Tyranny of (AI)Thought. Artificial intelligence in music composition: a case study on Krallice “Diotima”

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Abstract

In questo articolo intendiamo discutere la crescente influenza dell’intelligenza artificiale (IA) nei campi dell’arte. Il fenomeno, già da tempo familiare nel settore delle arti visive, sta oggi acquistando rilevanza anche in quello della musica. L’impatto dell’IA sulla musica, in particolare sui sottogeneri più avanguardisti e sperimentali, sta generando dibattiti che spaziano dai copyright, all’autenticità e, soprattutto, alla creatività. Il caso specifico discusso in questa ricerca è l’album *Diotima* della band newyorkese *Krallice*, uscito nel 2011, e la sua "controparte" generata da Dadabots, un collettivo che sperimenta con le IA, *Coditany of Timeness*, creata utilizzando una rete neurale addestrata su *Diotima*. Pubblicato al NeurIPS 2017, *Coditany of Timeness* esemplifica come l’IA possa reinterpretare stili musicali, permettendo di avviare una riflessione sulla creatività "macchinica". Entrambi gli album sono stati sottoposti ad analisi per quanto riguarda la struttura delle canzoni, la melodia e il linguaggio armonico. La dimensione creativa retrostante il progetto è stata approfondita attraverso un’analisi testuale di articoli e interviste online, per un totale di 37 documenti. Questo insieme di risultati sono poi stati discussi con i membri dei *Krallice* attraverso un’intervista semi strutturata. L’intento è quello di esplorare il modo in cui l’IA interagisce con il processo creativo umano, ponendo domande su come la macchina interpreti questi processi, e su come questi risultati siano percepiti dagli artisti stessi.

In this article, we intend to discuss the growing influence of artificial intelligence (AI) in the fields of art. The phenomenon, which has long been familiar in the visual arts sector, is now also gaining relevance in the music sector. The impact of AI on music, particularly on the more avant-garde and experimental sub-genres, is generating debates ranging from copyright, authenticity and, above all, creativity. The specific case discussed in this one is the album *Diotima* by New York band *Krallice*, released in 2011, and its ‘counterpart’, *Coditany of Timeness*, generated by Dadabots, a collective experimenting with AI, created using a neural network trained on *Diotima*. Released at NeurIPS 2017, *Coditany of Timeness* exemplifies how AI can reinterpret musical styles, enabling a reflection on ‘machinic’ creativity. Both albums were subjected to analysis with regard to song structure, melody and harmonic language. The creative dimension behind the project was deepened through a textual analysis of articles and online interviews, a total of 37 documents. This set of results was then discussed with members of the *Krallice* through a semi-structured interview. The intention is to explore how AI interacts with the human creative process, asking questions about how the machine interprets these processes, and how these results are perceived by the artists themselves.

Parole chiave/Key Words

Dispositivi per l’ascolto; spazializzazione sonora; soundwalk; immersività; tecnologia enattiva.

Listening devices; sound spatialisation; soundwalk; immersivity; enactive technology.

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1. Introduction

In recent years, the universe of generative artificial intelligences has been considerably enriched, both in terms of quantity and the fields of creativity and art it is able to touch (Zhang & Lu, 2021; Jo, 2023; Feuerriegel et al., 2024). This phenomenon, while not entirely new, is also beginning to make a significant mark in the field of music production. Similar to what has already happened in the field of graphic arts, the use of AI in music has become a heated and sometimes controversial topic of discussion (Kaliakatsos-Papakostas et al., 2020; Chu et al., 2022).

So far, the application of artificial intelligence in music has been less popular than in other artistic fields, but it is attracting increasing interest, especially in the musical mainstream (Deruty et al., 2022). This interest could lead to significant changes in traditional industry paradigms, including reducing production costs and increasing efficiency (Galaz et al., 2021).

Among the many issues raised by the integration of AI into the creative process are artistic creativity, copyright and the legitimacy of these productions as fully-fledged art forms. These issues are at the centre of discussions in an environment that is becoming increasingly complex and populated by new technologies (Anantrasirichai & Bull, 2022). Despite the topicality and popularity of the topic, the phenomenon is not new and, in order to try to understand some of its dynamics, it is necessary to trace a brief historical path.

2. Historical Dimension

The application of artificial intelligence to music began in the 1950s and 1960s, with the first experiments in algorithmic composition (Mansoori, Murali 2022). An emblematic example is the 'Illiac Suite' (Sandred et al. 2009), created by Lejaren Hiller and Leonard Isaacson in 1957, which is considered the first piece of music composed with a computer. These early experiments were based on simple mathematical rules and algorithms, with the aim of exploring the possibility of creating music through automatic processes, changing the conception of and approach to music and starting a path that would later branch out in multiple directions. In the 1970s, the use of computers and programmes for creating music began to become more sophisticated. On this path was the work of David Cope, who developed the Experiments in Musical Intelligence (EMI) programme (Cope 1989; Da Silva 2003). EMI was able to analyse the styles and techniques of existing composers and, from this data, generate new compositions in the same style. At the same time, there was the

introduction of synthesisers and electronic instruments, which revolutionised the possibilities of music creation in a peculiar way (Lanier, Rader 2021). As computing power advanced and the technologies themselves progressed (Chun et al. 2004), the 1990s saw the emergence and spread of software using artificial intelligence algorithms to aid and assist music composition. Programs such as Band-in-a-Box (Ferguson 2005) allow for the generation of automatic musical accompaniments, while tools such as Melody Assistant allow for the creation of melodies on the basis of predefined rules, bringing us substantially closer to the approach prevalent today in the use of these technologies. With the beginning of the 21st century, machine learning algorithms began to be used to analyse large amounts of musical data and generate new compositions (Verma 2021). This phenomenon is growing over the years, partly due to the increase in computing power and the availability of large music datasets. Music recommendation systems such as those used by Spotify (Eriksson 2019) and Apple Music (Datta et al. 2018) rely on machine learning algorithms to personalise users' experiences, altering not only production, but also consumption and the dynamics of popularity and diffusion (Seaver 2022). As 2020 approaches, AI becomes an established component of the music industry.

