CHAPTER SIX

UBIQUITOUS MUSIC, UNTOKENIZABLE RESOURCES AND CREATIVE-ACTION METAPHORS: INTRODUCING THE INTERNET OF MUSICAL STUFF (IOMUST)

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Abstract

As a subcategory of the blockchain technology that underwrites cryptocurrencies, Non-Fungible Tokens (NFTs) are prominently targeting the market of multimedia digital art. In this chapter, we revisit the concept of IoMusT within the context of the current attempts to monetize the web contents through the use of NFTs. Recent literature on musicology, cultural studies and digital economics helps us analyze the attempts at producing scarcity within systems of digital exchanges. We contend that the NFT initiative involves a massive reification of non-material resources whose transition into the status of "things" may set yet another barrier to creative music making. As a resistance strategy, we propose a reconfiguration of the IoMusT as IoMuSt — the Internet of Musical Stuff. "Stuff" is fluid, malleable, unfixable and pecuniarily irrelevant. Thus, it may be invulnerable to an assigned ownership or market value. Rather than focusing on devices, paid services or monetized assets, IoMuSt conceives its ecosystems in terms of interconnected processes, actions and support-mechanisms that yield socially responsible, sustainable and open creativity-oriented engagements. We exemplify the concept of IoMuSt through four ubimus examples: namely, an intercontinental live-patching experience; the deployment of a web tool for free improvisation; a community-oriented installation involving recycled electronics; and finally a mobile prototype for game-oriented musical creativity. These practices are based on volatile and antirivalrous resources, in other words, the resources only available during the activity and they gain social value through unrestricted sharing. They are also untokenizable, insofar as they benefit from an unlimited reproducibility. In contrast, NFTs rely on scarcity secured through the deployment of social labels such as "ownership", "the real thing" "market value". The

validity of these social labels in blockchain is guaranteed by energy-expensive calculations that not only preclude the flourishing of creative ecosystems, they also represent a risk for the existence of life on the planet.

Introduction

As a research and artistic collective, ubiquitous music (ubimus) deals with resources and byproducts yielded by creative musical activities (Keller et al. 2014). Since its beginnings in 2007, the ubimus community has strived to move beyond the straitjacket of the social paraphernalia surrounding concert-based music (i.e. the separation between the audience, the composer and the performer; the adoption of domain-specific knowledge as a requirement for music making; the enforcement of the myth of the genius as the source of creativity embodied by the virtuoso player, conductor or composer). Distributed interaction, unrestricted community-oriented sharing and an active support for everyday creativity have consistently been at the center of the ubimus agenda, in dialogue with creativity-oriented concepts (Kaufman and Beghetto 2009; Beghetto and Kaufman 2007; Rubenson and Runco 1995). Part of these targets have been attained through a militant reliance on democratic and (when possible) non-proprietary sharing of resources. Emerging from the weaker side of a geopolitical faultline that distinguishes "the West" from its peripheries, the group has managed to maintain a lively international dialogue among members scattered in five continents.

Ubimus emerges as a theoretical and methodological alternative to the technological approaches attached to the European instrumental musical tradition of the nineteenth century – grouped under the label *acoustic-instrumental paradigm*. Ubiquitous musical activities generally use distributed resources and engage multiple stakeholders with various levels of expertise. While ubiquitous music seeks to expand the access to creative activity by "laypeople" (we sarcastically employ this term in open defiance to the view proposed by Babbitt, 1958), the acoustic-instrumental paradigm enforces a strict separation between novices and musicians-performers.

Ubiquitous musical activities foster opportunities for musical creation by musicians and untrained participants outside studio facilities (Keller et al. 2014). Given the demands for deployments across non-standard settings, strategies that enable data collection without disrupting the creative experience become a requirement. Previous work unveiled three methodological paths to address this conundrum: 1. Avoid early commitment to specific tools (Flores et al. 2010; Radanovitsck et al. 2011); 2. Support iterative development through rapid prototyping (Lazzarini et al. 2014); and 3. Foster collaboration by building communities of practice (Lima et al. 2012). Whether these approaches are also applicable to the emergent hybrid activities involving both synchronous and asynchronous access to local and distributed resources through internet infrastructure is an ongoing research challenge that may foster both technical and conceptual reconfigurations of the ubimus frameworks. One proposal involves the notion of an Internet of Musical Things (IoMusT), defined as an ecosystem of interconnected computing devices capable of supporting distributed music making (Turchet et al. 2018). On the one hand, the IoMusT infrastructure may facilitate the development of computational

resources for synchronous musical activities shaped after the acoustic-instrumental forms of music making. For instance, augmented, "smart" or "hyper" instruments (Machover and Chung 1989) are just an extension of the performatic usage of acoustic instruments that permeates a large number of endeavors in musical interaction. A recent work by Turchet and Ngo (2022) envisions a series of possible applications of blockchain technology to the Internet of Musical Things (IoMusT), linked to BIoMusT (Blockchain-based Internet of Musical Things), targeting the monetization of a wide selection of applications and data. On the other hand, part of the current musical-internet functionality may be applied to less corporate-oriented approaches to music making. Our position is neither for nor against the implementation of IoMusT. However, we believe that a careful analysis of the negative consequences of this proposal is necessary to avoid the pitfalls of the introduction of technologies in everyday settings that may replace socially and culturally solid forms of interaction with disruptive and profit-oriented mechanisms.

This text documents the concept of an Internet of Musical Stuff, as an expansion and complement to the Internet of Musical Things, within the field of ubiquitous music. Moreover, we focus on the implications of the adoption of blockchain and cryptocurrency technologies to support the tokenization of the IoMusT, highlighting the social implications of this initiative. We also discuss the current attempts to monetize web content through the use of non-fungible tokens. We draw upon computer science literature (Puckette 2004; Stallman 2002) and digital economics (Chohan 2021) to indicate the restrictions on the distribution of resources through the mechanism of artificial scarcity. Considering the potential of the NFT agendas to limit the access to open and free sonic repositories, an analysis from a ubimus perspective unveils issues that remain hidden by a widespread celebratory corporate discourse. Finally, we present examples of ubimus usage of the Internet of Musical Stuff, pointing to its versatility and potential for expansion as an emergent strategy. These characteristics are aligned with various strands of the second wave of ubimus research that target a meshwork of strategies to increase community access, to reduce the ecological footprint and to support aesthetic diversity (Keller, Messina and Oliveira 2020).

Objects, Things or Stuff?

Several critiques of ontologies raise a red flag with regards to the adoption of the category "thing" as a compartmentalization of reality in discrete entities. Levinas maintains that "Western philosophy has most often been an ontology: a reduction of the other to the same by interposition of a middle and neutral term that ensures the comprehension of being" (1979: 43). He goes on to describe ontology a "philosophy of power" and "injustice" (1979: 46). Levinas's critique has important implications for ubimus, insofar as it links the categorization of reality into fixed things with the annihilation of difference. This is expressed in terms of "ontological imperialism", "tyranny of the State", and "the 'egoism' of ontology" (1979: 44-46). In his reading of Levinas, Pugliese argues that ontology "emerges as another aspect of Western colonialism" (Pugliese 1995: 476). He describes ontology as "the rewriting of the other into the language of the same" which fuses heterogeneity into a singularity (1995: 476).

