Unity & Multiplicity

by

Noah Rush

Class of 2014

A thesis (or essay) submitted to the faculty of Wesleyan University in partial fulfillment of the requirements for the Degree of Bachelor of Arts with Departmental Honors from the College of Music

Middletown, Connecticut April, 2014
The aim of this thesis is to explore the contradictions and conundrums presented by transitions between unity and multiplicity or unity in multiplicity in musical works. In the concert, various methods, from rhythmic content, improvisation, pulse, phasing, visual content and melodic themes are used to create and integrate themes of multiplicity and unity. While relevant at a musical level, there is a larger personal and societal framework at play that makes these concepts interesting to me both as a composer and a human being. The sonic textures presented throughout the concert are an engagement in the increasingly overwhelming background buzz of technological society. Each texture consists of many elements that gather to form an immersive whole. However, individual elements emerge and recede, distracting the listener by grabbing their attention for a moment before returning into the unified whole. In the first chapter, I discuss the first piece, which sets up the theme of the concert by overlaying single pulse rates creating a complex micropolyphonic texture. I discuss the work of György Ligeti, the meaning he found in micropolyphony and his engagement with the Fluxus movement. In the second chapter, I touch on more current societal trends of multiplicity and technology, and the new struggles of the individual and society. I discuss the works of Evan Roth and Godfrey Reggio's Koyaanisqatsi as contexts for works of art in the language of technology. In the third chapter, I relate my work with animation to the inspiration of past visual music composers, as well as tie in my specific motivations for creating this work based out of a mass of points into overarching theme of manipulating multiplicity. Finally, the fourth chapter discusses
holyphonic textures, those where individual events emerge out of a unified whole in an ensemble context.

Chapter 1: Piece 1

The first piece is a demonstration of the layering of pulse rates achievable with a new interface I designed using for an iPad using SuperCollider and Control OSC, developed by Charlie Roberts. The piece, diffused randomly in a six-channel audio field, layers pulses of different rates, pitch and volume on top of one another, creating a dense rhythmic field, that while based on the consistency of pulses loses its metric feel over time. The piece is not through composed, but is rather improvised freely by the performer-composer. The presentation unfolds slowly. At first, individual pulse rates are presented, giving the listener a sense of metric organization. Soon after, pulses with slightly higher or lower rates are initialized creating a syncopated feel. For example, while pulse A fires once a second, pulse B will fire every 0.8 seconds. If pulse A is initialized first, setting the metric space for the listener, pulse B will first fire 0.2 seconds before the beat, then 0.4, and then 0.6 seconds before and so on. In this particular case, the timings used generate 5 over 4 pattern is instantiated, and thus 4 seconds in; the pulses will land together creating the sense of a rhythmic cycle. However, introducing additional pulse rates whose rates create more complex ratios with the original create non-parallel rhythmic sequences that will not overlay and
converge. Of course, there are many other fruitful combinations that conform to familiar metrical relations as well as others that are not readily describable.

Figure 1.1 shows three graphs of possible relationships between three pulse rates as well as how long each relationship takes to complete the composite cycle. By finding the lowest common multiple of the three values, equivalent to rate of attack, these graphs reveal how many subdivisions are needed to achieve periodicity and reunification between three different rates. For example, in figure 1.1 the first pulse fires twice a second, while the second pulse fires four times a second, and the third fires five times a second. Each dot indicates an event, and the graphs allow you to see the overlay of rhythmic material. In this case, the lowest common multiple of 2, 4 and 5 is 20, so the graph ends after 20 subdivisions, when the rates all line up again.

In figure 1.2, the ratios of the rates are more complex, so the amount of subdivisions needed to return to unity firing is greater. In this case, the rates picked are 9, 4 and 5, and the lowest common multiple of those three numbers is 180. These graphs, however, do not contain any indication of time. The subdivisions are relative to the three rates, and could be stretched or contracted in time at will by the performer.
While the beginning of the piece plays on the introduction of a pulse and syncopated overlays, the next section of the piece deals with the disappearance of meter. Here rates still hover in the slow range, yet more pulse rates are introduced, and perhaps the initial pulse, that which sets the initial tempo and
meter, is shifted. Here, a sparse rhythmic texture prevails, with the illusion of syncopation, but no steady beat to form the basis on which syncopation offsets are usually based.

The intended effect here is to pull back the listener from the regular plane inside the pulse. At first, anticipation is built up as the listener catches wind of the pulse, but at some point a new relationship is born based on the texture of the sounds, with the pulse gone, or shifted. This invites the listener to mentally pull back, from a metrical understanding based on strong and weak beats, and arrive at a consideration of texture. At this point, the performer, having noticed this shift, begins to gain freedom in his composition of textures. Faster rates become part of the pallet of sounds, and the focus has shifted from a syncopation exercise into a micropolyphonic texture.

This is made especially easy to generate with super precise number generation available with computer processing as well as the GUI (graphic-user interface) used for initialization and control. The performer controls a bank of sliders on an iPad (see figure 1.3). The sliders send extremely precise readings to SuperCollider, yet the performer does not have the same mathematical absolute control. His or her experience is purely visual. Instead of having the possibility of absolute settings (i.e. Siri, set pulse A rate equal to 1), all understanding of control is relative to other rates, volumes and pitches in a visual sense. This is meant to simultaneously confuse the performer and move from a numerical understanding of the processes involved to a more purely aural encounter. I find
the creation and the performance of this music extremely precise and easy to follow, while allowing for infinite combinations and creative output.

Figure 1.3

Figure 1.3 is a screenshot of the iPad taken after the performance on April 4, 2014. Each rectangle is a slider controllable via a touch screen. The white is the activated slider, while the black is the null space available for change. The individual pulsations line up vertically. The bottom sliders control the frequency or pitch of each pulsation. The slider is graduated into midi intervals of one, so sliding up one of the sliders would be equivalent to a chromatic scale on a piano. The second level sliders control the amplitude of each individual pulsation, and the third or top level controls the rates of each individual pulsation. For this
performance the rates spanned 0.01 times per second to 4 times per second. The visual control allows only relative control, as it does not output or indicate specific values. The visual was designed to be reminiscent of a city skyline, creating an easy analogue to the themes of density (in the control of the rates and amplitudes) and multiplicity explored in the other pieces in the concert, specifically as a referent to the city scenes discussed late in this paper in Koyaanisqatsi. It is also extremely simple to create outliers that stand out in the sonic texture by imagining them visually.

_György Ligeti, “Poème Symphonique” and Fluxus_

The concept of micropolyphony, coined and developed by the Hungarian composer György Ligeti, refers to a texture consisting of many lines of dense canons moving at different tempos or rhythms. Ligeti writes in his own description of micropolyphony, "You hear a kind of impenetrable texture, something like a very densely woven cobweb."¹ Ligeti embraced the potential of micropolyphony to obscure sonic identity saying of specific elements, “It remains hidden in a macroscopic, underwater world, to us inaudible.”² This is something I wanted to embrace in the performance of this piece, as the sheer mass of electronic source noises tends to obfuscate specificities in rates. The audience, as well as the performer, loses track of which pulses are morphing into

---


² Ibid.
other rates or pitches, or staying the same. The performer can play games with the audience by creating outliers in the texture such as one high frequency pulse at a high volume at a high pulsation rate, while eighty other low pulses fire in quick syncopated succession.

