Telematic Music vs. Networked Music: Distinguishing Between Cybernetic Aspirations and Technological Music-Making

Eric C. Lemmon
Stony Brook University, eric.c.lemmon@stonybrook.edu

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Telematic Music vs. Networked Music:
Distinguishing Between Cybernetic Aspirations
and Technological Music-Making

ERIC LEMMON

Since the establishment of the Advanced Research Projects Agency Network (ARPANET) in the late 1960s, its subsequent development and expansion through the 1980s, and its final transformation into what we now know as the Internet in the 1990s, digital networking technologies have had a profound impact on culture and the means of artistic production. When these new networking technologies, including consumer telecommunications systems like cellular devices, were combined with the rapidly advancing computational power of informatic systems, many artists and thinkers—whether cyber-skeptic or -optimistic—began to see the Internet and associated computational systems as integral to their praxis. The notion of the networked computer’s cultural importance is partially attributable to its central position as an every-day tool of communication, work, and social organization, and this centrality has been further propelled by the reality of our increasingly connected world. Qualities, such as the ease and speed with which information and communications could be transmitted—and therefore work disseminated and/or produced without the baggage of old institutions—or the glints of utopia or dystopia that could be seen in the freshly technologically networked world, were unsurprisingly put into the service of various artistic mediums. Time-based art forms, like music, were no exception.

Today, there are two prominent forms of musical creation that are concretely linked to, and primarily produced through, the power of the telecommunications systems, which now connect just under 60% of humanity. The terms “networked music” and “telematic music” have become

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1 Department of Music, Stony Brook University, eric.c.lemmon@stonybrook.edu
buzzwords within the field of music, and are especially central to practitioners and developers that focus on the overlap between musical and technological research and development. These terms are often discussed side-by-side, partially due to the significant overlap in their respective practitioners and modes of production—and therefore histories—and partially due to the nascent state of both the telematic and networked music fields, which especially impacts the amount of research literature available. Since accountings of networked and telematic musical works are relatively sparse, there is a certain terminological fluidity at present, and the two terms are still evolving with passing artistic or research contributions. Yet, because the two terms are deployed regularly, and key differences in the values and ideals that they mobilize have developed, networked and telematic music deserve to be formally parsed through a theoretical and discursive examination. As I will show, by reviewing the histories of both terms alongside some of the current conversations on telematic and networked music, the discourses surrounding each term tend to signify slightly different things: telematic music will be designated as a musical practice that is more overt in its political and social goals, while networked music is conceived more broadly and focuses on the mobilization of a certain kind of technology for music making. To be clear, this is not to argue that there are no politics or social aspects related to networked musics’ mode of production and discourse. Yet, because these two terms are so fluid and interconnected, they often end up being used interchangeably in practice. Indeed, efforts to define each term can be taken to imply that they are the same, or at the very least nearly so, when, as was mentioned, each term truly carries its own, unique historical and discursive weight.

On the one hand, for example, in an article published in the Leonardo Music Journal and co-written by a veritable all-star cast of telematic (and networked) musicians from 2009, the authors define telematic music as “music performed live and simultaneously across geographic location via the internet.” Similarly, Matthias Ziegler, the well-known flutist and improvisor working out of the Zürcher Hochschule der Künste and William Lane, violist and artistic director of the Hong Kong New Music Ensemble, curated a group of telematic concerts. Drawing from their experience collaborating with authors of the 2009 Leonardo Music Journal article, the concerts occurring between Hong Kong and Zürich were billed as “the live performance via the Internet by musicians in different geographic locations.” On the other hand, John Lazzaro and John Wawrzynek, two

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5 Networked music performance itself also appears in variations, such as the thoroughly capitalized Networked Music Performance, which is then also commonly abbreviated as NMP, Interconnected Musical Networks, Net Music, or Network Music. This illustrates some of the difficulty in constructing common definitions for these terms, as authors mobilize language to emphasize their particular interest in the musical format.


7 “Conflux - A Telematic Concert,” ZHdK Connecting Spaces, July 2, 2016, accessed November 6, 2019, https://www.connectingspaces.ch/projects/lab/conflux-a-telematic-concert/. Indeed, these are but a few examples of telematic practitioners describing telematic music as such. For example, Michael Dessen also draws from his experience collaborating with authors of the 2009 “Telematic Music: Six Perspectives,” when he describes telematic music as “live performance via the internet by musicians in different geographic locations,” Michael Dessen, “Telematics,” Michael Dessen (blog), accessed September 19, 2019, https://mdessen.com/portfolio/telematics/. Alex Carney terms telematic
computer scientists and engineers who first attempted to define networked music performance in 2001, termed the musical format as “when a group of musicians, located at different physical locations, interact over a network to perform as they would if located in the same room.” Likewise, Christina Rottondi, Chris Chafe, Claudio Allocchio, and Augusto Sarti term Networked Music Performance as “enabling remote musicians to interact and perform together through a telecommunication network.”

As evident in these examples as well as a panoply of extant published sources, such as concert billings, event pages, journal materials, and conferences, both practitioners and theorists similarly emphasize two key points that link networked and telematic musics: 1) that musicians or sets of musicians are not physically in the same location, and 2) that the musicians perform together through the means of telecommunication or electronic networks. Ultimately, this begs the question: why have two terms within the field at all?

The purpose of this paper is to clarify why the distinction between the two matters. On closer examination, many of those involved in either telematic or networked music think about the two terms with more nuance than evident in the nominative discourse above—for a reason. Providing an analysis of the key differences between these terms by contextualizing them within their respective histories and modes of creation, I will pursue a two-pronged argument. On the one hand, I contend that telematic music as a practice holds a theoretical and historical background that is grounded more overtly in politics associated with cybernetics and is held within a more specific kind of performance space. On the other hand, I posit that networked music is a field-specific term that, which while also being socially constructed by practitioners, technologists, and theorists, describes a technique for producing music, in which certain kinds of networks are mobilized for said music making. Again, this is not to elide that networked music is social, or has political ideals embedded within, but to point towards what is emphasized in the extant literature’s discourse.

Ultimately, I aim to show that telematic music is necessarily a networked music; yet, not all networked musics are telematic. This distinction, I suggest, is important for both readers and practitioners as it highlights how these technologies, discourses, and practices are inscribed with the aforementioned values and politics and which then impact the ways in which we think about and go about making music.