Replete of interesting implications for ubimus, Object-Oriented Ontology (OOO, Morton 2011) argues against the distinction between subject and object, while also asserting "that real things exist—these things are objects, not just amorphous 'Matter,' objects of all shapes and sizes, from football teams to Fermi-Dirac condensates or, if you prefer something more ecological, from nuclear waste to birds' nests" (Morton 2011: 165). Incidentally, Morton's "amorphous matter" is akin to what we call "stuff" throughout the present work. On the one hand, Morton explains that "OOO decisively departs from [the] standard ecological criticism, by enabling a ruthless rejection of the concept of Nature, in part because Nature is correlationist" [that is, based on a subject-object dialectics] (Morton 2011: 64). OOO's relevance for ubimus is eminently attested to by Connors' (2017) work on Ecological Performativity which builds upon a strong thread of ecologically grounded artistic proposals dating back to the late 1990s (see Keller and Lazzarini 2017 for a summary). On the other hand, in his critique of OOO Cole (2013) argues against the alleged autonomy of things from human subjectivity, also targeting the purported post-humanist overtones of such claims.

These issues raise concerns for ubimus research: first, as advocated by Lindley, Coulton and Cooper (2017) there is a close connection between OOO and the Internet of Things (and its related cognates such as the IoMusT); second, the claimed link between OOO and post-humanism demands an assessment of the relevance of these philosophies to ubimus practices. In other words, should the ubimus frameworks be aligned with the "humanist" or the "post-humanist" approaches, or should they operate as a hybrid paradigm? Here, we might perhaps witness a structural or strategic ambivalence fostered by diverse tendencies within the ubimus community (Keller and Barreiro 2018): a substantial amount of work based on computer creativity (Messina and Aliel, 2019; Kramann, 2020) leans towards increased levels of machine autonomy pointing to an emerging post-humanist vision; complementarily, several works on territorialities (Messina et al. 2019; Simurra et al. 2023), dialogics (Lima et al. 2012) and wellbeing (Timoney et al. 2015) focus on humanist agendas that resonate with musical approaches based on decoloniality and participatory design.

Formulated from a non-hegemonic, anti-racist and militant *locus* of enunciation, Ahmed's "phenomenology of whiteness" addresses the thin red line between the visualisation/denunciation of a paradigm of oppression and privilege and the reification of the very same paradigm as an "essential something" (Ahmed 2007: 149), that is, an existing entity, materialized and strengthened by the very discourses that criticize its operativity. Ahmed addresses this problem by focussing on whiteness as a "phenomenological issue", or, in other words, by considering "what 'whiteness' does without assuming whiteness as an ontological given" (Ahmed 2007: 150).

> Whiteness could be described as an ongoing and unfinished history, which orientates bodies in specific directions, affecting how they 'take up' space. [...] Phenomenology helps us to show how whiteness is an effect of racialization, which in

> turn shapes what it is that bodies 'can do'. (Ahmed 2007: 150).

The implications for the ubimus community and for the development of the musical internet are multiple: first, Ahmed provides a conceptual and political framework that may help in delimiting the hegemonic aspirations and discourses that permeate certain trends in musicology, computer music, music education and sound studies; second, her critique of reification highlights movement and orientation in time and space while avoiding fixed categories, emphasizing dynamic processes rather than stable and static entities.

Things are vulnerable to the imposition of hegemonic territorialities and are subject to reification, objectification and — in the context of global transactions — monetization. These characteristics can have a negative impact on initiatives aimed at expanding the access to creative work by marginalized communities, by artists without financial support and by potential stakeholders located outside of the economic and financial urban centers ("the West"). In line with the anti-essentialist perspective of this paper, our use of the category "West" is not meant to depict a well-circumscribed sociocultural and geopolitical space. Rather we subscribe to a critical grasp of "the West": a set of discourses, images, ideas and historical constructs that yield charged dichotomies (e.g. center vs. periphery; urban vs. rural; developed vs. undeveloped, etc.), which in turn determine value judgements (e.g. good vs. bad; civilized vs. barbarian; fashionable vs. outdated, etc.) sustaining a status quo based on white European (and Euro-descendant) hegemony (Hall 1996; Said 1978; Messina and Di Somma 2017). Nofer et al. (2017) offer the following description of the blockchain technology:

> A blockchain consists of data sets which are composed of a chain of data packages (blocks) where a block comprises multiple transactions [...] The blockchain is extended by each additional block and hence represents a complete ledger of the transaction history. Blocks can be validated by the network using cryptographic means. In addition to the transactions, each block contains a timestamp, the hash value of the previous block (''parent''), and a nonce, which is a random number for verifying the hash. This concept ensures the integrity of the entire blockchain through to the first block (''genesis block''). Hash values are unique and fraud can be effectively prevented since changes of a block in the chain would immediately change the respective hash value. If the majority of nodes in the network agree by a consensus mechanism on the validity of transactions in a block and on the validity of the block itself, the block can be added to the chain (Nofer et al. 2017: 183-184).

The above description urges us to clarify two points: (1) the system has proved to be much more vulnerable to frauds than what is claimed here (Kharif 2022; Charoenwong and Bernardi 2022); (2) the same fraud prevention systems that permits to verify the legitimacy of a transaction is enormously energy-expensive, to the point of constituting a concrete preoccupation regarding energetic sustainability and the future of the planet. For the sake of intellectual honesty, we acknowledge that blockchain developers have been claiming for a long time that they will eventually transition to more sustainable protocols. Ethereum, for instance, has recently announced "The Merge", a move to "reduce Ethereum's energy consumption by ~99.95%", planned for the second or third quartiles of 2022 (Ethereum 2022). We will wait and see.

Objectification and Tokenization

As a subcategory of the same blockchain technology that is used to mint and exchange cryptocurrencies, Non-Fungible Tokens (NFTs) prevalently target the multimedia digital art market — predominantly visual, but with obvious monetization possibilities for sound files, music tracks and other necessary resources for artistic production on the web.

Chohan (2021) illustrates the evolution of the monetization of audio-centered creative works, starting from the obsolescence of media such as cassette tapes and compact discs, to the problems of online platforms like Spotify, indicating that NFTs may boost this trend to monetization. Chohan concludes that (1) the incorporation of NFTs targets artificial scarcity which increases the monetary value of digital assets; (2) their value is proportional to what people are willing to pay; (3) scarcity is artificial, insofar as it separates an allegedly "authentic" item from its copies (despite the possibility of coining several NFTs for the same digital object); (4) NFTs do not guarantee the ownership of a digital object: an image may be distributed or reproduced without permission. We emphasize that Chohan does not point to the dangers involved in creating a financial barrier to access the resources available on the internet.

As it becomes apparent when reading the corporate discourse of a blockchain colossus like Ethereum, NFT-based scarcity is secured through the deployment of labels such as "ownership", "the real thing" and "the market value".

> The creator of an NFT gets to decide the scarcity of their asset. For example, consider a ticket to a sporting event. Just as an organizer of an event can choose how many tickets to sell, the creator of an NFT can decide how many replicas exist. Sometimes these are exact replicas, such as 5000 General Admission tickets. Sometimes several are minted that are very similar, but each slightly different, such as a ticket with an assigned seat. In another case, the creator may want to create an NFT where only one is minted as a special rare

> collectible. [...] Naysayers often bring up the fact that NFTs "are dumb" usually alongside a picture of them screenshotting an NFT artwork. "Look, now I have that image for free!" they say smugly. Well, yes. But does googling an image of Picasso's Guernica make you the proud new owner of a multi-million dollar piece of art history? Ultimately owning the real thing is as valuable as the market makes it. The more a piece of content is screen-grabbed, shared, and generally used the more value it gains. Owning the verifiably real thing will always have more value than not (Ethereum n.d.)

