FOLIE À DEUX: A MUSICAL COMPOSITION FOR FLUTE, CLARINET, VIOLIN, CELLO, PIANO AND VIBRAPHONE WITH ELECTROACOUSTIC MUSIC AND LIVE AUDIO PROCESSING

by

MARK JOEL HANNESSON

B.Mus., Brandon University, 1995
M.Mus., The University of Alberta, 2001

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Abstract

Folie à deux is a musical composition for flute, clarinet, violin, cello, piano and vibraphone with electroacoustic music and live audio processing. It explores the idea of musical influence through the metaphor of shared delusion.

This dissertation is made up of four main sections. The first will look at the background to the piece, the historical and personal influences that led to its composition. The second section will discuss those aspects of the piece that are somewhat unique as well as an examination of how it does not correspond to standard practices. Next, a detailed examination of the steps taken to bring the piece to fruition will be explored. Finally, some concluding remarks will be made about the piece and the future creative directions that may be followed in its wake.
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Dedication

To Jennifer, Claire and Benjamin
1. Introduction

“Spectral music is allied to electronic music: together they have achieved a re-birth of perception.” (Harvey, 2001, p. 11)

_Folie à deux_ is a musical work for flute, clarinet, violin, cello, piano and vibraphone with electroacoustic music and live audio processing. The instrumental (acoustic) music is tightly interconnected to the electronic material (triggered sounds and digital signal processing) through spectral associations, rhythmic correspondence and a conceptual underpinning.

The piece explores the idea of musical influence. Each musical element acts as a stimulus for the other elements. The conceptual metaphor is the psychological condition of _folie à deux_, in which one person’s delusional state causes the same delusion to manifest itself in another person, a shared psychotic disorder (Sharon, 2007). Each instrument, with the exception of the vibraphone, begins by playing material modeled on its own spectral pitches. The vibraphone begins by playing pitches modeled on the spectrum of the composer’s voice. As the piece progresses, the instruments attempt to fight off the vibraphone’s delusional spectrum by combining theirs. First grouping into woodwinds, strings and piano, then the woodwinds and strings join and finally all of the instruments, except for the vibraphone join their pitch collections into a single unified collection. During the B section (beginning at measure 247), the instruments re-enter one by one and give in to the delusional influence of the vibraphone and adopt the voice spectrum. By the end of the piece, all of the instruments are united in the voice spectrum (now playing the larger, more complete voice pitch collection).

The idea of musical influence extends to the live processing of the instrumental music as well. The instrumental spectrums influence decisions made by the composer and implemented in the Max/MSP patch (see 1.1.1.3) controlling the live processing. Also, the aural result heard by the audience is different from what is being played on stage. A sort of aural madness ensues in which an altered sonic reality exists. This is not a madness that rages, instead it is a delusion of normality. It is an otherworldliness that becomes plausible due to the familiarity of the sounds of
the instruments. One that is subtly wrong but that could almost delude a listener into believing it to be real.

1.1 Background

1.1.1 Historical

1.1.1.1 Electroacoustic/Acousmatic

Electroacoustic/Acousmatic music is a branch of western art music in which the composition is produced in a studio to be presented in public at a later date. It is primarily produced upon a fixed media. To quote Jonty Harrison,

"Acousmatic music on the whole continues the traditions of musique concrete and has inherited many of its concerns. It admits any sound as potential compositional material, frequently refers to acoustic phenomena and situations from everyday life and, most fundamentally of all, relies on perceptual realities rather than conceptual speculation to unlock the potential for musical discourse and musical structure from the inherent properties of the sound objects themselves - and the arbiter of this process is the ear." (Monro, 2000)

The electroacoustic portion of *Folie à deux* is a series of computer sound files that are triggered within the Max/MSP patch (see 1.1.1.3). By triggering the samples individually rather than making one large sound file that runs concurrent to the acoustic music, a greater degree of synchronization with the instrumental music can be maintained. With triggered sound files changes in tempo in the instrumental music can be compensated for. In addition, delay and reverberation are added to the sound files by the Max patch at performance time.
1.1.1.2 Spectral

The instrumental music is composed in a fashion closely related to the Spectral style of composition. Spectral composition is an instrumental music primarily concerned with large, slowly evolving timbral structures which are modeled upon Fast Fourier Transforms (FFTs). FFTs can provide data which can be used to supply timbral details of a sound. This frequency information can then be used as pitch material for a piece. Spectral music is closely associated with the compositions of Tristan Murail and Gérard Grisey.

Earlier historical precedents in timbre based composition include several works of Edgard Varèse, “in which the notion of timbre is elevated to a compositional principle” (Anderson, 2000, p. 12). An example of this would be *Intégrales* (1924) which “largely consists of *blochs sonores*, each sharply defined in register, intervalic content and instrumentation (Anderson, 2000, p. 12). Another important, early influence on spectral composition is Giacinto Scelsi who wrote a series of works that “reduced pitch content so completely that the listener is forced to examine otherwise unnoticeable minutiae of sound, such as harmonics, beats and difference tones” (Anderson, 2000, p. 12). An example is the piece, *Four Orchestral Pieces on a Single Note* (1959). Several of the works of Karlheinz Stockhausen were influential on spectral thought. Most significant is *Stimmung* (1967) for six vocalists in which “a single harmonic spectrum on B-flat is filtered by perpetually changing phonetic coloration on the six notes, who also emphasize individual partials by using overtone chanting” (Anderson, 2000, p. 13), and *Mantra* (1970) for two pianos and live electronics in which ring modulators are used to make it “possible to hear inside the timbres, to hear them as real harmony” (Anderson, 2000, p. 14).

Murail has referred to Spectral composition as, “an attitude toward music and composition, rather than a set of techniques.” (Fineberg, Sculpting Sound: An introduction to the Spectral Movement-its ideas techniques and music, 1999, p. 2) Joshua Fineberg refuses to provide a detailed list of the characteristics that make a piece of music or a composer Spectral since it is so easy to find exceptions. However, in refusing to define Spectral composition in this way he has in fact provided a very good description of some of the more common characteristics. He says,
“…that the music has made color into a central element of the musical discourse, often elevating it to the level of the principle narrative thread; that orchestral fusion is often a main feature of its surface texture, so that individual voices are subsumed in the richness of the overall texture and color; that the basic sonic image is often sonorous and resonant giving the music a sort of acoustic glow that comes from the coherence – in the domain of frequencies – of the different constituent pitches; and even that this music simply sounds profoundly different from other musics…”(Fineberg, Spectral Music, 2000, p. 3)

Fineberg goes on to say that, “the only true constant for all these composers is that they consider music ultimately to be sound and see composition as the sculpting in time of those sounds that the listener will hear.”(Fineberg, Spectral Music, 2000, p. 3)

The primary model for the composition Folie à deux is Jonathan Harvey’s Mortuos Plango, Vivos Voco (1980). Mortuos Plango, Vivos Voco is a tape piece that utilizes two sound sources: the voice of Harvey’s son and the great tenor bell at Winchester cathedral (Harvey, 1981, p. 22). With this piece, Harvey produced a work in which, “every event, down to the smallest detail, can be deduced directly back to the bell spectrum and the eight pitches extracted from it”(Anderson, 2000, p. 19). It is, “a classic of computer music and probably the only serially composed spectral composition”(Anderson, 2000, p. 19). This concept of serially organized spectral elements was very influential on the compositional process of Folie à deux.

1.1.1.3 Live electronic processing

The signals of each of the instruments (flute, clarinet, violin, cello, piano and vibraphone) are passed through a computer running Max/MSP. As each of these signals passes through Max/MSP they may be delayed and/or filtered: reverberation is applied before being mixed with the triggered sound files (that are also passed through the delay and reverberation effects); and output is then provided to the loudspeakers in stereo (see 3.4.3).
Max was developed primarily by Miller Puckette at the Institute de Recherche et Coordination Acoustique/Musique (IRCAM) in Paris, beginning in 1986. At this point it developed as MIDI control software for IRCAM’s 4X synthesizer. In 1990 the development of Max split into two different directions. Opcode Systems, with David Zicarelli as the primary developer, produced Max as “a full-featured Macintosh programming environment with improved screen graphics, playback of standard MIDI files, multimedia capabilities and a large collection of new features.” (Winkler, 1999) In 1999 development of this version was taken over by Zicarelli’s company Cycling ’74. (Hart, 2008) Meanwhile Puckette adapted Max (Max/FTS) for the IRCAM Signal Processing Workstation (ISPW) that was introduced to replace the 4X system (Winkler, 1999, p. 16). Miller Puckette released his own open-source version in 1996 called Pd (Pure Data). In 1997 a set of synthesis and audio processing objects was added to Max called MSP (Hart, 2008).

Folie à deux exists within the tradition of live electronic music, specifically, that of live processed instrumental music. The electronic part in Folie à deux is not particularly interactive: the performer merely follows the conductor and triggers ‘bangs’ in the Max patch while operating the mixing console. The Max patch itself gives the perception of interactivity in that it processes the live instrumental music in real-time.

