

MEET ME BY THE PLEROMA

Thesis

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Contents:

1.	Introduction.....	6
2.	Development Process.....	9
	2.1 Preliminary Work.....	9
	2.2 Materials.....	15
	2.3 The Form.....	20
3.	Context Within My Work.....	21
4.	Context Within My Interests.....	23
	4.1 Musical Interests.....	23
	4.2 The Sonic Other.....	25
	4.3 Philosophical, Social, Political.....	27
	4.4 About the Title.....	32
5.	Concept.....	36
	5.1 Why Difference Tones?.....	36
	5.2 Considerations for the Performers.....	37
	5.3 Considerations for the Audience.....	38
6.	Signal Flow Performance.....	41
	6.1 Staging.....	41
	6.2 Comments on Performance.....	42
	6.3 Audience Reaction.....	43
7.	Appendix A. Score to <i>Meet me by the pleroma</i>	47
8.	Appendix B. Technical details.....	50
9.	Bibliography.....	54

List of Figures:

Figure 1. Mills College slentem pelog.....	8
Figure 2. Long string instrument.....	9
Figure 3. Conrad's minor thirds.....	11
Figure 4. Max/MSP prototyping patch.....	13
Figure 5. Stage setup for Signal Flow performance of <i>Meet me by the pleroma</i>	41
Figure 6. Spectrograph <i>Meet me by the pleroma</i> 26'48" to 27'40".....	42
Figure 7. Signal routing for <i>Meet me by the pleroma</i>	53

1. Introduction

Meet me by the pleroma is a composition I developed in late-2008 and early-2009 for violin, long string instrument, slentem (a Javanese gamelan instrument), and electronics. The principle subject of the piece is an acoustic phenomenon called a *difference tone* – a third tone that results from two tones sounding together. When electronics are used to amplify and magnify this phenomenon, the usually inaudible difference tones are available for use as rhythmic, harmonic, and melodic material. The piece is composed using a just intonation tuning system in order to produce predictable difference tones with a harmonic relationship to the intervals that create them.

The long string instrument features two strings ten feet in length and tuned in unison. It is played with a bow in the right hand while the left hand stops the strings on harmonic nodes. The slentem is a low register, tuned bar instrument played with soft mallets and its timbre is characterized by a strong fundamental. The electronics used in *Meet me by the pleroma* consisted of very simple analog processing (overdrive and filtering) and amplification.

The violin and long string instrument play sustained, harmonically tuned dyads. The difference tones created by the dyads are amplified so that they match the acoustic volume of the instruments for most of the piece. The slentem repeats a single pitch that is approximately 4Hz flat of the fundamental, and the tempo is determined by the frequency of acoustical beating created when the slentem is heard against a sine tone tuned to the fundamental frequency. The difference tones of each instrument play a role in the piece.

The violin part generates melodic and harmonic movement with the difference tone, while the pitch relationships between the notes played are relatively static. The difference tone created by the long string instrument remains fairly stable and provides harmonic reinforcement. The difference tone created between the slentem and the sine tone provides a rhythmic beating and a cue for the sense of time in the piece.

Musical and technical inspiration for *Meet me by the pleroma* comes from the pioneering work of those composers and sound artists whose creative mandate, as Bay Area electronic musician Tim Perkis describes it, was to create situations that allow for the manifestation of “sonic entities.”¹ Intrinsic to this approach to musical activity is the implication that composer, performer and audience occupy new, less mediated spheres of power when compared to traditional music practice. Although this experimental tradition has been around for half a century, and a large body of compositional work concerning tuning and acoustics exists, I believe that *Meet me by the pleroma* explores new possibilities by addressing the harmonic and melodic role of difference tones made audible. *Meet me by the pleroma* also engages with the esoteric intimations of Perkis’ description of experimental musicking, in which this creative practice can be seen as an invocation. The process of developing this piece allowed me to address what has become the core concern of my work: reconciling the internal and personal aesthetic incentives for making art with an understanding of how the work reflects – or doesn’t reflect – my values. What follows will be a description of the ideas and motivations that led me to

¹ Tim Perkis, “Complexity and Emergence in the American Experimental Tradition,” in *Art and Complexity*, ed. J. L. Casti and Anders Karlqvist (Amsterdam: Elsevier, 2003), 75-84.

compose *Meet me by the pleroma* and my account of the process of creating and presenting the work itself.