In Ligeti’s own work, he used the technique several times in mainly orchestral works. However, one piece stands out as particularly relevant to my realization of my piece. The micropolyphony of unparalleled complexity exists in Ligeti’s work *Poème Symphonique for 100 Metronomes*.

*Poème Symphonique* was written during Ligeti’s brief association with the Fluxus movement. The Fluxus movement arose and reached its artistic peak in the early 1960s as a series of avant-garde or experimental actions bound together by an anti-art or art-into-life premise. The Fluxus manifesto, written by Fluxus’ primary organizer, George Maciunas, pairs the dictionary definition of the term “flux” (applicable in many scientific disciplines, generally meaning the constant change flow of material through an object) with a call to

“Purge the world of bourgeois sickness, “intellectual”, professional and commercialized culture. PURGE the world of dead art, imitation, artificial art, abstract art, illusionistic art, mathematical art, - PURGE THE WORLD OF ”EUROPEANISM”

PROMOTE A REVOLUTIONARY FLOOD AND TIDE IN ART, promote living art, anti-art, promote NON ART REALITY to be grasped by all peoples, not only critics dilettantes and professionals.

FUSE the cadres of cultural social and political revolutionaries into united front and action.”

---

3 Fluxus manifesto, George Maciunas, this transcript is found at http://wwxtxt.blogspot.com/2009/03/fluxus-manifesto.html
In his essay on Ligeti and Fluxus, Eric Drott quickly outlines the qualities of a Fluxus performance, “The objects and events produced under its aegis possess a number of common aesthetic features: simplicity verging on minimalism; an emphasis on process; the exploration of intermediary zones between different art forms; a healthy dose of humor; and the incorporation of conventionally non-musical (or non-aesthetic) materials.” The healthy dose of humor would often occur as a gag at the expense of traditional conventions of music. The “gag” occurs in the fact that this simple performance breaks down the barrier of what we commonly consider performance, even today, and makes us reflect on our relationships to material objects and performance spaces. Some of the quintessential Fluxus pieces that do this are Ben Patterson’s “Paper Piece”, where the audience and the performers simply play with giant sheets of paper, and George Brecht’s “Event Scores”, which describe simple tasks to be performed such as picking up a ringing telephone, and then replacing it, and many other pieces that follow this same descriptive style.

Drott identifies multiple ways in which Fluxus events commented on traditional musical performance. In one sense all Fluxus pieces push at social conventions that surround the performance of music, yet they do so in different ways. Drott mentions two pieces, La Monte Young’s Composition 1960 #2 where Young starts a fire on stage as directly confronting what we expect music to be. On the other hand, George Brecht’s Drip Music fights the conventionality of

---

4 Drott, 212
musical performance not by explicitly confronting our definition of music, but rather by reframing readymade events. Drott writes, “In Drip Music, the mundane rises to the category of music.”

Usually in one of these two ways, Fluxus pieces would poke fun at traditional ways of performing music, or at the audience, or at the art world. While initial destructive intent of Fluxus, as well as its art-into-life motto, never fully materialized, the style and aesthetic of Fluxus has been extremely influential on modern music.

Ligeti was first involved with Fluxus at the beginning of their existence, composing events for the first “official” Fluxus event, the Fluxus Internationale Festspiele Neuster Musik. Drott notes that this event was Fluxus’s most wide-ranging artistic endeavor, featuring compositions by many modernist composers, amongst them Ligeti and Karlheinz Stokhausen. However, the Festspiele was the first in a tour of Europe, and by the end of the tour the roster of Fluxus artists had thinned out significantly, leaving those members most identifiable with the core of the movement. What became clear was that Maciunas, the organizer of Fluxus events and publisher of Fluxus publications, began to see a specific aesthetic and ideology as closely identifiable with his intentions. Maciunas held a disdain for polyphonic happenings where too many things were going on at once. He saw the “happenings” of Allen Kaprow and even John Cage, who he admired for his other work, as decadent. In a TV interview with Larry Miller (LM),

---

5 Drott, 205
6 Ibid, 213
Maciunas describes monomorphism, one of the things he believes is the defining characteristics of Fluxus.

GM: you mentioned monomorphism - that's an important item which should be mentioned That's where it differs from Happenings See, happenings are polymorphic, which means many things happening at the same time That's fine, that's like baroque theatre You know, there would be everything going on horses jumping and fireworks and waterplay and somebody reciting poems and Louis XIV eating a dinner at the same time So, that's polymorphism Poly means many forms Monomorphism, that means more one form Now, reason for that is that, you see, lot of Fluxus is gag That's part of the humour, it's like a gag In fact, I wouldn't put it in any higher class than a gag, maybe a good gag

LM: Really?

GM: Yes

LM: You don't consider Fluxus art”?

GM: A high art form" No I think it's good, inventive gags That's what we're doing And there's no reason why a gag, some people, if they want to call it art, fine, you know Like I think gags of Buster Keaton are really [a] high art form, you know, heh, heh, sight gags We do not just sight gags sound gags, object gags, all kinds of gags Now, you cannot have a joke in multi-forms In other words, you cannot have six jokers standing and telling you six jokes simultaneously It just wouldn't work Has to be one joke at a time

LM: Because jokes apply to our linear expectations

GM: Right The whole structure's linear and you cannot have even two jokes simultaneously, you don't get it So the whole structure of a joke is linear and monomorphic and I think that's why our concept pieces tend to be that way, it's like a gag You cannot have three gags simultaneously either, you're just going to miss two of them You'll get one and miss two Watch Buster Keaton He'll never have two gags at the same time They follow one another very quickly, but they will not be simultaneous And if they're simultaneous, usually they're bad gags That's one reason I think Marx Brothers are not that good on gags because they overcrowd them They just, you know, put many gags together and then you just miss.7

In the context of this categorization of Fluxus, it is interesting to consider how Ligeti's Poème Symphonique failed and succeeded as a piece in the "traditional" context of Fluxus. Ligeti wrote two other pieces for the movement. One, Trois Bagatelles for David Tudor, is traditionally composed yet contains long periods of silence in a similar vein to John Cage's 4'33". Although not many

7 Miller, 196
Fluxus pieces contained traditional scores, *Trois Bagatelles* did comment unfavorably on traditional conventions and was performable by a wide variety of performers (consisting only of a C# in the first movement, followed by two movements of rest). In another piece, *Die Zukunft der Musik* (The Future of Music), Ligeti describes the reaction to a lecture he gave on the future of music. In the lecture, Ligeti remained silent, commenting on how the future is unknowable, and then described the actions of the audience, which ranged from bemusement to pure anger. I find *Poème Symphonique* to be the strongest of Ligeti’s Fluxus pieces, both as a Fluxus piece and as the imperative for Ligeti’s dismissal of and departure from Fluxus.