“Imaginary relationships, however, may have been prepared in advance (soundfiles, control sequences etc.) in such a way as to imply a causal link of sound to performer action in the imagination of the listener. An instrumental gesture appears to cause a
sounding reaction in the electroacoustic part. In the performance the listener only perceives the net result of the two and cannot (by definition) disentangle them. This is the composer’s right – what sounds causal is effectively causal.” (Emmerson, 2007, p. 93)

Live electronic music can be traced back to as early as 1897, with Thaddeus Cahill’s Telharmonium, a keyboard instrument that played over telephone lines (Collins, 2007, p. 38). However, arguably (since it was not performed), the first piece to use live processing of acoustic instruments is Daphne Oram’s Still Point for orchestra, recorded sound and live electronics dating from 1948-50 (Davies, 2002). Significant examples of live processing of acoustic instruments include: Karlheinz Stockhausen’s Mikrophonie I (1964), Robert Ashley’s The Wolfman (1964), David Behrman’s Wave Train (1967), and Gordon Mumma’s Hornpipe (1967).

1.1.1.4 Conceptual: Madness, Delusional

The metaphoric madness of Folie à deux is not that of the raging, screaming lunatic. Instead, it is the madness of one who can still function in the world but perceives that world in a way that is incorrect and deluded. The music is intended to represent this otherworldliness.

The idea of musical influence is exhibited in the piece through the metaphor of shared delusion. This influence is manifest on several simultaneous levels. Pitch collections, whether melodic, harmonic or structural are derived from the spectral characteristics of the instruments in the piece. Once the spectral characteristics, and thereby the pitch collections, related to each instrument are determined, influence of one instrument over the others can begin. Spectral (pitch) content defines identity and the delusion is manifest through each instrument adopting an identity (pitch collection) other than its own. Eventually all of the instruments adopt the delusional pitch collection of the composer’s voice.
The live processing (see 3.4.3) takes the instrumental music and stretches it, filters it and alters it until it bears only a passing resemblance to the original. It is through the live processing that the music takes on an audible “wrongness”. That is, it does not sound like it is adhering to any natural laws.

Rhythms for the piece are generated from rhythmic transcriptions of recordings of the written ‘rants’ of Francis E. Dec, who suffered from paranoid delusions (see 3.2.2 and Appendix IV).

1.1.2  Personal

The progression through my own work to arrive at a piece in which acoustic instrumental music is linked to an electroacoustic part by an interlocking of spectral material began with the piece Shadows of the Wind (2004) for piano and electroacoustic music. In this piece, the electroacoustic music sound sources were the sounds of wind chimes, which were stretched and to which delay effects were added. From the finished electroacoustic music a spectrogram was used to derive the main pitches of the electroacoustic music’s constantly changing spectra several times per second. These pitches were then used as pitch collections that were organized using the same timeframe as the electroacoustic music. Rhythms for the piano music were strongly influenced by transcriptions of the wind chime samples which were used in the making of the electroacoustic music. The piece, taken as a whole, exhibited a high level of cohesion between the piano and the electroacoustic music in regards to pitch and rhythmic elements, as was expected. The difficulty with the piece was that the performer must stay in synchronization with a static electroacoustic part on compact disc. Long pauses in the piano part, followed by the exact time of re-entry, maintain this synchronization, but the performer’s need to rely on a stopwatch means that the performer is not able to truly engage with the piece.

Familiar Monsters (3 Views of a Secret) (2004) was the next step toward Folie à deux. Familiar Monsters is an acousmatic piece and so did not attempt to correlate live acoustic music to electroacoustic music. Instead it leads to Folie à deux through its detailed treatment of harmonic
spectra and the manipulation of the same. In *Familiar Monsters* samples of acoustic guitar and piano are stretched and portions of the sound’s spectra are filtered. It is the attention to spectral content that is carried over to *Folie à deux*. By avoiding performers altogether, *Familiar Monsters* avoided the issue of synchronization between the instrumentalists and the electronics. By using sound sources that were acoustic instruments and processing them in the studio, the level of aural recognition of the sources could be used as a thematic gesture in the piece. The main goal of these compositions that led to *Folie à deux* was to find a means of connecting instrumental and electronic sources. By eliminating the liveness of the instruments the integration that I was seeking was lost. *Familiar Monsters* did establish the aural result that I sought, one in which the instrumental sounds and the processed, electronic sounds merge in a convincing way.

Next came the piece *Zoohky* (2005) for flute, clarinet, violin, cello, piano and electroacoustic music on 3 boombox-style portable CD players. Similar to *Shadows of the Wind*, spectral analysis was done on the electroacoustic samples to generate pitch collections from which the instrumental music was based. *Zoohky* took this technique one step further; rather than being written for solo instrument, *Zoohky* was composed for small chamber ensemble. *Zoohky* also represents the first time that I have used “chain form” in a composition. Chain form is an idea borrowed from composer Witold Lutosławski. He describes it as,

“…chain form is an important element of my music. Historically, a musical construction has been made up from a series of sections, each having a cadence at its end. I wanted to break this convention. So I put forward an alternative conception of leaving one musical thought for another; namely, the method of asynchronous superimposition of two layers passing on to another section independently.” (Nikolska, 1994, p. 102)

In *Zoohky* short sections of music were composed for each instrument individually. These sections were then looped, that is, repeated a number of times, and the instrumental parts were layered over one another. The piece utilized chain technique in that the various instrumental loops moved from section to section without regard for the progression of the other instruments. *Zoohky* showed that electronic and instrumental music that has a spectral connection will sound
integrated. As with *Shadows of the Wind*, maintaining synchronization between the instrumentalists and the static electronics proved problematic. Using chain technique reduced the concern for synchronization but unfortunately also reduced the sense of dramatic direction of the music.

These three pieces were effective in creating an intriguing sonic experience. Complex sounds and unique timbres were created through the combination of electronic and acoustic sources. The careful attention to timbre and timbral relationships within the pieces provided an audible correlation between the sources. The next step in this progression was to add live electronic processing.

The piece *g h o s t s* for violin, cello and live electronics was this next step. It was premiered on April 18, 2008. The notated music for this piece is very simple. Sustained pitches in the two string instruments are presented with long gaps of silence between each. Timbre is constantly varied between the sustained blocks of sound through changes in bowing. Yet, once the Max patch is added, an aurally complex music emerges. Long reverb times coupled with long digital delays serve to eliminate the pauses, so that the musical character is one of crescendos and diminuendos over a nearly unbroken stream of sound. Nor is the pitch static. The Max patch transposes the played pitches almost constantly. Rather than blocks of static pitch, it is a piece of near constant pitch motion. Even the texture is aurally larger than the notated music would suggest. The incoming string sounds are copied and independently processed. Instead of the two string instruments the aural result is a total of six independent melodic streams. The piece *g h o s t s* proved to me that live processing could be extremely effective at creating the otherworldly sound that I was seeking in *Folie à deux*. It also showed me that the notated score would not be an effective indicator of the final aural result. Only with a performance of the piece would I have a definite indication of whether the piece would be successful.

*Folie à deux* continues along this creative path. It develops on *g h o s t s* by being a step forward in terms of size. More than twice the duration of *g h o s t s*, it required far more
planning in form. It is written for a larger ensemble and uses a larger and more complex Max patch.

On December 8, 2007 a version of the Folie à deux Max patch was performed as part of the live electronic piece Will o’Wisp (2007). The modules for sound file playing, delay and reverberation were used as part of a larger Max patch. This was done to test the patch’s robustness in a live setting. The patch was successful.

Folie à deux is the first composition of mine to utilize live processing of acoustic instruments and the first time I have used Max/MSP. It was my desire to force myself into new creative territory with this piece by expanding the toolset that I had at my disposal. It is also my belief that through live processing and the high level of control possible through Max/MSP that many of the issues of synchronization may be mitigated without sacrificing any of the positive sonic results of the earlier compositions.

2. Research Contribution
   2.1 Form

Folie à deux is modeled on the spectral characteristics of the instruments that it is written for, along with that of the composer’s voice. Pitch collections, harmonic root motion, the number of harmonies played by an instrument (frequency of root motion), and the rate that these harmonic changes occur are modeled on the spectral data. By modeling several formal characteristics on the spectral characteristics of the instruments (and the voice) a unity of material is achieved.

The other source material upon which several musical parameters are modeled are the Dec rhythms. The Dec rhythms provide two parameters that influence the piece. They are the 3 rhythmic patterns and the length of each of the 3 rhythmic series (7, 18, 27 measures). The rhythmic patterns have direct influence over the attack onsets of the instruments in the piece, as well as the delay rhythms in the live processing. The Dec phrase lengths help determine phrase
and section length in the piece, rate of harmonic change, and lengths of filter sweep in the live processing (see 3.2 and 3.3.2).

The spectral pitch characteristics and the Dec rhythms are tied together through the conceptual underpinning of the piece in the metaphor of delusional influence.

This connection, through metaphor, of musical material (spectral and electronic) to conceptual underpinning is not unique to composition. For example, it occurs in Jonathan Harvey’s *Mortuos Plango Vivos Voco*, however, while not unique it is quite unusual when taken to the degree that it is in *Folie à deux*.

2.2 Aesthetic Concerns

In discussing the new properties of sound created through Spectral composition, Tristan Murail has said, “These are often complex sounds, intermediate sounds, hybrids, sounds that possess new dimensions (transitions, development over time), sounds that are neither harmonic complexes nor timbres but something between the two.” (Murail, 2005) It is this desire for new sounds that is the impetus for *Folie à deux*. It is through the use of Spectral composition techniques, live electronic processing, and the inclusion of elements of acousmatic music that I have sought to create these “hybrid” and “complex” sounds.

