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Digital network connectivity has asserted a profound effect on music, radically altering its creation, distribution, performance, and consumption. As the musical landscape has been thoroughly democratized, the longstanding roles of composer, performer and audience are breaking down. Jacques Attali predicted this new network of composition in his seminal text *Noise*.

"Composition thus appears as a negation of the division of roles and labor as constructed by the old codes. Therefore, in the final analysis, to listen to music in the network of composition is to rewrite it....The listener is the operator." (Attali 1985, 135).

Music has been at the forefront of new developments in the online realm since the inception of the internet, and networks are shaping every aspect of the art form. In his 2005 book *Virtual Music*, William Duckworth explored how music was being affected by the world wide web.

"Virtual music is a decentralized, universal art form: anyone with a computer and Internet access can be involved, despite their location in physical space. Also, virtual music is participatory; people can alter it in ways that they, as well as everyone else, can hear...In cyberspace, there's room for everything; the possibilities appear endless; the future of the Web is filled with sound" (Duckworth 2005, 157).

Duckworth's prediction of infinite possibilities could not have been more accurate, as democratization, participation, and superabundance have become defining characteristics of music in our time. While the world wide web is roughly only 25 years old, the progression toward the massive diffusion of musical resources in evidence today has a longer history.

Early Reflections

In 1968 Fluxus artists Robert Filliou and George Brecht introduced the concept of "The Eternal Network," an international collaborative artistic project that "could effectively replace the concept of the avant-garde" (MUKHA 1976). Fluxus had originally developed out of John Cage's classes at the New School in the early 1960's (Snyder 1992), and from the outset, had a collective, collaborative focus. Music had a strong presence within Fluxus, from the historic concert series

curated by my mentor La Monte Young at Yoko Ono's loft to the works of Dick Higgins, Ben Patterson, and Joseph Beuys' *Siberian Symphony*. Like the other Fluxus artists, Filliou's Eternal Network advanced ideas of decentralization and democratization of art, provoking the audience to recognize art in their own lives and to live performatively, creatively. Filliou discusses The Eternal Network as well as his piece titled "Telepathic Music" in this video.

<https://youtu.be/9BgOfsG7J0Q?t=30>

In the same year that Filliou and Brecht began The Eternal Network in France, Douglas Engelbart's groundbreaking demonstration of personal computing technology took place in San Francisco. Engelbart's "Mother of All Demos" presented virtually everything that would define modern computing and networked systems including networked collaboration, videoconferencing, hyperlinks, digital text editing, a "mouse," and a small "keyset" which was modeled on a musical keyboard. Engelbart's Palo Alto lab was a nexus of the military industrial complex and the Bay Area counterculture, and his vision of collaborative connectivity through digital technology became a global reality.

The network visions of Filliou and Engelbart were extremely prescient, predating the internet by several decades and offering meaningful insights to its potential power. Today we feel the presence of network technologies in practically every aspect of our daily lives. While the networks that Filliou and Engelbart imagined and created were utopian, the broad proliferation of their ideas presents serious challenges. In the wake of the massive disruption created by technologies of connectivity, it is useful to re-examine the prototypic ideas of these early network pioneers.

The Demo, my 2014 electronic opera created in collaboration with [Mikel Rouse](#), explores these themes by re-imagining Engelbart's historic demonstration as a technologically-infused music theater piece. The work creates a sense of dreaming forward and backward within the frame of the original 1968 presentation, and culminates in an immersive depiction of media overload. The unresolved tension between the utopian visions and dystopian realities of networks reflected in *The Demo* is strongly operative in the field of music today.

