Music for Universities: Composing with MP3 and iPod

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The MP3 and the iPod digital audio player are both technologies that have been assigned to commercial obsolescence. On April 23, 2017, the German research institution Fraunhofer IIS terminated its MP3 patents, indicating that the MP3 no longer carried commercial value for the organization.[1] Just three months later, in July 2017, the iPod was also made commercially redundant as Apple withdrew the last iPod standalone digital music player from the market.[2] This article addresses *Music for Universities*, a bespoke musical instrument and composition assembled from the MP3 audio format and 12 iPods.[3] In assembling the MP3 and iPod into a musical instrument, I sought to interrogate the allure of these obsolescent audio technologies and explore what their reappropriation within an artistic work might reveal about the listening subject positions coded into the MP3 and the drive towards private and individual listening experiences that the iPod enacts.

As an artistic reappropriation of obsolescent technologies, I situate *Music for Universities* as a work of media archaeology: practice-based academic research that seeks to "critique media through making media."[4] Performing a media-archaeological study of the MP3 and iPod is generative in revealing the listening subject positions they afford. As these technologies enter into commercial obsolescence, the "blackboxing" that obscures their operations can develop fissures revealing the narratives of technological development that have informed the design, manufacture, and listening practices of the MP3 and iPod.[5]

A focus on listening and audio technologies provides an important critical perspective in this article. Political scientist Susan Bickford argues that

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listening is "central to the human capacity to make our presence felt in the world," a presence that is a prerequisite for meaningful political action.[6] This focus on the political potential in listening challenges both a dominant visual paradigm and contests the positioning of listening as passive, in contrast to an active politics of speech and voice.[7] The politics of listening is for Bickford always relational and best understood as "an active willingness to construct certain relations of attention."[8] Acknowledging listening's relationality is important in the analysis of this work because it allows one to embrace the significance of audio technologies and other non-human actors in listening. Mediated sound is contingent, occurring in the relationship between human and technology, with listening an experience of this relation and its contingencies. Audio technologies and the sounds they generate are a trace and an expression of this relationality.[9] An excavation of audio technologies is then an important site at which the modern listening subject can be accessed, with Jonathan Sterne noting that "[p]erhaps every sound technology in human history contains within it some model or script for hearing and an imagined ideal auditor."[10]

While acknowledging the critical potential of media archaeology, in reappropriating obsolescent technology there is a risk of reinforcing distinctions between new and old media and the linear narratives of technological development that this dichotomy sustains. Applied as a fixed and stable category, obsolescence can suggest an unreflective nostalgia in media archaeology harking back to a better or more authentic past. In contrast, *Music for Universities* and its interrogation of the MP3 and iPod positions obsolescence as a processual, uneven, and unstable category that is defined in relation to human actors, technological development, and economic imperatives.

As a pun on Brian Eno's *Music for Airports* (1978), *Music for Universities* is ambient music characterized by its sustained tones and minimal harmonic variation. Eno makes explicit this genre's critical engagement with explorative listening practices, describing how "[a]mbient music must be able to accommodate many levels of listening attention without enforcing one in particular."[11] In this article, I consider ambient music's critical engagement with listening, and how this is enhanced in a composition that applies a media-archaeological methodology.

The iPod

The Apple iPod was launched on October 23, 2001, and has been described by media scholar Michael Bull as the "first cultural icon of the twenty-first century."[12] With a novel "click wheel" navigation, sleek design, and aggressive marketing from Apple, the iPod quickly became a fetishized consumer object.[13] Apple's strategy of launching ever smaller and slimmer devices successfully secured the iPod's early market dominance, with Apple's market share rising to 74% in 2007 following the release of the iPod Nano 3rd generation. However, after a peak of 54.8 million sales in 2008, the iPod declined in popularity as a listening technology, superseded by the iPhone and other convergent mobile technologies.[14] From 2014 to 2015, Apple reported a 52% drop in iPod sales, and in 2017 they removed the iPod as a standalone music player from their online store.[15]

The iPod's journey from desirable consumer object to mainstream obsolescence within the span of a decade and a half illustrates well the practices of planned obsolescence and blackboxing, to which media archaeology is a creative response.[16] Planned obsolescence describes an ideology and design practice that seeks to artificially limit both the useful life of a technology and increase the consumer's desire to buy a replacement. The use of electronic parts and components that deteriorated quickly, a sealed casing, and proprietary software and hardware all contributed to blackboxing the iPod and accelerating its obsolescence. The copyright laws and corporate strategy that made the iPod's "shuffle" algorithm inaccessible to users also played a part in the infrastructures that sustained the iPod's black box.

The iPod's randomized "shuffle" provides one solution to the management of large audio libraries and contributes to the private and individual listening experience the iPod affords. For Michael Bull, "iPods are by their very nature primarily a privatising technology."[17] In this respect, the iPod is part of a long tradition of audio technologies that afford private listening in public places, but in comparison to previous individual listening devices such as the Sony Walkman, the iPod's capacity for composing a bespoke personal listening space is significantly enhanced by digital audio formats such as the MP3 that enable the iPod to store many hours of recorded sound.[18] Bull argues that the iPod and its shuffle produced a contradiction that was novel as a private and individual listening experience where "the unpredictability of the randomness of choice is prefaced by the certainty of what is contained in the iPod's memory."[19]

The MP3

The MP3 audio format is a set of rules for the coding and decoding of sound, an algorithm designed to drastically reduce the data required to encode audio, facilitating its efficient storage on personal audio devices such as the iPod.[20] To perform these operations, the MP3 utilizes processes known as perceptual coding, which produce a mathematical model of what humans are likely to hear within a piece of audio. Drawing on work from within psychoacoustics, perceptual coding works on the principle that it is "impossible for our brains to perceive all the data reaching our ears. It is therefore unnecessary...to store and reproduce all of that data."[21] For this reason, parts of the sound which an ideal listener is unlikely to hear can be defined by the algorithm and removed when audio is encoded to MP3. Developed by Fraunhofer IIS, the MP3 is significant as an audio technology because in 1992 it was one of the first compressed audio formats to be confirmed as an international standard by the Motion Picture Expert Group (MPEG). A standard assures interoperability between technologies and generates economic value when the patents that protect it are applied in new technologies. Jonathan Sterne states that the "moment of birth for a new format would have to be the moment it becomes a standard."[22]