Figure 1. Mills College slentem pelog



Figure 2. Long string instrument

2. Development Process

2.1 Preliminary Work

An early inspiration for *Meet me by the pleroma* came from a March 2008 lecture by composer and filmmaker Tony Conrad. The lecture was part of a series of talks he presented titled “The Harmonic Series and Applied Basic Arithmetic as Bases for Musical Practices.” In the lecture Conrad discusses possible applications of just intonation in composition and performance practice and demonstrates a technique for playing an interval on the violin in such a way that manipulates the difference tone created by the interval.

To illustrate this Conrad plays his violin through a distortion pedal and amplifier in order to make the difference tone audible. Although the sound is harsh and it takes him

a few attempts to get the intonation right, the effect is discernible as he plays three different just intonation versions of a minor third: $7/6$, $19/16$, and $6/5$. As he makes microtonal adjustments to move from one minor third to the next, the difference tone can be heard to move stepwise three octaves down, locking in to provide a consonant third voice in the bass register. The difference tone for each minor third imparts a unique flavor.

With an interval derived from the harmonic series it is possible to use simple arithmetic to determine what the difference tone generated by the two pitches will be, and that pitch can be represented with a simple integer ratio. The first-order difference tone is represented mathematically as $f_d = f_2 - f_1$, where f_1 is the lower tone in an interval and f_2 is the higher tone. Using this formula, Conrad's $7/6$ interval produces a difference tone of 7 minus 6 times the fundamental represented by the lower tone (6); which equals $1/6$. This is a perfect fifth three octaves below the fundamental, which transposed within an octave is a perfect fourth above the fundamental. The $19/16$ interval produces a difference tone of $3/16$, which is a perfect fourth three octaves below the fundamental or a perfect fifth when transposed. The difference tone of the $6/5$ interval is $1/5$, which is a major third three octaves below the fundamental or a minor sixth. So when heard along with the minor sixth difference tone voice the $6/5$ minor third has a darker, more "minor" tonality while the perfect fourth difference tone in the $7/6$ interval makes it sound more "major." The difference tone produced by the $19/16$ minor third is somewhat neutral but very consonant due to the strong harmonic reinforcement provided by the perfect fifth.

Figure 3 illustrates the minor thirds from Conrad's example. The derivation in cents from an equal tempered minor third is shown above the dyads. The first-order difference tone generated by the dyads is shown in the bass clef.

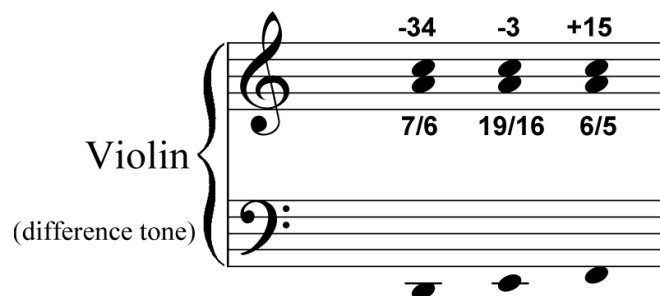


Figure 3. Conrad's minor thirds

Conrad provides this example in his characteristically off-handed style, and although it only occupies a few minutes of this nine-hour lecture series I immediately recognized the potential suggested by the minor thirds. If one could isolate the difference tone artifact in the lower register while matching it in volume with the acoustic sound of the instrument, the result might be a compelling sonic dichotomy. The listener would simultaneously discern the seemingly static, single interval of a “minor third” with slight microtonal variations in the acoustic sound of the instrument, as well as the amplified difference tone moving around as a third voice in the bass register, alternately blurring and clarifying the perception of consonance. It occurred to me that there might be other sets of intervals, or sets of variations on an interval, that could be played with in a similar fashion. Ultimately I chose four sets of intervals with which to explore this effect in *Meet me by the pleroma*.