In the same article Murail goes on to discuss a few methods for achieving these hybrid compositional states. His first example is that of echoes or re-injection loops:

“The set-up involves two recorders separated by a precisely calibrated distance; the tape runs from one to the other. The first recorder tapes the signals it receives (often an instrument recorded through a microphone); the second reads the tape after a lag, the length of which is determined by the distance between the recorders. As the second reader reads the tape, it sends the signal back to the first, where it blends with the new signals that are simultaneously arriving. This creates an accretion of sounds that is theoretically infinite. The process is not a classical canon, even if today’s machines are
without imperfections. The interest in the process is that the sound, recopied and, above all, continually remixed with the new signals, is progressively worn down, degraded, transformed, destroyed. The sound merges with white noise, and the process ends with the emergence of new frequencies, of self-generated rhythms, of interferences.” (Murail, 2005, pp. 124-25)

By using Max/MSP scenarios like the one he describes, far more complex ones are not only possible but relatively easy to achieve in real-time. In Folie à deux all of the sounds are recopied, delayed and mixed back into the sound complex. It is a scenario quite similar to the one described by Murail. This is music in which one compositional domain (electroacoustic music) does not merely provide the technique to be transposed to another domain (instrumental composition). Rather, the two domains share the same environment on equal footing, each influencing the other.

It should be noted that Folie à deux does not use any microtones; instead, the smallest interval is a semitone. This may seem counter to Spectral composition technique. However, as Joshua Fineberg says,

“the microtones in spectral music are simply approximations of a set of frequencies to the nearest available musical pitches…This approximation is often a last step, allowing the musical structure to be generated in its most precise form (frequencies), then approximated to the nearest available pitch depending on the details of the instrumental abilities and context. This also allows many spectral composers to tailor difficulty to individual realizations, adding or removing difficult notes in a way that does not change the underlying structure, but merely refines or coarsens the approximation of the abstract musical structure…the ear is able to hear past these approximations and hear the underlying frequency structure whenever the approximation is within tolerable limits.” (Fineberg, Guide to the Basic Concepts and Techniques of Spectral Music, 2000, p. 84)

Since neither the piano nor the vibraphone can easily perform microtones (this would require retuning the piano strings or performing on a microtonal vibraphone), I questioned whether their inclusion in the piece would be practical. I decided that the increase in difficulty for the performers was not worth the potential gains of a more refined “approximation” of the frequency-to-pitch component. I felt that these gains were minor and not necessary for the success of the piece.
*Folie à deux* plays with the listener’s perception of what is “real” and what is “imaginary.” The many repetitions of material that are created by the Max patch are of the same soundworld as the instrumental music.

“…the instrument on stage can simply ‘disappear’ into a continuous field of sound, relinquishing its role as instigator of locally focused interest. This can be true in mixed electroacoustic works in which the live instrumentalist produces essentially the same soundworld as that pre-recorded – in which case one might argue that the composer might just as well have pre-recorded the live element and mixed it in. However, the spectacle of the instrumentalist’s struggle against the elements may be one real aim of the work, thereby producing an expressive and dramatic result.” (Emmerson, 2007, p. 100)

This is especially evident at measure 336. The ensemble stops playing for seven measures, but because of the live processing the sound of the instrumental music continues. There is a disassociation between what the listener sees on stage and what is heard.

3. Materials and Methods

3.1 Process

The process of composing *Folie à deux* initiated with the idea of delusional influence. The title for the piece was one of the first aspects to be decided on.

Instrumentation was the next aspect to be established (see 3.3.3). The decision to write for flute, clarinet, vibraphone, piano, violin and cello was made for several reasons. Two instruments from three families (woodwind, keyed, strings) create a balance of ensemble. Groupings by family are natural. These instruments also provide a potentially wide pitch range while blending together well. Also, this is a moderately standard ensemble grouping. There are several high quality, permanent ensembles of this instrumentation (for instance, Eighth Blackbird and Continuum). This increases the potential for performance. Finally, since it would be necessary early in the process to collect sound samples of the instruments, choosing instruments that are
common meant that collection of the sound samples would be easy. The flute, clarinet, piano, violin and cello samples came from the University of Iowa Musical Instrument Samples Database (http://theremin.music.uiowa.edu/index.html) for which use is unrestricted for research or musical projects. The vibraphone sample came from my personal collection; it is a recording of an instrument owned by the University of Alberta. In selecting the samples, the middle to low-middle range (on the pitch C) of each instrument was selected so that a relatively large number of overtones would be present in the samples.

Spectral analysis was carried out on each of the samples. This was done in the computer program Cubase SX (version 2.2) using its spectral analysis tools. Pitch material was taken from the frequency data extrapolated from the spectral analysis. Pitches were rounded to the nearest semitone.

The pitch data was organized in several ways. Pitches were separated based on the relative strength of the frequency within each collection. For each instrument, strong and weak frequencies were grouped (see 3.3.1 and Appendix I). Decisions as to whether a frequency should be strong or weak or not included were done intuitively. This hierarchy of strong versus weak was done to break up the regularity of the harmonic series and prevent the ordered collections from being too similar, without changing their character too much. Three methods of organizing the pitch material followed. First, vertical, ordered collections were used as a guide for the vertical sonorities in the piece. Octave transposition was carried out whenever it was deemed intuitively necessary. Second, the vertical collections were written out linearly from lowest to highest pitch of the strong and weak frequency collections (see Appendix I). The linear, ordered collections provided the root motion for the vertical sonorities. Finally, linear, unordered pitch sets were extracted from the analysis. These were used as source material for melodic motion.

Once the pitch material for the piece was selected and organized, work on the rhythmic material began. It was necessary to find a method of incorporating the concept of delusion into the rhythmic material. Texts of the Francis E. Dec “rants”, specifically the rant, “Gangster
Computer God Worldwide Secret Containment Policy” (see Appendix IV) were found on the UBUWeb website (Kossy, 1999). I recorded myself speaking and whispering this text and chose three selections based on their rhythmic interest. These rhythms were transcribed by hand. The transcriptions were thinned and edited. The final rhythms were placed in a 4/4 grid with a tempo of 92 beats per minute. 92 bpm was intuitively chosen as a suitable tempo for the rhythms. The three rhythms were 7, 18 and 27 measures in duration.

Next, the structural plan for the piece was worked out (see 3.2). This plan laid out the order of the Dec rhythms that would act as an underlying, implied, rhythmic ostinato. It also laid out the spectral/harmonic changes for each instrument and the development of instrumental/spectral groupings over the course of the piece. Finally, it established the point at which the piece would switch from the A section of group influence (resistance) to the B section of individual influence (delusion). From this initial plan the piece’s harmonic plan and general rhythmic development could be conceived and the piece’s approximate duration established (see 3.2).

At this point the rates of harmonic change were determined by the Dec rhythm length (7, 18 or 27 measures) and the number of pitches in each of the spectral analyses. This was done for each instrumental spectrum and combination spectrum (e.g., woodwinds = flute + clarinet) and for each of the Dec rhythms (see Appendix III).

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<th>Instrumental Spectrum</th>
<th>Number of Pitches</th>
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<tr>
<td>clarinet</td>
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<tr>
<td>vibraphone/voice strong</td>
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<tr>
<td>piano</td>
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<tr>
<td>strings</td>
<td>18</td>
</tr>
<tr>
<td>woodwinds &amp; strings</td>
<td>19</td>
</tr>
<tr>
<td>woodwind, strings &amp; piano</td>
<td>20</td>
</tr>
<tr>
<td>voice all</td>
<td>20</td>
</tr>
</tbody>
</table>

Table 1 Pitches per Instrumental Spectrum
These rates are dependent on two criteria: the length of the Dec rhythm in which they occur, and the number of spectral pitches for that instrument or instrumental combination. For example, the flute begins the piece by playing its own spectrum of 8 pitches. The Dec 1 rhythm is 7 measures in length, that is, 56 eighth notes in duration. Dividing 56 (duration) by 8 (number of spectral pitches) gives a result of 7, therefore, during the Dec 1 rhythm the flute has a rate of harmonic change of every 7 eighth notes. Many of the combinations do not divide as neatly. For those, rhythmic values were added to the beginning or ending of the progression until they could be divided neatly. The clarinet, for example, over the Dec 1 rhythm has 10 pitch elements (spectral pitches) and the Dec 1 rhythm contains 56 eighth notes (duration). If one of the clarinet notes is given a value of a quarter note, then what is remaining is 9 pitch elements over 54 eighth notes, a rate of change of every 6 eighth notes (see Appendix III).

Each spectrum, including the combination spectrums, was transposed over the linear, ordered pitch collections that were to provide root motion (see Appendix II). These lists of pitch collections would be referred to in composing the piece.

In summary, the structural plan laid out the order of Dec rhythms. The Dec rhythms gave a rhythmic grid of note onsets for the piece. The rates of change lists showed the rate of harmonic motion for each section while the spectral pitch collections provided list of available pitches at any given time. This method of composition proved to be rather complex to manage, but this was eased once the supporting charts and lists were created (Appendix I, II, III). This system provided a method of maintaining a consistency of material throughout the piece, one that was strongly related to the materials that the piece was based upon (spectral pitches and Dec rhythms). In this way rhythm and harmony could generate form.

At this point work on the Max patch was begun (see 3.4.3). It was decided that the main focus of the patch should be to control a delay effect. The iterations of the delay would correspond to the Dec rhythms and would follow the order of Dec rhythms laid out in the Structural Plan.
Reverberation was added to increase the sense of depth of the processed sound, but would not be a major focus of the patch. Finally, a slowly sweeping highpass filter sweeping up and down over each Dec division (see Figure 26 and Table 2) was added to assist in delineating the structure of the piece and to provide a degree of contrast from the very thick texture of the piece, without undermining the process.