Sold initially as a copy-protected software to individual users, the Fraunhofer business model was severely disrupted in 1996 when the MP3 was hacked and made available for free online—the popularity of the MP3 then quickly increased, and 1997 has been pinpointed as the year in which the MP3 became a mass phenomenon online.[23] The ubiquity of the MP3 meant that manufacturers of new audio technologies were compelled to pay Fraunhofer for the use of its MP3 patents so that they could implement their standard. The commercial value of the MP3 then began to decline as more sophisticated data compression formats were standardized and applied within newer technologies. In 2017, Fraunhofer announced it was terminating its key patents for the MP3, and a raft of headlines declared the "Death of the MP3."[24]

The development, standardization, and subsequent commercial obsolescence of the MP3 was driven by two dominant, yet competing, linear narratives of technological development within sound engineering. Firstly, the MP3 was informed by a narrative that demands that technological development must demonstrate ever greater verisimilitude, the idea that a new audio media must be "closer to reality and more immersive and interactive than its predecessor." However, Sterne notes that technological progress within

digital audio media must also accommodate the second, yet countervailing, linear narrative of compression, which demands that new technologies must deliver efficiencies that "economize communication in the service of facilitating greater mobility."[25] The short press announcement released by Fraunhofer when it terminated its MP3 patents clearly acknowledges the significance of both verisimilitude and compression as drivers of planned obsolescence, noting that the MP3 is commercially redundant because it has been superseded by new audio formats that deliver "higher audio quality at much lower bitrates compared to mp3," while also emphasizing their own contribution to developing sonically superior and more desirable compressed audio formats that should replace the MP3 in new technologies.[26]

Like the iPod, the MP3 is also a blackboxed technology designed to be inaccessible to users. The 1996 hacking of the MP3 is relevant to the story of its commercial obsolescence because it made the MP3 available to DIY-practices and unauthorized appropriations already during the height of its consumer-commodity phase.[27] However, the complexity of the MP3 means that its operation remains inaccessible to non-expert users. Media archaeology offers here a repertoire of theory and method that can be used to infiltrate the black box of the MP3 and iPod, generating the opportunity to interrogate the narratives of technological development that inform their shift to mainstream obsolescence.

Media Archaeology as Theory and Method

As a theoretical approach, I place media archaeology as part of a tradition in media theory that embraces relational ontologies.[28] Within this tradition, media archaeology contributes important critical perspectives on temporality, interrogating how relations between technologies and their users alter over time. Media archaeology's emphasis on reappropriation and continued use in obsolescence is captured evocatively in Garnet Hertz and Jussi Parikka's designation "zombie media," emphasizing that obsolete media are not dead but continue to be "resurrected to new uses, contexts and adaptations."[29] Obsolescence is then understood in this article not as a fixed state but instead denoting a potentially slow and uneven decline in a technology's economic value and its potential to generate revenue. Although still in regular use, both the MP3 and iPod remain obsolete as high-functioning zombie media.

Media archaeology is compelling as a method through which to interrogate the obsolescence of the iPod and MP3 because it combines its relational

media theory with a rigorous practice-based approach.[30] *Music for Universities* is a media-archaeological project through which to access—as a composer, listener, and researcher—the sensorial, corporeal, and tacit knowledge of the iPod and MP3.[31] Creating a musical instrument and composition and performing it for others is a way to explore the shifts in listening's "relations of attention" that occur when obsolete technologies are recontextualized in artistic work.[32] It is the potential in practice-based media-archaeological research to address an audience or convene a public that positions *Music for Universities* as an artistic practice.[33] Artistic research methods offer two potential sites of knowledge production: firstly, in the process of creation and making itself, and secondly, in the potential that objects and performances have to generate experiences for a public removed from the initial act of creation.[34]

Hertz and Parikka position media archaeology as a continuity within the modern avant-garde and its reappropriations of consumer objects or "readymades."[35] Jacques Rancière also places the artistic reappropriations of obsolete commodities into longer histories of contemporary art, including collage and dadaist recontextualizations. Rancière argues that obsolescence increases the availability of a consumer object for artistic reappropriation because obsolescence enables an object to move between those categorizations and structures that determine how the world is ordered and disclosed, what is heard and what remains inaudible.[36] For Rancière, "[a]ny commodity or useful object can, by becoming obsolete, and unfit for consumption, become available to art...as an object of disinterested pleasure."[37] Following this argument, obsolescent technology reappropriated as media archaeology carry transformative potential because they can exist simultaneously as both commodity and as objects of disinterested pleasure, manifesting in Rancièrian terms "the presence of two worlds in one," an expression of "dissensus" that for Rancière is the essence of politics and critical art.[38] Media archaeology here facilitates the reappearance of the MP3 and iPod and the manifestation of their listening subject positions during a phase of commercial obsolescence that would otherwise obscure and silence these technologies.

Resisting the Allure of Obsolescence

Although acknowledging the potential in media archaeology to manifest critical art, it is also important to address the potential pitfalls in the reappropriation of obsolescent audio technology. As Parikka cautions, "[m]edia archaeology is always in danger of veering towards excavations of curious

instruments and odd gadgets just for their own sake."[39] This tendency in media archaeology represents the same territorializing impulses detected in specialist music cultures that celebrate the authenticity of older audio formats. As they enter commercial obsolescence, the MP3 and iPod risk being subject to these same nostalgic appropriations.[40] When Pitchfork attempted to predict future trends for 2030, they speculated that "MP3s [would] experience a cult revival among younger fans who long for something 'real.'"[41] Although Pitchfork's predictions are firmly tongue-in-cheek, this satire seems to capture a believable continuum in which not only vinyl records, but also audio cassette tapes, have been reappropriated by music connoisseurs and celebrated for the *authentic* listening experiences they afford.

