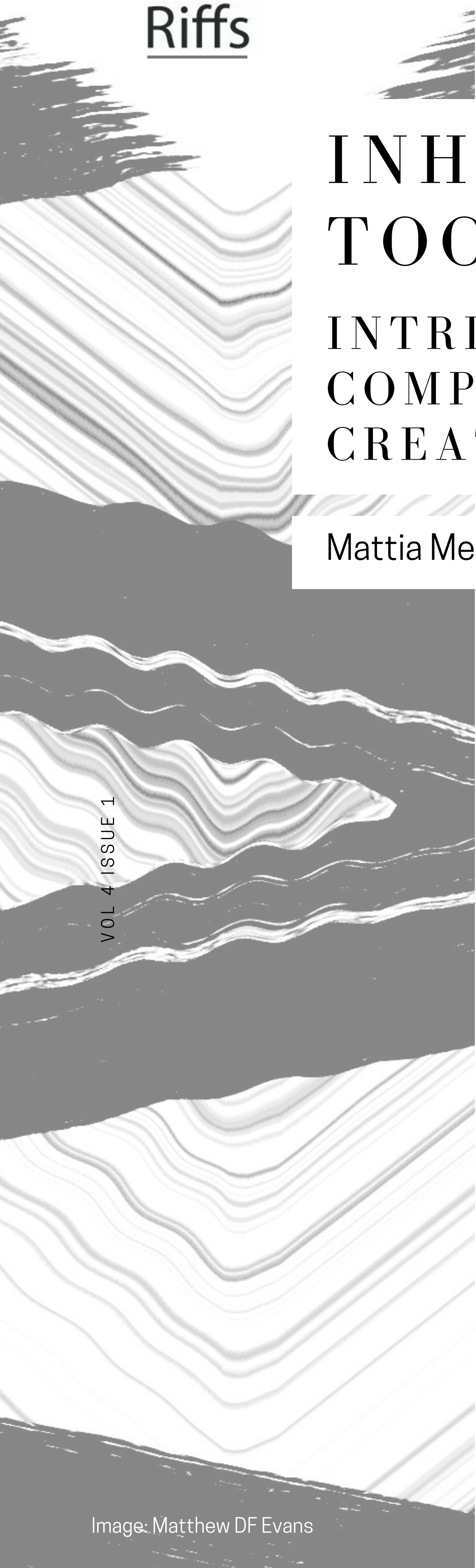

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INHUMAN, ALL TOO INHUMAN

INTRINSIC LIMITS OF COMPUTATIONAL CREATIVITY IN MUSIC

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In this paper we aim to reflect upon the human-machine relationship in creative contexts and, more precisely, on some of the limits that machines present when we take creativity into consideration. In particular, we want to raise some concerns about the possibility that machines can genuinely instantiate intelligence as we understand it (the thesis of *strong artificial intelligence*) and are therefore able to take our place as creative agents. However, even considering the more plausible positions regarding the potential abilities of artificial intelligence (e.g. machines' ability to reproduce behaviours that seem intelligent: the thesis of *weak artificial intelligence*), we are convinced that there are still some discrepancies in comparing creativity between human beings and digital agents. After having argued against the plausibility of human-like intelligent (and creative) machines, we are going to present some actual cases of *weak AIs* in action, alongside some questions that – we argue – are surely more imminent and interesting than the science-fictional scenarios depicted by *strong AIs* supporters: should we underestimate the importance of having a body in the creation of music? And what can be said about our understanding of pleasure and meanings? And also, what role should we grant to all of those social aspects and values that are related to music and that define a large portion of the meaning of the music itself, especially in the field of popular music? To answer these questions, we will address four orders of *issues* concerning musical creation by referring to sociology of music, musical semiotics and embodied simulation. Thus, it will become evident that music is much more than just a sonic phenomenon, and this is something we should never disregard while trying to assess the role of creative machines.

The Limits of Artificial Agents

To better understand the capabilities of the (inhuman, all too inhuman) artificial agents which populate our lives (e.g. smart assistants like Google Home and Amazon Alexa, or algorithms that help profile our online behaviour to better suggest what content should we pay attention to) we should first try to assess their limits. In the opening of this paper, we are going to confront the idea that it is possible to entirely recreate the human mind through computational means and – if, as we think, that is not the case – that we can at least mechanically (and limitlessly) reproduce/simulate human intelligent behaviours by deploying algorithms. These two ideas pertain to two different fields, the first being more akin to *metaphysics*, and the second – often labelled with the name of *mechanism* – representing the much more limited project of limitless mind *simulation*, which is rooted in the famous article written by Alan Turing (1950). During the next two subsections, we are going to present some arguments against both of these possibilities and in favour of the idea that machines bear within themselves some intrinsic limitations that could help us reject a set of (unjustified) worries, while making us shift our attention on the salient aspects of AI which can impact (and are impacting, as of today) the course of our lives as well as challenging our notion of creativity (e.g. how artificial intelligence can stimulate our creative processes and aid the human artist in his/hers creative moments). To further promote clarity and understanding of the point we are going to make in this paper, we give a brief schema of our argument:

