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Playing the Network

Just as the past centuries have seen great development and experimentation with the uses of traditional physical instruments, and the language describing the spaces their music inhabits, the current century could see, and to an extent has already seen, great development of network instruments and the treatment of networks as their own resonating bodies. While these new cyber instruments and spaces have been as simple as shared digital wave oscillators or synthesizers, they have also been used for more complex ideas of networks as their own resonant bodies, and interfaced with as network instruments or even network beings, that have the ability to improvise and evolve over time. In this paper, I will explore various uses and experiments with networks as palates for compositional experimentation, rather than simply media for transmitting data or standard physical sounds (such as a human voice or musical instrument), and some of the implications that these network experiments have had on traditional notions of musical space and idiomatic composition for technology.

For my exploration of the network as an artistic palette, I will discuss and analyze three examples of pieces and projects that have already taken steps in developing artistic notions of what network space can be used for. One example is *Global String*, by Atau Tanaka and Kasper Toeplitz, which makes use of a physical string (or large cable) as an interface with a network in order to create sound and interaction between two or more sites. Another example is *Prométhée Numérique*, also by Atau Tanaka, which is reminiscent of Max Neuhaus's early telematic work in that it is a participatory piece, in which many people submit audio and data to be incorporated into a live compilation of codes and structures within a network. This second work of Tanaka's greatly expands the notion of the network as an instrument, and actually goes so far as to treat the network as a performer as well. The third example I will discuss is *Graph Theory*, by Jason Freeman, which allows a

listener/participant/real-time composer to “choose their own adventure” through a piece of music that has only precomposed bits, not yet compiled. Each of these examples illustrates a unique use of the network as an instrument and opens up questions regarding the paradigms of musical space and online-musical communication.

Global String

Atau Tanaka is a composer and sound artist who has undertaken several projects that make use of this idea of the network as a space for creating music and art. One of his projects, which dates back to 1999,¹ that draws on the notion of the network as an artistic space is *Global String*, a multi-site network installation made up of two large steel strings in different geographical locations, connected through a network via a telematic link. Each string acts as an instrument, connected directly to an interface that measures the vibrations of the string and translates those vibrations into data to be read and sonified within a network program which defines rhythm, velocity, and duration. The two sites' strings also present an interactive element with one another, whereby the string at one site is activated by movement of the string at the other site. This telematic activation creates the notion of a single string woven through the space of a network with ends coming out at either site. Tanaka's telematic single string is meant to act as a kind of monochord, similar to the ancient greek instrument. This pseudo-monochord structure of this work evokes an interesting temporal metaphor,² where an ancient instrument is used to explore one of the newest fields of musical development. There is a kind of poetic simplicity in the invocation of the monochord, traditionally a pedagogical instrument, to use as an exploration of the treatment of a network as a resonant body. It is almost saying, “Let's learn to play and manipulate the network space with something simple before we create elaborate and complex interfaces.”

1. Weil, Benjamin. “Art in Digital Times: From Technology to Instrument.” p. 526.

2. Ibid., 526.

The use of the Internet in this case is as a transmission medium and not as a storage or information system. It is a resonating chamber, and not a canvas. The instrument cannot be accessed from the web. It is not a means to connect network surfers with people in the gallery. It is a single musical monochord that traverses physical space and network space, and in doing so, connects people in remote locations.³