I apply hauntology in my analysis of *Music for Universities* as a corrective to these nostalgic impulses, working to disturb the simple binary oppositions of new/old media. In his writing on hauntology, Jacques Derrida evokes the figure of the spectre as a metaphor. A spectre is neither dead nor alive, present nor absent—it is a being that is simultaneously of the past and from the future.[42] The spectre's ambiguous temporal location presents hauntology as a useful approach through which to conceptualize the liminal, uneven, and relational nature of obsolete audio media. Mark Fisher finds music's hauntological aesthetic in the sounds of "[audio] technologies breaking down," characterized by the static crackle of scratched vinyl records or the hiss of worn-out analog tape.[43]

These "sonic by-products of imperfect technology" are reappropriated into new music using digital audio technologies not to evoke a melancholic longing for a particular idealized time-period.[44] Instead, in Freudian terms, these sounds of older media constitute a progressive mourning, a longing for the possibilities of "lost futures" that find promise in the potential of technological development and its communicative possibilities.[45] Sound and audio media provide a fertile ground for cultivating a hauntological aesthetic because listening is itself relational and contingent, existing—like the figure of the spectre—in the "between-of-things."[46] Hauntology is applied in this work as part of a "sonic methodology," activating media archaeology as a site at which to manifest the listening subject positions of the iPod, the MP3, and their traces.[47]

Music for Universities

Music for Universities is a piece of generative music, a composition that is produced using a machine or system in which degrees of randomization are defined by the composer. This partial removal of authorial control enables the system to play unique variations of the composition every time it is performed.[48] The randomization engine within this generative composition is the iPod's own shuffle algorithm. Surrendering control to the iPod's own choices draws our attention to the particular compositional logic of the iPod, its playlist curation, and its processes of algorithmic selection. The oldest iPod used in this instrument is a white iPod Classic 4th generation launched in 2004; the newest iPod is a black iPod touch 4th generation launched in 2010. The other iPods used represent the diversity of the different iPod models launched between these dates, including the iPod Mini 1st generation, iPod Classic 5th generation, iPod Nano 3rd generation, and iPod Touch 1st and 3rd generations.[49] When assembled for a performance, this selection of iPods demonstrates in a vivid way the processes of upgrade and miniaturization that is characteristic of the iPod's planned obsolescence.

As a composer, the process of procuring, installing, and maintaining the iPods needed to create this work provided access to a tacit and corporeal knowledge of the technology, reactivating memories of my own iPod listening experiences.[50] The frustrations of trying to sustain these aging iPods sufficiently to produce music provided embodied experience of the black-boxing and the obstacles to replacing faulty parts. For example, the diminishing capacity of the iPod's battery and their inability to hold charge made two Nano 4th generation iPods bought for this work impossible to use, and they had to be discarded. The audio output from the 12 iPods used in this instrument is routed through their 3.5mm headphone jacks to a 16-channel audio mixer that enables the sound to be mixed down to a stereo output, which can be amplified in performance or recorded (see Fig. 1 and 2).[51]

Music for Universities takes a single fifteen-second vocal sample, a sung note at A#3, as its audio source material. This sung note is then re-sampled and shifted in pitch to create each of the seven notes within the A# major scale.[52] These different notes are then encoded as MP3 multiple times and loaded onto the 12 different iPods to be played back in shuffle mode. The MP3 data-reduction algorithm is another important obsolete technology that is reappropriated within *Music for Universities*. Since the MP3 is a digital compression format engineered to reduce the amount of data needed to

Fig. 1 and 2. The Music for Universities *iPod/MP3 instrument.*

encode audio, every time audio is encoded as MP3, more data is removed, altering the audio's sonic qualities. Before the voice samples are loaded onto the iPods, they are repeatedly copied and re-encoded as MP3 by using the iTunes convert-to-MP3 function. Some of the voice samples in the *Music for Universities* composition are encoded as MP3 as many as 768 times, producing audible distortions, uneven frequency variation, and digital aliasing.[53] During the copying process, one hears the gradual erosion of the voice sample, the removal of frequencies in an uneven and unpredictable way dictated by the algorithm that gives the voice samples a thin "watery" sound distinctive of heavily-compressed digital audio. In the samples speeded up and pitched to higher notes, one hears irregular clicks and pops, and subtle occurrences of white noise. In samples slowed down to lower pitches, one hears a hollowing-out and wobble reminiscent of the "wow and flutter" in analog reel-to-reel tape machines.

For the performance of *Music for Universities*, each iPod is set to shuffle mode, with the shuffle algorithm "randomly" choosing which track to play from the selection of different tones stored on the iPods. The low notes in this composition are slowed-down versions of the original sample, so their duration is longer, while the high notes are speeded up and play for a shorter duration. As each of the 12 iPods independently selects notes of different pitch and duration, the random combinations intertwine and overlap, generating complexity, giving the composition the gentle ebb and flow characteristic of ambient music. The limited number of notes selected for this composition exist in both consonant and dissonant relation to one another. The iPod's shuffle algorithm does not select notes in terms of conventional notions of harmony but instead performs combinations of notes that the composer and audience cannot predict—combinations that resemble at times the harmonies of a traditional choral work, and at others the discordant drones more familiar in electronic or noise compositions. The generative and indeterminate nature of the composition ensures that the composition will be different every time it is performed. A recording of the *Music for Universities* composition is available at http://www.artifactapparatus.com/journal/2021/1/Boothby/ and I hope that readers of this article will complement their reading by listening to this particular performance of this media-archaeological work.