Riffs

1. If we have good reasons to (at least) doubt the plausibility or the imminence of strong AIs and the truthfulness of mechanism, then we do not have to worry about truly intelligent and mind-possessing artificial agents which are going to replace us in creative contexts (in short, the issues linked to strong AIs in creative contexts are not impelling, imminent or plausible).

2. When confronted with two sets of issues, addressing the ones which are more impelling, imminent or plausible is a commonly good practice.

3. We have good reasons to (at least) doubt the plausibility or the imminence of strong AIs and the truthfulness of mechanism:

    a) Searle's argument against strong AIs and the addendum by al-Rifaie and Bishop against strong computational creativity and
    b) the philosophical implications of Gödel's theorems.

4. Hence, in short, the issues linked to strong AIs in creative contexts are not impelling, imminent or plausible.

5. Furthermore, we have a set of issues - concerning human-machine interactions in creative contexts - which are more impelling, imminent or plausible (some elements of this set are presented in the following article) than the ones linked to strong AIs and creativity.

6. Then, we argue, dedicating our attention to more plausible, impelling or imminent issues concerning machines and creativity would be a good practice (as we do by always presenting actual or very plausible scenarios).

Strong and Weak AIs

The first position we are going to present is taken from a paper written by John Searle (1980) in which the philosopher argues that (1.) *intentionality* – intended as the ability of the mind to be about, refer to or represent things, states or properties of the world – is a product of causal features of the brain (in humans or animals) and (2.) that we could *never* obtain *intentionality* by solely instantiating a computer program. In doing so, Searle proposes a distinction between two theoretical positions regarding AI and its nature, labelled *strong AI* and *weak AI*. According to weak AI, studying the mind through computational means gives us nothing more than a powerful tool to test our hypothesis. On the contrary, according to strong AI, we could use computers and algorithms to *create* a mind which is able to *understand* and to have mental states (Searle 1980:417). It is solely against the latter claim that Searle disagrees: to show its implausibility, the philosopher constructs a *thought experiment,* now famously known as the *Chinese Room Argument* (Searle 1980:417-419).

Suppose that I am a native speaker of English and that I know nothing about Chinese: I cannot recognize the ideograms, nor am I able to write or speak Chinese. Now, suppose that I am locked in a room and that I am given two batches of Chinese symbols along with a set of rules, which are written in English and can be used to correlate the second batch with the first. As a native speaker of English, I fully understand the rules and these enable me to correctly correlate one set of symbols from the first batch to one set of the second, only by identifying their shapes. Furthermore, suppose that I am given a third set of symbols in Chinese, alongside some instructions which allow me to correlate the symbols from the third batch to the previous two batches and suppose that the people which handed me the three sets of symbols call the first batch a “script”, the second a “story”, and the third “questions”. The symbols that are given by me – in response to the third batch – are called “answers to the questions”, and the set of rules that I possess is called “program”.

Now let's imagine that I can play this game also in English and that I get so used to manipulating symbols in Chinese (and that the programmers are so good at writing the programs for me) that my responses are indistinguishable from the ones that would be produced by a native speaker of Chinese (and my performance is equivalent – from the outside – to the one I give whenever I play this game with English batches). However, I still do not understand any of the Chinese symbols: "[...] in the Chinese case, unlike the English case, I produce the answers by manipulating uninterpreted formal symbols. As far as the Chinese are concerned, I simply behave like a computer; I perform computational operations on formally specified elements. For the purposes of the Chinese, I am simply an instantiation of the computer program." (Searle 1980:418). It is pretty clear for Searle, at this point, that there is a substantial difference between the English and the Chinese cases: in the former, I *understand* the stories, while in the latter I am only manipulating symbols. In the former, I can operate both on *syntax* and *semantics*, while in the latter I am forced on a *syntactic* level. By this experiment, Searle argues, we are inclined to refute the thesis of strong AIs' supporters: that is, we are inclined to say that a computer cannot be a mind for it cannot replicate one of the peculiarities of human minds, which is *understanding*. In short, syntax is not sufficient for semantics.

