MAP-MAKING TOWARDS AN ONTO-CARTOGRAPHY OF THE DIGITAL AUDIO WORKSTATION

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ABSTRACT

Levi Bryant's concept of "onto-cartography," (2014) or "map-making," presents a compelling framework for understanding complex systems, objects, and media. Map-making involves understanding these in terms of the operations of their constituent parts, what Bryant terms "machines." This "machine-oriented ontology" can be applied in order to map the digital audio workstation (DAW), a complex medium that pervades the creation of virtually all recorded music today, yet has evaded sustained critical investigation as a mediator of recorded sound. Using Bryant's four kinds of maps as a framework, the ways map-making might contribute to more nuanced understandings of the DAW, and how such a framework can lead to new compositional methodologies using the DAW, are explored.

1. INTRODUCTION

The digital audio workstation (DAW) mediates virtually all recorded music today. It's rapid rise to ubiquity in recorded music, especially electronic and popular music, demands new conceptual frameworks that provide better understandings around its role as a site of composition and as a mediator of cultural discourse.

Historically, until about the 1990s, the DAW was principally used for editing in recording studios, using expensive, purpose-built computers. Much of the processing and mixing was done using sophisticated outboard gear, relics of the analog era, and utilised by highly trained sound engineers and producers. It was presumed that the *composition* of the music took place prior to its insertion in the DAW (Pras, Guastavino, and Lavoie 2013). With the rise of the personal computer, much of the studio's functionality moved into the computer, and the DAW became a widespread site in which to create music.

The term "in the box" has been used to denote composition and production practices that entirely take place within the DAW. Many producers and composers today work entirely "in the box," without recording or mixing any sounds in an external, physical studio until the very final stages of composition, if at all (Power 2007). Despite the constraints implied by such a term, it can also point to a new way of composing—as Waters writes, "what musicians tend to be interested in and good at is using devices in a manner which operates at the edges of or outside the design brief" (Waters 2007). In other words, tools developed for the purpose of sound engineering and record production have been engaged for other means, such as composition.

As a popular site for the composition of recorded electronic music, the DAW is under-theorised. Barrett writes that all media are "encoded with historical knowledge and conventions and [are] therefore inextricably bound to conceptual and theoretical frameworks." (Barrett 2010, 191) If this is the case, then these frameworks are obscured by parties contingent to the DAW. A site of composition as popular as the DAW provides a new compositional methodology that deserves a greater interpretative nuance and a greater sense of care to its unique characteristics as a tool separate from its predecessor, the multitrack tape console. Composers, software developers, and human-computer interaction researchers could benefit from access to frameworks that can enable such productive interrogation of this relatively emergent medium.

This paper hopes to provide a sketch towards one such theoretical framework that interrogates the DAW, drawing from the critical and cultural theory of Levi Bryant, specifically his book *Onto-Cartography: An Ontology of Machines and Media* (2014). The framework proposed here is designed to interrogate the DAW from a posthuman, sociocultural perspective. The intention is to re-conceptualise the DAW as a compositional medium informed by many contemporary understandings of sound, music, software, and technology. In doing so, it can offer a blueprint through which composers can use the DAW in ways that interrogate its mediatic condition. A key benefit of this framework is that it doesn't prioritise conventional or even intended understandings of the DAW—this epistemological shift can enable new techniques and appropriations unique to the DAW. This positioning of the DAW also seeks to assuage the limits of the current conceptual resources in the fields of human-computer interaction and affordance theory, as would be more commonly deployed in researching new musical

interfaces. These limitations will be addressed throughout.

Mark Fell writes that "any tool is subject to redefinition through its uses, and dependent on its placement within wider social and cultural contexts; for example, my Dad's use of a screwdriver to open a tin of paint, or a friend's use of a shoelace to commit suicide." (Fell 2013) Here, Fell touches on the *pluripotency* of tools, a fundamental component of Levi Bryant's "machine-oriented ontology," described below.

