking about human intelligence, and we explore alternative intelligences, alien intelligences, augmented intelligences, artificial intelligences. These systems have behaviours, goals and memory of the past, and they can be seen as intelligent, but with sentience that's not of a human mind, and perhaps more akin to the intelligence of ants or plants. We might ask a further question, ecchoing Levin [77], whether it really makes sense to look at the world through the lens of the *anthropos*, claiming that every statement that we utter of a mind or intelligence in the world is about us anthropomorphising and projecting mind onto mindless matter.

CONCLUSION

This paper has discussed a range of theoretical issues as they relate to the field of AIMC, but in a subjective essayist manner. The aim has not to be comprehensive in introducing the complexity of those terms, as each of them warrants a book-length study, but rather to point to these concepts as analytical instruments with a large

corpus of literature and theories behind them that relate to the design, analysis and evaluation of new musical systems with creative AI. It is suggested that the field is in need of a broader theoretical base to engage with creative AI in music from an interdisciplinary or transdisciplinary perspective, and it is my hope that this curiously bizarre and absurd paper points to possible paths for expanding, extending, enlargening and exploding the theoretical base, through a broader lens than we have hitherto been applying in the AIMC practice domain.

ACKNOWLEDGMENTS

The Intelligent Instruments project (INTENT) is funded by the European Research Council (ERC) under the European Union's Horizon 2020 research and innovation programme (Grant agreement No. 101001848).

ETHICAL STANDARDS

This is a theoretical paper that did not involve any test subjects, no experiments nor user studies. No AI was used in the writing of this paper.

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