The "real thing" materialized by Ethereum emerges precisely in terms of what Levinas, as mentioned above, calls "ontological imperialism" which involves two operative concepts instrumental to the neutralization of otherness: namely, market value and ownership. By assigning these social labels to entities that without the labels are immaterial and unlimitedly reproducible, NFTs prepare the ground for the allotment, disciplination and regimentation of a network-based economy.

According to Menotti (2021), the cultural spaces generated by the trade of NFTs are by-products of the application of a blockchain technology that presents itself as a neutral space, without hierarchies or intermediaries, but which responds to the interests of the mining agents (Menotti, 2021). Thus, *cryptoart* is defined by its status as a commodity unrelated to a specific culture or means of expression, so that "the trade in NFTs sublimates the material, political and historical reality of this technology, providing it with a metaphysical authority [subjected to] the logic and speculative interests of the cryptocurrency industry, which [encourages] the diffusion of this logic and these interests in other social instances" (Menotti, 2021, p. 236). Menotti is saying that imposing the capitalist logic of "the market" in networked-based artistic practices serves as a preparation for ownership of all cultural and intangible resources. We will elaborate on this menace in our concluding remarks.

Access and Scarcity

Miller Puckette developed Max at IRCAM (Institut de recherche et coordination acoustique/musique - Institute for Research and Coordination of Music and Acoustics) in Paris in 1988 (Puckette, 2004). IRCAM intended to release Max commercially, to the point that Puckette, at a given moment, understood that he would no longer have control over his own creation. When Puckette left IRCAM, he had to abandon the Max project, and started to develop Pd (Pure Data, also an acronym for public domain). Aligned with the principles of the free software movement (Stallman 2002), Puckette articulates his critical thinking: he argues that it is absurd to own and commercialize something that is digital, immaterial and unlimitedly reproducible. According to Puckette, composers do not own the sequences of

notes, pitches, dynamics and other parameters that they produce. For him, the idea that data sequences and software be converted into merchandise is totally absurd. According to Puckette, in the current digital market regime, profit is generated through the production of scarcity, that is, by making scarce something that is, in principle, unlimitedly shareable and reproducible:

> Physical goods can only be in the possession of one person at a time; if I have a loaf of bread, I would still have to work to produce a second, identical loaf. If two people want the same loaf, they can't both have it. Material obeys conservation laws. Information and ideas don't obey any such conservation law; more ideas can come out of a system than went in. Information, in the form of a bit stream for instance, can be copied as many times as you wish, at almost no cost. [...] IP effectively makes a zero-value commodity cost money by making copies artificially scarce. All the billions of dollars' worth of 'software' are intrinsically worth nothing at all, and IP law's only purpose is to make them cost money instead of being free (Puckette 2004).

Puckette's critique of the artificial production of scarcity through the monetization of intellectual property is also applicable to Non-Fungible Tokens. NFTs rely on a scarcity that is secured by the deployment of social labels such as "property", "the real thing", or "the market value". Chohan (2021) states that "The primary interest in NFTs emerges from uses that involve creating scarcity to ascribe value to code-built digital objects" (Chohan, 2021: 3). Furthermore, within blockchain, the validity of transactions involving NFTs is guaranteed by high-energy cost computational operations that not only prevent creative ecosystems from flourishing, but also pose a substantial risk to the existence of life on the planet. The Ethereum blockchain is used by most NFTs and its current implementation uses validation algorithms that gradually increase their operational cost as new "blocks" are generated (Truby et al. 2022; Schinckus 2020). This mechanism of increasing the complexity and cost of accessing and maintaining infrastructure has a potentially catastrophic impact on a planetary scale. In addition to the use of a highly polluting energy system, the reduced useful life of the equipment increases the generation of physical electronic waste. This is yet another example of the industrial practice of programmed obsolescence. DeVries and Stoll (2021) show how the durability of equipment is reduced to a few months and how inefficient recycling causes a noticeable increase in environmental impact.

Fake Music

In the context of the monetization of audio-centered works, "fake music" may be described as audio products created without any artistic or aesthetic purpose, with the sole objective of generating profit through their commerciali-

zation. “Fake music” may be achieved by faking the artist, the content of the audio work, or both. As shown by Drott (2020), such commercialization does not necessarily require a human listener to succeed. The mechanism of consumption involves “faking the audience”.

Here, importantly, our appropriation of the category of “fake” does not imply the belief in any sort of underlying “truth” governing musical interactions — such a belief would mean reproducing the logic of the very same acoustic-instrumental paradigm we staunchly disavow.

Goldschmitt (2020) explores the concept of fake artists. According to him, it is important to acknowledge the changes in music consumption fostered by the streaming platforms. For instance, the playlist model allows the user to configure *mood* experiences while listening to audio (ex. *Music for concentration* or *Relaxing music*). Beyond the usage of musical products, ubimus frameworks address the impact of the act of music making on the participants and on the relational properties of the ecosystems that enable musical interaction. These experiences indicate a complex network of semantic associations that shape both the processes of decision making and the unintended byproducts of the activity (Keller et al. 2010; Keller et al. 2020). We should also consider that (1) the placement of an audio work on a popular playlist guarantees a substantial income enabled by a preexisting history of mechanisms of collection of royalties: Considering what the majority of musicians earn from royalties, for them it may be better to be contracted for a work on a hire basis than promoting their own names; (2) Streaming platforms complacently turn a blind eye to listening bots and fake audio tracks. Drott (2020) states that streaming companies may place some restrictions to keep the appearances but they are not interested in eradicating it completely since they rely on this phenomenon for profit. In 2017, Spotify contracted musicians through a company named Epidemic Sound, to produce audio tracks that matched some mood characteristics. This music was automatically placed on some of the mood-oriented playlists curated by Spotify, guaranteeing an income for the company who owns the rights, but not necessarily for the musicians. The information provided by the platform implied that the tracks were authored by “legitimate artists”, rather than as a subproduct of a scheme concocted by a global corporation to maximize its profit.

Drott (2020) discusses the economy of attention, in which “the exponential growth of information online has created a scarcity in that resource that information consumes: attention” (Drott, 2020, p.154-155). This scarcity results in the increase of economic value to attention. At the center of this economy of attention are streaming companies, originally meant to level the playing field for small artists, but that have eventually failed because of the “winner take all dynamics” (Drott, 2020, p.156) fostered by the interaction design enforced by the streaming platforms. In this business model, a pool with the money from all the users payment, minus spotify’s comision, is distributed between all the artists, but not in an proporcional way regarding the reproductions of each audio track. The big selling artists take a major part of the earnings and the regular musicians struggle to promote their music and make a living out of it. Consequently, a less than ideal relation between music and attention in the streaming platforms “appears less as a deviation from the proper functioning of markets and more as a consequence of their tendency

under capitalism to disproportionately concentrate not just financial wealth but symbolic power in the hands of a few" (Drott, 2020, p. 156). As a response to this, a pay-per-listening market (sometimes supported by human beings, other times automated through bots) has aligned the size of the audiences to the monetary cost of the service. Drott (2020) proposes two categories: (1) fake streamings — as a form of promotion — are intended to draw attention to an artist and promote her career by boosting her presence on popular playlists. Complementarily, fake streamings are oriented to generate profit through royalty payments. This is the case of the "Bulgarian Spotify scam" in 2017. In this scam, 1200 legally acquired and paid premium accounts were used to continuously play two playlists (the perpetrators of the scam had the royalty rights of those audio tracks). An investment of approximately 12000 dollars in the premium accounts could generate up to 415000 in profit, through the royalty payments. Maybe the most interesting part of this scam is that it was perfectly legal, no laws were broken.