2. ONTO-CARTOGRAPHY AND MACHINE-ORIENTED ONTOLOGY

Object-oriented ontology (OOO), also described as speculative realism, has surged in the last decade to become a principle point of contention in contemporary philosophy and metaphysics. Spearheaded by Graham Harman, Quentin Meillassoux and Levi Bryant amongst others, OOO emerged in opposition to the discursive, deconstructionist philosophies of the likes of Jacques Derrida and Slavoj Žižek, to advance realism and materialism as concepts that can and should be taken seriously in contemporary thought. A significant feature here is the decentring of the human subject as the inevitable mediator of reality, a trend usually associated with post-humanism. OOO, while accepting the inability for humans to perceive "reality," argues that questions of reality and ontology shouldn't end there. Thus, the project of OOO is the speculation on material reality as a distinct possibility. Meillassoux, one of OOO's central proponents, argued that philosophy since Kant has been principally disposed towards placing the human subject at the centre of all questions on the nature of being. Meillassoux called this stance "correlationism," because it is assumes that objects can only be explained in correlation with the mind of the human subject (Meillassoux 2009, 5). Correlationism is an anthropocentric concept that creates what the object-oriented ontologists believe is an unnecessary divide between human and world, subject and object. This correlationism is prevalent in many fields of inquiry—in relation to human-computer interaction, Ian Bogost writes, "[human-computer interaction studies] concerns itself with *human*-computer relations, not computer-computer relations. … Despite its technical tenor, computing is just as correlationist a field as everything else, obsessed with human goals and experiences" (Bogost 2012, 107).

Levi Bryant suggests that a more important ontological question than "what are objects?" is "what can objects do?" This shift in focus informs the basis of his "machine-oriented ontology." His central proposition is that material reality is composed entirely of machines, a term explained below.

2.1 Machines

A machine is a "system of operations that perform transformations on inputs thereby producing outputs." (Bryant 2014, 38) Adapted from Deleuze and Guattari's use of the term, Bryant uses the term "machine" instead of "object" not only to distance the concept from anthropocentrism (as the term "object" tends to be coupled with a "subject"), but also to emphasise the dynamic becoming of all material processes. A tree is a machine that transforms water, soil nutrients and sunlight into material outputs such as leaves, wood, oxygen and homes for various organisms and animals. A tree can accept many different inputs and transform them in a number of ways—for example, tying a rope and a tyre to a branch on a tree could produce a child's swing as an output. A chainsaw could fell a tree and produce fuel for a home's fireplace.

Machines are composed of other machines, and can assemble to form greater machines, but the hierarchy implied here isn't necessarily neat and tidy, and machines rely on each other's outputs to greater or lesser degrees. Bryant calls this the "gravity" of machines, in which machines can exert a strong influence over other machines that may be disabling for the subordinate machine—for example, a tree simply cannot survive without water, thus water exercises tremendous gravity over the tree.

Machines are understood not only by what operations they *do* (their products), but what they *can* do (their "powers"). Bryant distinguishes these as a machine's "local manifestations" and "virtual proper being" respectively. In doing this, Bryant sets up a degree of independence between a machine's *powers* and the outputs it produces. To treat these separately as Bryant does immediately presents the possibility of redefinition of machines we know well. A screwdriver may well be designed to fasten materials together by means of a screw and a human's twisting arm, but any definition of the human-screwdriver-machine will need to take into account its capacity to open a tin of paint, or be used as a weapon, or mix orange juice and vodka together. The virtual proper being of a screwdriver need not be limited to its manifestations as they correlate to human subjecthood—the screwdriver may operate on water to produce rust, or the handle may operate on light to produce photons of a certain wavelength, or it may operate on a magnet to produce magnetic attraction. This is what is meant by the *pluripotency* of machines—they will always have more possible manifestations than their *intended* ones. This concept is related to that of the more frequently deployed concept of affordance, however affordance tends to carry anthropocentric connotations, in which objects are positioned as enabling or disabling possible uses for the human subject only, as is insinuated by Mooney when he defines affordances by what they allow "us" to do

(Mooney 2010). Pluripotency relinquishes the necessity of the object/subject divide. By understanding the powers and products of machines in this way, object-object relations are given exactly as much priority as object-human relations.

Machines are "structurally open and operationally closed," (Bryant 2014, 54) in that they are open to any number of inputs or flows, but closed in the sense that a machine "always transforms that flow according to its own operations and 'processes' those flows in terms of the internal structure of the machine." (Bryant 2014, 56) Consider the soundwave: while humans are able to cognitively perceive and comprehend sound within elaborate conceptual and sociocultural frameworks, a screwdriver lacks these faculties, thus it transforms the sound, shearing it of all its (human) signifiers, in order to operate on it in a purely vibratory, physical capacity. Elephants and bats, known for their infrasonic and supersonic hearing respectively, transform sound in ways different to the human and the screwdriver.