The generative and system-based composition techniques applied in *Music for Universities* position it as part of a tradition of experimental music which "emphasizes an unprecedented fluidity of composer/performer/listener ro-

les" by placing the composer themselves as a primary auditor, experiencing new music as it is generated by the randomizing system.[54] This sensorial and corporeal engagement with the work by the composer is one important site at which the listening subject positions of the MP3 and iPod are interrogated. Performed in public, *Music for Universities* exists also as part of a tradition in ambient and experimental music that offers explorative and critical listening experiences for an audience, a tradition exemplified by composers such as Pauline Oliveros and Hildegard Westerkamp, whose work demands critical or deep listening, and in which the listening experience of the composer, performers, and audience are integral to the work and its meanings.[55]

The iPod Shuffle and its Listening Publics

Utilizing 12 iPods that are orchestrated to "shuffle" independently of each other and compose in concert produces a chorus of voice samples intended to amplify the sensorial experience of the iPod's shuffle algorithm. Patrick Valiquet recognizes "chourising," running multiple examples of a technology in parallel to emphasise its operations, as a recurring tactic in artistic media archaeologies to accentuate what he terms "the grain of the obsolescent."[56] Chorusing is also evident in Darsha Hewitt's *Electrostatic Bell Choir* (2012), which assembles an orchestra of salvaged television sets and telephone bells, and *Feedback Babies* (2014), created from a collection of reappropriated 1983 Fisher-Price nursery monitors.[57]

The iPod's shuffle algorithm is obscured within the iPod's black box. One cannot access the code for the shuffle algorithm or know how it is updated and revised as subsequent generations of the iPod are launched, but in *Music for Universities*, as the iPod's shuffle algorithm "randomly" selects which note to play next in the generative composition, one experiences the workings of the iPod at a sensorial and corporeal level. The "shuffle" is part of an individual and private listening experience that Bull describes as characteristic of an iPod culture that emphasizes the "micro-management of mood, sound and time."[58] Sarah Florini associates this iPod culture and its personal and private listening with what she terms "neoliberal individualism," arguing that neoliberal discourses have been important in shaping the fundamental organizing logic of mobile digital media and its associated listening cultures.[59] The privatization also works to position listening as passive and non-political, as Susan Bickford argues that if "listening is to be understood as political rather than a private phenomenon, then it must somehow *appear*

in the world."[60] The performance of *Music for Universities* and the "listening publics" it convenes is an intervention designed to disrupt the private and individual listening for which the iPod was designed, manifesting a listening experience that is instead public and communal.[61]

Anahid Kassabian's notion of "ubiquitous listening" provides a useful perspective from which to consider the practices of critical listening that are afforded by *Music for Universities*. Ubiquitous listening is tactile and experienced through different parts of the body, depending on a sound's frequency and our physical sensitivity to those frequencies, and it acknowledges the affective potential of listening as pre-conscious and non-linguistic. For Kassabian, ubiquitous listening is a listening

> without the primary *attention* assumed by most scholarship to date [but in which] *listening*, and more generally input of the *senses*, however, still produces *affective* responses, bodily events that ultimately lead in part to what we call emotion.[62]

Music for Universities affords spaces for critical listening for the composer during its creation and for a public during its performance. The performances and listening publics convened have most often positioned the work as a pedagogic or heuristic device, with *Music for Universities* having been performed in classrooms, lecture halls, and at academic conferences.[63] Used in teaching, *Music for Universities* illustrates the complexities of perceptual coding and prompts critical engagement with the histories of audio technologies and their listening practices. The ambient music of *Music for Universities* is well-suited to the modern reverberant spaces of the university buildings for which it was created and within which it has mostly been performed. This intersection of sound art and pedagogy is also evident in Hewitt's media-archaeological work *A Sideman 5000 Adventure* (2015), a series of videos in which Hewitt dismantles, describes, and instructs viewers on the use of an early and now-obsolete drum machine. For Valiquet, this is a media-archaeological approach that works to "denaturalize the educational exchange, mounting it in a hyperaesthetic frame."[64] Like Hewitt's work, *Music for Universities* has also been disseminated online, framed within a pedagogical context, most notably as part of the Medea Vox podcast series, in which the work was performed and analyzed by myself as composer in conversation with a fellow lecturer and researcher.[65]

The MP3 and its Auditory Aesthetic

The excessive copying and encoding of the voice sample as MP3 in *Music for Universities* is a tactic used to break open the black box of the MP3. This composition technique references Alvin Lucier's *I Am Sitting in a Room* (1969), in which the composer repeatedly copies a recording of his own voice between two tape recorders until his words become indecipherable, eroded to an indistinct undulating drone.[66] Lucier's work here articulates the sonic qualities of the tape recorders themselves and the resonant frequencies of the room in which the performance takes place. The excessive copying of the voice sample as MP3 for *Music for Universities* interrogates in a similar way the materialities of the MP3 as recording technology and explores the listening experiences it affords. In professional sound recording contexts, the audible distortions produced by the MP3's perceptual coding would be considered highly undesirable, but in *Music for Universities*, the distortions produced through excessive copying to MP3 are an important part of its aesthetic, illustrating a narrative of technological development in which new audio media must demonstrate both verisimilitude and compression, and how these two trajectories are held in tension by the MP3.

The MP3's auditory aesthetic became established in the listening tests through which the format had to pass to become a standard. Sterne argues that these listening tests aimed to capture a universal model of listening, one in which aesthetic considerations were supposed to be neutralized through the application of rigorous scientific method, but that in fact the MP3's listening tests

> show the degree to which a professionally defined aesthetic of "good sound" shaped the format as much as more scientific or technical determinations [and that] through MPEG's listening tests, expert listeners came to represent, in code, an anticipated future listening public.[67]

In its reappropriation of the iPod and the MP3, *Music for Universities* works to perform these expert inscriptions of ideal auditor and interrogate the narratives of technological development that inform them.