Telematics: Early History

In 1990, Roy Ascott, an artist whose work has long grappled with networked art and telematics, wrote a deeply influential article titled, “Is There Love in the Telematic Embrace?,” in which he sought to concretely define a telematic artistic practice. As an early adopter of the terminology around telematics, Ascott drew from the work of Simon Nora and Alain Minc, two researchers who were commissioned in 1976 by the French government to write a report, which was then published as The Computerization of Society: A Report to the President of France in 1978. Here, Nora and Minc first coined the neologism of telematics (télematique), which in French is a combination of the words for “telecommunications” (télécommunications) and “computers” (informatique).

This report, and the policies adopted by the French government thereupon, were fairly prescient in their consideration of the synergistic power of nodes arranged in a network, and more notably, their awareness of how power is accrued by networks. Indeed, a new understanding of these networks’ power was critical to Nora and Minc’s view of telematics, and they fretted about what kind of society these new technologies might create:

Are we headed ... toward a society that will use this new technology to reinforce the mechanisms of rigidity, authority, and domination? Or on the other hand, will we know how to enhance adaptability, freedom, and communication in such a way that every citizen and group can be responsible for itself?

These concerns broadly reflect what mathematician Norbert Wiener had already worried over with regards to cybernetic systems back in the 1940s-50s. Since cybernetic systems operate with automatic control and communication regulation based on feedback, telematics, with its newly theorized communication protocols, alongside then recent advances in computational power and hitherto unseen storage capacity would prove to be transformative for the recursive adaptability of a cybernetic system.

Minc and Nora, for their part, wrote on the subject of telematics from the viewpoint of the 1970s French state and inevitably reflected its interest in distancing itself from the geopolitical

13 In Wiener’s seminal work Cybernetics or Control and Communication in the Animal and the Machine, originally published in 1948, he declares that “the modern ultra-rapid computing machine was in principle an ideal central nervous system to an apparatus for automatic control”, and that the technical capacity for such control will be “unscrupulous[ly]” used to disempower the bargaining power of labor, Norbert Wiener, Cybernetics: Or Control and Communication in the Animal and the Machine (New York: M.I.T. Press, 1961), 26–29.
struggles occurring at the time between the USSR and the United States. After all, this report was written at the behest of the French president. These goals for geopolitical independence through technological independence, especially from the US and Britain, were mirrored by other French policies at the time. When *The Computerization of Society* was published in 1978, France had engaged in a series of actions to achieve this goal, such as withdrawing from NATO a decade prior, pursuing more nationalist policies under Charles de Gaulle, which included developing its own nuclear weapons program, and resisting political integration in post-war Europe even as France reaped the benefits of the European Economic Community.\(^\text{14}\)

Part of these policies was to develop a telecommunications system that was protocol and infrastructure independent from the US and Britain.\(^\text{15}\) To do so, France sunk considerable resources into building out its network and telecommunications infrastructure and eventually developed what became the Minitel system.\(^\text{16}\) The Minitel was a networked computer terminal that used France’s telephone lines in order to connect clients to a decentralized set of networks, the *Télétel*. The terminals installed in homes across France could access the networks to utilize services, such as phone and business listings, chat rooms, banking, etc. This networked platform solution was developed in response to the report, and the Minitel was successful, although eventually overtaken by the Internet.\(^\text{17}\)

While users colloquially referred to the system as a whole as “the Minitel,” the term actually only designated the physical computer terminal. Launched by decree the very same year that Nora and Minc issued *The Computerization of Society*, the Minitel became the quintessential example of a telematic system.\(^\text{18}\) As Nora and Minc argued in their report, telematics could radically reshape modes of communication, culture, and economic activity within society. Specifically, they pointed out that telematic systems “throw the traditional games of power into disorder,” because information technology “will disrupt the rules and conditions governing competition among numerous economic agents; it will confirm or annul the status of positions between the center and the periphery in most organizations,” and “will involve deep changes in essential functions (medicine, education, law, Social Security, working conditions).”\(^\text{19}\) It was thus in the interest of the French government to shape these changes towards a positive outcome, i.e. to the benefit of the state.

\(^{15}\) Ibid., 30–31.
\(^{16}\) Ibid., 32–34.
\(^{17}\) Ibid., 32–34, 179–180.
\(^{18}\) Julien Mailland, *Minitel: Welcome to the Internet*, 40–44. For a more in-depth discussion of protocols and network shape and design, see Alexander Galloway’s *Protocol: How Control Exists after Decentralization*. Here, Galloway describes centralized networks as consisting “of a single central power point (a host), from which are attached radial nodes,” a decentralized network as having “multiple central hosts, each with its own satellite nodes,” and a distributed network as being defined by, “each [node] in a distributed network is neither a central hub or satellite node.” Alexander R. Galloway, *Protocol: How Control Exists after Decentralization* (Cambridge, Mass: MIT Press, 2004), 11.
\(^{19}\) Nora, *The Computerization of Society*, 51–52.
Nora and Minc were in this way prescient in their realization that these telematic systems could radically reshape modes of communication, culture, and economic activity within society.

**Telematics: Theory & Politics**

As described above, Nora and Minc plainly saw telematics as a way to reassert control for the French state, which was increasingly paranoid of telecommunications networks and protocols controlled by external actors.\(^{20}\) Other advocates for telematics, though, saw it as liberatory, not just for the nation-state, as was in the case of Nora and Minc, but instead for the individual. For example, both the cybernetically influenced artist Roy Ascott and philosopher and media theorist Vilém Flusser, though independently from one another, sought out telematics as a means to free subjects from the situation in which the “sender” is the “controller of context and content,” which Flusser argued led to a society that is fascistic in nature.\(^{21}\)

The idea that the product of interaction on the network is essential to a telematic future without domination by the “sender and therefore the originator of meaning,” was laid out at length by Flusser in his book *Into the Universe of Technical Images*.\(^{22}\) In “To Scatter,” he points out that:

> A technical image radiates, and at the tip of each ray sits a receiver, on his own. In this way, technical images disperse society into corners. Each technical image...is received as the end point of a ray, as a “terminal.” So, the scattered society forms no amorphous heaps; rather the corners are distributed according to a structure that radiates outward from the center. These rays (channels, media) structure the society as a magnet structures iron filings.\(^{23}\)

Flusser wrote that the form of this society, controlled by technical images, is a “discursive society,” which he contrasts with an “ideal society” and a “dialogic society.” The ideal society holds dialogue—“the method by which information is produced”—and discourse—“the method through which information is transmitted”—in perfect balance.\(^{24}\) Whereas a looming discursive society is

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\(^{22}\) Roy Ascott. “Is There Love in the Telematic Embrace?,” 233–234. Vilém Flusser, *Into the Universe of Technical Images*. To be clear on complicated terminology, Flusser sees technical images as differing from traditional ones in that technical images can only be realized through “the computation of concepts”. These computations are necessarily mediated by cybernetic devices, which he often terms as ‘gadgets’, even in the original German, when dismissively describing how their full potential is not being exploited. Vilém Flusser, *Into the Universe of Technical Images*, 10.