Despite our knowledge of the numerous critical stances regarding this argument (for some of them see Searle 1980:419-423, Kurzweil 2000, Crane 1996, Churchland & Churchland 1990 and Pinker 1997), we believe that the Chinese Room Argument serves (at least) the purpose of inducing doubts towards the plausibility or the imminence of strong AIs. If that is the case, we can also accept the linked distinction made by al-Rifaie and Bishop, regarding *strong* and *weak computational creativity*: "[...] in Strong Computational Creativity, we argue that [the] computer is not merely a tool in the study of the creativity; rather the appropriately programmed computer really is creative, in the sense that, computers given the right programs can be literally said to *understand its creation* and have other cognitive states (e.g. teleological and emotive) associated with human creative processes." (al-Rifaie and Bishop 2015:45). Having good reasons to doubt the plausibility or the imminence of strong AIs gives us – at the same time – good reasons to doubt the existence of strong computational creative agents, leaving the door open to addressing more plausible and impellent problems concerning machines and creativity (to be discussed later in this article).

Anti-Mechanist Arguments and Gödel's Theorems

As a second attempt of making our reader doubt the plausibility or the imminence of *strong AIs* and the truthfulness of mechanism, we are now going to briefly present an argument against mechanism (as analysed in Beccuti 2018). In 1951, Kurt Gödel presented the philosophical consequences of his famous incompleteness theorems, claiming that his second theorem "[...] *makes it impossible that someone should set up a certain well-defined system of axioms and rules and consistently make the following assertion about it: All of these axioms and rules I perceive (with mathematical certitude) to be correct, and moreover I believe that they contain all of mathematics.* If someone makes such a statement he contradicts himself." (Gödel 1951:309). Let us expand on this claim: during the same conference from which this passage is taken, Gödel traces a distinction between mathematics in its *subjective* sense and mathematics in its *objective* sense. The former is the set of provable propositions starting from some axiomatic system, the latter is the set of true propositions in the absolute sense: are these two sets – Gödel asks himself – the same set? If so, we could not possibly "encase" the entirety of mathematics using only one axiomatic system: if this said system were to exist, in fact, the proposition that expresses its consistency could not be proved in it (as per the second incompleteness theorem), in which case the initial assumption is contradicted. If, on the contrary, we were to distinguish objective from subjective mathematics, then subjective mathematics – on the one hand could be axiomatized using only one system but - on the other hand - the problem of explaining (both philosophically and mathematically) the existence of true propositions which are not accessible by formal proofing would remain open (Beccuti 2018:2-3). Gödel is then inclined to accept the following *disjunction*: either we can not formalize subjective mathematics, or we can not reduce objective to subjective mathematics. In other words – and following Gödel's argument – "[...] *either mathematics is incompletable in this sense, that its evident axioms can never be comprised in a finite rule, that is to say, the human mind (even within the realm of pure mathematics) infinitely surpasses the powers of any finite machine, or else there exist absolutely unsolvable diophantine problems of the type specified* (where the case that both terms of the disjunction are true is not excluded, so that there are, strictly speaking, three alternatives). It is this mathematically established fact which seems to me of great philosophical interest." (Gödel 1951:310). Hence, according to Gödel, either mechanism is false, or there exist mathematical problems for which we can not hope to find solutions.

By analysing this argument in a deeper manner (see Beccuti 2018), we can unearth four different assumptions, mathematical and philosophical in nature, which are the usual common ground (Beccuti 2018:8-9) of a possible proof of the said disjunction: 1) the incompleteness theorem; 2) theories-machines isomorphism; 3) the Church-Turing thesis; and 4) consistency of the human mind. Suffice to say that the first two assumptions are out of the realm of informal debating (they are metatheorems of mathematics, mathematical results themselves. Questioning these requires us to question the entirety of mathematics) and the third – despite it being an hypothesis fuelled by empirical evidences – is widely accepted by the community of experts in mathematics and computer science. That leaves us with the (more easily) questionable assumption – the fourth one – on which a large part of the philosophical debate is focused. We will not consider here the entirety of the positions that try to favour or discredit this claim – or other more subtle ones, involved in this proof (Aldini, Fano & Graziani 2016): it is sufficient, for our needs, that the two arguments hereby presented grant the reader enough of a doubt concerning limitless (and creative) strong AIs to consider problems associated with them as not impelling, imminent or plausible (or, at least, less plausible than the ones we are going to present). By doing so, the reader will agree with us on the need of focusing our attention on more real (and already present) questions concerning machines and creativity, as per point 3 (a similar position, concerning the real problems and opportunities of AI towards which we have to direct our attention can be found in Taddeo & Floridi (2018) and in Floridi, Cowls, Beltrametti et al. (2018)).