Finally, pre-processed versions of the voice samples used for the Dec rhythms were added (see 3.4.1 and 3.4.2). These are triggered from the Max patch and are further processed by the delay and reverberation effects.

3.2 Form

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<th>delay #</th>
<th># site</th>
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<th>voice</th>
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| B       | 247     | 71           | 1    |                    | 7      |        |          |       |       |        |       |
|         | 254     | 71           | 1    |                    | 7      |        |          |       |       |        |       |
|         | 261     | 71           | 1    |                    | 7      | 7      |          |       |       |        |       |
|         | 268     | 71           | 1    |                    | 7      | 7      |          |       |       |        |       |
|         | 286     | 71           | 1    |                    | 7      | 7      |          |       |       |        |       |
|         | 287     | 71           | 2    |                    | 7      | 20     |          |       |       |        |       |
|         | 291     | 71           | 2    |                    | 7      | 20     |          |       |       |        |       |
|         | 311     | 71           | 1    |                    | 7      | 20     |          |       |       |        |       |
|         | 318     | 71           | 2    |                    | 7      | 20     |          |       |       |        |       |
|         | 336     | 71           | 1    |                    | 7      | 7      |          |       |       |        |       |
|         | 343     | 71           | 2    |                    | 7      | 20     |          |       |       |        |       |
|         | 370     | 71           | 1    |                    | 7      | 20     |          |       |       |        |       |

Table 2 Structural Plan

Folie à deux is divided into two main sections. The A section represents group influence and resistance to the delusion. This is exhibited in the instruments initially resisting the voice spectrum by playing their own spectrums but then responding to the vibraphone/voice by
grouping together. In the B section, this switches to a representation of individual influence (delusion) in that each instrument upon reentering the piece in the B section has accepted the delusion and is now playing the voice spectrum instead of playing their spectrum.

The piece begins by introducing each of the instruments playing their own spectral pitch components with the exception of the vibraphone. The vibraphone, rather than playing its own spectral pitches, is playing those of the voice (7 strongest frequencies).

At measure 109, the flute and clarinet combine their spectral pitches (woodwinds). At the same time, the violin and cello combine their spectral pitches (strings). At measure 168, the woodwinds and strings combine. Finally, at measure 195 all of the instruments, with the exception of the vibraphone, play one pitch collection made up of the flute, clarinet, violin, cello and piano collections. This represents the instruments’ resistance to the delusion (voice spectrum) of the vibraphone. Initially they offer this resistance through their own spectral pitch collections, but eventually they band together into groups of resistance.

The B section starts at measure 247. This section begins with the vibraphone, solo, and each instrument joins in turn. As each instrument enters, it does so by playing the voice’s larger pitch collection (16 strongest frequencies). Conceptually, this section represents the instruments’ capitulation to the delusion. Each of the instruments has abandoned both their own spectrum as well as the combined (group) spectrum. Once all the instruments have given in to the vibraphone’s delusion, the vibraphone adopts the expanded voice pitch collection that the instruments have been playing (measure 318). At this point all of the instruments have capitulated to the voice spectrum. The filter sweeps (see 3.4.3) that have been silent since the end of the A section now return, sweeping up from measures 343-370 and down from measure 370 to the end at measure 377.

Several methods are used to delineate form in Folie à deux. Section length (7, 18 or 27 measures per section), harmonic movement (lower to upper spectral components) and live processing (sweeping filter) all contribute to section divisions.
The two main sections of the piece (A and B) are further divided into sub-sections. The lengths of these sub-sections are a result of the lengths of the Dec rhythms (7, 18 or 27 measures; see 3.3.2).

The harmonic movement of the piece does not provide for cadential gestures in a traditional dominant to tonic sense, yet it still manages to provide a sense of closure to the sub-sections of the piece. This is achieved less by how the sections end than by how they begin. The first harmony of each of the sections is consistently a chord with a root of C. This return to a C harmony at the beginning of each sub-section helps to give a sense of closure to the section that preceded it.

In the A section the filter sweep further helps to give a sense of the sub-section length. In each of the sub-sections (corresponding to the Dec lengths), the filter sweeps from 20-2000 Hz and back again. The filter sweep also contributes to the sense of closure at the end of the piece.

3.3 Acoustic

3.3.1 Harmony

Vertical sonorities and harmonic motion are derived from the spectral pitches of each of the instruments of the ensemble and the spectrum of the composer’s voice. The note C was chosen for all the samples. The data was octave transposed (if necessary) to provide a large range of usable pitches. I planned to leave transposition of the pitches as a compositional decision and to use the intervallic relationship of the pitches as an influence on this. So I was not overly concerned with which C the samples represented.
From these sound samples a point during the sound’s steady state was chosen (see Figure 2) and spectral frequency data plotted.
Once the spectral pitches were chosen they were separated into strong frequencies and weak, based on their relative amplitudes. These harmonic collections would strongly influence the harmonies of each of the instruments and instrumental groupings.

Figure 3 Piano, spectrum plot

Figure 4 Piano vertical pitches. First measure represents strong frequencies, the second weak (transposed down 1 octave).
The vertical collections were laid out as an ordered, linear collection. These would become the harmonic root motion for each of the sections of the piece.

![Figure 5 Piano, ordered pitches. First measure represents strong frequencies, the second weak.](image)

Finally, an unordered pitch set was extracted from the pitch collections. This would be the basis for most of the melodic writing in the piece.

![Figure 6 Piano, unordered pitch set](image)

3.3.2 Rhythm

In order to tie the rhythmic elements of the piece to the conceptual aspect of delusion, the text of one of the “rants” of Francis E. Dec (January 6, 1926–January 21, 1996) was used. Dec wrote and self-published several fliers containing his paranoid delusions. His rant “Gangster Computer God Worldwide Secret Containment Policy” was used for this piece (see Appendix IV). First, I made a recording of myself speaking and whispering the rant. Next, three selections were
chosen based on rhythmic interest. From these selections rhythmic transcriptions were made and this resulted in the three rhythmic motives used in the piece. They are:

Figure 7 Dec 1
Figure 8 Dec 2
The three Dec rhythms act as a rhythmic underlay for the piece. All of the attack patterns for the piece are derived from the Dec rhythms. If a section is based on the Dec 1 rhythm, then that pattern determines the note onsets for that section for all of the instruments.
This process is widely used throughout the piece, but during the revision process, note onsets were occasionally moved according to taste and so may not always correspond exactly to the Dec rhythmic values. For example, in Figure 10 the flute and clarinet have note onsets on the downbeat to measure 82. This does not correspond to the Dec rhythmic scheme. These rhythmic alterations are quite rare.

It should be noted that only Dec 1 begins on the downbeat and none of the three Dec rhythms have rhythms that continue to the end of their final measure. This causes an absence of attack onsets during the last portion of the final measure of each subsection and of the first portion of each, with the Dec 1 being the exception. This lack of note onsets during the transition between subsections is a contributing factor to the sense of closure at the end of each subsection.
Larger areas of rest are interspersed through the piece (measures 57-64, 161-168). These allow the delay to run down and act like larger cadential gestures.

3.3.3 Instrumentation

The piece is scored for flute, Bb clarinet, violin, cello, piano, vibraphone with electroacoustic music and live audio processing in Max/MSP. The choice of instrumentation was made based on several factors. Primarily, I like all of these instruments and wanted to write for them. Also, this is a somewhat standardized ensemble which increases the likelihood of the piece receiving a performance. The decision to include triggered electroacoustic sounds provided a means to expand the sonic palette of the piece and provided a means to underscore the conceptual
underpinning of the piece. The live electronics processing provides a means to alter the sound of the instruments, creating an otherworldly sound that I felt suited the concept of delusion.

3.4 Electroacoustic

3.4.1 Sound Sources

Recordings of the composer reading Francis E. Dec’s rant “Gangster Computer God Worldwide Secret Containment Policy” (see Appendix IV) were made. A spoken version was used to generate the Dec rhythms used in the piece. Selections were edited from this version and a whispered version was used as source sound material for the sound file playback. The purpose of the whispered recordings was to provide timbral variation in the electronic source material.

3.4.2 Processing (non-real-time)

The recordings that were made of the Dec text and that generated the piece’s rhythms were used as sound sources for the processed, non-real-time portion of the piece. These heavily processed vocal sounds remain recognizable as voice, but the speech itself is almost completely obfuscated. These samples allude to the madness itself and to an inner confusion caused by the delusions.

The vocal sounds recorded were processed in non-real-time. Processes included: time stretching, convolution, chopping/gapping, granulation, and distortion. Carrying out the processing in non-real-time allowed for greater control of the final product. It also allowed for processes that are CPU intensive and otherwise would not be feasible in real time.

The playback of the sound files is triggered in the Max patch. There are a total of twelve sound files. This system allows for greater flexibility in timing and helps to maintain synchronization with the live music over running a single stereo track over the entire duration of the piece (as on fixed media).
The non-real-time sound files are related to the acoustic, live processed music through a rhythmic correspondence. Both are based on the Dec rhythm patterns. A further correspondence occurs on a timbral level. The non-real-time sound source is exclusively the composer’s voice which is the timbre that acts in the acoustic music as the delusional pitch material that the vibraphone plays and that by the end of the piece provides all the instruments’ pitch material.

3.4.3 Live Processing

The live processing is carried out in a patch made in the programming environment Max/MSP (version 4.6.3). The main interface allows for control of several subpatchers and is controlled on computer via mouse input.