Using Conrad's minor thirds as a starting point I began looking at other sets of intervals for the violin part. I was looking for sets that would provide at least three variations on an equal tempered interval and that would meet the following criteria.

Most importantly, I wanted to find variations that would create difference tones that are consonant but that also impart a unique harmonic identity to each interval. But I was also interested in finding intervals that create consonant difference tones even though they are based on prime-number harmonics usually considered too high to be consonant. Conrad's 19/16 minor thirds is a good example of this. Tuning theorist David B. Doty considers 19/16 to be a useful interval because it is only 3 cents flat of an equal tempered minor third, but he maintains that it is "definitely not a consonance" because of its ambiguous periodicity pitch.² While I accept that periodicity pitch can contribute to the perception of a consonant relationship between two pitches, I think the first- and second-order difference tones play a role as well. When these tones are audible they can affect the harmonic identity of the interval. As I mentioned earlier, 19/16 produces a first-order difference tone that is a perfect fifth relative to the fundamental. A perfect fifth is considered the most consonant interval after the octave, so when this difference tone is amplified and perceived as a third voice it has a reinforcing effect. This is in spite of the 19th harmonic's ambiguous relationship to the fundamental when compared to the harmonics from which Conrad's other minor thirds are derived.

By using simple arithmetic I determined the difference tones of just intonation versions of several equal tempered intervals. The next step was to move the project from my notebook into a format that I could actually listen to, so I created a prototype patch in

² David B. Doty, *The Just Intonation Primer: An Introduction to the Theory and Practice of Just Intonation*, (San Francisco: The Just Intonation Network, 2002), 64-65.

the Max/MSP programming environment. The patch consists of two banks of sine wave generators that can be tuned to integer ratios relative to a fundamental frequency. A dyad of sine tones are routed into basic overdrive and low pass filter objects. The overdrive boosts the difference tone produced by the dyad, while the filter is set to the frequency of the difference tone in order to attenuate the unwanted, higher frequency artifacts of the overdrive. I found that simply boosting the level without adding overdrive generated a less pronounced difference tone frequency with very little harmonic content. I preferred the sound of the overdriven difference tone because the even-order harmonics produced by the distortion created a string-like timbre. I felt that this was appropriate because I intended for these difference tones to be perceived as “ghost” voices on the string instruments.