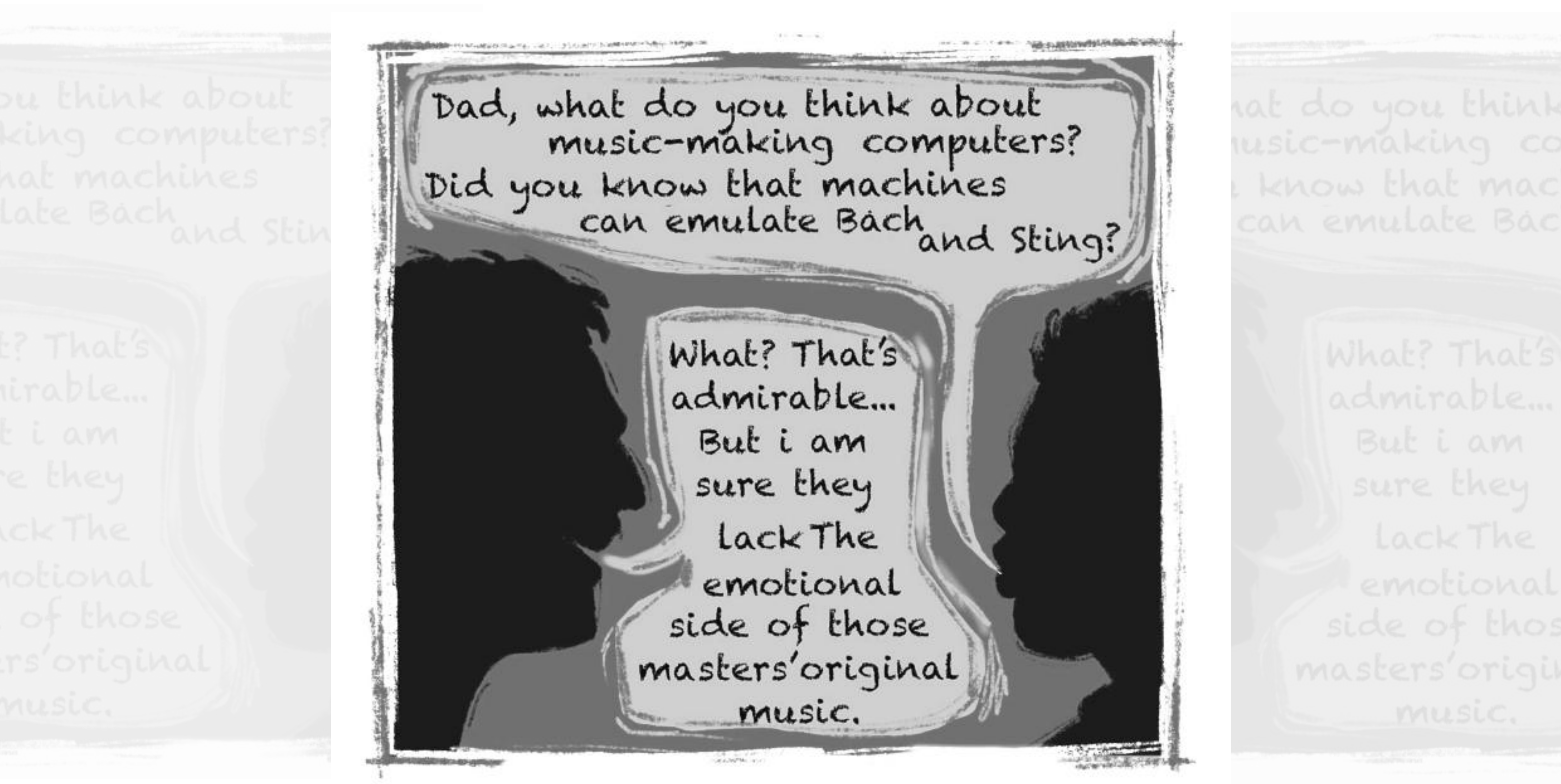
A Look to the Present

So, it seems like AIs cannot possibly take our place: we can definitively place our anti-Terminator weapons far from our children's reach. But one could argue that machines are already simulating – if not actually instantiating – music creation (and not only that, see Colton et al. 2012 and Cohen 1995 for examples of AI applications in the field of painting and poetry). Now, these are the kinds of matters that we have to reflect upon, instead of worrying about sci-fi strong comp-

-utational creativity. Because yes, computers can kind of create music, and this triggers a whole lot of points concerning creativity in general and the role of machines in our habitual activities. In the following lines we will try to tease out some of those questions, while trying to highlight more limits in computational creativity that we assume as implausible to trespass.