In the piece, 100 mechanical metronomes are wound fully and set to different speeds. Then, the performers wait. Eventually, after around two to six minutes, the metronomes are started as simultaneously as possible. At first, a rich dense texture is created, then the metronomes slowly begin to turn off, and periodicity becomes apparent as fewer and fewer metronomes are playing. Ligeti’s score resembles an event score in its high prevalence of irony, specifically with regard to the acquisition of metronomes, yet is atypically long for an event score. Also, the performance is a monomorphic experiment in the tradition of many Fluxus works; a concept or experiment is established, and an event occurs, and the piece is over when the piece energy of the metronomes runs out. In this way it references and resembles other Fluxus works like La Monte Young’s *Composition 1960 #2*, which requires a performer to make a fire and the piece is over when the fire dies out. However, I find it very interesting
that Ligeti’s work creates a polyphonic monomorphism, creating a highly complex sound of many out of one concept. Drott writes that *Poème Symphonique* “… presents a complex conceptual object, an object that simultaneously emulates and resists Fluxus, both stylistically and ideologically.”

This echoes Ligeti’s own statements about the piece,

“The other aspect is, however, the work itself. ... What bothers me nowadays are above all ideologies (all ideologies, in that they are stubborn and intolerant towards others), and *Poème Symphonique* is directed above all against them. So I am in some measure proud that I could express criticism without any text, with music alone. It is no accident that *Poème Symphonique* was rejected as much by the petit-bourgeois (see the cancellation of the TV broadcast in the Netherlands) as by the seeming radicals…. Radicalism and petit-bourgeois attitudes are not so far from one another; both wear the blinkers of the narrow-minded.”

Certainly, *Poème Symphonique* owes a stylistic debt to Fluxus. The metronome is a standard instrument in traditional music practice, and Ligeti turns it on its head and makes a joke out of it. However, at the same time, Ligeti made a work that he claims was directed against ideologies for a strongly ideological art movement. The piece was Ligeti’s last associated work with Fluxus, yet he did not dismiss the work in the future, even citing it as a preparatory stage for works he would later write. (“If you listen now to the work for metronomes, after hearing the pizzicato movement from the string quartet … you realize that the piece for metronomes was a preparatory stage for this

---

8 Drott, 225
9 *Ibid*, 228
pizzicato movement.” Later in his life, Ligeti would take a strong stance against the art-into-life dogma of the Fluxus movement and the work of John Cage, stating, “They (Fluxus artists and John Cage) believe that life is art and art is life. I appreciate very much Cage and many people, but my artistic credo is that art—every art—is not life.” This idea of art as artificial reflects the virtual interaction that defines our world today. Our experiences are often mediated through technological forms or reference semantics, where something only has meaning because it references some other cultural phenomena. Certainly, computer music allows us to create sounds separate from those found in nature, and explores the creation of illusion and acousmatic sound, which is separate from the source. Fluxus pieces like those described above (drip music, paper piece, etc.) revoke the idea of both representational (sound that is supposed to represent something) and acousmatic sounds, by utilizing direct objects and unifying the sound and source in an extremely direct manner. However, *Poème Symphonique*, while directly exposing the source of its sound and purporting to have no representational meaning, also opened up a new musical language for consideration in the realms of acousmatic and representational music. Today, micropolyphony serves as an excellent way to represent the multiplicity and distraction encountered in our modern technological society.

10 Drott, 233
11 Ibid, 202
Alvin Lucier's Clocker & unstable time

Another piece dealing with the manipulation of pulse in time, and thus our sense of time, is Alvin Lucier’s Clocker. In the piece, scored for a clock, galvanic skin response sensor, and a digital delay system, a test subject’s skin responses trigger and control the delay signal on a ticking clock. The idea is for the performer to be able to control time. The bank of delays shift from extremely short slap-back delays, which turn the ticking of the clock into a pitched noise, while slightly longer delays multiply the sound of the ticking clock, and still longer delays overlay the ticks in more interesting rhythmic articulations. The sensory experience of the piece clears and restarts the listener’s internal sense of tempo and gives them new scenarios. It is hard to remember the initial tempo at which the clock was initially ticking as time is constantly shifting.

Piece 1 Conclusion

A strong influence behind my piece was to create some monomorphic structure, one type of synth, one control medium, which like Poème Symphonique, became an exploration through proliferation and repetition, rather than polyphony of different sounds, a polyphony of similar sources to point out the inherit multiplicity and disorganization in institutions and structures we perceive as static and unified. I figured that giving the performer control of this movement would in some sense, like Clocker, give the performer control of time, but that eventually that control and power would spiral into chaos. Like Ligeti’s piece, any performance of my piece will split easily into two sections, a section
where individual rates are perceptible and a section of perceptible chaos, and that is where I find intersection and interest. However, unlike Ligeti’s piece, my work features the presence of a performer. In many ways, I feel that this interface features an easy enough control mechanism that anyone could improvise and utilize it in future work. Another aim was to make electronic music that was strongly understandable in its form even if dense in content. The was achieved by simplifying the performance into a manipulation of only three parameters (speed, pitch and volume). I would like to be able to use this interface in the future with other performers and possibly slightly different combinations of sounds to continue to explore the sonic potentials of the interface.
Chapter 2: Piece 2: Mundanity & Landscapes

I have always had a soft spot for the little patches of nature that form in the shadow of large structures, whether it was a patch of overgrown grass next to a Target department store or hidden spots behind the tires in my elementary school. These places are freeing spaces, not utilized for any purpose, but just there; little reminders of what used to be just there before civilization came along and imposed its own structure.

The second piece attempts to showcase these forgotten background spaces by featuring time-lapse videos ripped from Weather Underground. The site provides a depository of continuously updating weather cameras from around the United States and Europe. Weather cameras are installed in locales across the country simply to show the weather, allowing remote viewers to see the current conditions anywhere such a camera is mounted. The cameras portray largely ignored spaces in order to showcase the changes in the weather as opposed to the behavior of humans. The aim is to have the viewer and listener actually see those spots that are usually so mundane as to be invisible and how they reflect the cycles that structure our lives. By bringing the background to the foreground, I aim to create a group experience where the audience leaves the constant humming of their own personal condition to consider the patterns and rhythms of the entire society.
**Technological implementation**

The piece was created using SuperCollider and Processing. The main sound is a whooshing noise that crescendos to a sharp attack, kind of like sucking air into your mouth at an accelerating rate, generated using the Blip unit generator, and then filtered through a resonant low pass filter. A simple algorithm updates the decay on the filter, so the piece slowly transitions from its initial dry whooshing state to an increasingly pitched texture. The pitches switch randomly in a major pentatonic scale as the videos change and The various channels creating this sound are gradually offset in time, creating a flam like effect as one whoosh crescendos to a spike just after another. The algorithm also cues the videos via to change. In its longer form, the piece also contains sections of noise that sound like long rushes of wind that morph into tonality, and insect-like noises to complete the suggestion of a pseudo-environmental soundscape.

**Image & the Internet // Evan Roth**

Today’s digital culture drastically reshapes our understanding of images and our memories. From a younger and younger age, we are bombarded with images on TV and the Internet that are moving faster and faster and becoming more and more self-referential. Evan Roth’s work, *Memory*, examines the shifting size and capabilities of the modern memory. In his piece, he arranges all of the images he has viewed on the Internet over the three-month period after the birth of his daughter. The piece is massive. Domenico Quaranta writes that,
(It) offers a picture of the web, taken at an instant that is meaningful in the personal life of one of its users, but completely random in the life of the medium, and from a very specific point of view (a single user’s computer) that is rarely shared.\textsuperscript{12}

In one sense, the piece is extraordinarily personal, while on the other hand; a lot of the images in the work are extremely commonplace and easily recognizable to the viewer of the artistic work. However, there is no timeline to the events (at least in the gallery exhibition). Images can be viewed in any order, an experience of disordered multiplicity. The beauty of the piece is both in the recognition of shared experience between the creator and the viewer and the recognition that those experiences were completely temporally different. No narrative structure is implied; only spaces and images create a common experience, while time structure could be different for everyone.