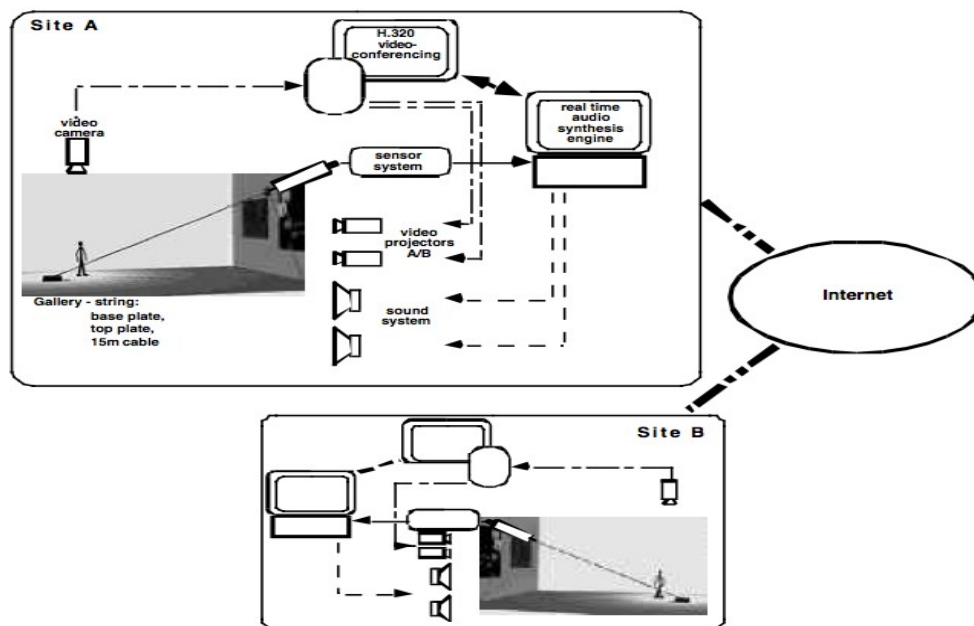


Figure 1: *Global String* Technical Diagram⁴

The actual sonification procedure of *Global String* involves algorithmic synthesis of a physical model of a string of enormous proportions. The data taken from the string is modulated, based on the number of hops the data packets have to take through the server space, the amount of traffic on the server nodes, and the delay time of sent information.⁵ By defining these parameters as ways to modulate the sound created in the network, a sonic infrastructure of sound is built within the internet. Thus, treating the internet as a resonant space with its own parameters of sound propagation. This, in some senses, parallels the ways in which sound is modulated in the physical world, whether it be by

3. Tanaka, A., Bongers, A.J. "Global String – A Musical Instruments for Hybrid Space." p. 2.

4. Ibid., 2.

5. Broeckmann, Andreas. "Reseau/Resonance: Connective Process and Artistic Practice." p.281.

number of reflective surfaces, medium through which a body is set into vibration, or any other number of parameters that could alter the ways in which sound is created. These parallels allow a performer to explore and learn to play the space of a network just as they would a concert hall or theater, each with its own idiosyncrasies of soundscape. Through this “acoustic” construction of sonification within the network space, *Global String* becomes its own electroacoustic instrument made through a telematic installation.⁶

With all this time spent “in the network,” so to speak, the issue of presence becomes important to discuss. Where are things being perceived as happening, within the space of the network or on either end of the physical strings, or both? Tanaka discusses issues he faced in presenting this work and questions of how the projected video interacts with the notion of a single network instrument. In *Global String*, the primary focus is musical and visual is secondary. However, poor quality video could cause for a loss of the experience of connectivity with other sites, as is often a major issue with telematic performance. Without the visual element, Tanaka suggests that performers might not be aware of whether they are playing with another human being or just a computer; also, that seeing a human being manipulating the string at the other location was crucial to the experience of *Global String*. For the installation, there were two separate video projections. One projection was a live feed of the string at the other site, in order to give a sense of the human collaboration at either end. The other projection was a display of data read within the network from the motions of the string, in order to give a visual sense of the network space and what was happening in it.

The importance of projecting a sense of telepresence is highlighted by these observations and presentations of video in Tanaka's piece. They open up room for experimentation with ways to project telepresence beyond a simple video feed. If the network can be treated as a resonant body, why couldn't it be treated as a physical space? In some senses it can be, as in Second Life, where a person can project themselves into virtual space, as an avatar, and perform music in virtual locations, built within

6. Broeckmann, Andreas. “Reseau/Resonance: Connective Process and Artistic Practice.” p. 281.

Second Life. Tanaka also expands and experiments with this notion in the other network piece of his which I will discuss later in this paper, *Prométhée Numérique*. There are countless other examples of virtual projections of presence into a perceived cyber “space:” Facebook, Twitter, World of Warcraft, etc., where someone can have a global telepresence that feels as if they are in a true virtual space, and even look to see who else is there with them. This sense of network existence is clear in the language we use to describe our presence in the cyber world. When we use phrases like “on Facebook” or “in Second Life,” we are metaphorically projecting ourselves, and others, into a perceived pseudo-physical space.

Global String, in essence, is itself a large-scale musical instrument that exists in a hybrid medium. Part of the instrument exists in the physical world and the other part exists in the cyber world. Tanaka describes it as a single “stringed instrument...made up of heterogeneous materials, or mediums.”⁷ The telematic medium seems particularly well designed for instruments involving multiple users at distant locations. *Global String* embodies this idea of one instrument that exists in multiple spaces and requires collaboration in order to be played. As a concept, this use of networks as musical spaces, is extremely exciting in that it pushes the boundaries of what telematic interaction can be. Rather than simply a means of long-distance communication or interaction, *Global String* creates an entirely new perceived musical space that can theoretically be explored and manipulated from any physical location. While this idea of a network location that can be reached from any physical location is not new, and exists in the realms of social media, and online gaming, and websites in general, it is a way to think about possible interactive musical spaces that could be developed and even standardized.