For the purposes of our argument, I would like to split music into two broad categories: *emotional* music and *rational* music. This distinction is purely instrumental, so no ontological claim is made here. The first one is the one that we usually listen to for the pure joy of listening and looking for emotions/sensations, it does not matter if it is in the music of Beethoven, The Beatles or Burzum. *Rational* music is that kind of music which major factor of interest lies in its rational side, in the fact that it is *interesting* but not necessarily pleasant. We do not usually listen to such music to empathize with the composer or to feel strong emotions, but rather to enjoy its structure and, most of all, the concept lying behind the work (much of the avant-garde music can be included here). Given that it is quite intuitive that computers can produce a piece of *rational* music (but we will see if that is the case), can this work with *emotional* music as well?

Emotional Music and the Social Issue



Standard Situation

Do they? And do they also lack the genius of great composers and songwriters? Quite paradoxically – if you consider our positions until now – we would answer negatively to that question. Or, to be more precise, we could say that there is no actual reason why we could not be moved by listening to a piece of music composed by a machine. David Cope, developer of the creative AI named EMI, is firmly convinced of the potential of his digital creature, whose musical output is actually so impressive that it managed to change the mind of Douglas Hofstadter, previously (Hofstadter 1979) quite sure of the opposite (to access the full debate, see Cope 2001). It can be quite emotional indeed! EMI can produce music using Markov chains that recombine pieces of previously analysed music by the composer that you want to emulate, and further working on it via additional phases of the elaboration, that give the new piece coherence and recognizable patterns (for details, see Hofstadter 2001:44-51).