\(^{24}\) Ibid., 83.
controlled by technical images, the dialogic society is one on the verge of collapsing; stratified between “an informed elite and an uninformed mass.”25 To counteract the threat of the discursive society’s stagnating control, or the dialogic society’s immanent stratification, Flusser proposed transforming technical images into telematic dialogue, through a sort of recursive, cybernetic system, in which the technical images could be used to program the devices that produce them. This telematic dialogue would supplant the distraction and dispersal that technical images produce by converting the technical images into surfaces through which a society of artists could “generate new relationships,” and “inconceivable possibilities would open to human existence.”26 Flusser did not stop there, though, and argued that “as a result of this creative play and counterplay, a consensus would arise, allowing society to program the apparatuses [that produce the technical images] by means of [the technical] images” — a cybernetic system.27

While Ascott and Flusser did not seem to be in direct conversation with one another at the time, the conception of telematics within a world of cybernetic and networked control marked a shared cultural moment that led both thinkers to very similar conclusions. For example, Ascott and Flusser both put their own spin on Nora and Minc’s conclusions; that the structure of communication in telematics could radically transform social structure “as the result of interactions between individuals and institutions in the process of negotiating relationships.”28 From an artistic perspective, Ascott saw telematics not merely as a means of distributing the artistic work to end viewers in telematic art—a means of artistic production he saw as incapable of reflecting the cybernetic, and then contemporaneous changes in society. Instead, he suggested that the artwork, just as in the social transformation above, emerges from the “product of interaction” with the network system.29 Indeed, in Ascott’s eyes, the output of interaction was more important than the actual form and content of artistic input, which would then be transmitted to receivers.30

In substantial parts, Flusser’s and Ascott’s respective theories on the political and artistic liberation that telematics provides thus overlap.31 Indeed, Ascott and Flusser use similar language. In comparison to Flusser’s “creative play and counterplay” above, Ascott calls for the conceptual space to close between the viewer and the practitioner, the material space between the network nodes to be virtually closed, and the artwork itself to be a mediated ‘playing’ of the network. What

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25 Ibid., 83
26 Ibid., 85.
27 Ibid., 86.
30 Ibid., 233.
31 It must be pointed out that while Flusser is writing critically on society more generally, his ideal society is one of artists. Ascott, for his part, is primarily writing on art, but he is also positing that telematics can do far more, linking “us with super connectivity, mind to mind, into a new planetary community,” what is in essence, a political project, Ascott. “Is There Love in the Telematic Embrace?,” 237.
is more, Flusser and Ascott both see such a telematically connected world as one that can then give rise to a kind of noosphere, which is a self-reflective, connected system of human minds that is at once a unity and will propel humanity into future stages of evolution through the emergence of a “global brain”; “the neurons ...,” as Ascott claimed, “would be individuals, all telematically interconnected, like a neural network.” Flusser, for his part, imagined “telematic society” as a “global super brain,” with “technical images” constituting “a kind of secretion” of this “global nervous system.”

Incidentally, these ideas can also be directly linked to media critic, futurologist and philosopher Marshall McLuhan’s concept of the “global village,” in which electronic and more specifically digital technologies have reduced the size of the globe to the space of a village. Indeed, some of the passages in Ascott’s and Flusser’s works seem to be an explicit expansion of McLuhan’s introduction to the first edition of Understanding Media: The Extensions of Man, which was published in 1964, especially as it pertains to space-time, unity and consciousness. As McLuhan posited here:

> Today, after more than a century of electric technology, we have extended our central nervous system itself in a global embrace, abolishing both space and time as far as our planet is concerned. Rapidly, we approach the final phase of the extensions of man—the technological simulation of consciousness, when the creative process of knowing will be collectively and corporately extended to the whole of human society.

It should be noted here that it is not only some of the conceptual specificities proffered by McLuhan that are similar to Ascott’s and Flusser’s, but that the choice of words also map onto one another—with a focus on technologically mediated embrace and unified consciousness. This conceptual noosphere, when considered alongside the inherent spatial closure and the globalizing discourses mobilized in telematic practice, is deeply embedded in notions of digital and networked culture. For example, one of the key aspects of contemporary digital culture is how information is taken and treated, which occurs through the process of digitalization. Sociologist Jan van Dijk, in his book The Network Society: Social Aspects of New Media, describes this as the process where:

> all signals are chopped into little pieces, called bits, consisting of nothing but ones and zeros. With the aid of microelectronics, these bits can be transported and connected fast and without

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33 Flusser, Into the Universe of Technical Images, 10.


interference...It facilitates the selection of sources, contents and destinations as they are all framed and assembled in the same language. Finally, all data types (sound, text, numerical data and video) can be added in the same multimedia source to increase the stimuli richness of the new media.  

This process of digitalization is integral to networked culture, which takes these bits of information and not only transports them, but puts them in relation to one another. As the media and communications theorist Tiziana Terranova argues, “any production of meaning ... is increasingly inseparable from the wider informational processes that determine the spread of images and words, sounds and affects across a hyperconnected planet.” In other words, when connecting the discourse of Ascott, Flusser and McLuhan to cultural elements of digital and networked culture, including globality, coalescence of meaning production, medium agnostic data, and interconnectivity, we can see, in turn, how these qualities and ideas informed telematic music practitioners.