The application of advanced deep learning techniques enables new generative possibilities, making the production of increasingly complex and articulated musical products easier and more accessible. Tools that are increasingly accessible to a wider audience are beginning to offer platforms for the automatic creation of music, both for personal productions and for productions for films, video games and multimedia content (an area also fueled by the enormous popularity that social media have gained over the years and, even more acceleratingly, as a consequence of the Covid 19 pandemic) (Venegas-Vera 2020). This growing interest in the use of AI in music is leading to significant changes in traditional industry paradigms. Artificial intelligence is enabling cost reductions and efficiency gains, on the one hand allowing artists to explore new creative frontiers, and on the other hand threatening some traditional professions and challenging artistic value and human creativity. Indeed, there are also ethical and legal issues concerning artistic creativity and copyright, issues that will necessarily have to be addressed systemically by business and industry and will hopefully form a crucial part of the future debate (Sturm et al. 2019).

3. An overview of actual AI-based technologies

The story of artificial intelligence in music is constantly evolving, both technically and stylistically, inevitably affecting the way music is created, distributed and consumed. For purely contextual reasons, it is worth listing some of the most popular tools currently available for creating or processing music through artificial intelligence. Among them, one of the best known is Amper Music (Verma 2021), an artificial intelligence-based music composition platform that allows users to quickly create original music. Used to produce soundtracks for videos, films and games, it allows users to customise the style, tempo and atmosphere of the song. The same can be extended to AIVA (Artificial Intelligence Virtual Artist) (Karpov 2020), an AI that specialises in creating orchestral soundtracks. AIVA has greater sophistication and was one of the first AIs to obtain the status of composer recognised by the copyright organisation in Europe (Samuelson 2023). A partially similar argument can be made for Melodrive, an AI designed to create dynamic and interactive music, particularly useful for video games and virtual reality applications. Under the aspect of immersiveness and customisation, mention should also be made of Endel, a tool capable of generating customised soundscapes aimed at improving users' concentration, sleep or relaxation according to their needs. As a glossa of this first corpus, we chose to mention Suno AI Music Generator, one of the innovative tools developed by Suno AI, given its growing popularity and diffusion (Helmanto, Dayana 2024). This system uses advanced machine learning models to produce music tracks, offering users the ability to generate music quickly and automatically. The complexity of the platform under consideration allows for various possibilities, including automatic music composition, which enables the generation of original music from scratch using algorithms trained on large sets of music of the most diverse styles. It is then possible to intervene with customisations in terms of style, tempo, key, instruments or mood. The sophistication of the Suno Ai Music Generator makes it capable of understanding the context for which the music is intended, autonomously choosing (or at least directing) certain compositional and stylistic choices.

A second category of these tools, in our opinion, is for "professionals" in the sector, people who are able to use software to process, compose or play music, and they usually consist of applications that speed up certain processes or simplify them. One example is Spleeter, an open-source tool that uses artificial intelligence to separate vocal and instru-

mental tracks. It is widely used not only for remixing, but also for music analysis. Another example is LANDR, an automated audio mastering platform useful for improving the sound quality of recordings. LANDR also offers distribution and publishing services for independent artists, further revealing the type of audience the product intends to address, i.e. a type of user more specifically interested in the music industry.

An even different case of hybridisation of different media tools is that of Jukedeck, a music generation platform allowing the creation of customised tracks for video content (Cole 2020). Acquired by TikTok in 2019, Jukedeck's technology was integrated into the platform itself. The short list so far consists of tools that can generate 'original' music productions from scratch, often for inexperienced or novice users. Of the many available, we intend to list only a few for their peculiarities, without any claim to systematic completeness.

To conclude this brief review, we cannot fail to take a closer look at the role of the main players in the digital and Artificial Intelligence sector. OpenAI has itself developed an application dedicated to music, Musenet (Civit et al. 2022), a model that uses neural networks to generate music in various styles. Musenet can create compositions with up to 10 instruments and is able to capture complex interactions between melody, harmony and rhythm. Among the big names in the technology sector that have moved into this theatre is Google, with its Google Magenta search project (신원식, 김민철 2020). It offers a number of tools and models, among which NSynth, which allows new sounds to be synthesised by combining properties of different instruments, is particularly interesting.

These artificial intelligences, each in a different way (and for different user sectors), are revolutionising the way music is created, produced and consumed. On the one hand, they allow greater accessibility to creative processes, reduce production costs and open up new artistic possibilities for musicians and producers, but also for amateurs. However, they also raise new questions, not only ethical and legal, and not only of a more ontological nature, which are present and vital in the academic debate (Ernst 2016; Napolitano 2022): how does the ever-increasing diffusion of IA influence music production and musical aesthetics?

4. A peculiar case: Dadabots

In the short list above, there are different types and various strands of these technological tools, but it is quite clear that all of them, for different purposes, are in some way

geared towards some kind of profit, whether it is to streamline production processes for the music industry, to make a service available for a fee, or to collect information. A different case seems to be that of Dadabots (Pošćić, Kreković 2020). The project, founded by CJ Carr and Zach Zukowski, two musicians and programmers, aims to use neural networks and deep learning algorithms to generate music, especially in the field of so called "extreme" (Kahn-Harris 2006; 2009) or radical genres such as death metal, black metal, math rock and other experimental music styles.

> What is DADABOTS?
> Not sure what DADABOTS is. We're a cross between a band, a hackathon team, and an ephemeral research lab. We're musicians seduced by math. We do the science, we engineer the software, we make the music. All in one project. Don't need nobody else. Except we do, because we're standing on the shoulders of giants, and because the whole point is to collaborate with more artists.[1]

From the words of the project's creators, several directions seem to emerge behind the decision to venture into the field of music generated by artificial intelligence, and it is also easy to deduce an avant-garde dimension, as recalled by the project's very name, a composite word formed from 'Dada', a movement founded by Hugo Ball and Emmy Hennings as a reaction against the traditional conventions of society, politics and art, characterised by an attitude of rejection, rebellion and critique of established values (Bigsby 2017), and by bots, an abbreviated form of 'robot', a term that often refers to software programs that perform automatic tasks. The provocation is quite obvious, it would seem to be an initiative to 'automate', to mechanise an unconventional artistic production. The process behind Dadabots consists of training neural networks on pre-existing musical datasets. The project uses deep learning models, specifically a variant of recurrent neural networks (RNNs) (Franklin 2006) and generative adversarial networks (GANs) (Chen et al. 2019), to learn the stylistic characteristics of a particular genre or musical group. RNNs were mainly used in the early stages of the project for their ability to process temporal sequences, such as musical notes, while GANs, a type of model that pits two neural networks against each other to improve the end result, were used to improve the quality of the generated audio. Through training, the model is able to create new compositions that replicate the style of the initial input submitted to it. One of the fascinating aspects of the project is the element of randomness and unpredictability.