Prométhée Numérique

Prométhée Numérique is another network installation piece, by Atau Tanaka, that presents a different use of a network as a palate for artistic experimentation. In the score, Tanaka describes the

7. Tanaka, A., Bongers, A.J. “Global String – A Musical Instruments for Hybrid Space.” p. 2.

piece as being written for network and radio infrastructures.⁸ In performance, the piece consists of three human musicians (each in a different geographical location, performing telematically), and a network built performer, created through contributions of written music, coding, and visual media to a web site. These contributions act as raw building materials in the “evolution of a life-like data creature.”⁹ Contributors add content to the server housing the creature for one month prior to the performance of *Prométhée Numérique*. During this time, the “data creature” evolves, based on the media it receives, and becomes a pseudo living being that can react to situations, either visual or musical.

The web-site is not an informational resource about the piece, but rather is an integral component of the work itself. It is a manifestation of compositional structure outside traditional musical time/space dimensions. It lends a different light to the materials and “houses” the machine performer of the piece.¹⁰

The data creature's “physical” form is also informed by the submission of content to the media database, such as images, videos, or graphic code. The creature's actions and behaviors are then programmed with life imitating algorithms. To give the creature further life imitating features, it has a dynamic visual that becomes the graphic interface for the database server.¹¹ This graphic form reacts to visitors movements and actions when in the presence of the installation. The creature's appearance also changes over time as new media is submitted to the server by users.

Tanaka cites multiple literary sources as metaphorical inspiration for the development and conception of this piece. Included as source texts are: *Prometheus Bound*, by Aeschylus; *Frankenstein*, by Mary Shelly; *Prometheus*, by Goethe; *L'Homme Machine*, by La Mettrie; and the *Cyborg Manifesto*, by Donna Haraway.¹² Each of these texts serves to illustrate the ways in which humanity assimilates technology into its own sense of biology. These sources also act as the libretto for the piece and each

8. Tanaka, Atau, “Prométhée Numérique,” Score Introduction: p. I.

9. Tanaka, Atau, “Prométhée Numérique,” Score Introduction: p. I.

10. Tanaka, A. “Composing as a Function of Infrastructure,” In Ehrlich, K., LaBelle, B. (Eds.) *Surface Tension: Problematics of Site*. Errant Bodies Press, Los Angeles. 2003. p. 7.

11. Tanaka, A. “Composing as a Function of Infrastructure,” p. 8.

12. *Ibid.*, 7.

has excerpts included in the score, in English, French, German, and Japanese. In *Prométhée Numérique*, Tanaka expands the idea of the network as an instrument to treating the network as a being unto itself. Perhaps this being fits into Haraway's notion of cyborg, or “post technological human.”¹³