The Internet offers a shared experience that even more so than previous televisual technologies, is becoming more and more individuated as the system grows bigger and denser. In this sense, to use the easy analogy of the information superhighway, there are many entrances, many roads, and always fewer exits. Roth’s work strikes at the contradiction that such a global networked culture produces. There are more images that live in our collective memory, but more disparate connections that lead us to the same images. By utilizing images sourced from the internet in no particular order, and using geographical images, as well as images of roads, my piece attempts to draw upon this collective memory (my images could be anywhere, look familiar or even be

\textsuperscript{12} http://blog.evan-roth.com/
familiar) and the disassociation of this collective memory as the videos are played in a random order and jump from geographical location to geographical location in no ordinary way a traveling individual could perceive by means other than the networks created by the new digital landscape.

*Digital Landscapes*

The piece also harkens back to an early computer phenomenon in my life, the prominence of landscape images in computer desktop backgrounds. Today's desktop background options on my computer include seven categories, along with a section for solid colors. The sections, labeled “Desktop Pictures”, “Nature”, “Plants”, “Art”, “Black & White”, “Abstract” and “Patterns” include highly processed photographs or computer graphics patterns. However, compared to the patterns, most of the images have something to do with nature. The “Nature” category has the most options of any section, followed by the plants category. This is not including “Desktop Pictures”, which also mainly includes nature pictures. The website Reddit continually features pictures of magical locales or landscapes that allow the viewer to escape that commonplace zone of home or work. Even HD nature documentaries are irresistible, where perhaps a generation before found nature documentaries boring, today the stunning imagery that fills those shows is tantalizing. Furthermore, in television coverage of natural disasters, networks use environmental images attempt to create empathy for those affective, but the experience is dissociative, as the viewer response is dulled by the proliferation of environmental images.
This work and line of thinking owes a lot to the work of Godfrey Reggio and specifically his Qatsi trio. The first film in the trio, Koyaanisqatsi ("life out of balance") was the beginning of Reggio's work with long-form image poems, which lack any use of language and rely solely on a combination of sound and image. In the work, released in 1982, Reggio and his cohort, Ron Fricke, utilize stunning footage combined with time-lapse and slow motion techniques to tell the dystopian tale of technology's impact on the environment. Reggio uses gross juxtapositions (beachgoers dwarfed by a nuclear power plant, hundreds of hot dogs being stuffed into tubing at once followed by humans riding escalators) to create visceral emotional reactions. On the other hand, some of the film's imagery is so stunning as to almost defeat the purpose of the dystopian narrative.

Even Philip Glass, who wrote the score for the movie, has commented on the shifting message of the film. In an interview about the film, he has stated, "Four years ago, for example, we thought Koyaanisqatsi was a very political film. Now, it doesn't look that way at all to me." Reggio himself has stated repeatedly that he does not mind this apparent duality of his work, stating, "Some people see these films as just boring, some leave right away, some see them as this or that, some see them as a celebration of technology, or, like yourself (the interviewer), you see it as a questioning."
Specifically, the work becomes almost inspirational for the accomplishment that Reggio and Glass have made in the audio-visual sphere. The scenes featuring sped up cars in Los Angeles are extraordinarily beautiful sequences paired with the gleefully racing music of Philip Glass. The hallucinatory passages that follow are even reminiscent of the works of visual music pioneers James and John Whitney (see figures 2.1 & 2.2), whose moving points and streams of light also led to a significant reaction in the commercial film world, and whose work will be further discussed in chapter three.

Figure 2.1\textsuperscript{15} (still from \textit{Koyaanisqatsi}):

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{koyaanisqatsi_still.png}
\caption{Figure 2.1 (still from \textit{Koyaanisqatsi}).}
\end{figure}

\textsuperscript{15} http://www.davidbordwell.net/blog/category/film-technique/page/3/
To me, this contradictory turf makes *Koyaanisqatsi* all the more interesting to encounter, as in the thirty years since the movie was released, humanity’s technological progress has only increased, and for many, remains the answer to the environmental questions posed by Reggio. In a more recent interview from the spring of 2011, Reggio says,

Also, I must say that I don’t consider myself an environmentalist, even though my films have been tagged that way. My view of technology is not how it affects the environment, not how it affects politics, not how it affects religion, the economy, it’s that now everything is situated in technology. Technology is the new host of life. In that sense, technology is not something we use, it’s something we breathe, it is the host of life, it is the new environment. So technology, we keep seeing it as something we can use for good or bad. It’s bullshit I think, that point of view. It has its own politics, its own determination, its own determinants. And so it’s, how would I say, it’s become the environment of life, it

---

16 Lorcanmak.tumblr.com
has replaced nature as the host of human habitation and the rest of nature pays the enormous price for that.\textsuperscript{17}

In the movie \textit{50 First Dates}, Adam Sandler dates a woman with a brain condition that causes her to think every day is the same day, the date of the car accident that caused her brain damage. At the conclusion of the movie, once Sandler has won the girl over, despite high odds against his favor, he comes up with a way to make her remember the current day of the year and fill in the gaps of her memory. Each morning, he shows her a video summarizing the events of the time between her car accident and the present. \textit{Koyaanisqatsi} is in many ways fulfills similar idea. The film reminds us of the things we take for granted in our society and the many processes that go on when we take a step back and look behind the curtain. In a way it riffs on Karl Marx’s idea that commodification creates a phantasmagorical object that obscures the realities of the object’s creation. One of the key themes of the movie is commodification, as several scenes feature the production of human goods, hot dogs, pants, etc. The film critic Scott MacDonald reflects that the film is both a critique of commodification’s disastrous environmental effect as well as a critique of how commercial film blinds us to our societal realities by means of focusing on individuals who tidily resolve their problems. MacDonald writes that \textit{Koyaanisqatsi}, “critiques this central dimension of the popular cinema, by revealing that our trust in individuality is often a function of our ability to blind

\textsuperscript{17} Interview with Reggio on the website, a riotous disarray
ourselves (really and cinematically) to the larger patterns within which what we call individuality is subsumed.”

In this context, we can better understand the choices made by the composer Philip Glass and by Godfrey Reggio in picking Glass to score the film. Composed in sections, for example, a sequence for the clouds, a sequence for the city etc., the score brings home the emotional narrative implied in the images. For the sections stressing the power and grandness of nature, Glass utilized large, slowly moving brass and repetitive low chanted. In one scene where an airplane appears as light as air due to blurring from heat on the tarmac, the music mirrors the ethereality of the image with high and light voices. In the frenetic scenes, Glass’s score echoes that energy with repeated yet slightly varying rhythmic phrases and layering arpeggios in different instrument voices. Each section features repeated sections that only change slightly over time creating the sense that each section could be stretched or shortened in time. Glass’s score mimics the central assertion of commodification of the film. Value is not placed on generating individuality in the music through the likes of lyrical phrases, or space, but rather a continuous and repetitive stream of entrances and exits, with subtle shifts, that focus on production and repetition like the foreman of an assembly line.