Hauntology

The distortions and digital aliasing of the MP3 are foregrounded in the *Music for Universities* composition intentionally to mark the work as hauntological. These are sounds that materialize the data that is removed by the MP3's perceptual coding and are sonically reminiscent of the vinyl surface noise and

analog tape hiss that we hear in the hauntological music of Burial and The Caretaker.[68] These are sounds that accentuate recorded music's evocation of a "time out of joint," a recurring theme in Derrida's writing on hauntology, sounds of sonic (re)presentation that for Fisher "won't allow us to fall into the illusion of presence"—an illusion of presence that the drive for verisimilitude in new audio technology demands.[69] In other words, in *Music for Universities* we are haunted by the continuing demand for verisimilitude in auditory communication.

William Basinski's *The Disintegration Loops* (2002) is a useful musical reference point when analyzing *Music for Universities* as hauntology.[70] Like *Music for Universities*, Basinki's piece is a minimal ambient composition that achieves timbral variation through the gradual erosion of an audio recording.[71] Hauntology is generative in an analysis of both *The Disintegration Loops* and *Music for Universities* because it theorizes erasure, the effect of what is not there.[72] Fisher conceptualizes this absence in hauntology as "the agency of the virtual with the spectre understood...as that which acts without (physically) existing."[73] In *Music for Universities*, absence, the spectre's virtual agency, is the data that has been removed by the MP3's perceptual coding and the sounds produced by the MP3's processing. One is then also haunted by the continual demand for increased efficiency in audio compression formats, the tension between verisimilitude and compression accommodated for in the MP3 manifesting hauntology's technological uncanny.

The iPod instrument and the generative composition that it produces are also hauntological in that they work to eventualize the "technologically uncanny" or haunted nature of automated and algorithmic composition through the iPod's shuffle function. Yair Rubinstein makes a compelling case for the hauntological nature of algorithmic composition, addressing specifically Sony Music's artificial intelligence-generated music that sought to create new songs that mimicked an existing artist's back catalog. Rubinstein describes how programmers analyzed music from the Sony archives to create a predictive algorithm that might translate human musical expression into a computational object. Rubinstien argues that algorithmic music is hauntological because it is "uncanny not only for what it represents, but for how it works at the level of its technical form." For Rubinstein, the hauntological nature of algorithmic music derives in part from the dispersed and indistinct location of its authorship, a crisis of authorial intention that is specifically

present in *Music for Universities* and the compositional choices that are deferred to the iPod's shuffle algorithm.[74]

The composition of *Music for Universities* as a hauntological work is a tactic to engage the processual, liminal, and relational nature of obsolescence and the potential to articulate this in an auditory media archaeology. The indeterminate and relational nature of the spectre and its evocation of broken time is central in elaborating the critical value of hauntology in its application to media archaeology. As Martin Hägglund states, "what is important about the figure of the specter, then, is that it cannot be fully present: it has no being in itself but marks a relation to what is *no longer* or *not yet*."[75] A nostalgia that risks fixing the iPod and MP3 as part of cherished but redundant listening practices articulates what Hägglund terms the "no longer" of hauntology.

The re-use and reappropriation of these technologies as an artwork—manifesting the MP3 and the iPod's perceptual coding and algorithmic composition as part of a continuing narrative of technological development—is effective in hauntological terms as an attractor, "an anticipation shaping current behaviour."[76] We hear, for example, the influence of the iPod's logic of algorithmic selection and private listening in contemporary music streaming technologies and mobile phones, and the tensions between verisimilitude and compression in the compressed audio formats of video conferencing software.[77] Accommodating but holding in tension the "no longer" and "not yet" is what permits a hauntological reading of *Music for Universities* and positions it as a critical response to dominant narratives of technological development.

Conclusion

The creation of *Music for Universities* and its analysis in this article charts a relational trajectory within media archaeology. Its aim is to dispute obsolescence as a fixed and stable category and emphasize instead the procedural and relational nature of technologies that continue to shift through uneven phases of obsolescence. If accepted as a fixed and stable category, obsolescence risks perpetuating binary distinctions between old and new media, and the practices of blackboxing and planned obsolescence that sustain dominant narratives of technological development.

Media archaeology is applied to *Music for Universities* as both theory and practice. The creation of a musical instrument and generative composition is a reappropriation of the iPod and the MP3 that positions them simultaneously as commodities and artifacts of disinterested pleasure, constituting

an expression of dissensus that for Rancière occurs within critical art.[78] The commercially redundant MP3 and iPod would conventionally be silenced by obsolescence, but *Music for Universities* makes them audible, resurrecting them in new configurations. Hauntology provides an important complement to Rancière's theory of critical art, with both addressing erasure and its effects, and Rancière himself stating that hauntology "deals with the same problem that [he] confront[s]: how are we to think the 'existence of the inexistent.'"[79] The shift in relations with human subjects and other technologies, and the erasure that occurs in obsolescence, is made present by a media archaeology that works to sound the materialities and affordances of the MP3 and iPod, generating a listening space within which to make apparent the listening subject positions inscribed in this technology. Hauntology as cultural criticism then provides a useful vocabulary to articulate the manifestation of a Rancièrian critical art and the significance of a relationship between auditory aesthetics and listening practices within media archaeology.

With its emphasis on sound and listening, *Music for Universities* contributes to the field of media archaeology through its application of what Salomé Voeglin terms a "sonic methodology," an understanding that engagement through sound addresses a sonic episteme and builds sonic knowledge that is qualitatively different from research methods that privilege visual data and written texts.[80] The sonic knowledge of sound and listening exists in relation, in the in-between of human and technology. *Music for Universities* builds sonic knowledge in the sensorial and tacit knowledge produced for the composer in the creation of the work and within the listening publics that convene in the performance. In applying a sonic methodology, *Music for Universities* contributes as practice-based research that emphasizes the pedagogic and heuristic potential of media archaeology. This composition and instrument are a music for universities devised to build knowledge through theory, practice, and pedagogy.