Prométhée Numérique - Frankensteins Netz
commissioned by the Sudwest Rundfunk

Atau Tanaka
2002

phase **1.01** 1.02
time 00:00 1:00 2:00 3:00 4:00

Creature	<i>Dormant...</i>
Atau Powerbook1 (Karlsruhe)	<p>1.01c1.Fr <i>p</i> Broue mon honore, quand tu l'as entendue, abandonne-moi ou plains-moi, mais étends-moi. Les coupables qui ont encor les crânes couverts de sang sont auto- risés par les lois humaines à se défendre avant d'être condamnés.</p> <p>1.02c1.De Verzissen meine Geschichte</p>
Atau PB2	<p><i>pp overlapping whispers...</i> 1.01p1-3.Fr/De</p> <p><i>fai pris dans la tige d'une fénile la sentence du feu que j'ai dérobé</i> Ich hobbe Stengel trug ich fort des Feuers Quell</p> <p><i>J'ai mis fin aux terreurs que la vie de la mort cause aux secrets.</i> Den Sterblichen adieu ich vorwissen ihres Tod.</p> <p><i>J'ai logé en eux d'ar- rogies espérances.</i> Ich siedete in ihnen hinde Hoffnung an.</p> <p style="text-align: right;"><i>diminuendo</i></p>
Atau PB3	<p><i>pp digital whispers</i> <i>hushed modulated noise</i></p> <p style="text-align: center;"><i>blip punctuation</i></p> <p style="text-align: right;"><i>diminuendo</i></p>
voice Zack (Montreal)	<p><i>pp whispering...</i> 1.01p1-3.En</p> <p><i>I sought the lozenge of fire in hollow reed</i> I took from man expectancy of death.</p> <p><i>I sought the lozenge of fire in hollow reed</i> I gave man sense, pos- sessed them Of mind.</p> <p><i>I took from man expectancy of death.</i></p> <p style="text-align: right;"><i>diminuendo</i></p>
computer	<p><i>pp digital whispers</i> <i>hushed modulated noise</i></p> <p style="text-align: center;"><i>blip punctuation</i></p> <p style="text-align: right;"><i>diminuendo</i></p>
voice Reiko A (Japan)	<p><i>pp whispering...</i> 1.01p1-3.Jp</p> <p><i>Watashi wa aoi no kubochi ni hi no gomen o sagasi mokometa</i></p> <p><i>Watashi wa ningen kara saku o uatara chikara o ubatte yatta.</i> Watashi wa karete ni iteyo o shite Fuzhetu o motomete yatanoda.</p> <p><i>Watashi wa aoi no kubochi ni hi no gomen o sagasi mokometa</i></p> <p><i>Watashi wa ningen kara saku o uatara chikara o ubatte yatta.</i> Watashi wa karete ni iteyo o shite Fuzhetu o motomete yatanoda.</p> <p style="text-align: right;"><i>diminuendo</i></p>
i.d. laptop (Japan)	<p><i>pp digital whispers</i> <i>hushed modulated noise</i></p> <p style="text-align: center;"><i>blip punctuation</i></p> <p style="text-align: right;"><i>diminuendo</i></p>

Figure 2: *Prométhée Numérique*: Score State 1¹⁴

13. Tanaka, A. “Composing as a Function of Infrastructure,” p. 8.

14. Tanaka, Atau, “Prométhée Numérique,” Score: p. 1.

In performance, each human performer plays from a full score (figure 2), containing sections of graphical notation as well as verbal quotes from the above literary sources. As each human player has a complete view of what the others are playing, the score acts as a unifying factor over which the network creature will improvise, in ways unknown to the human players prior to a performance. “The unpredictable nature of the network contributions and time delays can be seen as the Promethean fire we must tame.”¹⁵

The score is built in five sections, each built on its own metaphorical living state of the creature: 1 – Dormant (as shown in Figure 2), 2 – Awakening, 3 – Excited, 4 – Out of Control, and 5 – Tamed.¹⁶ The first three states are primary for the pre-performance period in which media contributions are being sent to the server. These three states act as evolutionary periods for the creature to learn and mature. During a performance of *Prométhée Numérique*, the creature cycles through all five stages in the period of 40 minutes.¹⁷ Although, in a performance, states 1 – 3 are quickly cycled through as presentational material and states 4 – 5 are the primary focus. Following a performance, the creature returns to its life in the internet and cycles between the five states, using algorithms that allow it to change its behavior over time and continually learn and evolve.

Latency of sound and quality loss of information over large distances is an aspect of *Prométhée Numérique* that Tanaka describes as being primary to the conception of the music for this work. Rather than go to great lengths to try to limit latency or give the illusion of simultaneity among performers at different locations. Tanaka writes that, “Network transmission latency became the “acoustic of the network” to be respected and used as one does when composing for specific resonant spaces. If the web component explored spatial domains, the performance addressed temporal domains.”¹⁸ Just as with *Global String*, this is another case of working with the resonant parameters of a network to create certain idioms of performance that fit with the tools being used, rather than forcing the idioms of other

15. Tanaka, A. “Composing as a Function of Infrastructure,” p. 10.

16. Ibid., 10.

17. Ibid., 11.

18. Ibid., 8.

types of space to work within the context of network space.

The actual audio latency for performances of *Prométhée Numérique* was approximately 30 seconds. The implications of audio latencies, of such a long duration, on music, especially when that delay is perceived differently in each location, are such that musical time and rhythms can no longer be unified through a regularly repeating pulse, but rather through extended moments, to be explored. The experience of musical time moves from a perceived absolute to an embraced relative, in which performers accept that the sounds are not simultaneously perceived but shared within a larger window of time.

Prométhée Numérique greatly expands the notion of idiomatic writing for technology, in general, but also for network spaces. Within the micro level of this piece, the musical idioms of the network are defined by submitted media. The creature then has no choice to but to explore within these idioms, as they are the only tools it has to work with. However, on a macro level, the piece itself is an enormous leap in what it means to compose idiomatically for a network. Tanaka lets the network music act as network music, complete with latency, algorithmic composition, and multi-media expression.