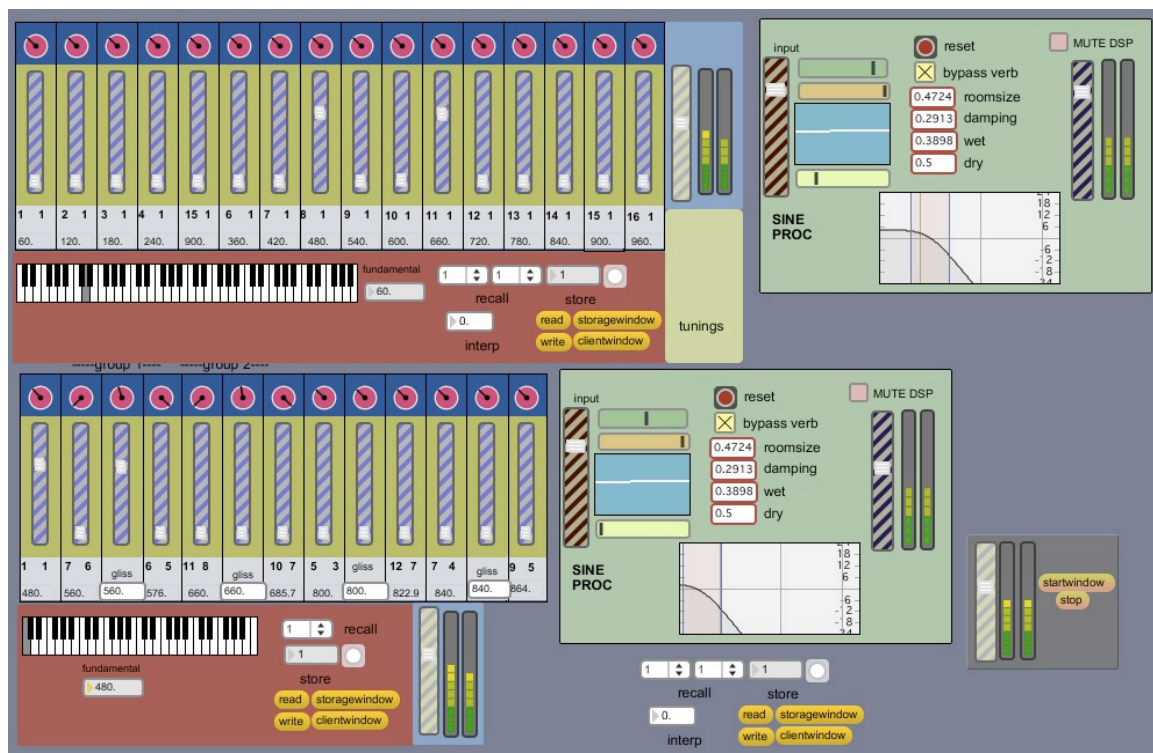


Figure 4. Max/MSP prototyping patch

In Figure 4 the two banks of sine wave generators appear as mixers with faders on the left side of the patch window. The upper bank is used to prototype the long string instrument. Only harmonics are played on the long string instrument so the oscillators in this bank are tuned to ratios of non-octave reduced harmonics – $3/1$, $4/1$, $5/1$, $6/1$ etc. up to $16/1$ – relative to a fundamental of 60Hz. A dyad formed by two of these tones simulates an interval played on the long string instrument. The lower bank represents the violin and the pitches are identified by the octave-reduced integer ratio nomenclature used in just intonation. As the violin part consists of dyads that always have the fundamental as the lower pitch, I simulated it in the patch by playing the fundamental $1/1$ with another pitch from those I selected for the violin part. Four of the oscillators in this bank can glissando between pitches in the set to simulate the violin technique. For example, one sine tone can glissando from the lower minor third $7/6$ to the higher $6/5$, passing through $19/16$ in between. This gave me a sense of how it would sound when the difference tone passed in and out of consonance.

On the right side of the patch are modules that add overdrive distortion and low pass filtering; the only processing I felt was necessary to achieve the intended effect. In the prototyping phase I realized that I didn't like the sound of the DSP distortion and decided that analog electronics would be preferable. Even though I tried several different types of distortion objects and built my own in Max, I was never quite happy with the timbre of the digital distortion. Additionally, it was difficult to know whether the artifacts I heard in the patch were being caused by the desired heterodyning or by digital aliasing. Nevertheless, at this stage in the process the Max patch was useful for prototyping and

for determining which intervals to use. Technical details on the analog signal paths used in the Signal Flow performance can be found in Appendix B.

During this prototyping phase I approached my colleague, violinist Brendan Aanes, about performing the piece. I knew that the violin part would be the most critical and wanted to find someone who could learn the technique and who would be comfortable performing a long-form piece consisting of sustained dyads with only a few rests. Aanes agreed and we met a couple of times in the fall of 2008 to try some of the interval sets and to give him a chance to practice manipulating the difference tones. Our early sessions were fruitful and Aanes demonstrated an enthusiasm for the piece as well as a proclivity for playing drones of long durations with the appropriate intonation techniques. Early in the spring semester of 2009 I rounded out the ensemble with Danishta Rivero on the long string instrument and Chad McKinney on slentem. The parts for these instruments would require specific techniques, but prior experience wasn't necessary, as I had planned to work out the performance techniques with the players over the course of the rehearsal process.