Ideology aside, Koyaanisqatsi is an audio-visual masterpiece that created a new genre of film. It gave room for the image and music to

---

18 MacDonald, 379
communicate directly to the audience in a way that remains viscerally striking, even if the effect has been dulled by the proliferation of time-lapse, slow motion, environmental and aerial footage. Reggio has taken note of this proliferation, saying

What happened, then, was time-lapse then got picked up by every commercial art designer in the universe. Now you can’t turn on a TV without time-lapse being constantly present. And the reason they picked it up was that all these bright young people who came out of college were, of course, all bought up by advertising agencies. And they always look for, not that these were mass-made films, but they also look for people that are working with the language of image, a new way to use image, and so with time-lapse, they were like, ’ooh, wow.’ Now there are a zillion people that do nothing but time-lapse photography and sell it to Getty Images, for example. So there is a big pool of stock footage that the world feeds on. Again, you can’t turn on a TV set for twenty minutes without seeing time-lapse footage somewhere. So it became part of the language of image. In other words, it got consumed by the beast.\(^{19}\)

\textit{Piece 2 Conclusion}

One gets the sense after watching \textit{Koyaanisqatsi}, or reading Godfrey Reggio, of being hit by a bludgeon of all the world’s problems at once. It is a disorienting, bewildering, counter-productive feeling that can make the viewer feel small and powerless as a hopeless cog in a machine much, much larger than him or herself. At once, the proliferation of the Internet has strengthened the alienation of Western Civilization from the destructive processes it carries out day-to-day and increased our fluency in the digital language needed to communicate in such a technological environment. Some could view this as an illusion of power, occluding the mass impotence of a civilization run amok.

\(^{19}\) Interview with Reggio on the website, a riotous disarray
Certainly, Reggio feels this way. However, Evan Roth’s artwork offers a starting point from which to understand and move forward with the remapping of our digital consciousness.

My piece attempts to fuse the techniques of Reggio with the more relevant and accessible motivations of Roth. Roth contributes a reaction to our collective disassociation. By compressing images viewed over time, he creates a static image that annihilates the temporal component of Internet surfing. His work creates a shared experience via common images on our personal devices pointing out the illusion in the term personal and commenting on the status of our growing collective memory. Growing from the implications of Roth’s work, I try to access, trigger and reflect our collective memory by utilizing the forgotten spaces we like to ignore with our digital devices. As stated at the start of this chapter, these are places between spaces of purpose, chosen for the lack of narrative in their viewpoint so one (via a camera) can literally watch the rain.

In a reversal of Reggio’s complaints about his techniques leading to a proliferation of pretty stock video, I utilize found video that offers a mundane birds-eye view of the daily rhythms of society. Unlike the dramatic environmental images in Koyaanisqatsi, which nowadays remind me of action sequences shot in high-budget productions or nature documentaries, the weather underground videos, reminiscent of security camera footage, do not to dwarf the viewer in the grandness of the crafted cinematic experience, but rather more closely relate to the viewer’s daily experience, in a way that
parallels Roth’s use of common website destinations. (Figures 2.2 and 2.3 show contrasting images from *Koyaanisqatsi* and the weather cam videos). Still, the piece, by offering a glimpse of our forgotten environment in the audio-visual language developed by *Koyaanisqatsi*, comments on the missing pieces present in our society’s endorsement of individualism. It forces the individual to step out of their own skin and offers no alternative individualized narrative for them to follow, but rather a reimagined landscape to encounter. The videos are churned out in an assembly line fashion, offering a montage of formally similar (time-lapse), yet slightly different videos. The videos are eerily familiar, as they don’t feature any revealing landmarks and showcase both rural and urban American scenarios. They remind us of the multiplicity of consciousness at play at any given moment, and showcase the similar, yet slightly unique, experience of each individual.

Figure 2.2: *Koyaanisqatsi*²⁰

²⁰ *Koyaanisqatsi* photo gallery -
http://www.koyaanisqatsi.org/images/gallery_koy/37.jpg
In composing the music, I tried to mimic the sounds associated with outdoor environments. Although made up from electronic noises, the music sounds like a combination of wind, insects and chimes. The chimes serve a secondary purpose in establishing both a static energy, with forward propulsion created by slight rhythmic changes, much like Glass’s music in Koyaanisqatsi. The chimes are tuned to a major pentatonic scale, which creates a harmonic stability. However, the rhythmic offset, and the quality of the rush of noise makes keeps the listener on their toes, instead of lulling them into boredom and passively accepting the images, the audience hopefully actively considers the images, the nature of our day-to-day lives, and the presence of a pretty interesting background.
Chapter 3 – Computer Graphics Animation

The inspiration for the third electronic piece comes from old memories I have of hanging out with my grandfather. The first was playing with old spirograph toys and the second was a sculpture we built and populated with a bunch of tiny felt animals. The first memory is influential in my appreciation of geometric patterns and the second deals with the creation and control of a myriad of little pieces to create a populated whole in an imaginary universe. For this piece, I created a piece of visual music based around geometric forms, motion and the manipulation of hundreds of points.

In their taxonomy of visual music, Jack Ox and Cindy Keefer outline four visual structures that can be called visual music. While the piece fits into multiple categories in its literal technical implementation, the second category describes it best.

A time based narrative visual structure that is similar to the structure of a kind or style of music. It is a new composition created visually but as if it were an aural piece. This can have sound, or exist silent.

Theorist/inventor Adrian Klein wrote in 1930: "...somehow or other, we have got to treat light, form and movement, as sound has already been treated. A satisfactory unity will never be found between these expressive media until they are reduced to the same terms."21

The piece is intended to work as a dance of light images, and I found that I used sound to guide the visuals rather than directly determine them. That being said, some of the visualizations are directly controlled by the quality of the music in the composition, such as the pitch and volume of the sounds. I envisioned the

21 Ox and Keefer
piece as a series of simple etudes in music and image, with an overarching unity achieved by either the continuousness of the image, or of the sounds. I was particularly inspired by the short studies made by visual musicians such as Oskar Fischinger and John and James Whitney. At its core, the animation consists of a group of points or spots, that can be manipulated to move, aggregate and morph. In this way, the piece follows the theme of multiplicity running throughout the concert. In the first piece, it is a multiplicity of simple pulse rates being tamed into a texture, in the second piece, I engage multiplicity in similar visual locations, and this piece is a personal experiment in the taming of dots into an image.

The use of dots tamed into geometrical shapes is not a new idea in visual music. In his article, “Towards an Aesthetic of Visual Music,” William Moritz writes “(James) Whitney limited the building blocks of his films to the dot, but in a film like YANTRA, he created an astonishing diversity and complexity of images by clustering the dots to imply solid shapes or aligning them to outline geometric forms, by choreographing the dots into dramatic patterns of movement, by varying textures through solarization of the film stock, and by balancing the colors of the dot figures against the background hues.”22 During the process of composing this piece, geometrical experimentation was crucial part of finding out what I wanted to do, and I even ended up improvising sonically and visually during the performance. One of the central tactics that emerged was to choose locations for the points to converge on, and then radiate out from. The resulting

22 Moritz
effect, as Moritz states, did indeed yield an “astonishing diversity and complexity”
of images, including hypotrochoid figures reminiscent of the spirographs of my youth, as well as attractive images of total chaos.