In drawing on the legend of Prometheus, Tanaka knowingly places himself, and this piece, in a long line of artistic and philosophical work dating back centuries. It is interesting that this character, and the ideas it brings to mind, continues to resurface again and again in artistic experimentation as a sort of obsession that artists get drawn to. Tanaka writes on his use of promethean themes:

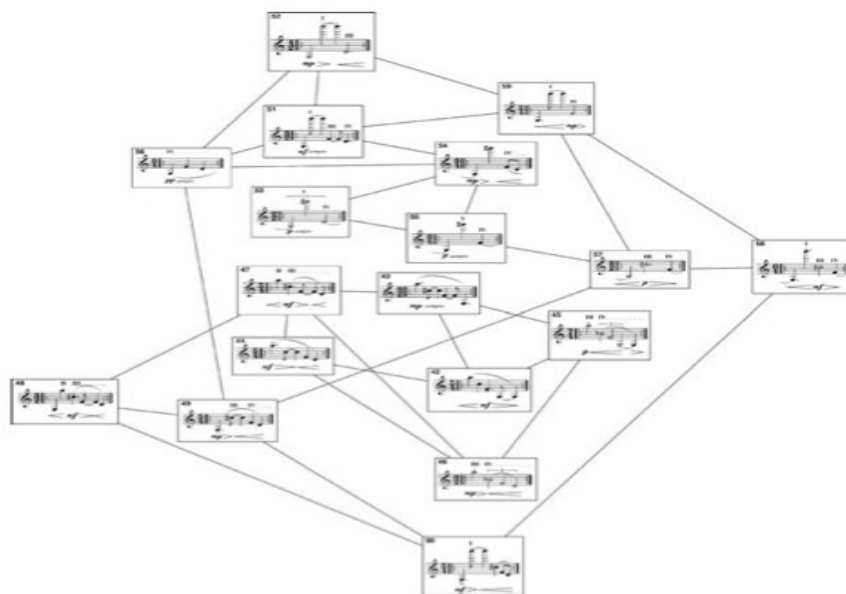
This is not the first musical piece inspired by the myth of Prometheus. Composers through time have called upon the legend in symphonic, operatic, and popular works. The story carries a power that seems to speak to musicians. For me it was particularly appropriate in offering a foundational viewpoint from which to address issues of media technology and network societies. It provided the basis to consider the fascination with the possibility of life in the machine.¹⁹

19. Tanaka, A. "Composing as a Function of Infrastructure," p. 12.

An aspect of my discussion on *Prométhée Numérique* that I have conspicuously left out is the use of broadcast radio in conjunction with online telepresence. While this is an incredibly important part of this work and integral to its conception, as it brings up questions of presence through online broadcast versus broadcast over the airwaves and the democracy of broadcast media, they are somewhat outside the scope of my online network-specific discussion. I have also chosen not to address, in any direct way, issues of artificial intelligence and what implications they have for art and experimentation within telematic media.

Graph Theory

Graph Theory, by Jason Freeman, presents yet another use of the network as a body for the creation of music and musical material. While this use of a network is somewhat less conceptually taxing as the previous two works I discussed, it presents a clear use of a network as a space for creativity and experimentation.



(Figure 3) *Graph Theory* Score Selection²⁰

20. Freeman, Jason. "Web-based collaboration, live musical performance and open-form scores." *International journal of performance arts and digital media* 6, no. 2 (2010): p. 159.

Graph Theory is a piece that doesn't exist in a single state, but rather has an “open-form score,”²¹ that develops a unique form and configuration with each performance. The piece is composed of 61 small musical fragments recorded on a violin. Each of these fragments acts as a node on a graph and is connected to three or four other nodes to act as possible paths through which to transverse the piece (figure 3). These musical bits are chosen, in real-time, by someone accessing the web-site that houses the piece. Thus, whoever is interfacing with the website acts as a performer as well as a composer/improviser. I categorized the performer as a composer/improviser as they are making real-time decisions about which musical bit to choose. However, these decisions are recorded by the server and become the full composition.

This work is unique in my discussion in that there isn't a clear performative aspect. As the piece is executed within a network server, playing prerecorded musical bits that are chosen in real-time, there is no clear audience outside of whoever is interfacing with the website. *Graph Theory* plainly brings up the question of the audience's role in network-based performance. While Tanaka, in his telematic works, went to great lengths to develop projects that could be presented to large groups of people, as they were both gallery installations, Freeman eliminates that problem all together and creates an almost exclusively private experience for performer-composers of this network piece. *Graph Theory* is a piece meant to act as an exploration in a web-interface with which performers can interact with the open-form structure.