These practices are not exclusive to the central countries. A composer located in a peripheral country agreed to share her experience anonymously. During the Covid-19 pandemic, facing financial problems and unable to maintain a regular income due to the social distancing protocols (and the inevitable shutdown of theaters and music schools), this composer generated different "audio works" using random processes via specialized audio software ("faking the content").

These "works" were launched in different streaming platforms using different aliases, which resulted in the same "work" being commercialized by different "personas". Thus, "fake artists" were generated (sharing some similarities to the case described by Goldschmitt, 2020) in the sense that anyone hearing these "works" could mistake them as the creative production of a human composer and assume that this composer matched the "persona" described in the accompanying biography. Also, another question arises here: similarly to what happens with the same digital item being minted as several different NFTs, with music streaming the same work can be monetized by different "personas" on different platforms. While this may not be an issue for established artists that have the full support of record and distribution rights companies, the situation for an independent artist from the Global South could be much more difficult to manage.

Using a small number of old smartphones, a domestic bot farm was created to generate consumption of the "audio works" for a period of 18 months ("faking the audience"). In this period, a total of 199.774 reproductions were made across different platforms generating a total income of $683 US dollars. Due to the high number of reproductions generated by the bots, some of the "audio works" were selected to be part of an automatedly curated playlist, which led to some casual listening by actual human beings, although these reproductions represent a negligible portion of the total.

When considering the practices that involve the monetization of audio-centered works by faking the artist, the audio work and/or the audience (or all of them as it is the case of our anonymous composer), we see problems that have been pointed out by Drott (2020), Goldschmitt (2020) and Vonderau (2021). Value (not only financial but also symbolic) is attributed to the musical experience (Drott, 2020). This experience is partially shaped by the way

music is distributed on the streaming platforms. As argued by Vonderau, "instead of invoking the notion of fake or false representation, that is, a critique of capital where some kind of value is real and some other kind is not, we may see such events, actors, and networks not as outside or opposed to distribution, but as part and parcel of distributive practices." (Vonderau 2021, p. 138). Ubimus practices present a possible solution to this predicament by empowering distributed stakeholders, promoting domestic creative processes and avoiding the reification of musical resources and outcomes.

Musical Stuff: Volatility, Rivalry, Flexible Temporalities, Territoriality

The NFT initiative involves a massive reification of intangible resources whose transition to the status of "things" may hinder musical creation in marginalized spaces. As a resistance strategy, we propose the reconfiguration of IoMusT, Internet of Musical Things, slightly modifying the acronym to IoMuSt, or the Internet of Musical Stuff (Messina et al. 2022a; Messina et al. 2022b). "Things" are separate, identifiable, materially distinguishable, while "stuff" is fluid, malleable, volatile and pecuniarily irrelevant. Being a community-oriented concept, musical stuff may feature emergent relational properties that only become accessible through deployment and usage (Keller et al. 2015). Thus, we will not attempt to enlist a fixed set of characteristics. In line with the parsimony suggested by ubimus methods, we discuss a provisional group of resource qualities that have been featured in recent ubimus projects. These are, of course, subject to revisions and adjustments as the field moves forward through field deployments.

Volatility. Focusing on creative music making as an activity has several implications on the study of material resources. Ubiquitous music phenomena involve both the locally available objects and the remote materials accessible through technological infrastructure. Therefore, we need to consider at least two types of resources: 1. the resources present on site, defined in the creativity literature as the *place factor* (i.e., *collocated resources*), and 2. the materials accessed through creativity support tools which may or may not be collocated (i.e., *distributed resources*). Iannis Xenakis (1992 [1971]) suggested that creative musical activities may occur in-time or out-of-time. This idea has been adopted by the human-computer interaction literature under the labels of synchronous and asynchronous activities (Miletto et al. 2011). Applying this notion to material resources introduces a new target for experimental work. Some materials may only become available during the creative activity and cannot be recycled for future use. Other resources may be repeatedly used in the context of asynchronous creative work. An example of the former case are the improvisatory performances based on network infrastructure. Each participant's action depends on the sonic cues provided synchronously by the other participants. These sonic cues are only available in-time, therefore they can be classified as *volatile material resources*. Other resources can be incorporated in the context of iterative cycles of creative activity. A good example is provided by the concept of musical prototype (Miletto et al. 2011). A musical prototype is a data structure that supports actions by multiple users through a network infrastructure. A single creative product is shared by the

participants collaborating throughout the creative cycle. Participants access the musical prototype remotely and cooperate by doing direct modifications and by providing comments on their actions and on their partners' actions. Creative decisions are the result of a cumulative process of material exchanges that can last from a few hours to several months. Hence, we can say that a musical prototype is a *non-volatile material resource*.

Antirivalry and nonrivalry. A group of perspectives that has direct application in ubiquitous music research comprises the psycho-economic theories of general creativity (Rubenson and Runco 1992, 1995; Sternberg and Lubart 1991). The underlying assumption of this group of theories is that creative activity both demands and produces resources. Economically oriented approaches provide opportunities for observation and quantification of variables that are hard to assess within other creativity paradigms. Given that available resources for creative activity are finite, they may be quantified. By observing the flux of consumption and production of resources, quantitative predictions may be linked to specific environmental conditions. The effectiveness of the creative strategy can be assessed by comparing the use of resources with the creative yield. The type of creative outcomes could be predicted by identifying what resources are available and how they are used throughout the creative cycle. And the relationship between resource consumption and creative waste can be used to assess the sustainability of the creative ecosystem under observation. Consequently, creative potentials and creative performance become linked to specific variables that can be studied through empirical work. Observable resources become the focus of the experiments, opening a window to quantitative comparisons among different strategies for support of creative activities.

From an economy-oriented perspective, material resources may be *rival* or *nonrival*. Rival resources lose value when shared. Nonrival resources can be widely distributed without losing value. Information is a good example of a non-rival resource. Information can be freely shared without any impact on its social value. Contrastingly, if a food stock is partitioned within a community its value is reduced proportionally to its depletion rate. An empty food stock has no social value.

There are some interesting observations to be gathered through the application of the quality of rivalry in creativity-centered design. Resources for creative activities can be characterized by their level of relevance and originality (Weisberg 1993). In the context of group activities, these two factors constitute opposite forces. Creative resources that are unique and have not been shared among group members keep their creative potential and have a high level of originality. Through sharing, original resources lose their creative potential while they gain acceptance among group members. The most relevant resources are the ones most widely distributed with the highest social acceptance. Therefore since creative rival resources lose value through social acceptance, they can negatively impact originality. On the other hand, creative non-rival resources can be freely distributed without affecting originality. Given that non-rival resources can be widely shared, they can attain higher levels of relevance than the rival resources.

Sound samples can be classified as creative rival resources. The novelty of the creative products that use samples decreases proportionally to the

number of copies of the original sound. Deterministic synthesis models generate the same sound for the same set of parameters, so they can also be classified as rival resources. Given that physical objects produce different sonic results each time they are excited, the events they produce can be classified as non-rival resources. On a similar vein, an stochastic synthesis algorithm can render multiple events without producing repeated instances (Keller and Truax 1998).