2.2 Materials

The decision to use a violin in the piece was inspired by Conrad, but it was also a pragmatic decision. The harmonic timbre of the violin suggested that it would lend itself to difference tone manipulation. The violin can be played comfortably in the register needed to produce difference tones in the 80-200Hz range. Moreover, I had a colleague who plays the instrument and with whom I had collaborated before. I decided that a *scordatura* tuning would work best, in which the A string would be tuned to 480Hz to

match the fundamental frequency of the piece. In the violin part this open string would provide the fundamental voice in all the dyads.

The long string instrument came to my attention during Daniel Schmidt's instrument building course in the spring of 2008. The instrument was built by Schmidt as a prototype for a design he was working on for the Paul Drescher Ensemble. It is ten feet long and has two strings tuned to unison. The instrument is played with a bow while the other hand stops the strings at harmonic nodes. Harmonics as high as the 23rd can be sounded due to the length of the strings. Designed as an acoustic instrument, it has two soundboards running the length of the instrument, one on each side. To increase the volume I coupled the two soundboards with a sound post. It occurred to me that harmonically accurate dyads in a high register could be played on this instrument, while producing difference tones in the bass register. I also believed that playing harmonics would yield very stable pitches.

At the outset wanted to use the slentem as a harmonic voice. The slentem is one of the lower register instruments in the Javanese gamelan, and its sound is characterized by a very strong fundamental frequency. The Mills slentem, which consists of aluminum bars instead of the more traditional copper, has an especially resonant quality with a long sustain. After the initial attack the timbre is very close to a sine tone with almost no harmonics. Once I began to develop the piece and discovered the effect of the low "6" pitch sounding against a sine tone tuned to the fundamental frequency of the piece, I started to prefer a more minimal part for the slentem. After listening to recordings of the first few rehearsals I decided to eliminate all pitches except for the low 6.

I determined that there would be three simple signal paths, one for each instrument. The violin and long string instrument would have similar paths, whose function would be to boost the signal coming from a piezo pickup on each instrument and then filter out the frequencies above the first-order difference tone. The difference tone for each instrument would then be sent to a powered speaker placed near the instrument in order to localize the processed signal and to help the listener associate it with the instrument from which it originated.

The slentem would be unamplified and played against a sine tone of 120Hz. The sine tone would be sent to a speaker near the slentem so that the sound of the gamelan instrument and the sine tone would blend. The discovery that the slentem was slightly out of tune with the fundamental frequency of the piece was a serendipitous accident. After a conversation with instrument maker Daniel Schmidt early in the development process I had the mistaken impression – due to simply remembering the talk incorrectly – that the Mills gamelan was tuned to 60Hz rather than the concert 55Hz. In actuality Schmidt had told me that he has prefers basing his tuning systems on 60Hz, but that when he worked with Lou Harrison to build the Mills College gamelan in the 1970's they used 55Hz as the reference frequency in order to make it more compatible with Western instruments.

There is a precedent for using 60Hz as a tuning reference in American minimalist music. During their time collaborating in the Theater of Eternal Music, La Monte Young and Tony Conrad realized that tuning to the frequency of the electrical grid would eliminate interference caused by ground hums in their amplification systems.³ Schmidt

³ Branden W. Joseph, *Beyond the Dream Syndicate: Tony Conrad and the Arts after Cage*, New York: Zone Books, 2008), 334.

told me that he and his colleagues discovered the same advantage to a 60Hz tuning reference when developing electro-acoustic instruments in the 1970s.

Moreover, I mistook Schmidt to mean that the “6” pitch – usually considered the fundamental in gamelan music – was the reference pitch. So when I played the low “6” on the slentem I expected it to be 120Hz. When I heard the slow beating it generated against a 120Hz tone I made the reasonable assumption that the instrument had fallen slightly out of tune over the years. In fact the “5” pitch on the gamelan had been used as the tuning reference. So on this instrument the low “5” was tuned to 110Hz and the 6 was actually a 8/7 whole step relative to the “5,” or approximately 116Hz. In any case, I immediately liked the sound that resulted from the tuning discrepancy and determined to make use of it.