By eliminating a sense of public performance from a musical work, the basic function of music changes on some significant ways. The notion of shared experience within collective performance is dismantled and pieces become about personal desire and exploration. In a sense, *Graph Theory*, is not extremely different from a single player video game in which a player personally interfaces with a computer. For single player video games that interface is the extent of the interpersonal transaction.

Although Freeman's “open-form score” pieces do not seem to have radically changed the face of what

21. Freeman, Jason. "Web-based collaboration, live musical performance and open-form scores." *International journal of performance arts and digital media* 6, no. 2 (2010): p. 158.

private music is, or can be, they have opened up possibilities for further development of these “musical video games.”

Following the creation of *Graph Theory*, Freeman did design a live performative aspect for this work that is quite drastically separated from the interface experience. Each time a piece is “composed” within the server, the chosen order of the bits is recorded and saved into a score format. These saved orderings have been performed for audiences as specific possible iterations of the work. This performative element adds a dimension to the work that is reminiscent of a sports playback, or perhaps watching a video of someone's run through a video game level. Also, the question of authorship becomes difficult when the performative element is added to the work, as any specific score ordering has been decided by both Freeman, in his composition of the original bits, and whoever has interfaced with the network score.

Looking Forward

The exploration of a network as an instrument or space for musical and artistic creation brings up countless questions and possibilities. What is the role of the composer in a network piece of music? How does an audience function? What duty does a composer have, if any, to explore and find what kind of music is idiomatic for a network; and from there, how does one push the boundaries of those idioms, once they have been established? Atau Tanaka describes his explorations into network composition as “an attempt to explicitly apply the notion of idiomatic composition to networks, to find a musical language that reflects inherent qualities of the medium.”²² Jason Freeman describes an “uneasy balance”²³ between retaining control of musical material, in the traditional role of the composer, and allowing the shared community of a network to control the musical material for composition, which opens up broad questions of authorship within telematic and collaborative artistic projects.

22. Tanaka, A. “Composing as a Function of Infrastructure,” p. 12.

23. Freeman, Jason. “Web-based collaboration, live musical performance and open-form scores.” p. 163.

What is interesting about many network instruments and network environments for musical experimentation that have been built over the past 20 years is that they never seem to catch on as standardized instruments for anyone to take up and practice. This is particularly notable as it is unlike other network platforms for communication, such as online games and social media. Reasons for this are probably complex and varied and include: cost of building, access to high bandwidth networks, lack of specific audience, and general practicality of size (in the case of either of Atau Tanaka's works). It seems as though it might be possible to develop a network instrument that could catch on fairly easily. In some ways, Freeman tackles this problem by keeping his project “forever” available on a server for continual web-interface possibilities. However, its popularity seems somewhat limited and has not really become standard or ubiquitous in the way that I am describing.

Building on Tanaka's notions of idiomatic compositional spaces for networks and Freeman's notion of semi-private musical experience, while keeping in mind the success of online social media platforms, I could imagine a sort of “Facebook of telematic music,” in which there would be some sort of physical interface like a long string (as in *Global String*) or a MIDI keyboard, or any possible object that could be used to interface with a network. Ideally though, the interface would be one that would not traditionally be associated with older musical objects, such as strings or keyboards, but rather something like gloves, chairs, ladders, standing platforms, or anything that can be wired with sensors and projected into a network through data. Using such non-traditional musical objects would allow for new idioms of network music to be created without interference from older idiomatic thought on traditional instruments. These new musical objects would be used to send data to a network and connect to any number of other people across a server that has various parameters of sonification and data modulation built into it, as in *Global String* or *Prométhée Numérique*, in order to develop the sense of a resonating space within the network. The purpose of this would be to communicate musically based on the defined musical space of that particular server. In this proposed development, there could easily be multiple “Facebooks,” each with its own server, defining unique musical spaces and idioms. It

would be like having multiple networks instruments (the musical 'Facebooks') that you could learn to play collaboratively with other telematic musicians, anywhere in the world. The audience of these connections would simply be those interfacing with the server together, as they collaboratively learn to play the space of the network. If these interfaces were situated in people's homes, rather than museums or galleries, it could have far reaching and revolutionary effects for what global musical communication could mean.

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