Pauline Oliveros, one of the most influential American composers of the 20th and 21st century, was also an early pioneer in telematic music. Indeed, she had a profound impact by introducing many of the current and notable practitioners to the field to a telematic mode of production. She describes in “Telematic Music: Six Perspectives” her participation in her first telematic music event in 1991, which is around a year after Ascott published “Is There Love in the Telematic Embrace?” In this event, which was organized by Joe Catalano to celebrate 40 years of Oliveros’s composition and collaboration with artists all over the world, participants connected telematically with one another by videophone and telephone. At the time, videophones worked by capturing an image and sending it over a telephone line, upon which the image would then be reconstituted as a still, while telephone conference calls worked by transmitting the loudest signal to all other nodes. Oliveros pointed out that the images updated every five seconds, and Catalano noted that, much as was in the case of the telephone lines’ loudest signal dominating the transmission, only when an image had been fully transmitted could another one be accepted by the video conferencing technology. These technological “limitations,” though, proved fruitful in the minds of the practitioners, as they had to tap into their artistic intuition in order to successfully “play” the network, even though data was unable to be sent contemporaneously in a multi-directional

38 To wit, many of these practitioners are participating in the first issue of this journal, either as editors or authors.
40 Oliveros, it seems, applied this term retroactively in the Leonardo article. Sarah Weaver points out that Jonas Braasch suggested the term telematic in the first place, and that Oliveros most often used “telepresence,” Sarah Weaver, Interview with Sarah Weaver, October 16, 2019.
41 Ibid., 30.
manner over the network. Catalano saw these technologies and interactivity as holding profound social implications. Oliveros also argued that there were important socio-political aspects wrapped up in telematics, and while she did not dive into as cyberutopian of a discourse as Flusser and Ascott, she did assert telematics as a means to “strengthen our relationship with global culture,” and for musicians to lead “the way to global development with a conscious way of connecting non-violently.”

It should also be noted that Oliveros initially used the term “telepresence” and preferred it to telematics, as it discursively made clear the format’s emphasized “presence manifest over distance.” That being said, she intimated that these two terms could be used interchangeably, and drew a conclusion that echoes Ascott’s telematic “virtual presence of others who are in their corporeal materiality at a distance.” These views on the social potential of telematics were shared by the rest of the co-authors in the retrospective “Telematic Music: Six Perspectives.” Indeed, the authors of this article variably emphasized their experience of telematics as one of collaboration, globality, distal and temporal closure, and one of interchange—not as one would expect from a simplistic definition of sending produced signals across networks in space.

The Telematic Performance Space

The political and social values inscribed in telematics and telematic art production during its early days are important to consider, not least because they lay out an agenda for what separates the practice from other modes of artistic production. Yet, there are still more material and social elements to telematic music than just an argument for this particular way of creating music (or art). While telematic music operates over and within material networks—a key intersection point with network musics in general—it also has a certain kind of space in which it unfolds.

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42 For example, Catalano said that, “videophone technology can be defined as an interactive, on-line visual communication medium in which all the users control the content of the broadcast and are able to instantly respond to what they are receiving,” and that, “people with different views and values can bring about new ways of presenting images and sounds.” Ibid., 32–33.


47 For that matter, it should also be noted that the term telematics has been adopted into writings on telecommunications systems related to automotive and transportation systems. The term in this case though, is used primarily to describe the (cybernetic) command and control that onboard telecommunications and informatic systems provide to managers and users of vehicles. This discourse is focused less on the social and political transformations that telematics impels. Instead, it centers the term telematics around economic transformation, which, to be sure, is still related to one aspect of Minc and Nora’s long-term view on telematics’ transformative power. See for example: Yilin Zhao, “Telematics: Safe and Fun Driving,” IEEE Intelligent Systems 17, no. 1 (January 2002).
Indeed, a key aspect of telematic music, especially when considering its growth from the Western Concert Art Music’s avant-garde, is its deterritorialization from the concert hall and its subsequent reterritorialization in what I will term the telematic performance space. This space is inherently cybernetic in nature, as telematic music’s reterritorialization affects both the physical experience of the space through changes in the materiality of the traditional concert hall, the types of institutions that are capable of containing the telematic space, its control and communication flows, and finally the experience of the resulting engagement with the telematic piece as the work spreads across and mingles with networked interactions out in cyberspace.

The terms “space” and “place” are difficult to grapple with, not least in that different thinkers from various fields, including geographers and philosophers, have attempted to address each word according to the plethora of ways in which each is used (i.e. “first place” vs. “to place” vs. “a place”). Further, authors have even defined them in ways that seem contradictory. In his review of literature on the terms, “Space and Place,” John A. Agnew concluded that across all the main theoretical backgrounds that attempt to grapple with ideas of “place,” i.e. feminist, Marxist or humanist critiques, all of them argue that places are constructed “through social practices,” and that “they have permeable rather than fixed boundaries and are internally diverse rather than homogeneous with respect to their social and other attributes even as they express a certain communality of experience and performance.” To be clear, these traits of “place” still maintain the fixed or specific sense to the term. Indeed, Agnew describes place as “a particular or lived space.” A space, then, is where a place is, or where things occur. As Michel de Certeau put it, space “is in a sense actuated by the ensemble of movements deployed within it”—it is generated, or activated by relationships and time.

While it is certainly true that the nodes within a particular telematic performance are necessarily places, complete with social meaning and construction, they are also activated as spaces as they are prepared and then performed in. Furthermore, an abstract concept of the telematic performance space is more general (space) than specific (place). Finally, as was mentioned above, it is critical not to overlook the ways in which the telematic performance is made manifest by transmitting signal over low latency networks, usually over vast distances. In The Rise of the Network Society, sociologist Manuel Castells described the impact that networks of all sorts have on economic, cultural, social and political life and succinctly defined the abstract concept of the network

50 Ibid., 317–318.
51 Ibid., 236.
52 Ibid., 318.
53 Michel de Certeau, The Practice of Everyday Life, trans. Steven Randall (Berkeley and Los Angeles: University of California Press, 1988), 117. I am indebted to Patrick Müller for introducing me to these considerations of 'space' and 'place' and contextualizing them within telematics.
as a “set of interconnected nodes” and nodes as a point where “a curve intersects itself.”\textsuperscript{54} More importantly, though, he argued that such networks are able to accommodate new nodes, expanding or reshaping themselves so long as the node seeking to join the network is able to adapt to the protocols and codes of the existing network. Therefore, the telematic performance space can also be considered to envelop the network that connects the individual nodes, with all of the functional baggage that being a network entails.