https://youtu.be/nQI_eatxoNU?t=12

Instruments of Change

The realization of Engelbart's network facilitated the democratized vision of art and music that Filliou and the other Fluxus artists imagined and idealized. However, musical expression and consumption have always been closely connected with technology. Organology traces countless examples of the influence of new technologies on musical creativity, such as the introduction of the pianoforte in the 18th century, the invention of valves and key systems in the 19th century, and the more recent development of electronic instruments. Jaron Lanier has pointed out that musical instruments "throughout history in various places and times seem to have been more advanced than weapons. The usual trope is that it's the weapons makers who are at the leading edge of technology, but it appears empirically that actually it's the instrument makers" (Lanier 2005). Thor Magnusson also references the advanced technology of instruments in the

introduction to his article which proposes new approaches to organology in the digital era. "Since the beginning of recorded history, we find technologies of music-making at the forefront of human technics; as artefacts, musical instruments can be seen as an individual culture's 'crowning achievements.'" (Magnusson 2017, 1; Nettle 2005, 82)

The introduction of sound recording to the development of musical technology was a major disruption to organology as it had progressed for centuries. The possibility of experiencing music as a purely sonic phenomenon is roughly only one hundred years old, a very short time when compared to the long history of music making, which is thought to reach back 45,000 years (Sarakatsanos 2016, 1). Recorded music was the first in a series of disruptions in the art form over the last century. Prior to that, all music technology was dedicated to instruments that required direct physical interaction, and musical experience demanded physical presence.

With the widespread proliferation of recorded music, for the first time in history the adjective "live" was required to designate different types of musical experiences. Music's traditional model of performance, which required human performers producing acoustic sound kinetically before a co-present audience, was challenged by electronic instruments and systems whose sound production is not directly linked to physical action (Sanden 2013). "With the developments of the telephone, radio, recording and so on, sounds have become more disembodied from their source or cause" (Doornbusch 2003). Tape music composers and Jamaican dub producers repurposed recording devices designed to document physical performance into instruments. The introduction of digital recording and sampling made the production of recordings progressively more accessible for both professional and casual music makers. Today, computer and smartphone-based music making tools are ubiquitous and relatively inexpensive, or free. As Sanden has pointed out, "Very little (if any) musical activity of the late twentieth and early twenty-first centuries has entirely escaped the profound influence of electronic mediation" (Sanden 8).

This pervasive mediation of music is an example of ephemeralization, a term first coined by Buckminster Fuller. Ephemeralization describes the pattern in which technology accelerates the efficiency of material, energetic, and informational processes, leading to the practical disappearance of distance, time, and energy (Fuller 1969). The ephemeralization of music which began with the advent of recording and electronic instruments was further advanced by another disruption when the world wide web was introduced in the 1990's. Not surprisingly, music quickly felt the effects with the introduction of Napster and other file sharing services that challenged established structures of value and distribution. Keith Negus has described how the new listening model of streaming playlists is "indebted to the practices of peer to peer sharing, facilitated by Napster, when music fans quickly began compiling their own lists, selecting from rather than accepting the sequences of tracks on released albums (Negus 2019, 8).

The creative aspect of music was affected as well. Liz Pelly has pointed out how the move to online streaming shaped musical creativity by encouraging shorter songs, shorter introductions, and a new genre she calls "Spotify-core" (Pelly 2018). A 2012 study of popular songs from 1955-2010 found pitch, timbre, and dynamics becoming more homogenized and compressed in recent

music (Serra 2012). These characteristics can be traced to the popularity of streaming playlists, which have eclipsed albums as the preferred mode of listening (Music Business Association).

Like the parameter on a reverb unit, the diffusion of music content through the network blurs individual sounds together into a wash without distinct definition.

New possibilities for collaboration and participation became possible with the availability of online networking. [TransJam](#) was an early web based system for real time collaboration developed by Phil Burk and members of The Hub in 1996 that is still functional using an executable Java file. It allows five users to improvise together using several different applications. For the past twelve years I have been successfully using TransJam in Music Online, a liberal arts course at Ramapo College that is open to students from all majors. The program still provides an effective platform for musical interaction no matter what the skill or prior experience of the participants.