**Figure 12 Patch Control Overview**
There are 8 areas of control in the main patch window. They are: Microphone Control, Soundfile Control, Tempo Control, (Delay) Rhythm Control, Buffer (tapin) Control, Bypass, Reverb Control, and Output Control. In addition, there are two control areas of the patch that are not used in performance, but have been included to ease the testing of the patch. They are: Rhythm Maker and the Microphone Test Control. There is also a select object that is hidden unless the patcher is in edit mode. It is included to allow the patch to be run automatically. The “auto” toggle in the Output Control area turns on this feature. If it is enabled, banging the “m1” bang starts the patch.

The Mic Control area handles the 6 signals as they enter the patch from the 6 microphones (flute, clarinet, vibraphone, piano, violin and cello). The signals enter through an adc~ (mono) and are then scaled through a signal level fader and finally passed through a send. A ‘clear’ message can be sent to the tapin~ to clear the delay buffer. Finally, delay feedback for each instrument can be turned on and off.

![Figure 13 Microphone Control](image-url)
The Soundfile Control allows for control of premade sound files stored on the computer (through “p voice#”). These sound files are triggered by the “p controlbangs” subpatcher by clicking on the bang objects in the Main Control area of the patcher.

![Soundfile Control Diagram]

Figure 14 Soundfile Control

The subpatcher “p voice#” contains the sflist~ object which is preloaded with all but the first sound file for the piece when the patcher is started. The first sound file of the piece loads directly into the sfplay~ object when the patcher is opened. The sfplay~ object accesses the sound files preloaded in the sflist~ object. The receive objects pass a bang when the corresponding bang object is clicked in the Main Control area. These bangs are delayed (in milliseconds) to ensure that the sound files play when they are compositionally intended.
Since much of the piece depends on a correspondence between the rhythmic elements in the electronics and the acoustic music, a method of controlling tempo in the live processing needed to be implemented. The Tempo Control section manages the selection of the piece’s tempo. A slider or number box can be used to select and make changes to the tempo that the patch operates at. The range is between 0 – 200bpm. The slider can only select integers while the number box can choose floats (to 2 decimal places). There are 3 preset tempos: 80 bpm, 92 bpm (default) and 100 bpm. The set message prevents a stack overflow error from occurring since the slider and number box react to input from each other. The resulting number is used in many of the timing calculations in the patch.
The Rhythm Control area of the main patch is where the rhythm that will be used for the delay interactions is chosen. The 3 Dec rhythms (first 20 rhythmic values) and a custom rhythm are available. The decision is entered through 4 radio buttons which is then passed to the “p rhythms” subpatcher.
In the subpatcher “p rhythms” the radio button selections are routed appropriately. The loadbang sets all of the sound streams to Dec 1 at the initiation of the patch. The incoming selections are routed 0=Dec1, 1=Dec2, 2=Dec3 and 3=custom.

Figure 18  Rhythm routing

The Rhythm Value Storage contains the Dec rhythm values. The values correspond to the first twenty rhythmic values expressed in milliseconds for each of the Dec rhythms.
Figure 19  Rhythm Value Storage
<table>
<thead>
<tr>
<th>note value</th>
<th>ms</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>1800</td>
</tr>
<tr>
<td>8</td>
<td>1200</td>
</tr>
<tr>
<td>16</td>
<td>900</td>
</tr>
<tr>
<td>32</td>
<td>600</td>
</tr>
<tr>
<td>64</td>
<td>450</td>
</tr>
<tr>
<td>128</td>
<td>400</td>
</tr>
<tr>
<td>256</td>
<td>300</td>
</tr>
<tr>
<td>512</td>
<td>225</td>
</tr>
<tr>
<td>1024</td>
<td>200</td>
</tr>
<tr>
<td>2048</td>
<td>150</td>
</tr>
<tr>
<td>4096</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 3 Note Values to Milliseconds (100bpm)
In the Custom Rhythm Maker up to 20 rhythmic values may be selected in numeric order from drop-down menus. This custom rhythm may then be used along with the three Dec rhythms. This portion of the patch is not used in *Folie à deux* but was useful during the composition of the piece to test the effect of changing the Dec rhythms. It is also a useful extension to the patch as it adds a degree of rhythmic flexibility.

Table 4  Dec Rhythms in Milliseconds

<table>
<thead>
<tr>
<th></th>
<th>Dec 1</th>
<th></th>
<th>Dec 2</th>
<th></th>
<th>Dec 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td></td>
<td>900</td>
<td></td>
<td>500</td>
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<tr>
<td>2</td>
<td>150</td>
<td></td>
<td>1200</td>
<td></td>
<td>600</td>
</tr>
<tr>
<td>3</td>
<td>300</td>
<td></td>
<td>1600</td>
<td></td>
<td>700</td>
</tr>
<tr>
<td>4</td>
<td>450</td>
<td></td>
<td>1800</td>
<td></td>
<td>800</td>
</tr>
<tr>
<td>5</td>
<td>600</td>
<td></td>
<td>2100</td>
<td></td>
<td>900</td>
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<tr>
<td>6</td>
<td>700</td>
<td></td>
<td>2300</td>
<td></td>
<td>1100</td>
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<tr>
<td>7</td>
<td>800</td>
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<td>2500</td>
<td></td>
<td>1200</td>
</tr>
<tr>
<td>8</td>
<td>900</td>
<td></td>
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<td>11</td>
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<td>3150</td>
<td></td>
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<td>12</td>
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<td>1800</td>
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<td>17</td>
<td>2550</td>
<td></td>
<td>4550</td>
<td></td>
<td>2600</td>
</tr>
<tr>
<td>18</td>
<td>2700</td>
<td></td>
<td>4850</td>
<td></td>
<td>2900</td>
</tr>
<tr>
<td>19</td>
<td>3000</td>
<td></td>
<td>4950</td>
<td></td>
<td>3150</td>
</tr>
<tr>
<td>20</td>
<td>3400</td>
<td></td>
<td>5050</td>
<td></td>
<td>3300</td>
</tr>
</tbody>
</table>

Figure 20  Custom Rhythm Maker
In the subpatcher “p dec_a#” the rhythmic values for the custom rhythms are listed in milliseconds at 100bpm. Selections made in the drop-down menus in the Custom Rhythm Maker are routed appropriately. The values will be corrected for tempo in another area of the patch (see Figure 24).

![Figure 21 Custom Rhythm Preset Routing](image)

The “p touts” subpatcher contains the tapout~ portion of the delay chain as well as the filter subpatchers. The signal paths for the sound files (sf1.wav – sf12.wav) do not pass through the filters so they skip those subpatchers after moving through the signal scaling subpatcher (“p delayfade”). The microphone signals first are scaled (“p delayfade”) and then move to the filters before being sent on. The length of filter sweep (up and back down over 7, 18, or 27 measures or 27 measures up and 7 measures down) is controlled from this area. Bangs from the Control Bangs area of the patcher are routed through send and receive objects (s and r) and trigger the corresponding lists inside of the filter subpatchers.
The lists of values sent from “p dec” (the Dec rhythms) are first broken into individual integers in the “p toutsf#” and “p toutmic#” subpatchers.

The integer representing the Dec rhythm in milliseconds at 100bpm enters the “p tapout” subpatcher through the inlet. This value is multiplied by the corresponding value from “p spcontrol”. If the value from “p spcontrol” is a zero the gate~ object stops any signal from passing through this subpatcher. The result of the multiplication is then divided by the tempo and multiplied by 100. The result of this operation is sent to the tapout~ object and becomes its delay time. The rp object is the required connection between the tapout~ and tapin~ objects.
The signal is sent to the gate~ where it passes out of the subpatcher. In the second and seventh of each “p tapout#” (i.e. “p tapout2” and “p tapout7”) subpatcher is a send object that forms part of the delay feedback loop.

The individual signals are then passed through the “p delayfade” subpatcher where they are scaled so that there is the perception of a decrease in amplitude as the delay line repeats.

The signals from the microphones (but not the sound files) pass through the filter subpatchers. The filter is the 2up_svp~ external by Randall Jones. It is a state-variable filter. In the help file it is described by Jones as the “original algorithm by Hal Chamberlin 2x oversampled and tweaked for musicality” (from 2up_svp~ help file, included in patch).
Although capable of several different filter types, only the highpass filter is used for *Folie à deux*. Several filter sweeps are preset as messages to the `line~` object. Three of them sweep from a cutoff frequency of 20 to 2000 Hz and back again over 7, 18 or 27 measures, depending on the Dec rhythm that a section is based on. The remaining two presets are for the last two sections of the piece. At measure 343 the filter cutoff sweeps from 20 to 2000 Hz over 27 measures and at measure 370 the filter cutoff sweeps from 2000 to 20 Hz over the final 7 measures of the piece, the most extreme filter sweep of the piece.

![Figure 26 Filter Subpatcher](image)

The signal enters the Delay Buffer subpatcher from the 2 sound files (Soundfile Control) and the 6 microphones (Microphone Control) through `receive` objects. The delay buffer size is set at
140000 milliseconds (140 seconds). This number has been chosen to allow enough buffer time for even the longest delay repetitions. At tempos slower than 80bpm the longest delays, near the end of the piece, may be cut off. The tapout~ object is able to access this stored delay line from the tapin~ object. The tapout~ objects are connected to the tapin~ via a send (s tp#). The signal, once sent to the tapouts, can return to the buffer if feedback is enabled. It does so through the right inlet of the gate~ object. The inlet object attached to the left inlet of the gate~ controls whether the gate is open or closed (feedback on or off). If the gate~ is open the signal passes through where it is scaled so that it decreases in amplitude on each pass.