3. MAPPING THE DIGITAL AUDIO WORKSTATION-MACHINE

Bryant is primarily interested in deploying onto-cartography in the service of a "thermodynamic politics," (Bryant 2014, 72–74) by attending to and deconstructing the constituent machines of undesirable ecologies, such as capitalism, heteropatriarchy, or global warming. This call-to-arms is brought about by what Bryant perceives to be the stymied state of contemporary critical theory, which is perfectly able to diagnose the problems of contemporary society, yet unable to specify effective remedies for them. (Bryant 2014, 274)

Yet this machine-oriented ontology framework can be applied specifically to the DAW. In an onto-cartographical framework, the DAW is an assemblage of machines in varying states of relation, mediation, and becoming. However, to describe the DAW as a self-contained system of relations would be insufficient. There are, after all, many machines that interact, and the DAW can and does interact with broader semiotic, sociocultural, aesthetic and political machines.

For Bryant, the onto-cartographer is concerned with creating maps with the aim of understanding the way machines relate and interact in order to "provide us with the means to constructively intervene in worlds so as to produce better ecologies or assemblages [of machines]." (Bryant 2014, 257) To this end, he devises four kinds of maps, each one mapping machines and their relations with respect to different temporal positions. These maps can not only diagnose problems within current machines, but offer a starting point for the devising of pragmatic methods for the deconstruction of "bad" worlds, and the creation—what Bryant calls *terraformation*—of "better" worlds. These maps can provide new ways for composers to intervene in the DAW in the creation of new work, and also provide software designers a means to re-evaluate the possibilities of the DAW.

3.1 Topographical maps

A topographical map provides "a sort of snapshot of worlds or assemblages at a particular point in time." (Bryant 2014, 259) Creating a topographical map involves identifying four things: the machines that constitute an assemblage, their hierarchical relations, their sources of energy, and their material outputs.

Identifying machines of the DAW is not a particularly difficult task. One of the machines most characteristic of the DAW's operation is the "audio track," a container in which an audio file is placed to facilitate the playback of that sound. The audio file, represented by a waveform, can be moved on a horizontal axis by the user for the sound to play at different times relative to the starting point (0:00). The track spans the horizontal length of the screen—theoretically there's no end to the possible temporal expanse of the track. The track is mediated by the "channel," a series of processes and controls—machines—that manipulates the contents of the track as they play. A channel's volume control will lower the amplitude of all audio on the track, and a panorama control will move the audio around the stereo or surround field, in effect changing the amplitude of each individual speaker. A "mute" button can prevent the track's audio from sounding at all. Each of these controls can themselves be controlled with respect to time by another feature of the audio track: automation. A coloured breakpoint function, drawn with the mouse by the user, can enable the volume, or panorama, or any number of other functions, to take on certain values at certain moments throughout the timeline. Many automations can cohabit the same track, in which case several horizontal "lanes" of automation underneath the audio track can represent different parameters.

Channels can also contain plugins that mediate the audio in a number of ways. These may effect the timbre of the audio, as in the case of the equaliser; or adjust the dynamic range of the audio, as in the compressor; or even replay the audio at a predetermined interval, as the delay effect does. The linear hierarchy of plugins on a track is strict, however on plugins such as compressors it can be bypassed by receiving audio from another track using what is known as a sidechain. Finally, all these concurrent tracks and channels are combined in a process often called "mixing," into a single, "master channel."

This may give an idea of the labyrinthine complexity and hierarchical relations that a topographical map of the DAW entails. While the relations described are mostly those *prescribed* by

software designers—themselves derived from the design of the multitrack tape console—that isn't to say that they are the only possible relations. Another example of this complexity comes from Cycling '74's "Live Object Model," a diagram that details the hierarchies of most of Ableton Live's parameters, which enables Max programmers to utilise the LiveAPI framework as part of Max for Live. (Cycling '74 2015)

One onto-cartographical exercise that can be applied to the DAW for a variety of unexpected relations to emerge, has become something of a tradition in OOO-based literature: the list, also described as the litany.

3.1.1 The litany

OOO-based literature deploys the list as a way of bringing disparate entities together into a field of relations. Bogost calls these productive lists "Latour litanies," after Bruno Latour's extensive use of them, (Bogost 2012, 30) and on that basis he developed an applet called the Latour Litanizer, compiling a short list of titles of random Wikipedia pages, encouraging the user to work out how these entities could possibly relate (Bogost 2009).

Continuing in this tradition, a list of machines in the DAW can be proposed, inviting the envisioning of how such machines *could* relate, despite them not being designed to relate specifically and directly. The key is understanding that all machines are pluripotent—we cannot know everything machines *can* do.