Since the artificial intelligence does not follow a previously established pattern, the compositions produced in this way are often experimental and, indeed, unpredictable, with unexpected transitions and unconventional structures. This characteristic lends itself appropriately to the genres chosen for this experimental experience, such as death metal (Phillipov 2012) and math rock (Gomez 2024), which are themselves characterised by unpredictable transitions and cutting-edge elements of innovation. Dadabots was developed to constantly learn and improve the quality of the music it generated, an element that can be seen in the increasing quality of its productions. While in the beginning the results were more rudimentary, over time the project managed to refine its outputs to the point of creating musical products that, in some cases, are hardly recognisable as automated productions, increasingly blending in with productions created by musicians. Dadabots, due to these characteristics, does not only present itself as an experiment of a technical nature, but also raises challenges and questions with respect to the artistic and creative dimension, which is as much human as it is artificial, machinic (Moruzzi 2021). The project has been the subject of interest from musicians, programmers and artists (as well as its creators, hybrid figures, musicians-programmers, on the borderline between the technical and artistic dimensions), not only for its production, which is avant-garde, but also because it is able to question what it means, especially today, in the presence of these increasingly widespread and accessible technologies, to "create" music, and what this means. A further question arises from this experience: can a machine really be considered creative? In many cases, Dadabots' achievements have been welcomed by the music community, mainly because its creations escape convention and bring something new and unpredictable to the music scene, but this more "philosophical" dimension has not always been taken into account. Carr and Zukowski conceived the Dadabots project primarily as a form of contemporary art aimed at challenging the concept of musical authorship. Rather than trying to create a perfect AI that imitates human music, their goal is to create something new and unique, a novel artistic expression that does not necessarily follow traditionally imposed rules.

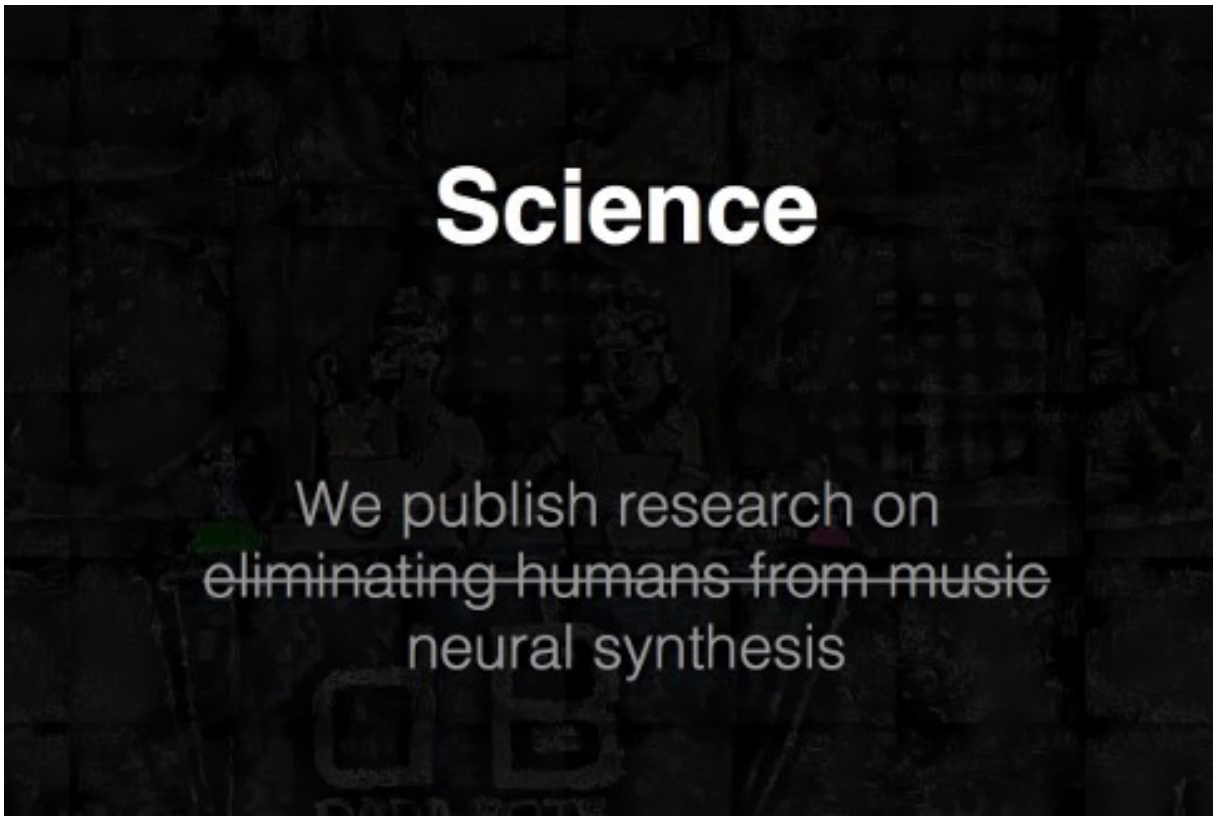

Fig. 1. Landing page of the Dadabots website.[2]

> Our aim is human augmentation.
> Few people write music, but almost everybody has a music aesthetic. Imagine a music production tool where you simply feed it music influences, like a Furby. It starts generating new music. You sculpt it to your aesthetic. Imagine hearing everyone's crazy weird music aesthetic come out of their Furby.
> Really this is just meta music - instead of playing the music, we are playing the musician.[3]

As can be deduced from the above quotation, the experiment does not aim to compete with human creativity, but intends to be a tool at its service, and for this very reason lends itself particularly effectively as an object of observation for reflecting on this dimension of production, both artistic and cultural, of our time (Born 2010). Among the various experimental applications that characterise the project, it is worth listing some of them for the purposes of the present discussion. Noteworthy is Math Rock AI, aimed at creating math rock music, a genre characterised by complex tempo changes and unusual rhythmic structures, and the same, but for the jazz genre (Gridley et al. 1989), applies to DeepJaz. Finally, as far as the present discussion is concerned, the "Relentless Doppelganger" project, an uninterrupted stream of AI-generated music, mainly death metal,

broadcast in real time via social networking platforms (YuoTube and Twitch). Dadabots represents a pioneering example of the use of artificial intelligence in music, and offers the possibility of engaging in discussions on creativity, intellectual property, and the intersection of technology and art. Although the results can be considered experimental, the project highlights the potential of artificial intelligence to inspire new musical styles and challenge traditional conventions of music composition. The latter aspect fits into the terrain chosen for this specific discussion.