What makes the performance space of telematic music unique, though, are qualities of the nodes that are able to be adopted into the telematic network. This exclusionary protocol, for example, would be that an external node attempting to participate is required to have connectivity to the internet—at the very least—but often also expensive and advanced music and Internet technologies and labor, such as large multi-channel mixers and interfaces, microphones, electronic and acoustic instruments, projectors, screens, video cameras, network administrators, music recording technology specialists, and computers to integrate and process all of the above—not to mention musicians and composers. These technical barriers to telematic performance, of course, demonstrate the fundamentally exclusive properties of many networks, as nodes are only able to join if they “share the same communication codes.”\textsuperscript{55} Further, while a telematic music event is partly occurring out in cyberspace, the music is still being produced in venues and transferred through the physical cables and servers that make up the backbone of the Internet and connect the telematic nodes. The network’s nodes, and the Internet itself, thus clearly have a material reality that occupies geographic, physical and social space.

An illustrative example of telematic space can be observed in the video recording of Matthew Burtner’s and Scott Deal’s telematic opera \textit{Auksalaq} (see Figures 1 and 2 in Appendix A, or variably the video link in the footnote).\textsuperscript{56} Through both the visuals and music in this video, it becomes easier to imagine the experience of a telematic music performance space. For one, the physical telematic performance space as seen here is just one of at least two nodes in a network of performance spaces that are exchanging sound and video.\textsuperscript{57} In contemporary telematic practice, these nodes have high-bandwidth and low-latency connections to the internet, and their spaces must concomitantly have access to both the network and the music technology that is required to capture, process and send sound and video to external locations and receive the same back. Additionally, as made clear in Castell’s example of the abstract network, and as was pointed out before, performances must occur in spaces that have access to the labor and expertise required to set up these music and network

\textsuperscript{55} Ibid.
\textsuperscript{57} In the case of this performance of Auksalaq, there are seven different nodes, Ibid. To be clear, the telematic performance space does not necessarily need to process and transmit sound and/or video as digital information but can also be transmit these media as voltage or light, as was the case in what can be considered early telematic musics that utilized telephones and radio. Pauline Oliveros et al., “Telematic Music: Six Perspectives,” 2.
technologies, which means hosting institutions must have such personnel on hand or at the very least the social or economic capital required to hire said personnel. Finally, the nodes must be able to accommodate physically present musicians in their space, although not all the nodes are required to have instrumentalists per se.\footnote{Mark Dresser conducted other nodes that hosted musicians from his own telematic node, in Resonations 2009: International Telematic Concerts for Peace, with no other instrumentalists performing at his physical location, “Resonations 2009: International Telematic Concerts for Peace - Highlights from ‘Hope’s Dream,’” YouTube video, 3:46, posted by “Sarah Weaver,” January 10, 2013, accessed October 1, 2019, https://www.youtube.com/watch?v=sChF0aNN3Lg.}

Beyond the infrastructure required for propagating sound and video from one node to another, \textit{Auksalaq} also has text and geolocational data projected on a screen on the right-hand side of the stage that is derived from comments provided by viewers watching from the different locations, which are then algorithmically represented as both sound and video through software of the artist’s own design. The mediated representation of the data and its interplay with the viewers points to Ascott’s interest in the “playing” of the network as the actual art-object, as data submitted by viewers—which is converted into, constituted by, and then interpreted as Unicode, or some other data type—is re-represented as sound or visuals through the algorithmic processing of Burtner’s software. In \textit{Auksalaq}, the key to the ultimate representation of data inputs (and subsequently a viewer’s observation of state changes, its interpreted meaning and therefore further interactive input) is that digital data is easily manipulated into alternative types of data and, with the appropriate technological infrastructure, other mediums—so much so that digital data can largely be considered media-destination agnostic while it retains its digital state. Indeed, Ascott draws on the work of Jacques Derrida and states that “data that is itself immaterial” and exists as “pure electronic différance” within a telematic work.\footnote{Ascott, “Is There Love in the Telematic Embrace?,” 233. Ascott seems to see Derrida’s différance as applying in this case, as the data ostensibly refers to an original input from an alternate media, for example soundwaves being turned into voltage and then digital data, which then come into play with other interactions that have provided data to the system—ostensibly the deferral in différance. Notably it seems Ascott does not address how the telematic data ‘differs’ in a Derridean sense, nor is there an explanation for what seems to be a real endpoint in the chain of deferral—in the original media(s)—which would seem to go against Derrida’s différance. Jacques Derrida, \textit{Margins of Philosophy} (Chicago: University of Chicago Press, 1982.), 1–27.} While a closer examination of data shows it nevertheless to often be material—e.g. the discrete state of a transistor, or electromagnetic waves propagating through copper wire—data within the telematic network or on a computer is \textit{unexperienced}, that is, until the data’s destination is reached, and the artists or participants choose to constitute the data as a particular medium.

More central to the phenomenology of a telematic music performance, and indeed almost as important as the music itself, is the figure of “the screen,” which in the example of \textit{Auksalaq} displays images of the changes in the sea ice coverage at the north pole, as well as videos from scientists and ships traversing polar waters. Although it is featured less in the cited video and figures above, a live stream of the telematically connected performance spaces—or nodes—is critical to most networked music performance videos and events. In this exceptional case, the connected
nodes are located in The Phillips Collection in Washington DC, The University of Alaska Museum of the North, the Lu Magnus Gallery in New York, the Tavel Center at Purdue University, the CIRMMT at McGill University, the Grieg Academy of Music in Bergen, Norway and the Open-Grounds Studio and Clemons Library at the University of Virginia. During performances, the telematically connected nodes are viewed either in a split-screen mode or by cutting between different locales via video monitoring. In the case of Auksalaq’s audio-video recording of the performance at the Tavel Center, the screen is a more visible object to the video frame than the musicians, who are off to the right side in a pit. Further, it is important not to overlook that the chain of microphones, speakers, interfaces and computers, which are variably embedded in the ensemble or in the “sound booth” and make the sonic interlocution that is critical to the performance possible as another form of a mediated screen. Indeed, the sound is “split,” or rather its experience is just as controlled as in the video screen through the space’s sound systems and mixers.