In the same article on visual music, Moritz warns of the pitfalls of visual music, specifically related to computer graphics, “The "computer artist," furthermore, usually has to refurbish the raw imagery by traditional film and animation processes, and still the finished product is often more of a "syndrome" than a piece of Visual Music - a particular style of pattern appears and "does its thing" repetitively for 5 or 10 minutes (often accompanied by attractive music) and then stops, for no particular reason.”23 These were certainly things I worried about in the process of composing this animation. Repetition, while often appropriate and certainly a theme of this performance, can lead to boredom as a smart audience becomes able to pick out the process and recognize exactly what is going on. On the other hand, I did not want to create one of the constantly morphing “acid-trippy” visualizers that populate music software like iTunes.

I attempted to find a middle ground, letting certain processes run for a while, but then to begin a new phase by overlaying multiple visual elements. For example, a long section of my piece is focused on black figures shifting from triangles to squares to circles in time with gong like music. Repetition is key in this section, as the audience begins to pick up and enjoy what is going only after a while, and then the experience becomes quite enjoyable. To transition out of

23 Moritz
that section I quietly introduced a distortion theme in the background audio, and attempted to mirror the background of the sound in the background of the image. As the distortion grows, the background of the image grows in intensity, becoming the foreground. The process, spread out over time, hopefully establishes a repetitive theme, and then morphs into another section, leaving the viewer aware of the transition but not clear on the distinct end and beginning points of the “syndrome,” as Moritz puts it.

However, Moritz’s main advice to practitioners of visual music, in fact his conclusion in “Towards an Aesthetic of Visual Music” states, “Are there "rules" for the composition of Visual Music? Perhaps so, but not any easy, exact values - no one color or shape or motion is always equivalent to a certain tone or chord or rhythm. And the secrets of constructing a satisfying overall structure must be learned from a great deal of comparative study of successful and unsuccessful Visual Music compositions - and a lot of trial-and-error practice!”24 While this may seem obvious, it is actually highly encouraging to an early practitioner of visual music, and in fact trial-and-error was the only way I was able to move forward in creating this piece.

*Absolute Film Attitude*

While the other pieces speak more towards a theoretical mission, this piece gave me the most personal and involved enjoyment in creation and I think it is important precisely because of that. I have found that in comparison to the

---

24 Moritz
artists in the other genres I have encountered in this paper, practitioners in absolute music tend to speak less about their own work, and theorists have less to say about the societal importance of the work. From Oskar Fischinger, who in a piece titled, “My Statements are in my Work,” reflects on how he considers the creation of absolute art and creative integrity to be of utmost importance.²⁵ To Jules Engel, who writes in Reflections: Graphic Choreography, "My aim is to discover and not to solve problems. It is to find things that you didn't know existed!"²⁶ We see how, in an almost defensive fashion, the creator of the absolute animated film distances himself from the realities and narrative present in conventional film, and instead prefers to reflect on their creative mission and speak through their work.

²⁵ Fischinger
²⁶ Engel
Chapter 4 – A musical ensemble

The final pieces of my performance consisted of three works for a ten-piece ensemble. The ensemble itself was made up of a rhythm section (drums, guitarist, bass), a string section (two violins and a viola), a woodwinds section (flute, clarinet and saxophone), a brass section (trumpet and trombone) and vocals. The pieces were an attempt to fuse my experience writing songs in a pop context, with my experience in large improvisational groups (specifically working with Anthony Braxton at Wesleyan) and my experience working with computer music. In a sense, it was an attempt to filter my very personal songwriting style through genres and mediums I have previously understood more conceptually than in practice to try and create an ensemble with what I found to be the positive aspects of all three environments.

One of the aspects frequently stressed in playing collective improvised music with Anthony Braxton is the need for the musicians to be acutely aware of one another as well as the overall sonic creation of the ensemble. Often this can start simply by playing quietly (especially since I am a trumpet player). This was something I frequently stressed during rehearsal and felt like I was able to achieve. In the concert, the horizontal spread of the band was perhaps too wide, and shunted reactive communication, but nevertheless the desired effect was achieved.

All the songs feature simple melodies sung by the lead singer. The chord progressions are all simple, extremely simple, as I really wanted the texture of
the instruments and the sound of the band to overpower any harmonic considerations. The focus instead was much more on dynamics and the layering of individual voices in unique timbral or rhythmic means. One of the reasons for this was a consideration of the overall sonic effect, but another was for the comfort of the musicians. I didn’t want the performers to feel like they could play a wrong note and instead turn the energy they could spend doubting themselves, especially in an improvisational context, into energy for the songs.

Another aspect of the band was the personal relationships involved. Most of the musicians in the band I have known for a while and have developed musical relationships. I find that I derive more enjoyment from letting the music grow out of personal relationships instead of personal relationships being stretched towards a form. One of great dynamics of this band was that since everyone knows one another, there was a give and take of ideas. Even though I was the leader of the band, wrote the songs, and was singing the songs, I did not feel like I was in complete control. There was a give and take of ideas, and the other musicians helped me to elucidate and develop the songs, especially because there was so little composition involved. Also, since the songs relied so much on swells and lulls of energy, it was important to have musicians who could

The composer Panayiotis A. Kokoras has proposed a new term for textural based sound compositions. He defines monophonic as the presence of one voice, polyphonic as the presence of multiple voices bound through
harmony, and homophonic, which consists of a melodic line with a chordal accompaniment. What is important to Kokoras, is a consideration of the listener and which line the listener will follow. In monophony and homophony, the listener will naturally follow the lead melody. In polyphony, the listener follows the voice from one to another. But in holophony, “the listener focuses on the synthesis of the simultaneously-layered sound streams.”27 The ensemble pieces, in reference to the electronic pieces, move through stages of homophony and holophony, accentuating sections of strong unity with a multiplicity of streams of noise, allowing the audience to shift from a consideration of the whole texture, individual emerging elements, and the main melody.

27 Kokoras
Conclusion

All in all, this concert covers a wide variety of mediums while attempting to meditate upon a single, human theme and trigger an emotional response.

Unity and multiplicity bring up the deeper human feelings of focus and distraction, loneliness and crowds, and originality and reproducibility. By framing the concert around all the simple contradiction of one and many, I hope to have engaged some of these feelings. In the first piece, a single pulse becomes multiplied into a web of texture, disorienting and distracting the listener. Outliers stand out for a moment, but then fade back into the milieu. In the second piece, the language of reproduction is considered as the audience considers the patterns of society larger than themselves. The third piece is an exercise in visual and musical organization. Hundreds of points coalesce and disperse, form unified repetitive structures, and then disperse once again. Finally the ensemble work attempts to engage all that by contrasting simple melodies and harmonic language with phasing and continuous stream sources that shift the listeners focus from the center to the periphery and back again.
Compositional Techniques

(For the full code used in the performance, see the Appendix on the CD included with this paper)

OSC

All of the pieces rely on OSC (Open Sound Control) messages. OSC messages transmit data between computing devices as well as programming languages. Each piece in the electronic section featured OSC communication between SuperCollider and Processing, and the first piece features OSC data being transmitted between an iPad and a computer.

OSC implementation between SuperCollider and Processing is quite simple, as shown below.