From a resource-flow perspective, the volatility of the material resources employed is a design quality that can be applied to gauge the level of support for asynchronous activities. Persistent resources, such as network-shared musical data allied to consistent metaphors for interaction, may prove useful to support creative activities across multiple devices, involving access by multiple stakeholders. Ubimus research carried out during the last seven years suggests that the resources' volatility should be taken into account when designing ubimus ecosystems. Creative rival resources do not add value to the creative product when shared. Therefore, distribution of copies of creative rival resources among group members should be reduced to a minimum. This limitation does not apply to the case of creative non-rival resources, (e.g. synthesis techniques that generate new material for each iteration, Keller and Truax 1998). These resources can be shared without imposing a steep reduction on the originality of the stakeholders' creative products.

Summing up, creative rival resources do not add value to the creative product when shared. Therefore, distribution of copies of creative rival resources among group members should be reduced to a minimum. This limitation does not apply to the case of creative non-rival resources. These resources can be shared without imposing a steep reduction on the originality of the stakeholders' creative products. Anti-rival resources gain value proportionally to their distribution among the stakeholders.

Flexible temporalities. Regarding their temporality, material resources can be classified as a continuum from persistent to volatile. Persistent resources provide firm referents for everyday musical activities because they tend to be available throughout the activity. Volatile resources' accessibility is limited since their life cycle tends to be shorter than the duration of the activity. Acoustic-instrumental improvisational practices feature sonic resources that only become available at the moment of sharing. These byproducts cannot be retrieved after they occur without resorting to technological support. Recycling and reusage are built into digital systems through their data structures. Given the casual nature of most interactions occurring in everyday contexts, a balance between volatility and persistence may be necessary to enable diverse musical practices. Storage and processing power of mobile and embedded devices is usually enough for the individual needs in short creative sessions. But when the number of stakeholders increases or when the creative activity extends for long durations, the amount of creative byproducts may force the implementation of a reliable managing system.

***Territoriality*.** Metaphors of geopolitical control and territorialized desire are not uncommon within creative collaboration, even in the case of distributed and asynchronous interaction (Messina et al. 2019). The complex and multiple activity of users across time and space over the same resources, on the contrary, is likely to generate some sort of conflict, be it metaphorical

or concrete. Drawing upon previous ubimus experiences, Kramann (2020) argues that this type of conflictuality may prove to be a substantial obstacle in the context of distributed creativity. We maintain that some degree of territoriality and conflictuality is, by definition, a necessary part of human (and non-human) interaction. However, we consider Kramann's argument extremely relevant, particularly when conflict and territoriality may escalate into situations of extreme imbalance in terms of access to resources. We argue that the forced objectification and tokenization that we address in this paper is one of the elements that permits such escalation. In general terms, ubimus reflections on territoriality are complementary to the fostering of ecologically grounded creative practices (cf. Keller and Lazzarini 2017).

Deploying the IoMuSt

Avoiding the focus on expensive devices and services and/or on tokenized digital content, the Internet of Musical Stuff (IoMuSt) conceives its ecosystems in terms of interconnected processes, actions and support mechanisms, based on social commitments and on responsible, sustainable and creativity-oriented forms of engagement. Part of these processes are based on volatile and anti-rival resources [Keller 2014], that is, resources that are available only during the specific activity and gain social value through unrestricted sharing. Adaptive strategies are employed to encourage the use and reutilisation of local resources. Both IoMuSt resources and processes resist tokenization, foster unlimited reproducibility, and are based on value judgments about the impact of creative practices on the local ecosystem. These characteristics subvert the NFT agenda and tend to break down financial barriers, allowing individual and casual participants to freely access creative resources.

Strategies that enable data collection without disrupting the creative experience become a requirement for the design of IoMuSt processes and resources. Previous ubimus work points to three methodological approaches: 1. *Avoid early commitment to specific tools or functionalities*. This strategy can be applied to multiple stages of the design cycle. During the early stages, design fictions can be employed to explore the philosophical underpinnings of the stuff ecology. Given the opportunistic adoption of local resources in ubimus practice, a fixed functionality of stuff cannot be taken for granted. Components gain meaning through usage, through interactions among participants and through connections and exchanges with other components. Consequently, mutual adjustments should be expected and support mechanisms should be incorporated into the stuff ecology. The latest stages of the design may call for adjustments to address unexpected and possibly deleterious byproducts. These issues need to be considered before the deployment stage. Thus, the usual policy "deploy to evaluate" should be put into question. The impact of unwanted behaviors of sonic objects within the domestic spaces cannot be downplayed. Intrusive noise is among the most pervasive cognitive stressors in urban environments. 2. *Apply iterative and participatory development through rapid prototyping*. An emergent strategy in ubimus design entails the combination of extant technological resources for creative ends. This is a form of combinatorial creativity (Boden 2006),

tailored to foster diversity while lowering the temporal investment to achieve a working prototype. The underlying principle is that the best design demands zero implementation efforts (Buxton 2007). An example of this strategy in ubimus is Creative Semantic Anchoring (ASC). For instance, the proposal laid out by Messina and Mejía (2020), *Contracapas*, entails the algorithmic control of text instructions to trigger performatic behaviors at the nodes of the network. Despite being deployed as a two-node performance, it may be readily expanded to multi-node topologies. 3. *Foster collaboration within communities of practice*. The expanding infrastructure for ubimus usage has opened opportunities for long-term engagement and community-building. There are several examples of metaphors for creative action that have been deployed, assessed and incorporated as strategies for artistic and educational purposes (Keller et al. 2020; Lima et al. 2012; Lima et al. 2017).

Musical Example 1: Intercontinental Live Patching

Our first example refers to an intercontinental live patching experience (Messina et al. 2019) based on simultaneous remote interaction using the software Kiwi, a graphical programming environment that replicates the functionalities of the aforementioned Max and Pd, but offering the possibility of real-time remote collaboration, whereby several users can work simultaneously on the same project from distant locations, similarly to what happens with Google Docs.

The intercontinental live patching experience involved two academic groups based in three different universities between Brazil and France, namely, the Live/Acc/Patch research group from the two Brazilian Federal Universities of Acre and Paraíba, and a working group based at the University Paris 8 in France, gathered around the undergraduate module *Introduction à la programmation avec Kiwi, Max et Pure Data 1*.

Assisted by the idiosyncrasies of the Kiwi infrastructure, the participants adopted an entirely open, collaborative and non-hierarchical approach. In principle, such an approach might be considered a downside by software developers, for whom it is normally desirable that the author of a document be able to “authorize” or “block” the collaboration of an additional author [25]. On the contrary, with Kiwi all the participants retain the same, unrestricted rights. In addition, the operations on each patch do not leave genealogical traces, that is, it is impossible to ascertain who created a specific object or added a specific comment on a patch. In this way, potential hierarchical barriers are totally avoided. Subverting the logic of scarcity and aforementioned social labels of “ownership”, this totally open, collaborative and non-hierarchical approach forms one of the pillars of what we call IoMuSt.

Musical Example 2: Playsound Space

Semantics-based musical interaction has a historical precedent in verbal-notation practices. Verbal scores were widely adopted by the experimental practitioners of the fifties and sixties, including composers such as La Monte Young and performance artists such as George Maciunas and Joseph Beuys.