This abstract screen is where telematics poses important epistemological problems for the experience of a performance’s “reality,” as telematic mediation can dissociate the viewer from the physicality of the experience. As the cultural theorist Paul Virilio puts it in Open Sky, a tract where he critiques the society-wide changes that modern communications technology has brought about, teletechnologies are “isolat[ed] from [their] here and now, in favor of a communicative elsewhere that no longer has anything to do with “concrete presence” in the world, but is the elsewhere of a “discrete telepresence” that remains a complete mystery.” This mystery arises out of the complications that the screen presents, where virtual reality—in which the results of interactive inputs are simulated—is difficult to distinguish from a “tele-reality” that “shows things that are real but that may not be “there” with the viewer or user.” Art historian Kris Paulson raises an important point in her 2017 book Here/There: Telepresence, Touch and Art at the Interface by positing that the screen potentially creates an epistemological break for viewers:

Our bodies seem “irrelevant” because, by the power of our minds coupled with networked machinery, we can functionally be in two places at once, something bodies—by their very nature—are not able (at least not yet) to do...Telepresence and its tactile interventions in and through screen space complicate the boundaries of our bodies, extend our corporal agency and influence, and blur the distinctions between physicality and virtuality.

This disembodiedness is one of the key characteristics that Katherine Hayles lists as part of the construction of the posthuman. Hayles argues that in part of the cybernetic and posthuman milieu, information “came to be conceptualized as an entity separate from the material forms in which it

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63 Kris Paulsen, Here/There: Telepresence, Touch, and Art at the Interface, 10.
is thought to be embedded.”64 I would argue that this disembodiedness partly occurs in telematic music too, as the information in the music, sound, which has traditionally been associated with production from musical instruments or human performers, is instead produced in whole or in part from the mediated “screen”—that being the loudspeaker system in each telematic node.65

These critiques of telematic art or telepresence are therefore predicated upon the perceived instantaneity and disembodiedness of telematic video, which in Virilio and Paulson’s cases discursively reflect that something is lost in the telematic experience. I contend, however, that the practice of telematic music still maintains some semblance of the performer’s and the listener’s embodiedness due to the fact that the time it takes for data to be transmitted over the often vast distances between telematic music nodes—even at near the speed of light—is unable to overcome human perceptual faculties when certain forms of synchronicity are attempted.66 This has resulted in the research and execution of various compositional and technical solutions within the field of telematics and networked music more generally.67 In a telematic music performance, the distance can be perceived as physical rather than virtual, especially in synchronous musical situations where sound from one node is transmitted to another, is reacted to, conglomerated and then sent back as an aggregate. Additionally, these “human” faculties inherently require a material—as opposed to a virtual—experience, as soundwaves in a node are ultimately propagated through the air and only those locally present are able to experience the sound situated therein. Every node’s experience is individuated due to latency, while socially experienced as live.

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64 Katherine Hayles, How We Became Posthuman: Virtual Bodies in Cybernetics, Literature, and Informatics (Chicago: University of Chicago Press, 1999), 2.
65 For an account on how speakers and more abstractly the spaces in which sound propagates are themselves integral to the listening experience of music, see: Cathy van Eck, Between Air and Electricity: Microphones and Loudspeakers as Musical Instruments (New York: Bloomsbury Academic, 2017).
66 For a description of the challenges of latency in telematic music, see Michael Rofe and Federico Reuben, “Telematic Performance and the Challenge of Latency,” Journal of Music, Technology and Education 10, no. 2 (December 1, 2017): 167–183. For a more in-depth account of different compensatory means of dealing with latency in networked music, and an overview of studies and the observed delay engendered in each experiment, see Rottondi et al., “An Overview on Networked Music Performance Technologies,” 8823–8843. Further, in his 2002 Master’s thesis, Nathan Schuett reviews the literature on the effect of delay (and therefore latency) on performance synchrony and tempo and develops an experiment designed to test for the point at which latency begins to affect the performance of an ensemble. He found that at a thirty-millisecond delay, an ensemble of two musicians began to slow down the tempo of their clapping to accommodate the delay, and beyond forty milliseconds in added latency, “all ensemble characteristics are lost, as synchrony and tempo are compromised.” See Nathan Schuett, “The Effects of Latency on Ensemble Performance” (Master’s Thesis, Stanford University, 2002). Alternatively, Sarah Weaver in her own review of the literature on latency, finds 25 milliseconds as the maximum acceptable latency threshold for performance. Sarah Weaver, “Latency: Music Composition and Technology Solutions for Perception of Synchrony in ‘ResoNations 2010: An International Telematic Music Concert for Peace’” (Master’s Thesis, New York University, 2011).
67 For example, in telematics, Chris Chafe explains compositional techniques that were developed for Water Naught and TeleCellio Concerto, etc. Carôt and Werner, and alternatively Gabrielli and Squartini discuss multiple ways in which compositional techniques have been developed for networked music. Carôt and Werner, “Network Music Performance” and Leonardo Gabrielli and Stefano Squartini, “Networked Music Performance,” in Wireless Networked Music Performance (Singapore: Springer Singapore, 2016).
As can be seen from an investigation of both the history and politics of telematic theory, in addition to the kinds of spaces where telematic music performances most often occur, telematic music is indeed quite distinct in its ideological roots and means of production. The fact that it is articulated explicitly by cybernetically inflected politics and by the reterritorialized space that it occurs in distinguishes it from the simpler definitions that position it as conducting music in real-time over the internet. While less dramatic telematic technologies (i.e. Skype) exist, and these technologies do allow for a very limited performance of telematic music per se, much of the telematic events and performances that are produced occur within well-resourced institutions. This is significant in that there is a real choice to conduct the musical practice in this way, and therefore highlights the values of the practice itself, that of interchange, distal-presence, and—tacitly—infrastructural complexity. What, though, distinguishes telematics from network music performance? In order to see the difference beyond the overlapping definitions, it must first be understood what, exactly, networked musical performance is.