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ENDNOTES

[1] "mp3," Fraunhofer Institute for Integrated Circuits IIS, accessed May 20, 2021, *https://www.iis.fraunhofer.de/en/ff/amm/consumer-electronics/mp3.html*.

[2] David Pierce, "Goodbye iPod, and Thanks for All the Tunes," *Wired*, July 27, 2017, *https://www.wired.com/story/goodbye-ipod-and-thanks-for-all-the-tunes/*.

[3] Hugo Boothby, "Transversal Media Practice as a Tool for Radio Research," paper presented at the Media, Communication and Cultural Studies Association (MeCCSA) conference at University of Stirling, UK, 2019; Hugo Boothby, "Music for Universities," paper presented at the Algorithmic Music: Value, Creativity and Artificial Intelligence symposium at King's College, London, UK, 2019.

[4] Jussi Parikka, *What is Media Archaeology?* (Cambridge: Polity, 2012), 137; Andreas Fickers and Annie van den Oever, "Doing Experimental Media Archaeology: Epistemological and Methodological Reflections on Experiments with Historical Objects of Media Technologies," in *New Media Archaeologies*, eds. Ben Roberts and Mark Goodall (Amsterdam: Amsterdam University Press, 2018): 45–68.

[5] Garnet Hertz and Jussi Parikka, "Zombie Media: Circuit Bending Media Archaeology into an Art Method," *Leonardo* 45, no. 5 (2012): 424–30, 428.

[6] Susan Bickford, *The Dissonance of Democracy: Listening, Conflict, and Citizenship* (New York: Cornell University Press, 1996), 20, 147. Bickford takes her definition of political action and the significance of appearance from Hannah Arendt. Although Bickford acknowledges that Arendt "never explicitly analyses listening as a political practice" she argues persuasively that listening as a "relation of attention" should be considered as "constitutive of political action for Arendt."

[7] Salomé Voegelin, *Listening to Noise and Silence: Towards a Philosophy of Sound Art* (London: The Continuum International Publishing Group, 2010), xi; Kate Lacey, *Listening Publics: The Politics and Experience of Listening in the Media Age* (Cambridge: Polity, 2013), 4.

[8] Bickford, *The Dissonance of Democracy*, 24.

[9] Salomé Voegelin, *The Political Possibility of Sound: Fragments of Listening* (London: Bloomsbury, 2019), 47.

[10] Jonathan Sterne, *MP3: The Meaning of a Format* (Durham, NC: Duke University Press, 2012), 2.

[11] Brian Eno, *A Year with Swollen Appendices: Brian Eno's Diary* (London: Faber and Faber, 1996), 296; Brian Eno, *Music for Airports* (Ambient Records, 1978). *Music for Airports* was the first release in Brian Eno's influential series of ambient recordings that applied tape loops in generative compositional techniques. In the sleeve notes to *Music for Airports*, Eno describes that the function of ambient music was to create an environment of ambience and that "it must be as ignorable as it is interesting."

[12] Eamonn Forde, "20 Years of the iPod: How it Shuffled Music and Tech into a New Era," *The Guardian*, October 23, 2021, *https://www.theguardian.com/music/2021/oct/23/20-years-of-the-ipod-how-music-and-tech-new-era-steve-jobs*; Michael Bull, *Sound Moves: iPod Culture and Urban Experience* (London: Routledge, 2007).

[13] Steven Levy, "The Perfect Thing," *Wired*, November 1, 2006, *https://www.wired.com/2006/11/ipod/*; Simon Reynolds, *Retromania: Pop Culture's Addiction to its Own Past* (London: Faber and Faber, 2011).

[14] Henry Jenkins, *Convergence Culture: Where Old and New Media Collide* (New York: New York University Press, 2006).

[15] Forde, "20 years of the iPod."

[16] Hertz and Parikka, "Zombie Media."

[17] Bull, *Sound Moves*, 5.

[18] Paul du Gay, Stuart Hall, Linda James, Hugh Mackay, and Keith Negus, *Doing Cultural Studies: The Story of the Sony Walkman* (London: Sage, Open University, 1997); Lacey, *Listening Publics*.

[19] Bull, *Sound Moves*, 137.

[20] Encoding CD quality audio (16 bit, 44.1 kHz) to MP3 (124 kbps) was designed to result in data reduction of 90%, producing an MP3 file about an 11th of the size of the CD quality audio. The MP3 seeks to remove this data without a perceptible difference in the listening experience.

[21] Ian Corbett, "What Data Compression Does to Your Music," *Sound on Sound*, April 2012, *https://www.soundonsound.com/techniques/what-data-compression-does-your-music*; psychoacoustics is the science of how we perceive sound. See Gareth Loy, *Musicmathics: The Mathematical Foundations of Music, Volume 1* (London: MIT Press, 2006), 154.

[22] Sterne, *MP3*, 22. Although the MP3 was "born" as an international standard in 1992, the file extension .mp3 was not agreed upon until three years later in 1995. See "The MP3 History," Fraunhofer Institute for Integrated Circuits IIS, accessed October 9, 2019, *https://www.mp3-history.com/*.

[23] Sterne, *MP3*, 27, 205. 1997 is also the year that Michael Robertson starts mp3.com as a website for information about MP3 technology, encoders, and players. See also Fraunhofer, "The MP3 History."

[24] Andrew Rafter, "The MP3 is Officially Dead, Declares Its Creators," *DJ Magazine*, May 16, 2017, *https://djmag.com/news/mp3-officially-dead-declares-its-creators*; Andrew Flanagan, "The MP3 Is Officially Dead, According To Its Creators," *NPR*, May 11, 2017, *https://www.npr.org/sections/therecord/2017/05/11/527829909/the-mp3-is-officially-dead-according-to-its-creators?t=1637073224686*.