At the time, the computational infrastructure was restricted to large companies and research centers. So the adoption of computational tools would have involved constraining artistic practices to specialized venues – a requirement that went against the grain of the artistic proposals championed by Fluxus. Contrastingly, the current tendencies in creative music making indicate that computational resources are employed at some stage in almost all artistic practices (see a historical overview of technology-based music making in Keller and Costa 2018). But these resources are not always available to lay participants and various design challenges forfeit the full engagement with creative activities outside of the specialized venues. Given this context, semantics-based musical interaction may furnish a way to promote musical knowledge transfer without resorting to traditional notation.

The open online resource Playsound.space (Stolfi, Milo and Barthet 2019) extracts accessible and modifiable sound content free of charge through Creative Commons licenses: this material serves as a basis for free improvisation, and is available for free to all users. Playsound.space aims to increase the circulation and transformation of sound resources, through flexible temporalities, the overlapping of several sound layers, and the promotion of collaborative participation.

Musical Example 3: Memories Tree

As mentioned above, one of the standpoints of Object-Oriented Ontology is the rejection of the concept of Nature. Such a rejection is not based on the assumption that "there is nothing out there" (Morton 2011: 178), but rather on the idea that anthropocentric subject-object binaries tend to otherize Nature as something external to the subject, as if humans were not part of it. OOO asks us to think of ourselves as "just another object" (Morton 2011: 173).

While ubimus research endorses non-anthropocentric views, we are not convinced by the eclipse of the subject professed by OOO. The interactive multimedia installation Memory Tree (also Memories Tree, Ribeiro Netto et al. 2015) is based on augmenting a live tree with a system that allows interaction with users. The project fosters the recycling of scrap and electronic waste. Among the components of this system, we highlight the auditory resources originated from the sharing of sound messages on social media. The tree ceases to be interpreted as a passive element and becomes a repository of memories of the events that surround it.

Rather than construing reality as a series of objects, the Memories Tree project unearths and reclaims the irreducible subjectivity of a non-human being, thus overturning the logic of OOO. In virtue of the interconnected, transitory and absolutely valueless nature of its nodes and components — for commercial goals — the Memory Tree could hardly be described as a "Tree of Musical Things". It is made of scrap. The sonic messages are personal and fleeting. Its value depends on the engagement of a community. But this engagement is necessarily selfless, it breaks down when invaded by corporate or commercial messages. Thus, it is not a tree of things, and we prefer to describe it as a "Tree of Musical Stuff".

Musical Example 4: Pulse 2357

Taking as a starting point the ubimus principle of distributed creativity, Kramann (2020) devised pulse2357 as a "board game with an inherent correlation to music" (2020: 24). Implemented and disseminated online as a free Android application, it is also a real-time tool for composition (2020: 29). Featuring a limited range of actions, the game is intended to quickly familiarize untrained users with selected aspects of musical creation.

As a tool for algorithmic music-making, pulse2357 defies the reification. A first, obvious element is the form of dissemination of the board game, distributed as a free mobile app — even though sharing free software on Android's Play Store is very far from being an exclusive prerogative of Kramann's work. Secondly, the musical material produced while playing pulse2357 does not constitute creative "works", but rather exists ephemerally in the form of volatile game practices. We (happily) fail to envisage the material resulting from pulse2357 games as tokenizable into NFTs and sellable as — to quote Ethereum's own corporate rhetoric — "the real thing".

Final Remarks

The topics covered in this chapter are part of the ongoing ubimus discussions on the relevance and necessity to expand the strategies for creativity support, highlighting the demands from communities living in peripheral ("non-Western") locations in which the easy access to technological resources and know-how are not guaranteed. We underline sustainability as an emerging topic among second-wave ubimus proposals, with potential impact on infrastructure-design decisions entailing the expansion or the reduction of creativity support. To restrict the usage of the Internet of Musical Things within the scope of instrumental practices entails the exclusion of communities due to their lack of access to resources. Furthermore, this view implies the imposition of a set of assumptions on what constitutes 'correct' music making.

We also underline the problems of adopting the category "thing" as the foundational entity of creative practice, including the dangers of imposing the object over the values of knowledge sharing, dialogic practices and free circulation of digital assets, values defended by multiple initiatives within the ubimus community (Lima et al. 2017; Keller 2014; Messina et al. 2019) and outside (Puckette 2004; Santos 2011). This reification of musical resources tends to give way to the monetization of ubimus practices that rely on the musical internet for resources and infrastructure, seriously compromising the sustainable program defended by the ubimus movement. A community built around the free circulation of material and intangible assets will most likely not survive the restrictions imposed by corporate usage. In line with Ahmed (2007), the Internet of Musical Stuff is proposed as a path of resistance to reification.

As an alternative to the reified edifice enforced by the corporate usage of blockchain technology, we sketch a flexible set of qualities tied to a provisional notion described as "musical stuff". Stuff is pliable, it is fairly amorphous, it changes with usage, it relies on context to acquire meaning, it

may be persistent or volatile depending on the demands of the stakeholders, it supports handling through flexible temporalities, it incorporates value through sharing and it easily adapts to non-hierarchical territorialities. Given these characteristics, stuff tends to be resilient and does not yield to monetization pressures.

Let us consider stuff's volatility. Methodologically, volatility can be applied to gauge the level of potential creative support. Persistent resources, such as network-shared musical data ground on consistent creative-action metaphors, may prove useful for musical activities that involve multiple devices and asynchronous access by distributed stakeholders. Complementarily, volatile resources gain importance in everyday music practices that entail support for casual interaction (Keller and Lima 2016). Without time for training or preparation, casual interactions may take place in public with the ensuing pressure of social exposure. Varying light conditions and noisy backgrounds may also interfere. Thus, the ability to explore the resources without enforcing preestablished practices may be more advantageous than the synchronous decision-making processes typically adopted by networked music performance.

The impact of sharing on creativity has emerged as one of the key features of ubimus practices. Collaborative strategies highlight the socially distributed nature of creative resources and impact the value ascribed to musical materials. Relevance and originality are closely tied to the spread or the concentration of resources in the stakeholders' hands. Rivalry establishes a bridge between sharing and the creative potential of the pooled resources (Keller 2014). Some assets gain creative value when shared (anti-rival) while others are negatively impacted by a lenient distribution policy (rival). A third category affords sharing without reducing its potential for creative outcomes (non-rival). Ubimus endeavors may take place in public spaces where participants freely engage or quit a creative activity. Therefore, a careful analysis of the dynamics of sharing and selection should be promoted in tandem with support for the multifarious qualities of musical stuff. Remote resources and collaborators may be accessible through the use of the IoMuSt, hence the activities may involve resources available on site and also remote resources, as shown in examples 1, 2 3 and 4. How to strike a balance between presence and remote engagement is an open issue to be addressed through field deployments.