____________________________________________________________________________

```plaintext
var processing = NetAddr.new("169.254.165.140", 12000);
processing.sendMsg('freq'++(i), x.value);
```

___________________________________________________________________________________

In the first piece, the interface with the iPad was created using a similar technique.

____________________________________________________________________________

//Information for creating interface on control OSC
~ip = "169.254.234.50";
~port = 8080;
~myIP = "169.254.88.28";
~myPort = 57120;
// creation of the interface
n = NetAddr(~ip, ~port);
CNTRL.init(~ip, ~port, ~myIP, ~myPort);
n.sendMsg("/control/createBlankInterface", "testing", "portrait");
**Piece 1**

In piece one, several Synth objects (continuously playing sounds) are created and stored in an array.

```
~numSynths = 150;
~synthArray = Array.fill(~numSynths);

//simple synth def that sends a pulse through a sine tone
SynthDef(sin, {freq=60, amp = 0, gate = 1, rate = 0.5, pan, out-0l
  var audio = SinOsc.ar(freq.midelcps) * Pulse.ar(rate);
  audio = audio*Linen.kr(gate, 0.01, 1, 0.01, 2);
  OffsetOut.ar(out, amp * audio}).add;

s.plotTree;

//creation of synths
(~numSynths - 1 ).do{|i|
  ~synthArray[i] = Synth(sin, [amp: 0, freq:60, out:6.rand ]);
};```

Then the sliders are created, each synth receives an equivalent volume, pitch and rate control. Most of the data relates to the actual drawing of the slider, but the “callback” function is what actually happens when the sliders are utilized. In this case, it modifies the pitch parameter of the playing pulse rate.

```
//pitch sliders
CNTRL.slider{{min: 30,
  max: 100,
  y: i /~numSynths,
  height: 1/~numSynths,
...```
This is pretty much all that is happening in piece one, as only slightly different code is required for volume and rate control.
**Piece 2**

The second piece features a continuously running sound synthesizer, played through Ndefs that stream a sound yet have parameters that are able to be accessed and changed on the fly.

At first, a bunch of these Ndefs are created.

```plaintext
~blip = {freq0 = 60, freq1 = 60, amp = 0.2, decay, rate1 = 0.1, rate2 = 0.1, out!
  var source = WhiteNoise.ar([Blip.ar(rate1), Blip.ar(rate2)])*4;
  var filter = Ringz.ar(source, [freq0.midicps, freq1.midicps], decay);
  OffsetOut.ar(out, filter*amp)
};
```

Here, initial parameters are created. The low decay creates the “dry” sound and the slow rate leaves a lot of space at the beginning. The tonic centers the sound in one key.

```plaintext
16.do{|k| var name = "i" + k;
  ~decayfunc.(name.asSymbol, 0);
  ~ratefunc.(name.asSymbol, 0.1);
  Ndef(name.asSymbol, ~blip).ar;
  Ndef(name.asSymbol).set(freq0, 60);
  Ndef(name.asSymbol).set(freq1, 60);
  Ndef(name.asSymbol).set(amp, 0.001 + 0.005.rand);
  Ndef(name.asSymbol).set(out, 6.rand);
};
```

```plaintext
~counter = 0;
~rates = 0.1;
~amp = 0.1;
```
\[ \sim \text{decays} = 0; \]
\[ \sim \text{tonic} = 60; \]

This section creates a loop that runs until the counter reaches a certain rate. The method \emph{.wait} indicates how long each loop of the cycle will run.

\begin{verbatim}
while({\sim \text{counter} < 51}, {

“updating material”
{(4.0 + 6.0.rand).wait},
{(10.0.rand).wait}
\sim \text{counter} = \sim \text{counter} + 1;
}
\end{verbatim}

Another section updates in a different matter, by keeping track of the value of one parameter, in this case rate, the program waits for a certain musical quality to be achieved before introducing new elements.

\begin{verbatim}
while({\sim \text{rate} > 0.01}, {

“updating material including decreasing the rate”
{(4.0 + 6.0.rand).wait},
{(10.0.rand).wait}
}
\end{verbatim}

At the end of the loop, the counter, along with the parameters mentioned before, decay and rate update, creating more rhythmic density and tonal presence. SuperCollider also sends a message to Processing every time this happens, which updates the videos. Contained in the loop this happens each time the loop
refreshes.

~decayfunc.(name.asSymbol, ~decays);
~ratefunc.(name.asSymbol, ~rates+rateshift, ~rates + rateshift);
Ndef(name.asSymbol).set(freq0, notes.choose + shift.choose);
Ndef(name.asSymbol).set(freq1, notes.choose + shift.choose);
Ndef(name.asSymbol).set(amp, 0.0001 +0.005.rand);

~counter = ~counter+1;
~counter.postln;
~decays = ~decays +0.01;
~rates = 0.15 + 0.1.rand;

While the rates also increase to multiply the density of the sound, another simple algorithm picks one of the playing sounds by randomly picking a number, and then offset the rate of that one sound, creating the flam effect. This algorithm runs through each playing sound, sets of their rateshifts to 0, meaning no change, except for the one synth picked by the random number generator.

var changepoint = 16.rand;
16.do{|k| var name = "i" ++ k ;
    var rateshift = 0;
    if(k == changepoint,
        {rateshift = 1.0.rand;}
    )
};

Here is the full code for the introductory section of the piece, which uses methods defined above.

while({~counter<51},{
    var notes = [~tonic, ~tonic + 4,~tonic +7, ~tonic +9, 
~tonic +12];
    var shift = [-24,-12, 0, 12, 24];
```javascript
var changepoint = 16.rand;
16.do{|k|
  var name = "i" + k;
  var rateshift = 0;
  if(k == changepoint,
    {rateshift = 1.0.rand;}
  
  
  
};

~decayfunc.(name.asSymbol, ~decays);
~ratefunc.(name.asSymbol, ~rates+rateshift, ~rates + rateshift);
Ndef(name.asSymbol).set(\freq0, notes.choose + shift.choose);
Ndef(name.asSymbol).set(\freq1, notes.choose + shift.choose);
Ndef(name.asSymbol).set(\amp, 0.0001 +0.005.rand);

~counter = ~counter+1;
~counter.postln;
~decays = ~decays +0.01;
~rates = 0.15 + 0.1.rand;
if(~counter <30,
  {(4.0 + 6.0.rand).wait},
  {4.0.rand).wait});
~processing.sendMsg("/go");
}
});
c.play;
};
)
```
**Piece 3**

Sound and image generation:

Unlike in piece 2, where the sounds are continuously playing using Ndefs, piece 3 features SynthDefs, which store a sound quality, and allow specific instances to be played using patterns (like a score). Here, the template sound is created and stored on the SuperCollider server.