5. Case study: Krallice "Diotima"

In April 2011, the experimental black metal band *Krallice* released *Diotima*, a work that became a milestone for the genre and the underground. Six years later, in 2017, during the Annual Conference on Neural Information Processing Systems (NeurIPS 2017), *Coditany of Timeness*, a project for the "Workshop for Machine Learning, Creativity and Design: Generating Black Metal and Math Rock", was presented. The album in question was generated with an RNN, trained on the raw audio of *Krallice*'s *Diotima* album. All titles were generated by a Markov chain and the album cover was also created by a neural transfer. Today, with the passing of years and the advancement of these technologies, the significance of this experimental work would seem to take on a new light.

The band *Krallice* was formed in New York in 2007, originally by Colin Marston, at the time already involved in various experimental music projects, and Mick Barr, who was also quite active in the same scene. As Mick Barr stated, «Colin and I had talked about trying to make a black metal record together, with no intention of making it sound good or releasing it, but as we were writing the music we let it take its shape and liked it more than we expected»[4]. Thus *Krallice* was born, and consequently their self-titled record. Drummer Lev Weinstein and bassist Nicholas McMaster joined the group shortly afterwards, the former to record the band's first work, while the second did not contribute to the record as the bass lines were provided by Marston and Barr themselves. The four members have remained the same ever since.

Krallice's music has always been considered divisive by the more radical black metal community from the very beginning, partly due to their inherently experimental influences that come from areas far removed from black metal (as do the band's members, though profound connoisseurs of the genre). Specifically, the very variegated black metal scene is characterised by

different currents (Olson 2008; Hunt-Hendrix, 2010; Kulesco, Cima 2024), some of which believe that black metal itself must adhere to quasi-religious ideologies, as Enslaved, who have always been considered leading exponents of black metal culture, stated in an interview:

> For us, black metal will always be extreme metal with a Satanic ideology, and that we'll never have. But we still revisit our roots. [Mayhem founder] Euronymous was my main inspiration for guitar playing and as a songwriter[5].

However, as their Bandcamp description eloquently states: "Formed in 2007. Woodhaven, Queens NY. Black metal. Or not", *Krallice* have never considered themselves strictly "black metal". Stylistically, as mentioned above, and at least at the beginning of their career, *Krallice*'s music seems to be influenced by several strands: by Norwegian black metal such as *Ulver*, by some USBM [United States Black Metal] influences especially from *Weakling*, and by all the cultural and personal backgrounds of each band member, considering their previous experiences ranging from math rock to avant-garde metal and alike.

Diotima, the album at the centre of our case study, was first released in 2011. Pressed by the already established Canadian underground label Profound Lore, *Diotima* helped to establish their sonic trademark, consisting of polyphonic and ever-talkative guitars, present and intricate bass writing manifested through Colin Marston's typical clattering tone in the midrange, furious, relentless yet dynamic drumming, sonically spatialised through an emphatic use of rooms in mix blending, and tortured vocals ranging from McMaster's lower growls to Barr's desperate screams.

The researchers at Dadabots have been interested in developing their tools and research in the field of more underground music from the very beginning of their activity, in fact their first two works presented were based on Calculating Infinity by Dillinger Escape Plan (another example of experimental metal music) and *Diotima* by *Krallice*, precisely our case study.

By means of the Markov chain (Norris 1998), a random stochastic process through which the change of each system depends exclusively on the immediately preceding one, the Dadabots researchers were able to recompose *Diotima* in its entirety with fairly consistent results; even the titles were thus regenerated, in a language reminiscent of the English syntactic structure.

The same can be applied to the artwork that has been recreated, through a neural transfer of style: it resembles the chromatic structure of *Diotima*, but within it one can recognise a deconstructed figure of Colin Marston playing the guitar.

Fig. 2. Cover artwork of *Diotima*.

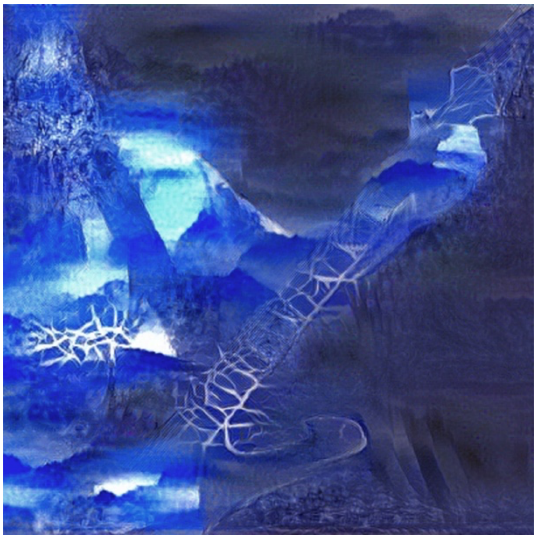

Fig. 3. Cover artwork of *Coditany of Timeness*.

6. Methodology

Both *Diotima* and *Coditany of Timeness* were subjected to in-depth analysis (Dunsby, Whittall 1988) with regard to song forms and structures, the use of choruses and melodies, possible leitmotifs, harmonic language and, last but not least, the subcultural context. after which, in order to explore the meanings and motivations behind the machinic processes of computing, 37 were analysed, sampled from the Dadabots website itself, containing reviews, interviews with the creators of the algorithm, insights from fans and those interested in the technology. The results of these analysis were then discussed directly with the *Krallice* band members through a semi-structured interview outline (Knott et al. 2022), using a reflexive approach (Bovone 2010). The aim here was to delve into the entire universe of stories, creativity and skills that were addressed, but often remain difficult to identify (Cook 2018), in order to initiate a deeper discussion on artificial intelligence (Shank et al. 2023).

7. Analysis of musical material

New York represented the ideal geographic convergence for all four musicians involved in the project, although Colin Marston was originally from Philadelphia and moved to New York later to establish himself as a sound engineer in his own recording studio.