**Networked Musical Performance: A Technology Put into Service**

Since networked music calls upon the concept of the network, a theoretical understanding of the network is critical. After all, a network need not necessarily be a telecommunications network, as it could also be an electrical transmission network, a biological network or a logistical network. As such, a reminder is needed: a network is made up of nodes, and curves—or lines—intersect, which then connect the nodes.\(^{68}\) Taken literally by the abstract definition of a network, which is then put into service to create music, networked musical performance could entail a performance generated via a social network, which could mean any chamber music party full of string quartets and libations, or alternatively, recording to hard disk and shipping it across the country.\(^{69}\) Yet, this is not, I think, what practitioners, technicians and thinkers in the field of networked musical performance typically mean when they employ the term. Instead of pursuing the meaning of networked musical performance from an etymological standpoint, we should be asking what kind of network is mobilized for musical performance, and how information is transmitted across the network by those making the networked music to arrive at a working definition for networked music performance. These questions can be answered through examining the construction of current definitions proffered and through examining where the literature coalesces its attention on foundational works. As was mentioned at the beginning of this paper, when telematics and networked music definitions were compared, there are a few factors that crop up frequently in the definitions of networked music performance from the literature: 1) there is necessarily significant distal space

\(^{68}\) Castells, *The Rise of the Network Society*, 470.

between the performers, and 2) the music making is conducted over a computer network or the Internet. Both of these qualities, considered separately or together, do not end up encompassing certain kinds of extant networked music performance.\textsuperscript{70}

Jonas Braasch and Pauline Oliveros’s writings on telematics point to the possibility of using non-electronic or non-electromagnetic long-distance communications systems—the \textit{télécommunication} in \textit{télématique}—that are music-like or musical, i.e. “birdsong,” “whistled signals,” and “talking drums.”\textsuperscript{71} There are also examples of networked music where performers are located in the same space, most notably networked music pioneers The League of Automatic Music Composers. The group, which was founded in 1977 and comprised mainly of John Bischoff, Jim Horton, and Tim Perkis, alongside the intermittent participation of David Behrman and Rich Gold, would transmit electronic sound from one MOS KIM-1 microcomputer to another via a hard-wired network, which could be manipulated, controlled by yet another performer, and then passed back.\textsuperscript{72} These performances would be conducted around a table top. Therefore, it can be reasonably concluded that performer distance is not the defining factor in networked music.

Networked musical performances also need not be performed over computer networks or the Internet, specifically. While the example provided by the League of Automatic Music Composers disabuses one of the notion that the Internet is required for networked music performance—indeed the Internet existed only in its nascent form at the time that group worked—it is also true that much of the networked music produced today is performed over computer networks of some sort, even those that are not connected to the Internet. Yet, there are network technologies that do not require computers at all and still provide performers with the opportunity to create networked musical performances.

For example, radio technology does not necessarily require a computer in order to create a networked performance, as transmission can involve only transducers, transmitters and receivers, and the requisite, voltage-controlled audio technology connected to said transducers. Alain Renaud, Alexander Carôt and Pedro Rebelo, in “Networked Music Performance: State of the Art,” remark that John Cage’s \textit{Imaginary Landscape No. 4}, which has performers and a conductor operating twelve radios as part of the piece, is considered the first example of a Networked Music Performance in 1951.\textsuperscript{73} While Cage instructs pairs of performers to operate the radios in the concert hall, which receive transmissions and then play them in the space, there is a clear network at play, even


\textsuperscript{73} Gabrielli and Squartini, “Networked Music Performance,” 3–19.
if it may be unidirectional (i.e. a directed network). Therefore, conceptual works that involve radios without computers can be realized and can qualify as networked musics.

Other authors have made clear that networks have qualities beyond the technology that controls how information is sent and received, or how much physical space is between nodes (although typically these issues are not either). For example, since nodes of a network are related by the curves connecting each, the relationship between nodes is therefore seen as critical to the creation of networked musical performance. This emphasizes the interactivity of the network, which Gil Weinberg focuses on when laying out a theoretical definition for “Interconnected Musical Networks.”

In a 2005 article, Weinberg points out that while music is generally “interdependent” due to social and cognitive factors embedded in the medium, these models of interdependency “do not allow for actual manipulation and control of each other’s explicit musical voices.” The network, then, may be vehicularized into a “topology of interconnections and mutual responses” in order to “enhance the social context of music performance and enrich its social ritual roots,” which is best achieved through the command and control provided by electronic or mechanical technologies.

David Kim-Boyle, in “Network Musics: Play, Engagement and the Democratization of Performance,” discusses the structure of musical networks and their interface design through an analysis of works by Max Neuhaus, Jason Freeman, Metraform, and Atau Tanaka. Yet, he similarly focuses on how participation and interactivity are key qualities that should be encouraged when considering the network structure and interface, and through which he emphasizes the democratization process that the interactivity of networked music provides. Álvaro Barbosa in his 2003 review of networked music systems, “Displaced Soundscapes: A Survey of Network Systems for Music and Sonic Art Creation,” also highlights systems that emphasize their collaborative and interactive design. What this literature, among others, points to are some of the social aspects that networked music practitioners find critical to the musical format. In these discussions of the social qualities of music, the attention is not drawn towards reshaping how society is structured, or connecting globally with distant presences, instead it is drawn towards advocating for ways to make music more social. Taking these social qualities into account alongside the technical questions of “what...

75 My interpretation of Weinberg leads me to believe that he is not arguing that players cannot manipulate or control another’s musical voice—it is easy to imagine a trombone’s slide and mouthpiece being played by one player, while a plunger mute to manipulate the timbre of the instrument is being controlled by another. Gil Weinberg, “Interconnected Musical Networks: Toward a Theoretical Framework,” Computer Music Journal 29, no. 2 (June 2005): 23.
76 Ibid., 24.
kind of network?” and “how far apart are the nodes positioned?” can lead one to a more concrete
definition of networked musical performance.

There are scholars who have naturally addressed some of these concerns on their own and,
through a broader review of networked music, have subsequently attempted to proffer definitions
that account for some of the critiques that I have offered here. Golo Föllmer, for example, in “Elec-
tronic, Aesthetic and Social Factors in Net Music,” focuses on the material aspects of the network
in addition to social and relational aspects that are embedded in the process of producing music
through or related to networks:

“Net music” comprises all formal and stylistic kinds of music upon which the specifics of elec-
tronic networks leave considerable traces, whereby the electronic networks strongly influence
the process of musical production, the musical aesthetic, or the way music is received.79

Here, Föllmer finds that “Net Music” is a form that is bound significantly to electronic networks,
which was later expanded upon by Robin Renwick:

Network music is a musical practice in which conceptual, technological, ideological, and/or
philosophical concepts of the network are included in the design, composition, production,
and/or performance process. The network may influence the work’s aesthetic, composition,
production, or reception. The network may or may not be limited to electronic computerized
networks.80

Renwick ultimately arrives at an extremely permissive definition and therefore covers all possible
configurations of networked musics, whether they involve electronic networks, are inspired by
the concept of the network, or are networked in their constructive process.