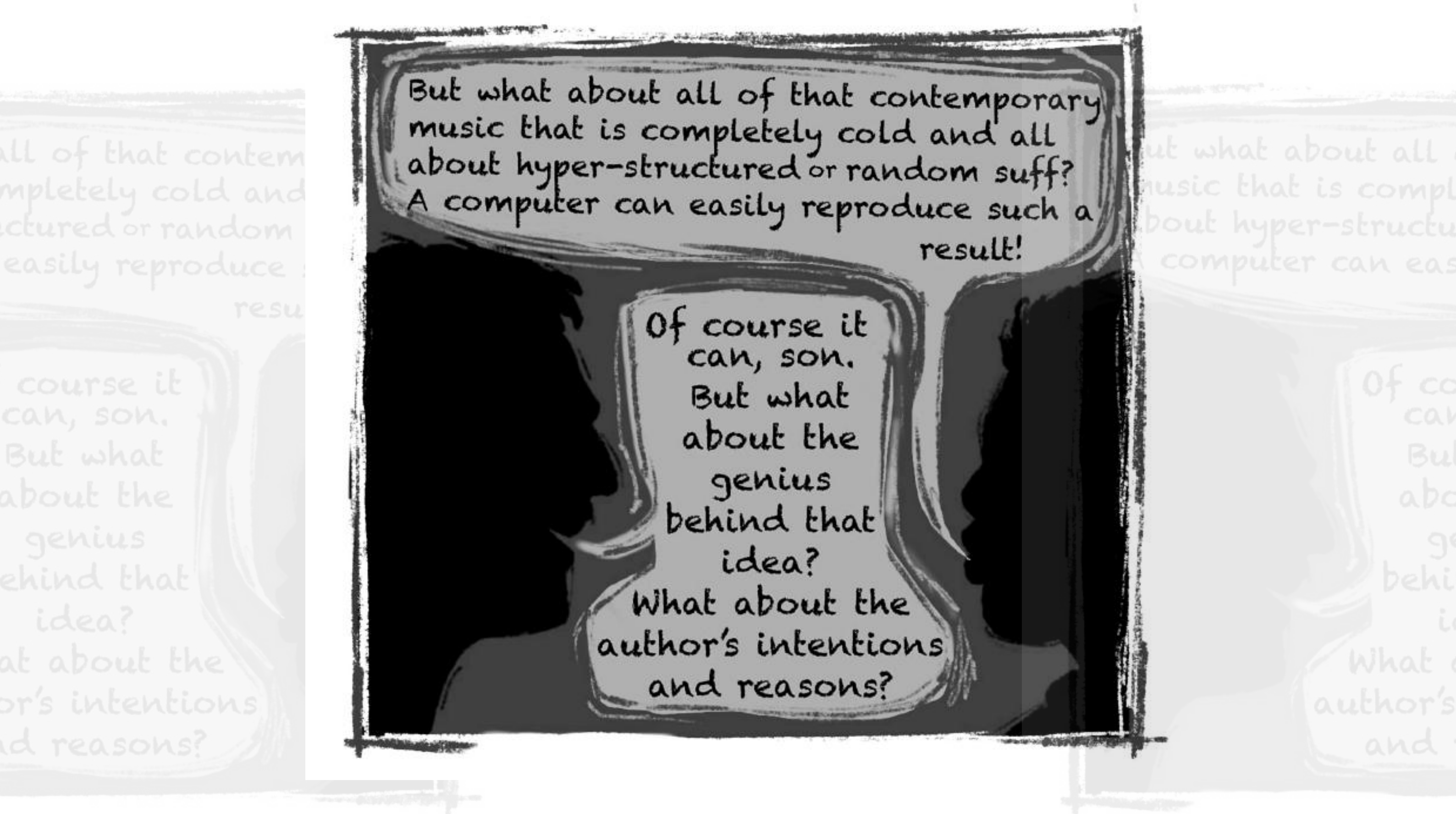
EMI Demo

This process makes sense if you start from the assumption that creativity is "the association of two ideas heretofore not considered related but now revealed as logically connected" (Cope 2015: 310), as Cope does, but of course it does not work so well if you take other factors into consideration (to which we shall return soon enough). Even at first sight you can spot some insidious (and classic) critiques, like the one concerning the lack of intention in what the computer is doing, and the superficiality of the “recombination” it is producing. Hofstadter refers to this in the terms of *sounding like* vs *speaking like* a composer (Hofstadter 2001: 53-55), presenting a layered conception of *style*, in which what EMI does is just imitate the surface and sound like Bach, which is basically the same kind of argument as that of the Chinese room. Of course Cope does not agree on most of Hofstadter’s critiques, but he also provides responses (Cope 2001: 83-92) that are mostly questionable themselves, especially when he provides *ad hoc* definitions of what music and creativity should and should not be, and when he mixes some aspects of EMI’s work with some others that must be attributed to his own work on EMI (e.g. when he responds to the critiques about the “soullessness” of “20,000 lines of code” by pointing out that such an apparently inspiration-less and imagination-less task required thousands of hours of passionate human labour and programming, see Cope 2001: 90… but this has nothing to do with EMI’s capabilities, we argue). His arguments only work if you assume him to be the actual composer using EMI as a means to compose (quite derivative) music, as he sometimes seems to assert himself. But this has nothing to do with EMI itself delivering results that are actually equivalent to music composed by real people, which is the very idea Hofstadter was criticizing.

That is why we argue that it makes much more sense to acknowledge the limits of computational creativity and develop something like Pachet’s Flow Machines. In such a context, style is conceived as "a malleable texture that can be applied to a structure, defined by arbitrary constraints" (Ghedini, Pachet, Roy 2016:334), so Flow Machines are useful to study that particular human behaviour that is style (the same kind of use we can make of weak AIs), by applying those textures to constraints defined by the user (so you can get, for instance, a Beatles song harmonized by Wagner or a dodecaphonic ‘Boulez Blues’).

Flow Machine Demo

Such an approach does not pretend to transform machines into artists, and this act of modesty is the result of a much more mature attitude towards computational creativity. And that is because what we are really losing with AI-created music is not really emotion, nor the genius or the intention, but the very humanity of it, in several different senses. The first one will be presented now as the social issue: Pachet can easily generate a new song “in the style of The Beatles”, but there is something about the original songs by the Fab Four that a machine cannot reproduce, which is the social context. Music and its meaning always rise from very concrete situations, so, for instance, the music of The Beatles was carrying a whole set of meanings which would not make sense in a computer-based context. Moreover, those ideals – or merely the shared passion for the same kind of music – are what keeps fans together, so there is an actual social context surrounding the music and defining it far beyond its supposed textual meaning (Spaziante 2007:33). Of course there might exist a community of computer-generated music lovers but… would it really be the same? Can we feel the same about that music? Cope (2001:335) argues that such problems are basically much ado about nothing, because music (as sound) stands by itself, in some sense – it is the only tangible thing we have and it is basically the only thing that actually matters in our relationship with music. Which is a very musicologically naive perspective.



Standard Situation - Reprise

This time, the person on the left is kind of right. Though many attempts of contemporary art aim to delete those intentions and reasons, there are always residual elements that are, once again, making things more complicated than they might seem. After all, if we take John Cage's work as example, his music was an attempt to free music from human creativity by giving the sceptre of the composer to the case (Cage 1961), and Xenakis took the game a step further, by letting stochastic formulas define the form of the composition, leading to a structuration of case – as it is in nature – but the same composer also highlights the centrality of human choices in such a process, not to mention his very personal cultural roots and interests, his ideals and rejection for much of the avant-garde music of his time, and we might go on like this for a while (Xenakis 2003). This leads to the very issue discussed here, the one we shall call *experiential issue.*

> What a computer lacks – and will always lack, if the first section of this paper makes some sense to you – is the capability of having an experience not merely in terms of manipulating 0s and 1s, but in terms of a lived experience, just like Xenakis was arguing (see above). Please note that this argument should also be effective when talking not only about avant-garde composers, but also highly structured music like that of extreme metal band Meshuggah, which features a very strict and mathematical procedure (Pieslak 2007), which is already possible to simulate online.