Thus, to return to summarise the cultural premises relating to their location, it can be said that the specific substratum very much present in the New York experimental under-

ground (in particular Brutal Prog, Avant and Free Jazz) (Piekut 2011), very well embodied by Mick Barr in primis, is fundamental to understanding the approach that *Krallice* have provided through their music. This approach is therefore eclectic, and the songwriting is often free-form and sometimes even 'through-composed', fragmented. By speaking of fragments, it is meant that these songs consist of a set of short sections that contrast rather dramatically with each other, resulting in an overall sense of incompleteness. In several respects, this choice plays an important role in the way the songs are structured through the composition, as none of these short sections return once left behind, resulting in a significant amount of riffs and ideas for each track. These aspects are some of the elements to be taken into account when considering that Dadabots reassembled the record via the aforementioned Markov chain, which means that the algorithm had to deal with a higher level of complexity (Schmid et al. 2011) than the creative tools used in mainstream activities today, which are formally less rich in variables and data.

Compared to the more abstract, borderline atonal era of *Krallice* (detectable in their successive works), a certain tonal context is maintained in *Diotima*, albeit extended and dilated. However, it can hardly be said that they show a rigid attachment to baroque or classical functional harmony (Moore 1992). Rather, these tonal roots, though 'extended', provide some reference points for an algorithm charged with modelling a coherent musical structure. It is essential to clarify that the analysis proposed here moves on a double track: on the one hand, aesthetic and musical aspects are considered; on the other, the result obtained by the algorithm in processing a given audio signal is examined. This approach aims to highlight how musical elements perceived by human listeners can be emulated or reinterpreted by the generative model, but also how, in the creative process, AI does not necessarily follow compositional or artistic patterns that are consistent for humans (Balaban et al. 1992; Hong, et al. 2022).

A good example of this phenomenon can be the final section of *Diotima*, with its continuously repeated carrier melodic line, which is presented as a precise thematic statement. This continuously repeated pattern is particularly useful for the algorithm, suggesting a clear and memorable pattern, not only for the human listener, but also from a mathematical and purely structural point of view. A similar approach can also be found in the introduction, the simplest track on the disc from a structural point of view: here, only two main ideas alternate in an almost hypnotic way, both with well-defined melodic themes. Again, such ele-

ments favour a coherent reinterpretation, as they offer ordered 'material' that can easily prove memorable to the human ear, and with which artificial intelligence can operate more nimbly, being less data- and information-rich (Hernandez-Olivan, Beltran 2022).

That said, it is crucial to question the very nature of "interpretation" by an algorithm. When it is stated that Dadabots displays an "embryonic harmonic understanding", this is not meant to suggest that the model possesses a musical awareness comparable to that of humans. On the contrary, such 'understanding' derives from the way the model is trained to process the audio signal at a mathematical level. The algorithm does not "read" or "analyse" musical categories (such as pitch or harmony) in a human sense, but rather identifies recurring patterns and reassembles them according to its architecture and the provided dataset.

A further consideration concerns the difference between human and algorithmic listening. Humans attribute musical meaning according to aesthetic, cultural and cognitive categories (Leman, Maes 2014; Vuust et al. 2022); algorithms, on the contrary, analyse audio signals through statistical and mathematical models, without an intrinsic notion of what harmony or rhythm are. This point is particularly evident in Dadabots' reinterpretation: the system reconstructs recognisable fragments of harmony and rhythm, but it does so as a result of statistical correlations extracted from the data, consistent with its programming (Fosler-Lussier 1998), rather than from actual musical awareness (Clarke 2014).

This distinction also explains some of the limitations of the model. Although it is impressive to observe how the algorithm succeeds in creating drum fills that introduce more frenetic sections or maintain a consistent tonality (e.g. the E minor ostinato reinterpreted from the title track), these capabilities derive from mathematical processing rather than a narrative or semantic understanding of the music. It is for this reason that the complexity of *Krallice*'s writing - labyrinthine, fragmentary, far removed from the conventions of pop music (Tagg 1982; Percino et al. 2014) - poses a consistent challenge to the capacity for machinic computation. The algorithm struggles to 'understand' the band's narrative transitions and open structures, resulting in some inconsistencies, at least from the human listener's point of view. An example is the endings of songs, which are often abrupt or incomplete.

Finally, the question of how an algorithm listens to and interprets music compared to human beings remains open and deserves further reflection. The main difference lies in the fact that, while for humans, aesthetic and musical categories are central, for an algorithm these are

an emergent effect of the way the audio signal is processed (Bown 2021). This distinction not only clarifies the current capabilities of the model, but also provides a basis for discussing the philosophical and technical implications of music creation by artificial intelligence.

Another difficulty lies in a notion that we humans take for granted, namely the ability to recognise and clearly distinguish each instrument, a skill that can be learned through ear training. For an instrument based on binary code, this would translate into the ability to separate the frequency response of each instrument, which even in very competent mixdowns naturally overlaps in certain areas of the spectrum. The researchers of the Dadabots did not have the stems of the *Diotima* instruments at their disposal and therefore the rewriting of the material is based on the reinterpretation of edited fragments extracted from the already mastered material, not on the parts of the individual instruments; consequently, it was not possible to obtain songs completely rewritten from scratch, but only a recomposition of the material resembling a 'collage'. The band members themselves perceived this aspect, thus considering *Coditany of Timeness* to be in some way "a reflection of *Diotima* in a funhouse mirror" (McMaster int.).

It should also be taken into account that AI from 2017 to the present has increased dramatically, and there are now in fact tools for artificially separating instrument stems - in this case for mixing and sampling applications - which opens up the possibility in the future of listening to a complete reinterpretation of any material, even if it has already been edited, a fact that raises further problems, primarily copyright, mentioned in the previous paragraphs.

8. Ideas and creativity behind Dadabots

In order to deepen this analytical dimension, a sample of articles related to this topic was chosen to be analysed in depth. The selection consisted of collecting all the links on the Dadabots page itself. They refer to different editorial media, from the more mainstream ones (such as BBC, New York Times, Times) to those more sectorial and dedicated to underground music (such as Metal Sucks, Metal Injection, Loud Wire). All this material has been analysed and coded with the aim of deepening the knowledge of the dynamics behind the 'creative' mechanisms of the machine itself (Wodak 2011). A total of 37 texts were analysed, which will be described according to the historical moment in which they were published.

Carr and Zukowski conceive artificial intelligence a revolutionary tool for expanding the boundaries of artistic creativity. According to Carr, it is all part of what I see as the deep learning

revolution in art, in which artificial intelligence provides new spaces for creativity[6]. This suggests that the two creators see AI not only as a means to replicate human art, but also as a potential collaborator whose unique processes could generate entirely new artistic expressions. The two creators of Dadabots see value in the artefacts generated by AI, even when they are not perfect or realistic. As stated: «While we set out to achieve a realistic recreation of the original data, we were delighted by the aesthetic merit of its imperfections» (Carr, Zukowski 2018).