In Indonesia gamelans are intentionally detuned so that the same key on two instruments will beat against each other, creating a shimmering effect from the pulsing difference tones of numerous detuned pairs. The instrument makers and musicians believe that the acoustic beating serves as an invitation to the gods. Balinese gamelan master I Wayan Sinti claims that a key is incomplete without its detuned partner, and likens this to the Hindu concept of dualism as seen in the archetypal male/female pair Shiva and Shakti.⁴ When I first learned about this practice I was reminded of Perkis’ “sonic entities” and the metaphor of experimental music practice as invocation.

The three basic elements of the piece would involve difference tones. The violin would be the most prominent part and would consist of sustained tones that alternately

⁴ Rajakumar Manickam and Wayne Vitale, “We Play to Entertain the Gods – and People: An Interview with I Wayan Sinti of Bali,” (September, 1997), <<http://www.hinduismtoday.com/archives/1997/9/1997-9-15.shtml>> (29 March 2009).

remain stable or move the difference tone around to create melodic and harmonic movement. Because all the pitches played on the long string instrument are harmonics, the difference tones generated by it would be multiples of the fundamental to which the open strings are tuned – 60Hz. This would create stable pitches with a strong harmonic relationship to the 480Hz fundamental being played at all times on the violin. And the beating produced by the slightly detuned slentem played against a 120Hz sine tone would provide a sense of time.

While listening to recordings of an early rehearsal, Professor James Fei pointed out that in certain sets of intervals the violin signal path was creating artifacts other than the difference tones I had predicted and indicated on the score. There was a very audible tone sounding in the octave below the expected difference tone, and its pitch was moving in the opposite direction. I later realized that this artifact was a second-order difference tone. The timbre of an open string on the violin has a very pronounced second harmonic, which is exaggerated by distortion. So the unexpected artifact was the tone created by the difference between the second harmonic of the fundamental minus the higher voice in the dyad, represented by the equation $f_d = 2(f_1) - f_2$ where $2(f_1)$ is the second harmonic, or octave, of the fundamental f_1 .

The second-order difference tone was most prominent in the minor sevenths (7/4, 16/9, and 9/5). The minor sevenths are the widest intervals used in the piece, and the first-order difference tones are less pronounced and sound in the treble clef, between 360Hz and 384Hz. So when Aanes played a glissando from the 7/4 dyad (480Hz and 840Hz) to the 16/9 (480Hz and 853.33Hz), the second-order difference tone would glissando from 120Hz (or 960Hz – 840Hz) to 76.67Hz (or 960Hz – 853.33Hz). The

combination of first-and second-order difference tones moving in different directions resulted in a sound similar to ring modulation. Even though this was a more complex phenomenon that I had planned, the effect was nearly impossible to avoid with simple processing so I decided to let it become part of the piece.

2.3 The Form

In the score time is indicated by minutes and seconds above each instrument's part. The staff is separated with bar lines corresponding to exact times at which changes occur. The final version of *Meet me by the pleroma* is thirty minutes long, and the score is divided into three pages with ten minutes per page (see Appendix A).

I decided early on to represent the violin and long string instrument parts as having both treble and bass clefs in order to show the dyads and the difference tones they produce. The slentem part indicates pitch in gamelan notation – the number six with a dot beneath it signifies a “6” note played in the lowest octave of the instrument. The electronics part is divided into two staves for the violin and long string instrument signal processing signal paths, each with an envelope across the timeline indicating volume for that channel. There are numbers under the staves connoting the frequency of the difference tone in order to give the performer an idea of where the cutoff for the filter should be. No adjustments in the processing are necessary besides volume and cutoff frequency.

In early versions of the score, the processed sound faded in very gradually over the course of the first few minutes. Both James Fei and Laetitia Sonami suggested I try presenting the subject immediately, and then play with its dynamics later in the piece. So

I revised the score to include an expositional opening section in which the violin is featured playing stable dyads and in which the processed sound is audible. I found this to be an effective way of introducing the subject at the beginning of a long piece, much like the way *alap* functions in Hindustani raga form. This violin solo lasts until the five minute mark, at which point the long string instrument enters with a similar introduction to the instrument's acoustic and processed sound, accompanied by the slentem sounding against the sine tone, striking once every thirty-two interference beats, or roughly every eight seconds.