Yet, to take such a broad stance on networked musical performance would end up classifying
every music as networked in the end, due to the nature of music’s interactive and social dimen-
sions. For example, the performance of a Brahms symphony by a major performing arts organi-
zation has a stage crew, marketers, musicians, an administration, fundraisers, an audience, etc., all
arranged as actors in a network of political, social and economic relationships mobilized towards
the production of the concert. Further, Renwick’s definition as is, I contend, goes beyond the ways
in which the literature has constructed its research and artistic focus, which does have a heavy
emphasis on computerized and telecommunication networks. This is especially pronounced when
considering the history that the field has coalesced around, in which networked music

80 Robin Renwick, “Topologies for Network Music” (PhD diss., Queen’s University Belfast, 2017), 15.
performance is traced variably to Cage’s *Imaginary Landscape*, Max Neuhaus’s *Public Supply I*, Maryanne Amacher’s *City Links* works, or music by the League of Automatic Music Composers.\(^{81}\)

These interrogations of the extant definitions of what networked music constitutes are but a few examples that lead one to question: is there a definition that is permissive enough to include the multitude of works that are considered networked music performance while still accounting for the ways in which the literature on networked music has traced its history and centered its technological focus? I would argue that there is: **Networked music performance is a socially constructed term for a musical performance that is conducted through the mobilization of telecommunication, electronic, and electromagnetic technologies to transmit musical signals across networks with more than one node.**\(^ {82}\)

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**Conclusion: Terminological Baggage**

As I have attempted to make clear throughout this paper, prior writings on both telematic music and networked music performance describe the two terms in ways that may lead casual readers to the conclusion that they are one and the same. Yet, these terms are in all actuality not. This conflation is due to how closely related both terms are, the nascence of the literature of the field more generally, and the fact that research into the music produced under both formats has been limited up until now, which leads to a certain fluidity to the terms. While more published research is required into the multiple ways in which telematic and networked musics are performed and produced, I believe that the history and literature review laid out above offer a way to tease out the differences between each term. Telematic music has a more overt political and ideological background associated with its terminology and is carried out in its particular telematic performance space. Networked music performance, meanwhile, is employed to describe a particular technological type vehicularized for a kind of musical production, even while it is social and interactive. The works produced by the League of Automatic Music Composers, for example, are

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\(^{82}\) Here, the permissiveness of these different technological categories is key, as they can be ascribed to numerous extant communications technologies in addition to future technologies that are not yet invented. So too is the point that the term is socially constructed, as these types of terms tend to be porous and flexible, much like genre. I have also left aside some very important issues pertaining to whether networked music needs to be “live” or “concurrent,” which I believe may eventually need addressing, as networked music poses fascinating temporal issues.
most certainly not telematic, but they are networked. Conversely, telematic works like Auksalaq are necessarily networked music performances.

This paper has focused extensively on a critical examination the history, theory, and politics of telematic music, and these subjects were partially left alone when considering networked music performance. It should be made clear, though, that the elision of these subjects does not mean that networked music performance does not carry ideological, social or political weight. After all, the choice to use telecommunications, electronic or electromagnetic technologies as a means to produce music, especially given that these technologies provide new modes of interactive control and music making, is meaningful from a host of perspectives due to the very real politics that are inscribed in these technologies.

For example, the underlying material conditions for much of networked music performance rely upon advanced infrastructural and economic development. This engrained shape of limited technological access, and often access to the Internet as well, affect the potential participation in networked musical performance due to the often needed high-bandwidth fiberoptic cables required to transfer audio and perhaps video—data types notorious for large file sizes. Because fiber is expensive to lay, and cities are given priority for the expansion of new, higher bandwidth lines due to the economic returns on the cost of providing service, more remote areas can be, and often are, simply left out. Additionally, a more nuanced examination of internet based networked music shows that the technology that enables the music can fall prey to the tiered nature of internet infrastructure, in which competing protocols, access and end-point technologies alter material aspects of a performance. The 2018 NowNet Arts Conference focused on some of these particulars of networked music, and Chris Chafe, Sarah Weaver and Trevor Henthorn presented on this topic in a panel discussion. Chafe’s slides on the matter showed how fiber-optic connections, consumer and business cable, in addition to hardwired and wireless endpoints compared when it comes to delays in timely packet delivery, a significant issue for streaming audio. Further, networks or other computational underpinnings like the algorithm, are often thrust in the background for users, mostly as a design choice for ease of use, yet, by doing so, this obfuscates protocological or coded control, which is common to many of the experiential aspects of our digitized and networked society.

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83 One of the few networked music events I found in the literature that attempted to step outside the metropole at all was a telematic music education project conducted by Alex Carney, which served children the area around Fanatal in Brazil, a rural area known for its wetlands. At one of the ‘nodes’ where he telematically conducted music lessons, the Internet was provided by a radio internet system, which had limited bandwidth and high latency. Carney, “Telematics: A Case Study in the Co-Creation of Music and Technology,” 7.


Ultimately, it is imperative to consider what it means to conduct networked music performance or engage in telematic music-making. What implications and weight does each term bring to bear when it is discursively deployed? What history does a practitioner draw from when setting out to make telematic music, and what aspects of artistic control does one hand over to software developers and technicians when choosing to make networked music? What kinds of temporalities are at play in each? Our focus should not only be on the creative possibilities made available through technologically mediated interaction and interplay, or through the modes of artistic production manifested by technology, but also on the social and political elements that telematics and networked music performance are inscribed with, as these elements can profoundly impact our music, both in its production and its perception.
Appendix A:

Figure 1: Auksalaq 10/29/12 Excerpt 1

Figure 2: Auksalaq 10/29/12 Excerpt 1


Ibid.
Works Cited