Imperfections, therefore, are not considered a failure but a source of new creative insights. For example, AI transforms solo voices into ghostly choruses or produces sounds that sounds like a surreal fusion of different musical styles, transcending the usual stylistic and creative choices, as well as possibilities, of the human. The approach taken here is different from traditional algorithmic composition systems, which generate symbolic notes (such as MIDI) to be subsequently transformed into audio, creating a system that could produce actual waveforms, raw sound that can range from a screaming electric guitar to percussion and even wailing vocals.

This approach makes it possible to create music that exploits timbre and compositional space, qualities that are essential for modern music genres such as black metal and math rock. Carr describes how artificial intelligence moves from chaotic and grotesque sounds to recognisable musical structures, reflecting a view of the AI process as a learning journey, similar in some respects to the evolution of a human artist gradually honing his or her skills (Morriss-Kay 2010).

The future picture is imagined as a setting where artificial intelligence could be not only a tool but also an active collaborator or even a competitor of human artists. The dizzying possibility is that deep learning, with its tendency for strange intuitive leaps, could serve not only as a tool for human performers, but even as a collaborator - or potentially a competitor.

This reflection highlights their interest in the philosophical and cultural implications of digital creativity.

Carr and Zukowski see their generative albums not only as artistic products, but as constantly evolving experiments. For instance, Carr stated that they intend to release new albums every week, experimenting with different styles and influences, reflecting an intent to explore the still largely unexplored potential of AI in music creation.

On the other hand, the opinion of listeners and fans does not seem to be particularly structured, at least at first. In fact, we can read in a well-known music magazine that

> Coditany of Timeness raises all sorts of interesting philosophical questions about the meaning of art, I'm not gonna delve into any of those questions now, because… well… the album isn't very good. I mean, it's fine. It's super-generic old-school style black metal. I can't imagine anyone choosing to listen to it over, like, the actual Krallice or anything. Maybe the A.I. just needs time to develop its own artistic identity or whatever. I dunno[7].

Carr and Zukowski also show some confidence in the future of the project, acknowledging that the AI results are interesting but still far from fully satisfying. Their technique works best when working on an album with consistent instrumentation and production style, but the results are often unstable and require trial and error to achieve good sound fusions. Creating effective fusions is a challenge, but an exciting goal as many bands have requested it. In terms of processing time, the AI starts by first learning short-term patterns (e.g. a snare drum hit or the timbre of a scream) and needs more time and training before moving on to longer patterns (a guitar riff or a steady beat). Although longer training creates more complex patterns, progress diminishes over time, and overtraining leads to over-memorisation. Some of the most interesting sounds therefore emerge when the AI is only partially trained, resulting in its own distinctive aesthetics. From the information online it seems that the sole human element is in the editing of the results.

> How close is the network to being able to perform that action?
> Auto-curation is not on our radar. Takes the fun out of it. The fun is in making the final artistic choices. That said… it's a challenging problem. If the net consistently made interesting music in real-time, we would do stranger things…[8]

9. Interview Analysis

The reflections developed as a result of the analysis of both the music products and the sampled lyrics were used as input for interviewing *Krallice* themselves. A first important element that emerges is the relationship between the four band members. In metal music, especially in its extreme sub-genres, it is not uncommon to witness continuous and sudden line-up changes, which in the case of *Krallice* never happened, denoting a certain artistic and human harmony between the members. This aspect certainly has implications from a creative point of view, in fact it is stated that, in their productions, the result is not only the result of personal contributions, but of a creative effort 'greater than the sum of its parts'. In contrast to many other groups belonging to the same subculture, often linked to charismatic leader figures, *Krallice* are quite radically different.

> most bands are essentially dictatorships. Megadeth is a good example of it— one clear leader who writes most of the music and has the power to fire and replace the other members. Krallice, however, is a true democracy, in songwriting and creative decisions. So the records that result could not have been made by any one of us alone— even if some individual songs are mostly written by one member. As we know, democracy is administratively messier than authoritarianism, and there were times early on when I found the unruly variety in Krallice's output a little frustrating: I wanted us to have more of the unified aesthetic that other black metal bands did. But the ability to produce these records that truly are the product of our communal creativity supersedes all that. (McMaster int.)

Even in the writing and 'authorship' of songs or riffs, this process allows for the realisation of a participatory and shared dynamic, where the contribution of the individual mixes almost chameleon-like with that of other individualities and with the collective. This aspect emerges in a definite way, in fact talking about the writing of the tracks Nicholas McMaster states that

> [When] I say "write" I usually only mean what we call "initiated"— writing a full song on my instrument, but only my instrument, and sending a demo recording of it around to the other guys to write their parts. This leads to a cool situation: though I started the song, my instrument is only 1/4 of the resulting composition. I remember Mick [Barr] saying during the writing/demo recording of Dimensional Bleedthrough [second Krallice record, 2009] that his favorite part was when he listened to Colin [Marston]'s and my parts over the song he had started, and there were sections where he momentarily no longer recognized his original song. That's very powerful in my opinion. (McMaster int.)

This 'democratic' dimension in the creative and artistic decision-making process is an element that must also be taken into account in relation to *Diotima*. It is claimed in the interview that the band's first work, the eponymous '*Krallice'* (2008), was not produced in the same way. The original intention was not to form a band, but in the process resulting from the production of the record "and after we'd played a few shows the dynamic of the band as a social-creative community started to form". The narration of the song transformed to the point of being unrecognisable to those who had initiated it not only illustrates the transformative potential of collaboration, but also highlights how the 'creative genius' in *Krallice* resides in the network of artistic relationships between the members. The band operates as an organic creative community, where ideas are shaped and reshaped through mutual confrontation, reaction and reinterpretation.

On the other hand, artificial intelligence operates as a solitary entity: a single algorithmic system that processes data and shapes musical outputs based on pre-programmed statistical patterns and defined databases (Braguinski 2022). This comparison highlights an in-

teresting tension between two conceptions of creativity: one that emerges from the complexity and diversity of multiple human minds, and the other that is based on the ability of a single system to simulate complexity, albeit in a different and peculiar way.

The lack of a dialectical process or social dimension in artificial intelligence raises questions about the nature of the creative process itself. In *Krallice*, the group's identity and musical output are the result of human interactions, where the dialogue between ideas, stories and personalities contributes to a result that no single member could have achieved alone in the same way. In contrast, in the case of Dadabots, the entire creative process is reduced to a single agent, with 'creativity' arising not from interaction but from the replication and transformation of pre-existing data.