3. Context Within My Work

On a technical level, *Meet me by the pleroma* relates to my other compositional work in that it employs sustained tones and tunings derived from the harmonic series. This has been an area of interest for several years, and during my time at Mills I have developed three pieces that can be grouped into this category.

Fluvial Cortex sets a trombone part consisting of multiphonic, just intonated intervals and glissandi within a cluster of harmonically tuned sine tones. In *Stoa Poikile* a string trio navigates through a series of sonic structures created by a bank of 96 resonant filters tuned to just intonation scales. *Polystate* is an interactive audio and visual environment that I developed as my final project for the “Interface” course at California College of the Arts and subsequently refined and installed as part of my participation in the 2009 Mills Signal Flow festival. Users interact with *Polystate* by manipulating three small balance scales. In addition to affecting a variety of parameters that process the sound and projected image, the position of the scales controls the frequency of three sine

wave oscillators such that they drift between the frequencies of several closely tuned intervals within a set of pitches.

In all three pieces the instability introduced by the human element is essential, and the idea of perfect “in-tuneness” is problematized. Harmonic tunings are used so that the listener can recognize those fleeting moments when the pitches are locked in, while the texture and sonic motion is often created by the acoustic beats that result from the near misses and blurred misalignments. The same is true for *Meet me by the pleroma*. The slentem pitch played throughout the piece – the fundamental “6” in gamelan notation – was chosen because of the slow beating it creates when played against the fundamental frequency of the piece. The human element is most apparent in those sections of the violin part where microtonal adjustments in the top voice of a dyad are used to create melodic movement in the difference tone. As the difference tone moves in and out of pure, harmonic relationships with the fundamental, beating patterns accelerate and decelerate and contribute significantly to the drama of the piece.

If I step back from a micro context defined by technical elements, I also see *Meet me by the pleroma* as a part of a conceptual pattern in my work. Some of the ideas that comprise this are balance, differentiation, and the friction between internal and external concerns. That is to say, the process of creating this piece has given me a new perspective on my creative practice and motivations. At this macro level I recognize an intuitive drive to investigate ideas of duality and the listener / participant’s relationship to the subject.

4. Context Within My Interests

4.1 Musical Interests

I have listened to Tony Conrad's music since he first resurfaced as a musician in the mid-1990s. Conrad's music led me to the work of other artists working with similar materials, many of which are his contemporaries. The music of La Monte Young, Terry Riley, Charlemagne Palestine, Arnold Dreyblatt, Eliane Radigue, Alvin Lucier, and Phil Niblock share this concern for working with acoustic phenomena and perception. Most significantly, the "ghost tones" featured in Pauline Oliveros' pioneering heterodyning pieces offered inspiration by addressing autonomous sonic phenomena as the subject of the work.

The use of the minor third relates to another musical interest – the role of tonality in minimalist and post-minimalist music. Since reading Paul Hillier's analysis of Arvo Pärt's *tintinnabulist* techniques I have been keenly interested in the Estonian composer's approach to harmony inspired by the chiming sonorities inherent in the minor triad. Although his post-1970 work is marked by a decisive turn towards tonality in contrast with his earlier serial works, Pärt eschews common practice techniques of harmonic movement and "functional" harmony in favor of a style suggestive of Medieval music. Hillier asserts that this is far from a post-modern appropriation but rather "a new blend of tonal and modal forces."⁵ The subject of Pärt's work is always the triad, often explicated by a diatonic scale and triadic arpeggios in such a way that a sense of tonal stasis forms around the tonic triad from which the harmonies are derived. His most important pieces

⁵ Paul Hillier, *Arvo Pärt* (Oxford University Press, 1997), 92.

are profound meditations on the inner structure of this (usually minor) triad in which the simple tonal structure is closely examined from within this place of stasis.