![Figure 27 Delay Buffer (tapin~)](image)

Spray Control contains the lists of values that will be multiplied by the delay times (Dec rhythmic values). The first zero in each list is a message to the spray object, and the following 20 values are the multipliers. Integers greater than zero cause a delayed repetition of the incoming signal. A series of 7 ones will cause a delay stream that matches the first 7 rhythmic values of the Dec rhythm; twos will cause a delay stream that is the same as the first 7 Dec rhythmic values with their durations doubled. A list of \([0 \ 1 \ 2 \ 3 \ 4 \ 5 \ 6 \ 7 \ 0 \ 0 \ 0 \ 0 \ 0 \ 0 \ 0 \ 0 \ 0 \ 0 \ 0 \ 0]\) would cause a delay stream in which seven repetitions of the incoming signal will occur, the first repetition will occur at the value of the first value in the Dec rhythm, the second at 2 times the second Dec value, the third at three times the third Dec value, and so on.
Take, for example (simplified scenario), the list \([0 \ 2 \ 3 \ 0 \ 0 \ 0 \ 0 \ 0 \ 0 \ 0 \ 0 \ 0 \ 0 \ 0 \ 0 \ 0 \ 0 \ 0\] sent to Dec 1. The first zero in the list is required by the spray object and can be ignored. The first 3 rhythmic values of Dec 1 are 3 sixteenth notes (see Figure 7). At 100bpm a sixteenth note is 150 msec. in duration. The first value in the list is 1: it is multiplied by 150 (sixteenth note), resulting in a value of 150 being passed. The second value is 2, so it is multiplied by the second Dec1 value. This is also 150, but added to the previous sixteenth since it is the second value, summing to 300, results in a value of 600. The third Dec 1 value is 3, multiplied by the third Dec 1 rhythmic value, also a sixteenth note (150 msec.). This third sixteenth note is added to the values of those previous (150 + 150 + 150 = 450 msec.). This value of 450 msec. is multiplied by the corresponding list member (3) resulting in a value of 1350 msec. being passed. The remaining 17 zeros will each result in a zero being generated when it is multiplied by the corresponding Dec 1 value. Therefore no delay is generated for these values.

![Figure 28 Sprayer List Storage (excerpt)](image)

In the Bypass Control, toggle buttons can turn on or off the delay, global feedback (used only in testing) and sound file and microphone bypass. When the bypass is enabled the signal passes through the patch without any signal processing being added. It is possible to have both the
bypass on and the delay on. This sends a signal through the patch unprocessed, as well as a separate signal through the effects. This was used in testing the patch so that a scenario similar to what would be heard in concert (a mix of wet and dry signal) could be simulated. These controls are sent to the subpatcher “p bypass_gates”.

![Figure 29 Bypass Control](image)

If delay is enabled in the Bypass Control, then the signal is allowed to pass through the two leftmost gate~ objects. The signal from the sound files and microphones enters the subpatcher through receive objects. If the individual bypasses are enabled, the signal is allowed to pass through the gate~ objects and continues to the Output Control.

![Figure 30 p bypass_gates](image)
Reverberation is added at the end of the signal chain. The Reverberation Control is not meant for real-time control. Instead, a reverberation setting is to be determined at the sound check and used statically for the duration of the piece. Two presets are included. Others can be saved in the patch by the user. Four parameters can be changed: decay time, size, damping and diffusion.

The processed signal level can be controlled from the Reverberation Control area of the patch. After passing through the subpatcher “p rev” the signal is sent to a pair of signal level faders before being sent to the Bypass on its way to the Output Control area of the patch.

The Reverberation subpatcher is by Randall Jones, called Yafir2. According to Jones,

“Based on the great 1997 J Dattorro article on effects in JAES It's [sic] a fairly detailed topology of a reverb design “in the style of Greisinger,” who was working for Lexicon at the time. I added the modulation of the allpass times with filtered noise, which sounds better to me than periodic modulation.” (Jones, 2007)
Figure 32 Reverberation subpatcher

Plate reverb, in the style of Griesinger. via J Dattorro. Randy Jones rej@2uptech.com
The Output Control area of the patcher is where the signal exits the patcher and is sent to the loudspeakers. It is made up of an `ezdac~` object, which turns on and off audio processing in the patcher, two signal level faders that control the overall signal level of the audio that is passing out of the patch, and two signal level meters that provide a visual indication of the output signal levels. A preset box is included so that once all of the levels in the patcher are set in sound check a preset may be saved and recalled at performance time.

![Output Control](image)

**Figure 33  Output Control**

The Main Control area of the patcher contains 30 `bang` objects, each labeled by the measure number at which on the downbeat of that measure the `bang` should clicked. Each `bang` is patched to the processes and parameter changes that need to be triggered at that point in time.
The **bang** objects in the Main Control area trigger a series of **send** objects in the “p controlbangs” subpatcher. The proper filter sweep is triggered (if necessary), the correct Dec rhythm is set, the multipliers in the “p spcontrolsf#” and “p spcontrolmic#” subpatchers are set, feedback can be turned on or off, and sound files triggered.
The Microphone Testing area contains 6 simplified versions of the Soundfile Control patchers. Each unit contains a \texttt{sfplay~} object, an open message, an on/off toggle and a signal level fader. A toggle enables the user to turn all of the units on or off at one time. This area of the patcher is for testing purposes. Sound files can be loaded into each unit and simulate the 6 microphone inputs. The signals from these \texttt{sfplay~} objects follow the same paths through the patcher as the microphone inputs.

\begin{figure}[h]
\centering
\includegraphics[width=0.5\textwidth]{microphone_testing.png}
\caption{Microphone testing}
\end{figure}
The Reporting area provides information on sample rate (left number box) and CPU utilization (right number box). CPU utilization is polled every 500 milliseconds when enabled and gives a value as a percentage.

![CPU Reporting](image)

**Figure 37 CPU Reporting**

A patcher has been included to count and report measures and beats.

![Measure Reporting](image)

**Figure 38 Measure Reporting**

This patcher receives tempo information from the Tempo Control. Counting begins with the first **bang** message of the piece. While not necessarily an exact indication of placement in the score (as tempo may fluctuate), it does provide an indication of approximately how much of the piece has elapsed. The Measure Reporting area was also useful for the testing of the piece. A fully automated version of the piece could be run with each section triggered by the measure counter.
3.5 Integration/Diffusion

The piece is diffused to stereo (2 channel). Other diffusion options that were considered were 4 channel and 8 channel. Stereo (2 channel) provides several advantages over these alternatives. The ease of setup for performance increases the likelihood of repeat performances, especially since many venues are already equipped to handle stereo diffusion. Also, stereo provides a directionality of sound similar to the stage/audience performance space. This works best for an ensemble piece such as this where source direction cannot be easily covered up. Instead, by having the sound from the speakers approaching the audience from the same direction as the ensemble it is easier to create a unified sound. The main disadvantage of stereo is that the spatial aspect of the sound is more difficult to control and less can be accomplished. Due to the large and complex nature of the sounds created in this piece, having less options for spatiality seemed a minor concern when compared to the advantages of stereo already listed.
4. Conclusions

Folie à deux received its premiere on April 17, 2009 in Convocation Hall, Edmonton, Alberta. The ensemble included Shelley Younge (flute), Jeff Campbell (clarinet), Aaron Au (violin), Joanne Yu (cello), Roger Admiral (piano), Brian Jones (percussion) and was directed by Angela Schroeder.

Folie à deux represents the next stage in my exploration in the integration of instrumental music with electroacoustic sounds and techniques. Past compositional experiments toward this goal of integration have proven largely successful and Folie à deux improves upon these. In the past, the relationship between spectral identity and musical materials was kept relatively simple. In Folie à deux this relationship increases in complexity. Folie à deux takes those elements of the piece that are influenced by spectral materials and uses them to define the structure of the piece. This creates a piece in which pitch, rhythm, delay repetitions, rate of harmonic change, and phrase length are all related to the spectral identity of the instruments or of the voice samples.

Furthermore, by bringing into question the spectral identity of each of the instruments through the metaphor of delusion, spectral identity becomes a formal principle and a dramatic device.

The live processing of Folie à deux takes what is relatively simple written music and creates an aural result that is quite complex. By layering complex delay patterns, themselves based on the rhythms of the instrumental music, new rhythms are created, overlapped and mixed together. This creates the “accretion of sounds” that Murail speaks of (Murail, 2005, p. 124) as an ideal example of the interaction between materials and compositional technique. This is a dense, distorted sound world that is based on the written music but is something quite different, something otherworldly. It is an analog to the delusions of the mad. To the listener, this music will seem stretched and distorted by the electronics. The irregularity of the delay patterns will enhance this sense of wrongness and will grow as the piece progresses. Further, as the delay patterns feedback and fade away the related process of entropy surfaces (Murail, 2005, p. 125; Anderson, 2000; Anderson, 2000). This entropy or erosion of texture with its progressions from
musical sound to noise is at the center of the aural world of *Folie à deux* and is a further metaphor of the increasingly delusional mental states that the piece represents.