This difference also highlights a qualitative distinction: whereas *Krallice*'s music is a product of the relationships between the members, which intertwine aesthetic intentions, personal visions and emotional reactions (Sawyer 2010), the music generated by Dadabots is the result of an algorithmic process that reorganises information according to mathematical rules. This does not mean that Dadabots' experiment is worthless or qualitatively inferior, but that its result represents a profoundly different form of creativity, devoid of the emotional and social tensions and nuances that emerge in a human context (Csikszentmihalyi 2014).

At the same time, it is interesting to note how the algorithm manages to simulate a certain degree of complexity and 'musical intelligence,' which suggests that some aspects of *Krallice*'s collective process can be interpreted as emergent patterns even in an isolated system, how cultural products can be utilised in unprecedented and layered, unpredictable ways (Runco, Jaeger 2012; Birtchnell, 2018). The reflection becomes even more intriguing when one considers that a human listener could perceive in Dadabots' work a coherence and intentionality similar to that of a human work, even in the absence of a social process underlying its creation, nor even of a traditionally recognised creativity as such (Sun et al. 2024).

Ultimately, the comparison between the collegial and dialogical dimension of *Krallice* and the creative singularity of Dadabots offers fertile ground for exploring a further facet, a potential distinction between human and machinic creativity. The difference between these two dimensions, one collegial and articulate and one individual and schematic, is clear. In spite of this, the creation of *Coditany of Timeness* was not received in a hostile manner, in-

deed "everyone in the band felt only positively about it." This approach is partly motivated by a clear understanding of the historical dimension and context

> Dadabots was years before ChatGPT and the cultural attitudes that have arisen out of AI-generated art, so we weren't thinking about the societal implications at all. I was mostly stoked that someone would like the record enough to want to do this, and then fascinated that it was even possible. I remember Colin noting that the software had "understood" the concept of a blast beat in a metal mix— a rapid alternation of a low sound and a higher sound that sort of warped the soupy buzz of "guitar" around it. It's a holistic view of such, built from observing the entire mix as one indivisible entity, not of understanding that there is a thing called a drum kit and this contributes one kind of sound to the overall mix, but the end result is not far off. That is fascinating. (McMaster int.)

Although there are, in contemporary scientific discourse, various positions, both techno-optimistic (Striphas 2015; Taddeo, Floridi 2018; Floridi 2021) and almost dystopian towards artificial intelligences (Russell, Bohannon 2015; Simon 2023), among practitioners and artists there is a certain diffidence towards them, going to almost 'Luddite' extremes (Moruzzi 2020). In the specific case under analysis, artificial intelligence is not demonized or feared, but instead viewed with curiosity. This brings up the question of creativity and art, which would seem to be under 'attack' by AI nowadays (Jiang et al. 2023). Regarding this dimension, an interesting point of view emerges, according to which

> AI is perfect to make the kind of music that is not truly artistic. Muzak to play in elevators or dentist's waiting rooms, sure let the computer do that. Even a level up: my friend's 7-year-old is obsessed with the orchestral score to "Godzilla: King of Monsters" so I have heard this score many times driving the car. It is to me the flattest, blandest kind of movie score, every beat utterly predictable, managing to be so amazingly flat despite its constant bombast. So yeah, I'd say let the computer make that shit too. It could hardly be worse. However, there is a social-economic element to that, which was that that score was a paying gig for the orchestra that recorded it. I don't want those people to be deprived of work. But I think that speaks to larger problems in our society, and shouldn't be diagnosed in such a narrow way. Why do those musicians have to play shit music to pay the bills? If we had a different society and cared for each other's needs they could focus on "truly artistic purposes". (McMaster int.)

In addition to presenting a broader view, not limited only to the worlds of art (Becker 2023) and the creative industries (Potts et al. 2012), a division would also seem to emerge between artistic productions in the strict sense and entertainment productions, almost 'industrial'. The concept expressed here is by no means new as far as academic discourse is concerned (Benjamin, Jennings 2010), but the fact that it is thematised by the composers

themselves as a relevant fact is quite evident. Although a borderline between these is not unambiguously marked, it is clear that the former have a somewhat different value and dignity from the latter. This makes productions of a 'non-artistic' nature a matter that does not require the same caution, or the same fears, should AI be able to replace them.

An ontological distinction seems to emerge between what is and what is not art. This difference is not attributed because of a supposed intrinsic qualitative superiority of a product as such, but because of the dynamics behind it and the use for which the said product is conceived and marketed (Barrett 1994). The difference outlined here would almost seem to clash with an almost capitalist and consumerist idea of cultural production, which is increasingly widespread today (Mclntyre 1992; Bauman 2013). People, their relationships, the time in which they live, are all unique and peculiar elements that constitute what is called 'creativity'.

> I believe creativity to be a product of both longstanding aspects of the author's personality (eg their training, where they were born) and aspects that are very time-sensitive (eg they were depressed that year, or they had an interesting conversation with a stranger the day that they wrote a particular song). It also of course reflects things the artist is consciously trying to do, but any artist will tell you that you almost never achieve what you set out to do with 100% accuracy. (McMaster int.)

This conception, for which even the work of man, creative or otherwise, is an approximation, makes machine competition a different problem from the widespread fear of being replaced, with all the proto-Luddite drifts (Chung 2023) associated with it.

> It is impossible for AI to make our music, for the simple fact that it is ours. I can't make another human musician's music, not really, even if I could learn to copy it and write songs in the same style. Even if somehow it made a picture-perfect copy of music we'd already made (if Dadabots had "100% accuracy") it would be fascinating to me that such a different process could create such a similar result. The whole thing only raises questions for me (in the positive sense). And yes, Dadabots is already ancient technology in terms of AI, so I wish someone would try again with the current tools. (McMaster int.)

This conception of artistic creativity reflects, and overlaps with, a complex, unpredictable, and even fallacious view of humans. This view not only downplays the issue and role of AI in the music industry, but also that of human beings, turning a threat into a stimulus and a possible compass to advance towards new and different frontiers.

> the intentional, the random, the constant and the fleeting are all mixed together. This is why I don't really believe artistic plagiarism is possible: even the most craven attempt to

> copy another artists' work will bear some hallmark of the personality of the plagiarizer, or the socio-economic context that made them want to so faithfully copy someone else's work. (McMaster int.)