The four musical examples outlined in this chapter resist reification by means of the use of flexible temporalities. They challenge the fixedness of objectified musical practices. Asynchronous interaction, casual participation and volatile resources are all elements that help to overcome fixed temporalities. A territorial metaphor may also be relevant to most of the examples. Especially in the first two, online interaction emerges as the simulacrum of shared spaces. Apropos of territoriality, the connection of the Amazon Center for Music Research with the local history allows us to draw a parallel between the free extraction of sound content typical of mechanism implemented in Playsound.space, as opposed to the mining practice that characterizes the economy of blockchain: the first can be compared to the extractivist activity of rubber tappers, while the second emulates the destructive practices of predatory mining and gold-digging. Transposing this

to the concrete historical events involving Western Amazonia, we visualize, on the one hand, the trade union militancy linked to the extraction of rubber in the State of Acre between the 1970s and 1980s, with its innovative proposals in terms of sustainability and complete reformulation of the institution of private property (Mendes 1992 [1988]), and, on the other hand, the environmental destruction caused by gold mining, for example, along the Madeira River in the state of Rondônia (Martinelli et al. 1988). This environmental metaphor illustrates the relationship between IoMuSt and blockchain: a sustainable creative ecosystem stands as opposed to the nefarious reality of the predatory exploitation of the forest.

The criticisms that permeate this article are part of a general call to increase ethical commitment and militancy within ubimus research. This is partly due to a tight connection of ubimus creative practices with the development of material and cognitive support via technological design and through the expansion of musical knowledge. After 2020, we face challenges that were not fanthomable during the previous century. Therefore, the difficulties multiply. As artists and developers of new technologies, we need more evidence of the positive impact of our practices and more modesty in our musical attitude. We hope the approaches proposed in this chapter may serve as a counterbalance to the celebratory incorporation of corporate discourse that we are witnessing in part of the artistic circles of central countries.

References

Ahmed, S. (2007). A phenomenology of whiteness, *Feminist theory*, 8(2), 149-168.

Barreiro, D. L., & Keller, D. (2010). Composição com modelos sonoros: fundamentos e aplicações eletroacústicas. In Keller, D., & Budasz, R. (eds.), *Criação musical e tecnologias: Teoria e prática interdisciplinar*, (pp. 97-126).

Beghetto, R. A. & Kaufman, J. C. (2007), 'Toward a broader conception of creativity: A case for "mini-c" creativity', *Psychology of Aesthetics Creativity and the Arts* **1**(2), 73-79.

Charoenwong, B., & Bernardi, M. (2021). *A Decade of Cryptocurrency 'Hacks': 2011–2021.* Available at SSRN 3944435.

Chohan, U. W. (2021). Non-fungible tokens: Blockchains, scarcity, and value. *Critical Blockchain Research Initiative (CBRI) Working Papers.*

Cole, A. (2013). The Call of Things: A Critique of Object-Oriented Ontologies. *The Minnesota Review*, 2013(80), 106-118.

Connors, T. M. (2017). *Audiovisual Installation as Ecological Performativity: A creative research practice* (Doctoral dissertation, The University of Waikato).

De Vries, A., & Stoll, C. (2021). Bitcoin's growing e-waste problem. *Resources, Conservation and Recycling*, 175, 105901.

Drott, E. (2020). Fake Streams, Listening Bots, and Click Farms: Counterfeiting Attention in the Streaming Music Economy. *American Music*, 38(2), 153-175.

Ethereum (n.d.). *Non-fungible tokens (NFT)*, website. Retrieved from: https://ethereum.org/gl/nft/ [25/06/2022].

Ethereum (2022). *The Merge*, website. Retrieved from: https://ethereum.org/en/upgrades/merge/ [25/06/2022].

Ferraz, S., & Keller, D. (2014). Mdf: Proposta preliminar do modelo dentrofora de criação coletiva. *Cadernos de Informática*, 8(2), 57-67.

Flores, L., Miletto, E., Pimenta, M., Miranda, E., & Keller, D. (2010). Musical interaction patterns: communicating computer music knowledge in a multidisciplinary project. In *Proceedings of the 28th ACM International Conference on Design of Communication* (pp. 199-206).

Goldschmitt, K. E. (2020). The Long History of the 2017 Spotify "Fake Music" Scandal. *American Music*, 38(2), 131-152.

Hall, S. (1996). The West and the Rest: Discourse and power. In: Hall, S., Held, D., Thompson, K., Hubert, D. (eds.). *Modernity: An Introduction to Modern Societies*, Oxford: Blackwell Publishers, 1996, pp. 184-227.

Kaufman, J. C. & Beghetto, R. A. (2009). 'Beyond big and little: The four c model of creativity', *Review of General Psychology* **13**(1), 1-12.

Keller, D. (2014). Characterizing resources in ubimus research: Volatility and rivalry. *Cadernos de Informática*, 8(4), 57-68.

Keller, D., & Barreiro, D. (2018). Editorial Seção Temática Música Ubíqua: Forças de atração e desafios na pesquisa ubimus. *Revista Vórtex*, 6(2).

Keller, D., Barreiro, D. L., Queiroz, M., & Pimenta, M. S. (2010). Anchoring in ubiquitous musical activities. In *ICMC*.

Keller, D., & Lazzarini, V. (2017). Ecologically Grounded Creative Practices in Ubiquitous Music. *Organised Sound*, 22(1), 61-72. doi:10.1017/S1355771816000340

Keller, D., Lazzarini, V. & Pimenta, M. S. (2014), *Ubiquitous Music*, Vol. XXVIII, Berlin and Heidelberg: Springer International Publishing.

Keller, D., & Lima, M. H. (2016). Supporting everyday creativity in ubiquitous music making. *Trends in music information seeking, behavior, and retrieval for creativity*, 78-99.

Keller, D., Messina, M., & Oliveira, F. Z. (2020). Second Wave Ubiquitous Music. *Journal of Digital Media & Interaction*, 3(5), 5-20.

Keller, D., & Truax, B. (1998). Ecologically-based granular synthesis. In *ICMC*.

Kharif, O. (2022). Blockchain project Ronin hit by $590m crypto heist. *Al Jazeera.* Retrieved from: https://bit.ly/3btL4sd [25/06/2022].

Kramann, G. (2020). Of renouncing to do something grandiose. In *Proceedings of the 10th Workshop on Ubiquitous Music* (UbiMus 2020). Porto Seguro: g-ubimus.

Ingham, T. (2018). The great big Spotify Scam: Did a Bulgarian Playlister Swindle Their way to a fortune on streaming service?. *Music Business Worldwide*, February 20.

Ingham, T. (2016). Spotify is making its own records… and putting them on playlists. *Music Business Worldwide*, August 31.

Lazzarini, V., Costello, E., Yi, S. & ffitch, J. (2014), Development tools for ubiquitous music on the world wide web, in Damián Keller and Victor Lazzarini and Marcelo S. Pimenta, ed., 'Ubiquitous Music', Heidelberg Berlin: Springer International Publishing, pp. 111-128.

Lemmon, E. C. (2019). Telematic Music vs. Networked Music: Distinguishing Between Cybernetic Aspirations and Technological Music-Making. *Journal of Network Music and Arts*, 1(1), 2.

Levinas, E. (1979), *Totality and Infinity: An Essay on Exteriority*. Translated by Alphonso Lingis. The Hague; Boston; London: Martinus Nijhoff Publishers.

Lima, M. H., Keller, D., Flores, L. V. & Ferreira, E. (2017), Ubiquitous music research: Everyday musical phenomena and their multidisciplinary implications for creativity and education, *Journal of Music, Technology and Education* 10(1), 73-92.

Lima, M. H., Keller, D., Pimenta, M. S., Lazzarini, V., & Miletto, E. M. (2012). Creativity-centred design for ubiquitous musical activities: Two case studies. *Journal of Music, Technology & Education*, 5(2), 195-222.

Lindley, J., Coulton, P., & Cooper, R. (2017). Why the internet of things needs object orientated ontology. *The Design Journal*, 20(sup1), S2846-S2857.