Visit djen.co to generate music in the style of Meshuggah.

It is that kind of experience that sets the very conditions of every musical creation, in the theory of music semiologist Jean-Jacques Nattiez (2007): the choices composers take (and so the core of their music) spring from situational factors, discourses and personal experiences, like for instance their relationship with existing music (and composers). Nattiez's aim is to focus our attention on the aesthesic (Tagg 2012: 196-198) side of musical creation, claiming that – obviously enough – creative choices do not come out of the blue (see, for instance: Amabile & Pillemer 2012; Ghedini, Pachet, Roy 2016: 325-329, Kozbelt, Beghetto, Runco 2010), neither do they relate to some kind of metaphysical Zeitgeist. Nothing of this fundamental commerce with the world is compatible with computational creativity.

On Top of It All. The consciousness and Body Issues

We may have closed the previous paragraph in a much too insistent way. But the reasons for our determinacy will be unveiled in this paragraph, which you might consider as a small coda that will hopefully convince you of the fact that we can relax when talking about AI-apocalypses with art and creativity playing the role of the main victims. In facts, further applications of the positions discussed above lead to the ultimate core of the problem, which is the intrinsic absence of consciousness and body in machines. The consciousness issue should be clear enough by now, and it is something that makes very much sense if we start from Searle's position, but also from a phenomenological perspective. Once again, weak AI seems to be the only possibility.

And what about the body issue (to read more about this specific issue, see Merlini, Nicoletti 2020)? Well, did you ever listen to the majority of post-rock music feeling a strange kind of chill in your body (especially in your hands) whenever the guitarists use tremolo picking? This is just one of the endless examples that one could think of to briefly explain how much having a body affects what we get from music. Such a point can be found in the reflections of French philosopher Merleau-Ponty (1945), but also finds support in contemporary neurosciences, and especially in the idea of *embodied simulation* (see, for instance: Gallese, Sinigaglia 2011): we can simulate (via mirror neurons) actions carried out by other individuals in our very body and flesh, including the physical actions that give birth to music (for some more advanced results in this research area, see Molnar-Szakacs, Overy 2006). The simulation is influenced by our competences (i.e. a guitar player can understand what tremolo picking physically feels like, unlike a piano player; see Moore 2012:4) and this might also explain why we tend to empathize in such a natural way with vocal performances and with their very "grain of the voice" (Barthes 1977:49-54), which is also carrier of meaning, since we all know, to some extent, how it feels like to sing. Let's also keep in mind that popular music is usually created by actually playing the instrument (Moore 2001:56-60) which is a very specific action with its more and less obvious affordances (Gibson 1979) and carrying a whole set of specific body shapes and physical sensations, so the creative choices themselves are body-driven, to some extent.

Music is not just notes and pure sound. It incorporates values, stories, ideals, concepts, sensations and kinds of pleasure (intellectual and physical) that require the very being that we call *human* for them to be understood, embodied, elaborated and used as fuel for new creations in the field of art, a field that we think is bound to be – and remain – exquisitely human.

Conclusions

In this paper, we argued that theories on strong artificial intelligences in creative contexts – capable of taking our place in every aspect of creation, and musical creation in this particular case – are not very plausible if we take into consideration the four previously mentioned issues, which can ultimately be brought back to Searle's Chinese Room argument, which we explained at the very beginning of the article. Nonetheless, AIs have taken huge steps into the field of creativity – and they will most likely continue to do so – and this should stimulate research around other problems, much more impellent (and less futile) than all the science-fictional worries that often lead us – more for the fascination they carry along, than for actual well-motivated fears – to discuss about artificial intelligence. Already between the present lines, we were able to address some of those topics and issues, that range from the necessity of a better comprehension of what "creativity" or "intelligence" might be, to the understanding of what defines the musical work as such, and to the question of whether or not there are strictly human features that we can find in art and that we tend to take for granted. All things considered, we believe that this seminal work leaves the door open to subsequent studies regarding the human-machine interaction in creative contexts and, in conclusion, we would like to outline some directions for further research.