In conclusion, the human dimension, with its agency and variables (Carruthers 2006), remains a difference that the machine does not seem able to fully bridge. The status and value of machine creativity could be compared to several other experiences of non-human 'creativity', for instance

> Tectonic movements of the earth's crust have the capacity to produce diamonds, which are valuable (financially and aesthetically) and some are original (in the sense of being saliently different from other diamonds); but it would be conceptually confused to call tectonic movements creative. (Gaunt 2012).

This is often valid from the point of view of the end-users, users of the cultural product in its finished form, but not so often discussed with the creators of the music itself. This peculiar case study has allowed an exploratory lunge in this direction, opening up unprecedented viewpoints and uncharted terrain. Emotions in art, particularly in music (Schubert, McPherson 2006), remain a crucial element even in this historical moment of positivist techno-optimism (Alexander, Rutherford 2019).

> the period in which Diotima was created was one of deep depression, the worst in my life. So it is hard to separate that from the music. But that is why music is amazing: it is both therapy (in the moment of creation) and a historical record of how you felt at that time. Coditany of Timeness by contrast is a reflection of Diotima in a funhouse mirror. It's an interesting intellectual exercise. But there is no comparison in emotional significance. (McMaster int.)

10. Conclusion

In our conversation with Nicholas McMaster, it emerged that AI should deal with music that is purposely made without artistic intentions, or so-called elevator music or 'music d'ameumblemant', as defined by Eric Satie in 1920 (Bernardini 2008), i.e. music that should not be actively listened to, rather than simply existing as 'furniture'. He also suggested that even such a use would not be painless, as there is also a chain of workers (composers, but also performers and audio technicians) involved in these more 'artisanal' areas of music whose employment could be endangered (Regev 1994).

However, despite this positive assessment of the possible interaction of artificial intelligence tools with the artistic field, the members of *Krallice* conclude that *Coditany of Time-*

ness remains an interesting experiment but lacks the emotional significance that characterises their original record. This observation, while valid from a human perspective, also reveals the urgency of rethinking the concept of creativity, going beyond the traditional distinction between human and non-human, to explore the techno-social nature of creative processes and their philosophical and cultural implications.

Traditionally, creativity has been conceived as an inherently human capacity, linked to intentionality, subjectivity and interaction with historical, cultural and emotional context (Sawyer, Henriksen 2024). Various philosophical approaches have emphasised the unique and unrepeatable character of human creative action, linked to individual agency, its rootedness in the world, and its context (Czobor-Lupp 2008). However, these new possibilities offered by the machine, by its ever-increasing penetration not only into the technical, but also into the ordinary, challenge this anthropocentric view, suggesting that creativity is never an exclusively human phenomenon, but a process of co-evolution and relationality that emerges through a network of interactions between human and non-human (Braidotti 2006; Roudavski, McCormack 2016).

According to Simondon (2009), every creative act is the result of a trans-individual relationship, a process in which individual agents (whether human or non-human) contribute to a process of collective individuation. In this framework, technology is not simply a passive tool in the hands of the human being, but an active entity that participates in the production of the new, as we could see here for Dadabots' musical production (De Mori 2017). This element also recurs in the thought of Deleuze (Deleuze, Guattari 1991), who also introduces the concept of the 'desiring machine' as a metaphor for understanding creativity, seen as an assemblage of forces and flows, in which the human and the non-human intertwine to produce something that cannot be traced back to a single source or intention (Colebrook 2020).

These approaches allow an overcoming of a dualistic view, leading to the interpretation of artificial intelligence not as a mere counterpart of human creativity, but as an integral element of a broader creative ecosystem, where creativity emerges from interaction and not isolation. Dadabots' creatures can be interpreted as simulacra (Baudrillard 1994), which do not merely emulate, to be a copy of reality. Its characteristics make it the bearer of autonomous systems of meaning, which even if they do not replace reality itself, break out of its dichotomous reading schemes.

In the case of *Coditany of Timeness*, we can therefore see the algorithm as a creator of simulacra: the sonic result is not a copy of *Diotima*, nor does it aspire to be one (since there is not even an intentionality comparable to human intentionality in the algorithm), but a new entity that exists in an order separate from the original reality, a 'hyperreal' level. This musical hyperreality, although derived from structures and patterns extracted from the original album, is no longer linked to the subjectivity and intentionality that emerges from *Krallice*'s narrative. As a simulacrum, the result of AI does not attempt to represent the original but distorts and amplifies its elements in a way that may have no emotional meaning for humans, but nevertheless possesses its own internal coherence and aesthetics (Scruton 1999).

Baudrillard thus forces us to ask crucial questions: if the product of an artificial intelligence is a simulacrum, what does this tell us about the nature of the creative process itself? If human creativity has traditionally been associated with subjective expression and emotional narrative, the algorithmic simulacrum challenges us to see creativity as a process of simulation, in which meaning is not given a priori but emerges from the interaction of patterns, contexts and perceptions. Moreover, the production of simulacra by AI destabilises the idea of artistic authenticity, questioning the very notion of the 'original' and prompting us to reflect on how we attach value to works of art in an increasingly technologically mediated world.

In the context of experimental music, this reflection is particularly relevant. Artificial intelligence, through the creation of musical simulacra such as *Coditany of Timeness*, does not merely replicate existing sound structures, but transforms them in unpredictable ways, opening up new aesthetic and theoretical possibilities. At the same time, his work highlights the artificial and constructed nature of all cultural production, including human production, revealing that authenticity and meaning are not intrinsic qualities, but emerge from context and interpretation. This prompts artists and theorists to reconsider the role of technology as a co-author and not merely a tool.

Human perception ultimately plays an essential role in this process. As Baudrillard suggested, the hyperreality of simulacra is inseparable from our ability to interpret and value them (Ryan 2007). *Coditany of Timeness*, although perceived by *Krallice* as lacking emotional significance, can be understood as an experiment that reveals new forms of relationship between human and non-human, between original and simulacrum, and between creativity and simula-

tion. This approach not only invites us to rethink creativity as a distributed and techno-social phenomenon, but also forces us to confront how our cultural system responds to these changes.

In conclusion, the Dadabots experiment, *Coditany of Timeness*, is not just a reinterpretation of *Diotima*, but an emblematic example of the transformation of creativity in the age of hyperreality and simulation. It challenges traditional categories of authenticity, intentionality and meaning, paving the way for new understandings of cultural production as a process that transcends the human and the non-human.

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[2] https://dadabots.com/science/
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