Machover, T., & Chung, J. (1989). HyperInstruments: Musically Intelligent and Interactive performance and Creativity Systems. In *Computer Music Conference* (Columbus, Ohio).

Martinelli, L. A., Ferreira, J. R., Forsberg, B. R., & Victoria, R. L. (1988). Mercury contamination in the Amazon: a gold rush consequence. *Ambio*, 252 -254.

Mendes, C. (1992). Excerpts from Chico Mendes's Fight for the Forest. *Latin American Perspectives*, 19(1), 144-147.

Menotti, G. (2021), Criptoarte: A Metafísica do NFT e a Tecnocolonização Da Autenticidade, *Revista do Centro de Pesquisa e Formação*, 13, 236-255.

Messina, M., & Aliel, L. (2019). Ubiquitous music, gelassenheit and the metaphysics of presence: Hijacking the live score piece ntrallazzu 4. In *14th International Symposium on CMMR* (*9th Workshop on Ubiquitous Music - UbiMus 2019*) (pp. 685-695).

Messina, M., Célio Filho, M., Mejía, C. M. G., Keller, D., Aliel, L., & Simurra, I. (2022). A Internet do Bagulho Musical (Internet of Musical Stuff) -IoMuSt. In *Proceedings of the Ubiquitous Music Symposium (ubimus2022)* (pp. 85-93). Curitiba: g-ubimus.

Messina, M., & Di Somma, T. (2017). Ocidente. In: *Uwa'kürü - dicionário analítico: vol. 2*, Rio Branco: Nepan Editora, (pp. 272-286).

Messina, M., Keller, D., Aliel, L., Mejía, C. M. G., Célio Filho, M., & Simurra, I. (2022) The Internet of Musical Stuff (IoMuSt): ubimus perspectives on artificial scarcity, virtual communities and (de)objectification. *INSAM Journal of Contemporary Music, Art and Technology*, (9), 26-50.

Messina, M., & Mejía, C. M. G. (2020). Contracapas for remote double bass and effects: Creative Semantic Anchoring, Corpus Linguistics and Remote Interaction. In *Proceedings of the 10th Workshop of Ubiquitous Music* (UbiMus 2020) (p. 173-174).

Messina, M., Svidzinski, J., de Menezes Bezerra, D., & Ferreira, D. (2019). Live patching and remote interaction: A practice-based, intercontinental approach to kiwi. In *14th International Symposium on CMMR* (*9th Workshop on Ubiquitous Music - UbiMus 2019*) (pp. 696-703).

Miletto, E. M., Pimenta, M. S., Bouchet, F., Sansonnet, J. P., & Keller, D. (2011). Principles for music creation by novices in networked music environments. *Journal of New Music Research*, 40(3), 205-216.

Morton, T. (2011). Here comes everything: The promise of object-oriented ontology. *Qui Parle: Critical Humanities and Social Sciences*, 19(2), 163-190.

Nofer, M., Gomber, P., Hinz, O., & Schiereck, D. (2017). Blockchain. *Business & Information Systems Engineering*, 59(3), 183-187.

Oakes, S., Brownlie, D. & Dennis, N. (2011), Ubiquitous Music, *Marketing Theory* 11(1), 93-95.

Pimenta, M. S., Miletto, E. M., Keller, D., Flores, L. V., & Testa, G. G. (2014). Technological Support for Online Communities Focusing on Music Creation: Adopting Collaboration, Flexibility, and Multiculturality from Brazilian Creativity Styles. In *Cyber Behavior: Concepts, Methodologies, Tools, and Applications* (pp. 744-766). IGI Global.

Puckette, M. (2004). Who owns our software? A Firstperson Case Study. In *Proceedings of the International Symposium on Electronic Art* (pp. 200-202).

Pugliese, J. (1995). Literary Histories and Ontologies of Nation. *Canadian Review of Comparative Literature/Revue Canadienne de Littérature Comparée*, 467-486.

Small, C. (1998). *Musicking: The meanings of performing and listening.* Middletown CT, Wesleyan University Press.

Radanovitsck, E. A. A., Keller, D., Flores, L. V., Pimenta, M. S. & Queiroz, M. (2011), mixDroid: Time tagging for creative activities (mixDroid: Marcação temporal para atividades criativas), in 'Proceedings of the XIII Brazilian Symposium on Computer Music (SBCM 2011)', Vitória, ES: SBC, Vitória, ES: SBC.

Ribeiro Netto, A. R., Castheloge, L., Oliosi, A., Mateus, A., Costalonga, L., & Coura, D. (2015). Arvore das Memórias: Instalaçao Multimıdia Interativa. In P*roceedings of the 15th Brazilian Symposium on Computer Music* (pp. 76-83).

Rubenson, D. L. & Runco, M. A. (1995), The psychoeconomic view of creative work in groups and organizations, *Creativity and Innovation Management* 4(4), 232-241.

Said, E. W. (1978). *Orientalism*, London: Routledge & Kegan Paul Ltd.

Santos, M. (2011). *Por uma outra globalização: Do pensamento único à consciência universal.* Rio de Janeiro, RJ: BestBolso.

Schinckus, C. (2020). The good, the bad and the ugly: An overview of the sustainability of blockchain technology. *Energy Research & Social Science*, 69, 101614.

Simurra, I., Messina, M., Aliel, & L., Keller, D. (2023, forthcoming) Radical Creative Semantic Anchoring: Creative-Action Metaphors and Timbral Interaction. *Organised Sound* 28(1).

Stallman, R. M. (2002). *Free Software Free Society: Selected Essays of Richard Stallman.* J. Gay (ed.). GNU Press: Boston.

Sternberg, R. J., & Lubart, T. I. (1991). An investment theory of creativity and its development. *Human development*, 34(1), 1-31.

Stolfi, A. S., Milo, A., & Barthet, M. (2019). Playsound. space: Improvising in the browser with semantic sound objects. *Journal of New Music Research*, 48(4), 366-384.

Timoney, J., O'Leary, S., Czesak, D., Lazzarini, V., Conway, E. E., Ward, T. E., & Villing, R. C. (2015). The beathealth project: Application to a ubiquitous computing and music framework. *Journal of Cases on Information Technology (JCIT)*, 17(4), 29-52.

Truby, J., Brown, R. D., Dahdal, A., & Ibrahim, I. (2022). Blockchain, climate damage, and death: Policy interventions to reduce the carbon emissions, mortality, and net-zero implications of non-fungible tokens and Bitcoin. *Energy Research & Social Science*, 88, 102499.

Turchet, L., & Ngo, C. N. (2022). Blockchain-based internet of musical things. *Blockchain: Research and Applications*, 3(3), 100083.

Turchet, L., Fischione, C., Essl, G., Keller, D. & Barthet, M. (2018), 'Internet of Musical Things: Vision and Challenges', *IEEE Access* **6**, 61994-62017.

Vonderau, P. (2021). 6. Questioning the Content Supply Model: A Provocation. In Digital Media Distribution (pp. 126-142). New York University Press.

Weisberg, R. (1993). Creativity: Beyond the myth of genius. New York: WH Freeman.

Wessel, D., & Wright, M. (2002). Problems and prospects for intimate musical control of computers. *Computer music journal*, 26(3), 11-22.

Xenakis, I. (1992). Formalized music: thought and mathematics in composition, Sheffield: Pendragon Press.