<https://soundcloud.com/benneill/sets/transjam-recordings-from-music>

Remix and mashup sites as well as AI software based on machine listening that composes rhythmic, melodic, and harmonic sequences are becoming more common. These tools enable the general public to participate in music composition, production, performance, and analysis. A few examples are listed below:

[Kutiman's Mix the City](#) enables users to create and record remixes with musical materials from different regions of the world.

[Blok dust](#) is a graphically based interactive music making site.

[Plink](#) by Dinahmoe Labs is a game-style interface that allows several users to play music together.

[Soundtrap](#) by Spotify enables users to collaborate using a network based DAW.

[Cyanite.ai](#) uses machine listening to analyze and map the emotional content of recorded music.

Artists Kutiman and Christian Marclay have used social media platforms YouTube and Snapchat to create works that direct the disparate expression of their users into new forms and shapes which would be unthinkable without network connectivity. Their work points to a new model of diffused musical creation.

<https://www.youtube.com/watch?v=tprMEs-zfQA&list=PL2C189BC49E25D16A>

<https://www.youtube.com/watch?v=Xp9-Nq3wfT4>

Network Organology

In order to address how networks are transforming contemporary life, philosopher and former IRCAM director Bernard Stiegler extends the musicological definition of organology to a broader context.

"General organology posits that the organological – understood in the sense of the technical and technological supplement – is what modifies the organic, that is, the process of its *différance*: of its differentiation and its delay [temporisation], its spacing and its temporalization, and in such a way that from it a new process of individuation emerges, that is, a new form of life" (Stiegler 2020, 2).

Stiegler discusses how technologies and networks function as artificial organs driven by algorithmic automatism in which human processes are externalized, a process he calls "exosomatization" (Stiegler 2019). This is certainly true of music, as demonstrated in the development of virtual instruments, file sharing systems, and music recommendation engines. The abundance of music has necessitated even more reliance on algorithms, and this dependency continues to grow as the democratization of production, distribution, and marketing that Chris Anderson outlined in his 2006 classic *The Long Tail* increases (Anderson 2006). Stiegler suggests that this new democratized audience constitutes a new avant-garde.

"The mechanical re-organisation of perception taking place with the digital leads to the reconstitution of forms of knowledge held by audiences and publics. There thus comes to be formed a new avant-garde: one that constitutes new publics" (Stiegler 2010, 18).

Stiegler's description of a culture transformed by networks can be observed in the current superabundance of music. Currently, sixty thousand songs a day are released on Spotify alone, roughly one every 1.4 seconds (Music Business Worldwide 2021). By comparison, in 1988 fifty thousand songs were released in one year, and by 2007 that number had increased to three hundred fifty thousand (Waldfoegel 2017, 202). In 2020 there were five million independent artists releasing music, and the new creator culture continues to grow (Mulligan 2021). Eighty three percent of recorded music revenue was generated by online streaming services in 2020 (Friedlander 2020), which organize music into playlists to accompany the activities of the listener/user. From working out, to cooking, even to sleep, there is music for every second of the day.

Passive engagement with recordings is being superseded by what Patrik Wikstrom calls "creativity as consumption," (Wikstrom 2020, 196) and Douglas Rushkoff has pointed out that we define ourselves now "not by what we consume, but by what we produce" (Rushkoff 2006). Tik Tok encourages users to approach recorded music as material to be manipulated rather than as finished works, and musicians create songs which are specifically designed to induce appropriation and remix. The concept of the social studio is growing rapidly, with the tools of creation and channels of consumption merging in new applications such as Tik Tok's Music Machine, a loop-based MIDI production tool built into the app (Thakrar 2021). The BandLab social studio app enables users to "make and share music, no matter your skill level or background" (BandLab). Facebook is launching new in-app audio creation tools that are "powerful enough for the pros, but intuitive and fun — like having a sound studio in your pocket" (Facebook).