Firstly, the intrinsic difference between the creative capabilities of human subjects and artificial agents could be captured in a stricter manner: we are convinced that some narrower arguments could be made in support of the intrinsic limitations concerning AIs, this time without the need to rely upon broader philosophical claims about human minds and their mechanical reproducibility. Secondly, we believe that neuroscientific claims about creativity and embodied simulation/cognition deserve a broader and more in-depth discussion: some further work could be addressed to unearth potential links between the field of neuroscientific studies and the one concerned about AIs limitations, not forgetting to also compare the results with the phenomenological suggestions of authors such as Merleau-Ponty, that gave much importance to the relationship between our world and the body. Lastly, we reckon that the theoretical framework hereby outlined could benefit from the confrontation with the reality of computational creativity: whether or not any of the limitation concerning AI and creativity is to be found inside the product of this (mechanical) creative (?) process is another question that remains open.

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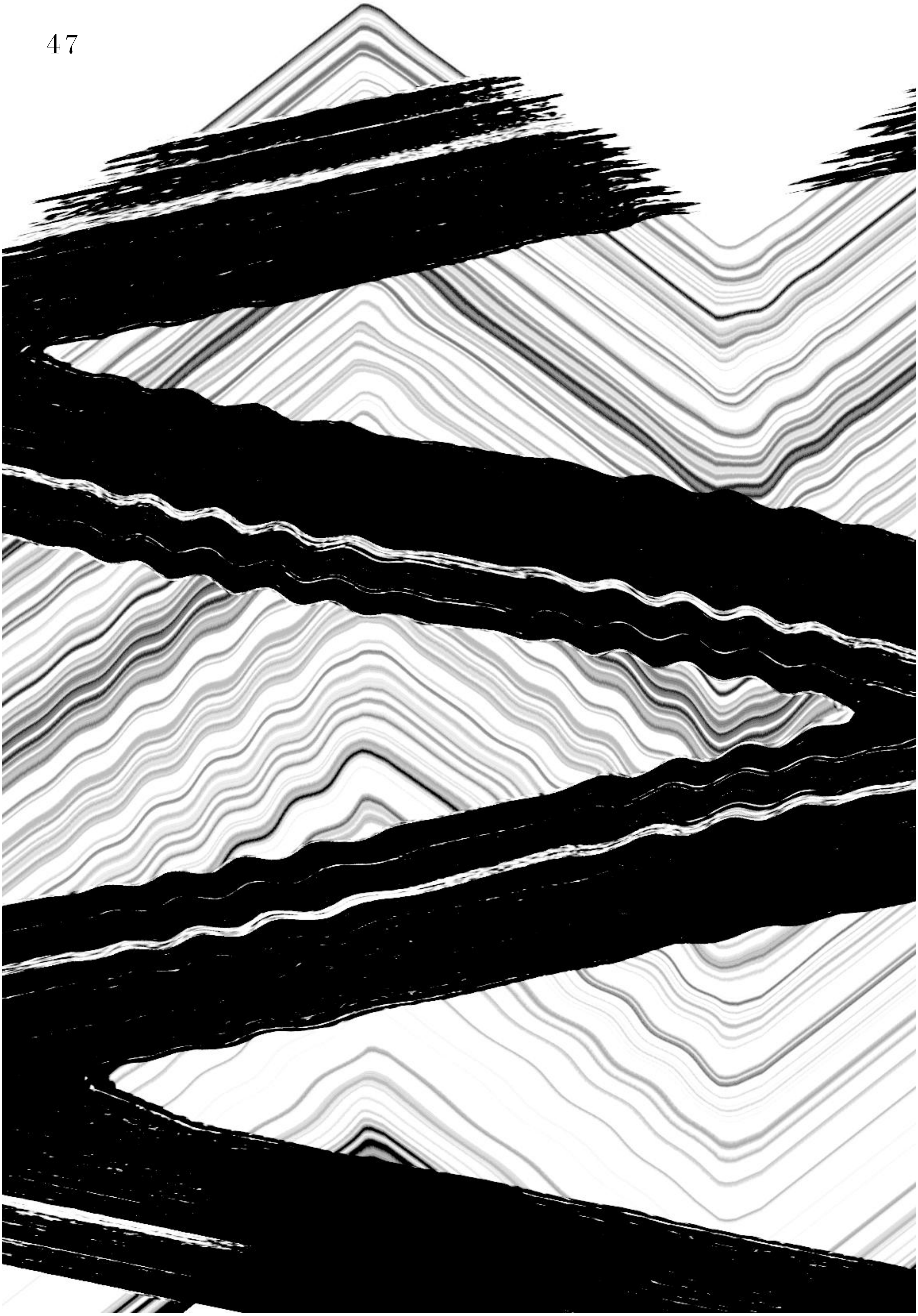

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