[25] Sterne, *MP3*, 4–5.

[26] Fraunhofer, "mp3."

[27] Sterne, *MP3*, 26.

[28] This tradition of media theory encompasses medium theory, format theory, and theories of media ecology. These are media theories that acknowledge that the meanings and affordances of technologies shift as they come into relation with human subjects and other technologies. See Marshall McLuhan and Eric McLuhan, *Law of Media: The New Science* (Ontario: University of Toronto Press, 1988); Marshall McLuhan, *Understanding Media: The Extensions of Man* (Abingdon: Routledge, 2007 [1964]); Matthew Fuller, *Media Ecologies: Materialist Energies in Art and Technoculture* (London: MIT Press, 2005); Sterne, *MP3*.

[29] Hertz and Parikka, "Zombie Media," 429.

[30] Kristoffer Gansing, "Transversal Media Practices: Media Archaeology, Art and Technological Development" (PhD diss., Malmö University, 2013).

[31] Fickers and van den Oever, "Doing Experimental Media Archaeology," 45.

[32] Bickford, *The Dissonance of Democracy*, 24.

[33] Kristina Lindström and Åsa Ståhl, "Patchworking Publics-in-the-making: Design, Media and Public Engagement" (PhD diss., Malmö University, 2014), 154; Patrick Valiquet, "'100% Expert!' Mastery and Equality in Darsha Hewitt's *Sideman 5000 Adventure*," in *The New Age of Electronic Dance Music and Club Culture*, eds. Anita Jóri and Martin Lücke (Cham: Springer, 2020): 89–99; *Parikka, What is Media Archaeology?*

[34] Henk Borgdorff, Peter Peters, and Trevor Pinch, "Dialogues between Artistic Research and Science and Technology Studies: An Introduction," in *Dialogues between Artistic Research and Science and Technology Studies*, eds. Henk Borgdorff, Peter Peters, and Trevor Pinch (Oxon: Routledge, 2020): 1–12.

[35] Hertz and Parikka, "Zombie Media," 426.

[36] Jacques Rancière, Davide Panagia, and Rachel Bowlby, "Ten Theses on Politics," *Theory & Event* 5, no. 3 (2001).

[37] Jacques Rancière, "Problems and Transformations in Critical Art," in *Participation*, ed. Claire Bishop (London: Whitechapel, 2004): 83–93, 86.

[38] Jacques Rancière, *The Politics of Aesthetics: The Distribution of the Sensible*, trans. Gabriel Rockhill (London: Bloomsbury, 2013 [2004]); Rancière, Panagia, and Bowlby, "Ten Theses on Politics."

[39] Parikka, *What is Media Archaeology?*, 144.

[40] Julia Banim, "Wired 'Retro' Headphones Are Now A Trend Widening The Gap Between Millennials And Gen Z," *UNILAD*, November 14, 2021, *https://www.unilad.co.uk/viral/wired-retro-headphones-are-now-a-trend-widening-the-gap-between-millennials-and-gen-z/*.

[41] "22 Musical Predictions for the 2020s," *Pitchfork*, January 17, 2020, *https://pitchfork.com/thepitch/22-musical-predictions-for-the-2020s/*.

[42] Jacques Derrida, *Specters of Marx: The State of Debt, the Work of Mourning and the New International* (London: Routledge, 2006 [1994]), 12.

[43] Mark Fisher, *Ghosts of My Life: Writings on Depression, Hauntology and Lost Futures* (Winchester: Zero Books, 2014), 21.

[44] Adam Harper, *Infinite Music: Imagining the Next Millennium of Human Music-making* (Alresford: Zero Books, John Hunt Publishing, 2011), 148; Paul Gilroy, *After Empire: Melancholia or Convivial Culture?* (Oxon: Routledge, 2004).

[45] British music critics Simon Reynolds and Mark Fisher proposed hauntology as a term to describe a confluence of musicians and music producers that used digital sampling technology to recombine old vinyl recordings and analog tape archives to create ghostly or spectral soundscapes. These were musicians and producers on the Ghost Box record label including The Focus Group, Belbury Poly, and the Advisory Circle. Subsequently, hauntology has been applied to a broad variety of music in diverse genres including the dubstep artist Burial, electronic musicians Boards of Canada, and William Basinski, the song writer Ariel Pink, and sound artist Philip Jeck. Fisher, *Ghosts of My Life*, 21, 26; Simon Reynolds, "Haunted Audio," *The Wire*, November 2006: 26–33.

[46] Voegelin, *The Political Possibility of Sound*, 47.

[47] Salomé Voegelin, "Sonic Methodologies of Sound," in *The Bloomsbury Handbook of Sonic Methodologies*, eds. Michael Bull and Marcel Cobussen (New York: Bloomsbury Academic, 2020): 269–80.

[48] Eno, *A Year with Swollen Appendices*, 330.

[49] The full list of iPod models used in the instrument includes one iPod Classic 4th Gen., released July 2004; two iPod Mini, Pink and Blue, released January 2004; two iPod Classic 5th Gen., White and Black, released September 2006; four iPod Nano 3rd Gen., Silver and Grey, released September 2007; one iPod Touch 1st Gen., released September 2007; one iPod Touch 3rd Gen., Black, released September 2009; and one iPod Touch 4th Gen., Black, released September 2010.

[50] Fickers and van den Oever, "Doing Experimental Media Archaeology," 46.

[51] The convenient and standardized routing afforded by the 3.5mm headphone output was later removed from many of Apple's portable media devices, substantially reducing their interoperability.

[52] The seven notes of the A# major scale are A#, C, D, D#, F, G, and A. These are notes that exist in both consonant and dissonant relation to one another.