Negus has also written about the new dynamic model of musical creation and the consumption that is emerging today. He writes that this trend calls into question "the social and artistic value of music, how this should be recognised and rewarded, and how music should be circulated within digital networks that apparently allow the 'free' flow of ideas and information" (Negus

2019, 14). As music becomes more and more dynamic and interactive via online networks, the notion of a finished musical composition or recording could vanish altogether and be replaced by a fluid, dynamic system in which musical meaning is always emergent and variable. For the conglomerates such as Google, Facebook, and Amazon, the value of music is its capability to engage users. "Music becomes a means to another end rather than an end in itself" (Negus).

Virtual Uncertainties

Ephemerization and the shift toward the participatory have removed many of the challenges that existed for musicians to record, distribute, and perform their music. It has contributed to the democratization of the art form, but it also has created tremendous uncertainty. As Jean Baudrillard described in his essay on *Transaesthetics*, "The unavoidable goal of all liberation is to foster and provision circulatory networks. The fate of the things liberated is an incessant commutation, and these things are thus subject to increasing uncertainty" (Baudrillard 1993, 4).

Baudrillard, Negus, Rushkoff, Lanier, and Stiegler all express concern that the exosomatization and democratization brought on by technology is resulting in a loss of knowledge and cultural memory that has potentially damaging consequences. The uncertainty that is created by democratization seems to be driving music toward "the inevitable victory of the aleatory and the unfinished" (Attali 1985, 148), Attali's prediction in the final sentence of *Noise*.

Uncertainty reached a new level with the Covid 19 pandemic, which forced the sudden adoption of network technologies in every aspect of life. Scott Galloway from NYU has pointed out that the reliance on remote systems and virtual communication leapt ahead five years in the first three months of the pandemic alone (Gladstone 2020). With music's close relationship to technology, it is not at all surprising that the impact of Covid on music has been tremendous. Even live music performance has been mediatized now, as many musicians adopt live streaming as a performance medium, blurring the boundaries of live and recorded music that have existed for the last several decades.

Due to the pandemic, my ten-member Digital Music Performance class at Ramapo College used the [Sonobus](#) application to perform ensemble pieces virtually during the Spring 2021 semester. The improvised works of Pauline Oliveros, who coined the term "telematic music" and spent 20 years developing and performing it, were the first pieces I introduced to the group of undergraduate Music Production students. I had the opportunity to perform and record with Pauline numerous times, and her concept of "deep listening" takes on a new significance in a telematic performance situation. In performing her *Tuning Meditation* and other pieces in a telematic setting, the lack of physical cues and body language which are already inherent qualities of laptop performance are greatly accentuated, increasing the sensitivity of the participants to the emergent sonic amalgam. The sense of ephemerization is heightened by the fact that the sounds are completely disconnected from any physical source of origin. The resulting disorientation leads to an increased awareness of the subtleties and nuances in the sounds they are creating. This increased sensitivity is a powerful sensation for the performers, and creates a new performative context that reinvents the concept of "reduced listening" described by Schaeffer and Chion (Chion 1994).

The animated graphic scores in Nicolas Collins' *Brackets* and Oliveros' *100 Meeting Places* also take on a different quality in an online networked setting, unifying the geographically dispersed ensemble with a virtual conductor. This is another example of Stiegler's exosomatization in practice.

<https://youtu.be/doXYeZLUw6E>

The uncertainty and instability that characterizes the larger effects of network technologies are present at the more intimate level of music performance as well. Latency, dropouts, and other technical issues can create extra tension for performers in a networked environment. As a result, composers and musicians must learn to accommodate unpredictable events and timing glitches. This parallels my experience performing with live electronics. Over the years I have incorporated more improvisatory, flexible structures in which unforeseen results of my interactions are incorporated into the vocabulary of the piece. This kind of flexibility is essential for networked musical performance.