DAW Litany: Piano roll, "insert silence", sidechain compression, tap tempo, automation, zoom in, solo track, audio waveform, panorama, freeze track, undo, transient detection, EQ, duplicate, record arm, master track, quantisation, send effect amount, pencil tool, Rewire, CPU usage display, buffer size, software synthesiser, volume fader.

A litany such as this discloses two facets about the DAW, and of complex systems in general. Firstly, the litany's random assembly can reveal unusual relations that could potentially become an impetus for new compositional methods. Finding or creating new relations between, say, the "tap tempo" and panorama controls invites a composer to experiment with how they can relate in practice. Secondly, it reminds us that the DAW consists of machines, and while these machines may be relating to one another in different ways, they remain distinct and specific—machines are never defined simply by their relations to other machines. (Bryant 2014, 181). "Lists remind us that no matter how fluidly a system may operate, its members nevertheless remain utterly isolated, mutual aliens." (Bogost 2012, 40)

3.2 Genetic maps

Genetic maps are another of Bryant's map types, that "chart the genesis or history of how particular worlds came to be." (Bryant 2014, 263) Histories of the DAW do exist, but they often reduce to a chronological listing of new technologies as they are released, incrementally more powerful than their predecessors. (Holmes 1985, 287–88) A genetic map of the DAW would, as Jonathan Sterne compellingly argues, need to take into account "the social and cultural conditions that gave rise to these sound [technologies] and, in turn, how these technologies crystallized and combined larger cultural currents." (Sterne 2003, 2) Such genetic maps of sound technologies are becoming more commonplace, thanks in part to Sterne's advancement of sound studies as a viable avenue of cultural inquiry (see Sterne 2012).

One particular historical example as it applies to the DAW is that of its predecessor, the multitrack tape console. As Duignan notes, the DAW's design takes many cues from the design of the multitrack tape consoles of pre-digital recording studios. (Duignan 2008, 51–74) Tracks are striated and ascribed their own independent parameters and hardware/screen real estate. The linearity of the track is readily apparent in the DAW—even terminologies developed for tape such as "splice" and "snip" are used as metaphors to describe software editing procedures. Metaphors, for personal computer software designers, were thought to enable this efficient, frictionless interaction between the master user and the slave-like tool. (Barr 2003) This emphasis on metaphors is what Bolter and Gromala called an "aesthetic of transparency," where programmers set out to design interfaces that would "serve as a transparent window, presenting the user with a workspace without interference or distortion." (Bolter and Gromala 2006, 375)

As Pold writes, software was, and still is, utopically envisioned to become "a more or less direct coupling on the consciousness allowing the machine the ability to establish a direct connection between mind and machine … [becoming] the perfect butler, partner or surveillance apparatus." (Pold 2011, 96)

Of course, such a transparency never existed, and if we accept Bryant's machine-oriented ontology, then such a "frictionless" interface is literally impossible between operationally closed machines. This design aesthetic heavily informed the DAW, according to Duignan, and any genetic map of the DAW should thus take software aesthetics into account. A composer may use such a genetic map of the DAW and its metaphoric relationship to analogue media in a way that antagonises or problematises these "analogue" tropes inherent in the DAW, thus potentially discovering new relations amongst machines in the DAW.

3.3 Vector maps

A vector map is essentially a futurological analysis, a map that "chart[s] the trajectories along which worlds are unfolding." (Bryant 2014, 265) Like all futurologies, there are varying degrees of fallibility. An example of a widely agreed-upon vector map is that of global warming in the 21st century. Due to anthropomorphic greenhouse gas emissions, if no intervention is enacted, Earth will see average temperatures rise by over 2°C by 2100. The implications of such a temperature rise—the melting of the polar ice caps, the destruction of reefs, rising sea levels, etcetera—provides the necessity to interfere in the present, in order to avoid such an adverse future. The stakes, of course, aren't quite so high in mapping a futurology of the DAW. In fact, such futurologies are rarely expounded in current art discourse. A simple example of a vector map might be to say that as professional "creative" software increasingly becomes more intertwined with internet or cloud functionality, the DAW will follow suit. A subscription-based model to use a DAW, similar to Adobe Creative Cloud's model, might have significant consequences for the mobility of a composer, who cannot open such software in locations that lack internet access.

A more complex vector map can be elucidated by turning to other theories of media.