~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
~klanktri = { l out=0, dfreq1 = 60, dfreq2 = 64, dfreq3 = 67, dfreq4 = 69, dring1 = 1, dring2 = 1, dring3 = 1, dring4 = 1, damp1 = 0.5, damp2 = 1, damp3= 1, damp4=1, dusty1 = 3, dusty2 = 9, dusty3, dusty4, dusty5, dusty6, amp, rate, gate = 1, sus = 1, rel = 1, rate1= 1, rate2= 1, rate3=1, rate4=1, id= 100 |
  var freqs, ringtimes, audio, amps, amptracker;
  var env = Linen.kr(gate, 0.4, sus, rel, 2);
  freqs = [dfreq1.midicps, dfreq2.midicps, dfreq3.midicps, dfreq4.midicps];
  ringtimes = [dring1, dring2, dring3, dring4];
  amps = [damp1, damp2, damp3, damp4];
  audio = DynKlank.ar([freqs, amps, ringtimes ],
  LFTri.ar([rate1, rate2, rate3, rate4], [3, 6, 9, 12]);
  SendReply.kr(Impulse.kr(rate1), '/rate1', [id]);
  SendReply.kr(Impulse.kr(rate2), '/rate2', [id]);
  SendReply.kr(Impulse.kr(rate3), '/rate3', [id]);
  SendReply.kr(Impulse.kr(rate4), '/rate4', [id]);
  OffsetOut.ar(out, audio*amp*env);
};
SynthDef(\klanctri, ~klanktri).add;
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

In the definition of the template sound, multiple things are going on. The sound is created and shifted by parameters like pitch and amplitude. However, the value of these parameters, via the SendReply class, are being sent as messages to other parts of the program, at a rate equivalent to the sound above. Notice that rate1, shows up twice. It is present both in the creation of the sound,
(audio = DynKlank.ar([freqs, amps, ringtimes ], LFTri.ar([rate1, rate2, rate3, rate4]), [3, 6, 9, 12]);

and the triggering of the SendReply class

(SendReply.kr(Impulse.kr(rate1), '/rate1', [id]);).

This allows for the animation to sync up with the music. At the other end of the communication in SuperCollider is an OSCdef that receives the messages.

__________________________________________________________________________

OSCdef(square1, { | params |
  var processing, id = params[3];
  id.postln;
  processing = NetAddr.new(~procstring, 12000);
  processing.sendMsg("/rate1", id);
}, '/rate1');

__________________________________________________________________________

This object responds any time the synthDef defined above is accessed and played. This occurs through the creation of patterns, which are analogous to scores of music. Here is an example for the “klanktri” instrument defined above.

__________________________________________________________________________

~tri2 = Pbind(*[
  instrument: \klanctri,
  dur:1,
  id: 6,
  rate1: 6,
  rate2: 4,
  rate3: 1,
  rate4: 2,
  amp: ~triamp,
  damp1: 3,
  damp2: 3,
  damp3: 3,
  damp4: 3,
]
dring1: 0.4,
dring2:1,
dring3:1,
dring4:1,
dfreq1: \texttt{Pstep(\texttt{Pseq([84,72, 60,48, 69],inf)}, 1),}
dfreq2: \texttt{Pstep(\texttt{Pseq([48, 67,64, 69],inf)},1),}
dfreq3: \texttt{Pstep(\texttt{Pseq([67,64, 69],inf)},1),}
dfreq4: \texttt{Pstep(\texttt{Pseq([64, 69, 67],inf)},1),}
sus: 1,
rel: 1

The pattern holds specific instructional material for the noise (pitch, volume etc.) To recap, a noise template is created, via the SynthDef. In the template, it tells the computer what to do with the values it is sent, simultaneously playing and sound and forwarding the information to the animation program. The pattern feeds the template information, triggering sound and image. In the piece I also use graphics patterns, which cut out the middleman (the OscDef) and directly sends values in a sequence to processing. For example,

```
processingplayfunc2 = {
  \texttt{~processing.sendMsg("/curve");}
};
curvesnoise = \texttt{Pbind(*[
  instrument: \texttt{badnoise},
  freq: \texttt{~pyramid},
  //freq1: \texttt{Pseq([24, 12],inf)},
  decay: 2.0,
  amp: \texttt{~curvesamp},
  dur: \texttt{Pseq([0.2,0.1, 0.05, 0.025, 0.3,0.01, 0.01, 0.01,0.01,0.01], inf)},
  out: \texttt{Pseq([0,1,2,3,4,5], inf)}
]});
curvesgpattern = \texttt{Pbind(*[
  play: processingplayfunc2,
  processing: \texttt{NetAddr(procstring,12000)},
  dur: \texttt{Pseq([0.2,0.1, 0.05, 0.025, 0.3, 0.01, 0.01, 0.01,0.01,0.01],inf)}
]};
```
These are two patterns that run simultaneously. The effect of one is to provide data for a sound, the other, with equivalent durations, directly sends data to Processing which draws a curved line as soon as it receives the message, creating a unity of sound and image. Finally, animation responds to various triggers that cause a myriad of effects, lines filling up the points, lines changing to circles, scene changes etc. Below are a few of these messages with their descriptions attached.

```processing
~processing.sendMsg("/points", 0.5, 0.5) – aggregates points into groups and sends them to particular nodes. This example creates one node at the center of the image and sucks all the points toward that node like a black hole.

~processing.sendMsg("/movement1") – triggers movement one, where the points emanate outward in a circle from whichever node they are attached to. If movement1 is on, and the points message is sent, changing the location of the node, the points will reset their direction, creating hypotrochoid effects.

~processing.sendMsg("/speedmove1", 2.0) – changes the speed that the points move in movement 1.

~processing.sendMsg("/movement3") – creates shape centered on the location of nodes.

~processing.sendMsg("/linesincirc") – triggers “linesincirc”, which continuously creates lines between points centered around a node.

~processing.sendMsg("/choose", 5.0) – choose calls different effects to be utilized with linesincirc, essentially “linesincirc” runs in loops through the group of points associated with a node, this message can change the lines to circles or shift the point of origin of the lines from one of the points to the node associated with the group.
```
There are also OSCdefs in the supercollider code that receive information from the image. The following code waits until all the points on the screen are filled up with points, and then starts the next section of the piece by cueing a new routine.

```
OSCdef(curves, { arg msg, time, addr, recvPort;
    var parapara;
    msg.postln;
    Pdef(curves).clear(0);
    OSCdef(coinscolourchange).disable;
    Pdef(intro).fadeTime = 5;
    Pdef(intro, parapara).play;
    ~y.play;
    r2.play;
    }, '/ceiling').enable;
```

Here are two screenshots of the animation, before and after the curves have filled up the screen (see next page).
Works Cited


**Image Sources**


<http://31.media.tumblr.com/cd6ee63e4e1d2f6c0bd85022595002c/tumblr_m0klcUGB1qaxnilo8_500.jpg>.


The text from the Fluxus manifesto (by George Maciunas) and the score for *Pòeme Symphonique* were found at


And

http://www.artnotart.com/fluxus/gligeti-poemesymphonique.html


**Acknowledgements**

This work would not have been possible without all the communities of people developing SuperCollider and Processing, writing examples and building libraries. I would like to specifically thank Charle Roberts for his work with Control OSC and for Andreas Schlegel for developing oscP5 for processing. I also am extremely grateful to my advisor, Professor Ronald Kuivila, for allowing me to take on such an ambitious and multifaceted project, and offering support, guidance, and code along the way. I would like to thank Jacqueline Soro, Gabriel Greenberg, Evan Scarlet, Adam Johnson, Isaac Silk, Sean Winnik, Nate Repasz, Rebecca Schisler, Julius Bjornson and Rachel Connor for performing the ensemble works with me. And finally, last but not least, I would like to thank my family and friends for offering me constant support and inspiration.