[53] Aliasing here refers to the additional audio artifacts or distortions that occur when audio is reconstructed from digital samples that cannot accommodate the full frequency range of the original audio source.

[54] Michael Nyman, "Towards (a Definition of) Experimental Music," in *Audio Culture: Readings in Modern Music*, eds. Christopher Cox and Daniel Warner (London: Bloomsbury, 2019 [1999]): 315–24.

[55] Pauline Oliveros, *Deep Listening: A Composer's Sound Practice* (Lincoln: iUniverse, 2005); Hildegard Westerkamp, "Linking Soundscape Composition and Acoustic Ecology," *Organised Sound* 7, no. 1 (2002): 51–56.

[56] Valiquet, "'100% Expert!,'" 92.

[57] "Electrostatic Bell Choir," Darsha Hewitt, accessed December 2, 2021, *https://darsha.org/artwork/electrostatic-bell-choir/*; "Feedback Babies," Darsha Hewitt, accessed December 2, 2021, *https://darsha.org/artwork/feedback-babies/*.

[58] Bull, *Sound Moves*, 148.

[59] Sarah Florini argues that "[n]eoliberalism imbricated individualism with market logics, redefining individual freedom as synonymous with the freedom to compete in the market." See Sarah Florini, *Beyond Hashtags: Racial Politics and Black Digital Networks* (New York: New York University Press, 2019), 8, 12–13, 77.

[60] Bickford, *The Dissonance of Democracy*, 153; Lacey, *Listening Publics*.

[61] Kate Lacey applies the term "listening public" to emphasize the political agency of listening as a "critical activity of individuals producing and participating in political and public culture." See Kate Lacey, "Listening in the Digital Age," in *Radio's New Wave: Global Sound in the Digital Era*, eds. Jason Loviglio and Michele Hilmes (Oxon: Routledge, 2013): 9–23, 13.

[62] Anahid Kassabian, "Ubiquitous Listening," in *Audio Culture: Readings in Modern Music*, eds. Christopher Cox and Daniel Warner (London: Bloomsbury, 2019 [1999]): 135–47, 135.

[63] Fickers and van den Oever, "Doing Experimental Media Archaeology," 55; Valiquet, "'100% Expert!'"; Parikka, *What is Media Archaeology?*, 157.

[64] Valiquet, "'100% Expert!,'" 8.

[65] "The iPod Orchestra: Music for Universities," *Medea Vox*, June 2018, *http://medea.mah.se/2018/06/vox-music-for-universities/*.

[66] Brandon LaBelle, *Background Noise: Perspectives on Sound Art* (New York: Bloomsbury Academic, 2015), 123.

[67] Sterne, *MP3*, 25–26.

[68] Burial, *Burial* (Hyperdub, 2006); The Caretaker, *Selected Memories from the Haunted Ballroom* (V/Vm Test, 1999).

[69] Derrida, *Specters of Marx*; Fisher, *Ghosts of My Life*, 21.

[70] William Basinski, *The Disintergration Loops* (2062, 2002/2003). Mark Fisher, Adam Harper and Jakko Kemper all place *The Disintegration Loops* as an important part of a contemporary hauntological canon. See Fisher, *Ghosts of My Life*; Harper, *Infinite Music*; Jakko Kemper, "(De)compositions: Time and Technology in William Basinski's *The Disintegration Loops* (2002)," *Intermédialités: histoire et théorie des arts, des lettres et des techniques/Intermediality: History and Theory of the Arts, Literature and Technologies* 33 (2019).

[71] Basinski describes how *The Disintegration Loops* were created as he transferred old tape loops from analog reel-to-reel to a digital format. As the magnetic tape passed the play head, its ferrite fell away with the tape deteriorating more each time the tape loop played. The tape and sound slowly degrade until all that is heard is a gentle drone with intermittent interference. In *Music for Universities*, however, it is the gradual degradation of sound coded excessively as MP3 that produces a digital erosion, rather than disintegrating analog audio tape. See Lars Gotrich, "Divinity From Dust: The Healing Power of 'The Disintegration Loops,'" *NPR*, November 15, 2012, *https://www.npr.org/sections/therecord/2012/11/12/164978574/divinity-from-dust-the-healing-power-of-the-disintegration-loops*.

[72] Jacques Rancière, "The Thinking of Dissensus: Politics and Aesthetics," in *Reading Rancière: Critical Dissensus*, eds. Paul Bowman and Richard Stamp (London: Continuum, 2011): 1–17.

[73] Fisher, *Ghosts of My Life*, 18.

[74] Yair Rubinstein, "Uneasy Listening: Towards a Hauntology of AI-Generated Music," *Resonance: The Journal of Sound and Culture* 1, no. 1 (2020): 77–93, 80, 82, 85.

[75] Martin Hägglund, *Radical Atheism: Derrida and the Time of Life* (Stanford: Stanford University Press, 2008), 82.

[76] Fisher, *Ghosts of My Life*, 19.

[77] Maria Eriksson, Rasmus Fleischer, Anna Johansson, Pelle Snickars, and Patrick Vonderau, *Spotify Teardown: Inside the Black Box of Streaming Music* (London: MIT Press, 2019); Salomé Voegelin, "The Grain of Online Voices," *Norient*, April 28, 2021, *https://norient.com/salome-voegelin/grain-online-voices*.

[78] Rancière, "Problems and Transformations in Critical Art."

[79] Rancière, "The Thinking of Dissensus," 12.

[80] Voegelin, "Sonic Methodologies of Sound"; "Technologies of Listening: Roundtable," audio recording of roundtable organized by the Auralities Research Network at the Centre for Research in the Arts, Social Sciences and Humanities (CRASSH) at Cambridge University, UK on October 16, 2019, accessed December 9, 2021, *http://www.crassh.cam.ac.uk/gallery/audio/technologies-of-listening-roundtable*.