Auto-Organology

My work as a composer/performer is strongly connected with organology and electronic mediation. The Mutantrumpet is a hybrid electro-acoustic instrument that I originally designed with Robert Moog in the early 1980's and is the primary vehicle for my creative output. Its design integrates digital technology as a prosthetic for a mutated physical instrument, expanding the acoustic capabilities of the trumpet and extending its capabilities to the digital realm. My recent work *Fantini Futuro* (2019) reflects on this expansion of the trumpet through the historical lens of Girolamo Fantini, the 17th century trumpet virtuoso and composer who introduced the trumpet to the realm of art music, bringing it indoors from the hunt and the battlefield.

<https://www.youtube.com/watch?v=xvx1qw0gvT8&t=16s>

The Mutantrumpet utilizes a transductive model in which its physical and electronic components have a dynamic, symbiotic relationship, influencing and feeding back on each other sonically and conceptually. Over the years the instrument has become a more powerful digital interface incorporating interactive visual media. However, I have intentionally maintained the balance between the physical instrument and its electronic components so as to maintain continuity with the trumpet's developmental history.

My response to the Covid pandemic has been a new durational series of ambient pieces for the Mutantrumpet called *Trove*, created in collaboration with my long time production partner and former A&R rep at Verve Records, Eric Calvi. In *Trove* the synergistic connection between acoustic and electronic sound is emphasized. Each piece is created as an improvised performance in which I play a single pitch with timbral variations into a harmonic/rhythmic processing matrix with no editing or overdubbing. The acoustic sound of the Mutantrumpet is captured and processed in real time via the instrument's twenty-eight onboard electronic switches, joysticks, and knobs, and no other sound sources are used. *Trove* exemplifies the increased productivity that Fuller described as one of the results of ephemeralization, and also is composed for the context of superabundant streaming networks. Two pieces are being released each week over the course of

a year, culminating in a one hundred track album/playlist. Four videos with imagery by [Sybil AI](#) are offered as NFTs on [Open Sea](#). Distance, time, and energy have been greatly reduced in this project. While *Trove* is highly collaborative, it has been created entirely remotely.

<https://open.spotify.com/playlist/6qRI4R9GRzXCy9p8lJy8eE?si=e225dc1b0bbe4842>

Ubiquitous Musicking

Filliou and Engelbart's visions have come to astonishing levels of fruition in the course of a little over fifty years. Their intersection in the 21st century has fundamentally changed the art of music. In Stiegler's essay on "The Power and Knowledge of Art in the Twenty-First Century," he points to the work of another Fluxus artist, Joseph Beuys, as a model for devising a way forward in this confusing age of disruption. Stiegler sees Beuys' concept of social sculpture as a way of thinking about our uncertain cultural moment, harkening back to Filliou and Engelbart's visions of democratization and empowerment for all.

"A work [oeuvre] is the spatialization of a time that never ends, and this is what presents itself to sensitivity through works of art. Such a time is the fruit of a social sculpture in precisely this sense – accessible to everyone because, in one way or another, everyone is a sculptor or a cultivator" (Stiegler 2018, 11).

Stiegler's quote is strongly reminiscent of Filliou's Eternal Network concept. The philosophies and aesthetics of Cage, Beuys, and others that informed the early explorations of network creativity remain relevant and compelling in light of the challenges created by superabundance and democratization. As technology enables more and more people to engage in the act of musicking, the design of interactive systems and AI applications becomes a new form of composition that facilitates mass creativity. Music's intimate connection with technological development and its nonverbal communicative aspects can also provide cues for more sensitive and nuanced use of network technologies generally. In order to be a good musician, being an excellent listener is essential. My own artistic project - the Mutantrumpet - has consistently focused on integrating physical, real world musicking with the virtual, exosomatic realm. In light of the massive diffusion of the musical art, I embrace this approach in order to maintain continuity with the rich organology that has brought us to this point. In this way, we can continue to advance and simultaneously honor the history of the art form.

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