3.3.1 Post-DAW music, post-DAW interfaces

Maras and Sutton explore the trajectories (or vectors) of media, and the fuzzy transition of media from "emergent" to "established." (Maras and Sutton 2000) According to Maras and Sutton, new media tend to undergo a period in which imitation of established media is done in order to legitimise the new medium as capable of expressiveness in much the same way. This tends to be followed by a period wherein work in this new medium engages in forms and structures unique to its physical characteristics. A common example is photography's relationship with painting—photography as an artistic medium usurped the painting's depictions of the real, before developing uniquely photographic tropes that play with the material reality of photography.

After the emerging media engages in this "medium specificity," the established media may lose fixity. Here, Maras and Sutton describe the movement towards the use of the prefix "post," "indicating a questioning of foundational materiality of the medium." (Maras and Sutton 2000, 105) Thus, painting develops impressionistic or abstract styles in reaction to photography's effortless depiction of "real" visuality. As the authors note, it's important to remember that media are perpetually in flux, and "no medium exists in a final form," (Maras and Sutton 2000, 104) thus mediatic relationships aren't so clear-cut.

In this understanding, it would take new music tools and compositional interfaces to emerge, innovate and re-imagine themselves in order for the DAW to reciprocate. We are starting to see this, with the re-emergence of electronic music being made outside the DAW, as can be seen in analog synthesis, modular synthesis and drum machines in electronic music recording and performance. This can be for a number of reasons—Stuhl writes that digital tools are still widely seen as unsatisfactory emulations of their more "authentic" analog counterparts, (Stuhl 2014) while practitioners such as Richard Devine have said that the DAW encouraged neurotic and un-productive over-editing, that the relative confines of modular synthesis didn't enable. (Future Music 2013)

Perhaps, then, these trends and viewpoints are setting the stage for the emergence of a post-DAW music—a music that derives new outputs from the DAW's virtual proper being. The specifics of what and how such a music will sound are beyond the scope of this paper, but the onto-cartographical framework presented here might be able to explain such material engagements and how they differ from music currently made with the DAW.

3.4 Modal maps

Whereas vector maps describe a world in the future without intervention, modal maps describe *possible other* worlds. Modal maps "map futures that *could* exist if we intervene in ecologies in particular ways." (Bryant 2014, 266)

The vector map works on a linear conception of time—a straight line from past to present, then extrapolating further towards some endpoint where the vector map resides. Modal maps, on the other hand, can be thought of as nonlinear in their possibilities stemming outward from the present. Modal maps operate on the premise that all events are contingent, that everything that has happened *could* have happened differently, unlike the relatively strict causality implied by the vector map.

A modal map can be described as a utopic futurology—a best possible outcome if intervention is enacted. Thus, it tends to be "the domain of activists, militants and generals." (Bryant 2014, 266) Creating such a map of more socially significant machines, such as the state, might seem more easily applicable here, but the question of what a best possible future of the DAW might be isn't an irrelevant question to ask. The DAW isn't an untarnished medium—as Bell points out, the prevalence of DAWs like GarageBand threaten to centralise music pedagogy, in which "software developers [become] the music educators with the greatest reach and influence in the computer-dependent world." (Bell 2015) Magnusson points out that the DAW and its popularity demands alternative interfaces

and possibilities for electronic music, lest the DAW epitomise the "fossilization of music into stylistic boxes." (Magnusson 2010) Magnusson's modal map thus involves a plethora of new user interfaces that negate the linear, repetitive and segregated nature of the DAW and its track system.

Interactions between the DAW and sociality are of greater importance for the modal map than problems with the DAW's user interface (as explored in great detail in Duignan 2008). A modal map of the DAW should be cautious of the DAW's complicit role in these various social circumstances, assuring that inequity is not introduced or exacerbated.

4. CONCLUSION

Bryant has little to say about the role of artistic practice in onto-cartography. He writes that "a great work of art is plastic in the sense that it is *pluripotent*. It is a machine that is capable of resonating in a variety of ways given the historical and cultural milieus that it encounters." (Bryant 2014, 52) This emphasis on the pluripotency of art is appropriate, however the implication that art only becomes "great" through its perserverance through time, through different milieus, is conservative. What if art becomes "great" through its reappropriation of machines?

Bryant's four map framework provides a way to think about the DAW when it is engaged in composition. To what extent can the artwork be the *map*, and its creators its map-makers, rather than just machine operators? Of course, maps are themselves machines that can lead to material manifestations if used in their intended way, that is, the deconstruction and terraformation of machines. (Bryant 2014, 124)

The framework outlined in this paper posits four ways to plot out and understand machines and assemblages of machines, specifically with the intention of instantiating new discourses and compositional techniques, upon a medium that has evaded sustained critical inquiry considering its privileged position as the mediator of most recorded music today.

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