*Folie à deux* is not the wailing, frenzied madness of the crazed. Rather, it is more closely akin to a paranoid anxiety or an overwhelming depression. Constant and without any moments of lucidity it is all-encompassing. It is a subtle madness that inhabits every moment of the sufferer. Further to this, the delusion is so powerful that it begins to affect those who come into contact with it. It is a loss of self, a delusion of identity. The vibraphone for the duration of the piece plays pitch material not derived from its own spectrum but rather from that of the composer’s voice. The electronics strengthen this delusion by manipulating samples of the voice itself as well as applying a repeating delay to the deluded instrumental music. All of the processed samples are of the composer’s voice and the live processing becomes increasingly overwhelming as the delusion takes over each of the other instruments. The main action of the piece is the dissolution of the will of the main body of the instrumental music (all except the vibraphone, which is delusional throughout, and the electronics, who support the delusion) to resist the delusion. The vibraphone and electronics erode the sanity of the other instruments until the other instruments adopt the delusion of the voice identity. That is, their music becomes based on the spectral characteristics of the voice rather than their own spectral identities. They eventually abandon their own identities and adopt the erroneous identity of the voice.

A common concern in pieces that mix instrumental music with an electroacoustic music on compact disc or tape is that of synchronizing the two. Methods exist for managing this, for example, using click-tracks, or providing timings and asking the instrumentalists to maintain synchronization by watching stopwatches. These methods are distracting to the instrumentalists and prevent them from giving a performance of the music at the level that they otherwise might. By utilizing Max/MSP a large number of sound files can be easily triggered at appropriate times. This frees the instrumentalists from the need to focus on timing aspects and lets them concentrate on their performance. By keeping the sound files relatively short, but frequent, synchronization can be more easily maintained. As well, since the instrumental sounds can be processed in real time by Max/MSP a further degree of integration can be achieved. With all of the sounds,
electronic and instrumental, being mixed in the loudspeakers the listener cannot rely on spatial
cues to suggest what is live and what is electronic. By using the same types of effects processing
on all of the sound sources yet another level of integration is achieved.

My future compositions will continue to work with the ideas of instrumental/electronic
integration dealt with in Folie à deux. Folie à deux used the steady state portion of the sounds
for its spectral models. Future pieces will attempt to deal with the spectrums of the note onsets
as well.

“With acoustic instruments the initiating transition from “off” to “on” is most often a
complex event in its own right, a clang, a breathy release, or whatever with the
dimensions of a grain and with its own intrinsic sonic properties. These properties are, in
fact, so important that we can destroy the recognisability of instrumental sounds (flute,
trumpet, violin) fairly easily by removing their onset portion.”(Wishart, 1994)

By working with the spectrum of the onset portion of an instrumental sound as well as its steady
state, I hope that the correlation between the instruments and the spectral model based on them
will be more obvious, thereby allowing for more complex relationships.

On a separate avenue of exploration, I will be increasing the degree of interaction between the
instrumental musicians and the electronic performer. A first step in this process will be to
compose a piece for live electronics solo. It will utilize game controllers for greater flexibility of
performing and will feature a much greater degree of improvisation than my previous pieces
have. The goal will be to enlarge the role of the electronics so that it becomes less of a supporter
to the instrumental music and more of a performer in its own right.
5. Works Cited


Appendix I: Spectrally derived pitches

Each of the instruments, as well as the composer’s voice, were recorded. From the amplitude/time representation (shown) a steady state point was selected. A frequency spectrum representation (shown) of that point was then created. Frequencies from that representation were selected (possibly transposed) based (intuitively) on the relative strength of the frequencies. These frequencies were separated into strong and weak (relatively) frequencies (shown as vertical pitch collections) and would influence the vertical sonorities of the piece. These collections were linearly ordered (shown). This would provide the root motion for the vertical sonorities. Linear, unordered pitch sets (shown) were taken from these collections. These were used as the source material for melodic motion. (For details on the compositional materials and methods, see 3.1.)

Figure 40  Flute, amplitude
Figure 41 Flute, spectrum

Figure 42 Flute, vertical pitches
Figure 43  Flute, ordered pitches

Figure 44  Flute, unordered set
Figure 45 Clarinet, amplitude

Figure 46 Clarinet, spectrum
Figure 47  Clarinet, vertical pitches

Figure 48  Clarinet, ordered pitches

Figure 49  Clarinet, unordered set
Figure 50 Piano, amplitude

Figure 51 Piano, spectrum
Figure 52 Piano, vertical pitches

Figure 53 Piano, ordered pitches

Figure 54 Piano, unordered set
Figure 55 Violin, amplitude

Figure 56 Violin spectrum
Figure 57  Violin, vertical pitches

Figure 58  Violin, ordered pitches

Figure 59  Violin, unordered set
Figure 60  Cello, amplitude

Figure 61  Cello, spectrum
Figure 62  Cello, vertical pitches

Figure 63  Cello, ordered pitches

Figure 64  Cello, unordered set
Figure 65 Voice, amplitude

Figure 66 Voice, spectrum
Figure 67 Voice (strong frequencies), vertical pitches

Figure 68 Voice (strong frequencies), ordered pitches

Figure 69 Voice (strong frequencies), unordered set
Figure 70 Voice, spectrum (db view to see larger number of peaks)

Figure 71 Voice (all frequencies), vertical pitches, second measure are strong frequencies
Figure 72 Voice (all frequencies), ordered pitches

Figure 73 Voice (all frequencies), unordered set
Appendix II: Harmonic progressions

This Appendix shows the harmonic progressions of the piece. The number that follows the instrument name is the rate of harmonic change (see 3.1 Table 1). The first system of each example first shows the vertical pitch collections (strong and weak frequencies). This is followed by the root motion. The remaining systems map the vertical collections over the root motion and transpose by octave where the composer deemed necessary.

flute (8)

Figure 74 Flute, chord progression
Clarinet (10)

Figure 75 Clarinet, chord progression
piano (13)

Figure 76 Piano, chord progression
Figure 77  Violin, chord progression
cello (12)
Figure 78  Cello, chord progression
woodwinds (combined) (12)

Figure 79 Woodwinds, chord progression
strings (combined) (18)

Figure 80 Strings, chord progression
woodwinds and strings (combined) (19)
all instruments (20)

Figure 82  Woodwinds, Strings and Piano combined, chord progression
voice (strong frequencies) (7)

Figure 83 Voice, strong frequencies, chord progression
voice (all)

m.1 weak frequencies to be used as ornamental notes
m.2 strong frequencies main pitch material
m.3 weak frequencies alternate pitch material
Figure 84 Voice, all frequencies, chord progression
Appendix III: Rates of Harmonic Change

These rates of change are dependent on the length of the Dec rhythm (7, 18 or 27 measures) and the number of spectral pitches for each instrument and instrumental combination (equals the root motion number, Appendix I). Numbers above the staves are measures and numbers below the staves are root motion.

Figure 85 Flute (8): Dec 1

Figure 86 Flute (8): Dec 2

Figure 87 Flute (8): Dec 3
Figure 88 Clarinet (10): Dec 1

Figure 89 Clarinet (10): Dec 2

Figure 90 Clarinet (10): Dec 3
Figure 103  Strings (18):  Dec 1

Figure 104  Strings (18):  Dec 2

Figure 105  Strings (18):  Dec 3
Figure 106  Woodwinds & Strings combined (19):  Dec 1

Figure 107  Woodwinds & Strings combined (19):  Dec 2

Figure 108  Woodwinds & Strings combined (19):  Dec 3
Figure 109  Woodwinds, Strings & Piano combined (20):  Dec 1

Figure 110  Woodwinds, Strings & Piano (20):  Dec 2

Figure 111  Woodwinds, Strings & Piano (20):  Dec 3
Figure 112  Voice (strong frequencies) (7): Dec 1

Figure 113  Voice (strong frequencies) (7): Dec 2

Figure 114  Voice (strong frequencies) (7): Dec 3
Figure 115  Voice (all frequencies) (16):  Dec 1

Figure 116  Voice (all frequencies) (16):  Dec 2

Figure 117  Voice (all frequencies) (16):  Dec 3
Appendix IV:  Dec Rant - Gangster Computer God Worldwide Secret Containment Policy

Gangster Computer God Worldwide Secret Containment policy made possible solely by Worldwide Computer God Frankenstein Controls. Especially lifelong constant threshold brainwash radio. Quiet and motionless, I can slightly hear it. Repeatedly this has saved my life on the streets.

Four billion worldwide [sic] population, all living, have a Computer God Containment Policy brain bank brain, a real brain in the brain bank cities on the far side of the moon we never see. Primarily, based on your lifelong Frankenstein Radio Controls, especially your Eyesight TV, sight and sound recorded by your brain, your moon brain of the Computer God activates your Frankenstein threshold brainwash radio lifelong, inculcating conformist propaganda, even frightening you and mixing you up and the usual, "Don't worry about it." For your setbacks, mistakes, even when you receive deadly injuries. This is the Worldwide Computer God Secret Containment Policy.

Worldwide, as a Frankenstein slave, usually at night, you go to nearby hospital or camouflaged miniature hospital van trucks, you strip naked, lay on the operating table, which slides into the sealed Computer God robot operating cabinet. Intravenous tubes are connected. The slimy vicious Jew doctor simply pushes the starting button, based upon your Computer God brain on the moon which records progress of your systematic butchery. Your butchery is continued exactly, systematically. The Computer God operating cabinet has many robot arms with electrical and laser beam knife robot arms with fly eye TV cameras watching your whole body. Every part of you is monitored, even from your Frankenstein controls. Synthetic blood, synthetic instant-sealing flesh and skin, even synthetic electrical heartbeat to keep you alive are some of the unbelievable Computer God instant plastic surgery secrets. You are the highest, most intelligent electrical machine in the Universe.

Inevitability of gradualness. Usually, in a few years, you are made stringbean thin or grotesquely deformed, crippled and ugly, or even made over one foot shorter or one foot taller, as the Computer God sees fit. Virtually all of the important instant plastic surgery is done to you inside the Computer God sealed robot operating cabinet. Even unbelievable, impossible plastic surgery operations, all impossible even for dozens of vicious kosher bosher doctors working around the clock for weeks. The Computer God sealed robot operating cabinet can perform all of the above impossible plastic surgery operations overnight, even dwarfting you over a foot, or increasing your height by two feet. This is possible because Computer God robot operating cabinet imitates your microminiature electrical current intelligence system in your body. It even duplicates the microminiature electric currents that soften your broken bones to create mending of them and then create stress either compressing the bones thereby shortening them or stress to make the bones grow longer.

Spring, 1984, Mr. Dec, lifelong would-be doctor and printer. Insight to the Worldwide Computer God stratified closed society, perfected by hospital birth making possible lifelong Frankenstein controls and lifelong hampering human defects containment policy. Hospital birth lifelong gifts
example, deformed, crippled, retarded, pox, hives, warts, moles, blindness, deafness, poor vision, etc. Kosher bosher containment policy work good doctors secret health example cataract, rheumatism, weak heart, damaged vision, epilepsy, fainting spells, paralysis, loss of memory, trembling, gout, diabetes, many diseases.

The worldwide unbelievable lowest deadly gangster kosher bosher vicious medical profession worldwide unbelievable instant plastic surgery butchery of the body and brain, especially the face. Wipe on hormones and laser beam surgery causing instant ugly deep wrinkles, scars, age spots, arthritis, freckles, blemishes, pimples, red, brown, black or even sick white face and body. Worldwide dark negroidic colored male sex organs. The brainwash inferior female brain from overall plan intermarry with niggers. Total graying and balding, even hairy body and furry body, mustached, bearded women, even wipe-on synthetic hormones causing cancerous growth. Bloating, swelling, deformed, big pickle nose, bulldog, hanging cheeks and jowls. From teen-age gradual wipe-on yellowing, frowning and blackening of teeth, and instant grinding and acids leaving hollow brown stumps so vocal chords are made raspy, aged, creating a wrinkled, ugly gargoyle clown booze face, worldwide population by age 70. Deformed, crippled, weak and brain damaged, senile. Lingering for inevitability of gradualness extermination. For your only hope for a future, do you know one word of pray for me, Francis E. Dec?

Computer God computerized brain thinking sealed robot operating arm surgery cabinet machine removal of most of the frontal command lobe of the brain, gradually, during lifetime and overnight in all insane asylums after Computer God kosher bosher one month probation period creating helpless, hopeless Computer God Frankenstein Earphone Radio parroting puppet brainless slaves, resulting in millions of hopeless helpless homeless derelicts in all Jerusalem, U.S.A. cities and Soviet slave work camps. Not only the hangman rope deadly gangster parroting puppet scum-on-top know this top medical secret, even worse, deadly gangster Jew disease from deaf Ronnie Reagan to U.S.S.R. Gorbachev know this oy vay Computer God Containment Policy top secret. Eventual brain lobotomization of the entire world population for the Worldwide Deadly Gangster Communist Computer God overall plan, an ideal worldwide population of light-skinned, low hopeless and helpless Jew-mulattos, the communist black wave of the future.(Dec)
Folie à deux

for Flute, Bb Clarinet, Piano, Violin, Cello and Vibraphone

with

Electronic Processing

by

Mark Hannesson

2008
Folie à deux  (2008)       duration c. 18 minutes

for Flute, Bb Clarinet, Piano, Violin, Cello and Vibraphone with Electronic Processing
by Mark Hannesson

program notes

Folie à deux explores the idea of musical influence through the metaphor of shared delusion. The psychological condition of folie à deux is when one person’s delusional state causes the same delusion to manifest itself in another person, a shared psychotic disorder.

notes to performers

The piece includes a Max/MSP patch (version 4.6 required, tested in OSX and WinXP sp2). It requires 6 microphone inputs (1=flute, 2=clarinet, 3=vibraphone, 4=piano, 5=violin, and 6=cello). Output is to stereo.

A number enclosed in a box, [1] corresponds to a numbered bang in the Max patch (the number equals the measure that it occurs in). At the point marked in the score (always on beat 1) click the corresponding bang. The actions listed after the number box are then triggered by the patch.

- rhythm = the Dec rhythmic pattern that the digital delay uses, either 1, 2 or 3.
- delay = the number of repetitions of the digital delay and the multiplier (faster=1, fast=2, slow=1 for the first repetition, 2 for the second, 3 for the third etc.).
- filter sweep = highpass filter per instrument sweeps up and then back down unless specified as up or down.
- feedback = feedback is turned on or off per instrument.
- sf#.wav = sound file playback is initiated. If this is prefaced with a number then the playback is delayed by that number of milliseconds.

The final mix should seek to blend the unprocessed sound of the instruments with the processed sound so that the two are as equal as possible. Neither should dominate the mix.
Folie à deux

Mark Hannesson

Flute

Clarinet in B♭

Vibraphone (2 medium mallets)

Vienna: 

Piano

Violin

Cello

Electronics

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rhythm: Dec1
delay: soundfile(ch1) 20slow soundfile(ch2) 20slow vibe 20slow feedback: vibe on
filter sweep: vibe +3261ms - sf1.wav
Fl.
Vib.
Pno.
Vln.
Vlc.
Elec.

Filter sweep: vibe
sf2.wav
delay: vibe 7 faster
filter sweep: vibe
+7827 - sf4.wav
delay: flute 8 fast
clarinet 10 fast
vibe 7 fast
filter sweep: vibe
Rhythm: Dec 2
delay: flute 8 fast
clarinet 10 fast
vibe 7 fast
piano 13 fast
filter sweep: vibe
Rhythm: Dec 3
delay: flute 8 fast
clarinet 10 fast
vibe 7 fast
piano 13 fast
violin 12 fast
cello 12 fast
filter sweep: vibe, piano
feedback: piano - on
Fl.

B. Cl.

Vib.

Pno.

Vln.

Vlc.

Elec.
Rhythm: Dec 1
delay: flute 12 fast
clarinet 12 fast
vibe 7 fast
piano 13 fast
violin 18 fast
cello 18 fast
Filter sweep: vibe, piano
sf6.wav
+ 7827ms - sf7.wav
Fl.
Bb Cl.
Vib.
Pno.
Vln.
Vlc.
Elec.

rhythm: Dec 2
delay: flute 12 fast
clarinet 12 fast
vibe 7 fast
piano 13 fast
violin 18 fast
cello 18 fast
filter sweep: vibe, piano
Rhythm: Dec 3
delay: flute 12 fast
clarinet 12 fast
vibe 7 fast
piano 13 fast
violin 18 fast
cello 16 fast
filter sweep: flute, clarinet, vibe, piano
feedback: flute, clarinet - on
Rhythm: Dec 3
delay: flute 19 fast
clarinet 19 fast
vibe 7 fast
piano 13 fast
violin 19 fast
cello 19 fast
Filter sweep: flute, clarinet, vibe, piano
rhythm: Dec 1
delay: flute 20 fast
clarinet 20 fast
vibe 7 fast
piano 20 fast
violin 20 fast
cello 20 fast
filter sweep: flute, clarinet, vibe, piano
rhythm: Dec 2
delay: flute 20 fast
clarinet 20 fast
vibe 7 fast
piano 20 fast
violin 20 fast
cello 20 fast
filter sweep: flute, clarinet, vibe, piano
Rhythm: Dec 3
delay: flute 20 fast
clarinet 20 fast
vibe 7 fast
piano 20 fast
violin 20 fast
cello 20 fast
filter sweep: flute, clarinet, vibe, piano, violin, cello
feedback: violin, cello - on
Fl.

B. Cl.

Vib.

Pno.

Vln.

Vlc.

Elec.
Fl.
Bs Cl.
Vib.
Pno.
Vln.
Vlc.
Elec.

Rhythm: Dec 1
delay: soundfile(ch1) 20 fast
soundfile(ch2) 20 fast
flute 20 fast
clarinet 20 fast
vibe 7 slow
piano 20 fast
violin 20 fast
cello 20 fast
sf9.wav
rhythm: Dec 2
delay: flute 20 fast
clarinet 20 fast
vibe 7 slow
piano 20 fast
violin 20 slow
cello 20 slow
rhythm: Dec 1
delay: flute 20 fast
clarinet 20 slow
vibe 7 slow
piano 20 fast
violin 20 slow
cello 20 slow
Rhythm: Dec 2
delay: flute 20 slow
clarinet 20 slow
vibe 7 slow
piano 20 fast
violin 20 slow
cello 20 slow
rhythm: Dec 1
delay: flute 20 slow
clarinet 20 slow
vibe 7 slow
piano 20 slow
violin 20 slow
cello 20 slow
rhythm: Dec 2
delay: flute 20 slow
clarinet 20 slow
vibe 20 slow
piano 20 slow
violin 20 slow
cello 20 slow
rhythm: Dec 1
sf12.wav
delay: flute 20 slow
clarinet 20 slow
vibe 20 slow
piano 20 slow
violin 20 slow
cello 20 slow
filter sweep: flute, clarinet, vibe, piano, violin, cello - up
Fl.

Bb Cl.

Vib.

Pno.

Vln.

Vlc.

Elec.
Rhythm: Dec 1
delay: flute 20 slow
clarinet 20 slow
vibe 20 slow
piano 20 slow
violin 20 slow
cello 20 slow
filter sweep: flute, clarinet, vibe, piano, violin, cello - down