Pärt's ability to create rich work using such primary materials prodded a curiosity about how we hear minor tonality. The ability to discern subtle shades of emotive signifiers in tonality, rather than the oversimplified minor = sad / major = happy understanding we have inherited, is possibly a casualty of the adoption of equal temperament in the West.

It is illuminating to contrast this with the *maqam* modal system of Arabic cultures, where a wealth of gradation is available in microtonal variations on scales. Joy and sorrow are only starting places, basic colors represented by a set number of fixed scales. Several *maqamat* may be built upon a single scale, and certain pitches in each *maqam* are microtonally unique identities, serving as emotional signifiers to the listener who is accustomed to the music.⁶ Myriad, subtle hues of sadness can be perceived in the numerous *maqamat* derived from the minor scale.

Is it possible to present the Western listener with a broader palette and re-encode the cultural *pathosformel* over time?⁷ Might this contribute to what La Monte Young

⁶ Krisitna Nelson, *The Art of Reciting the Qur'an* (Cairo: The American University in Cairo Press, 2001), 66-67. Nelson suggests that the pairing of *maqamat* with text from the Koran has encoded emotional associations with the subtle tonal differences.

⁷ German cultural theorist Aby Warburg (1866-1929) suggested that the meaning of bodily expressions are engraved in the cultural memory and communicated through art by means of the *pathosformel* or "pathos formula." It seems logical to extend this notion to the archetypal potential of musical gestures.

describes as our self-initiated evolution?⁸ These questions have fueled my interest in working with tonality and altered tunings.

4.2 The Sonic Other

The practitioners of this type of music build machines, or things akin to machines or simulations, things that have a behavior of some kind that is unanticipated by the composer. – Tim Perkis⁹

In his article “Complexity and Emergence in the American Experimental Tradition,” Bay Area electronic musician Tim Perkis describes what he sees as the unique qualities of the American tradition of experimental music practice. As I mentioned before, I was intrigued by his suggestion that the essence of this practice is composing *situations* in which “sonic entities” might appear. This de-emphasis of the ego-driven practice of “composition” has become a familiar concept in the half century that has transpired since John Cage first began redefining the role of the composer. But I found something intriguing about Perkis’ framing of this creative process as an esoteric practice. In order to create compelling work, the musician / composer / media artist has to do more than simply take a step back from the traditional, control-oriented role. He or she assumes the role of the occultist who, having studiously applied a craft – whether that takes the form of computer code or an application of some principle of acoustics – now

⁸ Frank J. Oteri, “La Monte Young and Marian Zazeela at the Dream House: In Conversation with Frank J. Oteri,” *NewMusicBox*, (2003), <<http://www.newmusicbox.org/article.nmbx?id=2216>> (13 May, 2008).

⁹ Tim Perkis, “Complexity and Emergence in the American Experimental Tradition,” in *Art and Complexity*, ed. J. L. Casti and Anders Karlqvist (Amsterdam: Elsevier, 2003), 75-84.

creates a space for the manifestation of the *sonic other*, an event, effect, or phenomenon that can communicate with the participants and help the work transcend the level of mundane experiment and become *art*. The sonic other can be invited and even predicted to some extent, but it can't be controlled.

In my opinion, this practice can require as much skill and discipline as that of encoding every nuance of a symphony in music notation. Yet the experimentalist tradition offers something that was previously unavailable – a significant step towards unmediated access to the means and to the result. Like the esotericist who employs centuries of knowledge in order to access a truth that is unavailable through sanctioned and less direct means, the artist uses modern tools and new techniques to invoke Adorno's *methexis*.¹⁰ And by applying (or misusing) technology, new approaches to form, or simply defining "instrument," "performer," "composition" on one's own terms, this practice can exist outside of traditionally established channels of access, institutions, and power structures.

I approached *Meet me by the pleroma* with Perkis' model in mind. In this case the "sonic entities" are the difference tones and acoustic artifacts that are prescribed by the score, precise tuning and electronic processing, and yet are not under the direct control of any one of these elements. I hoped this other voice would be perceived as having a causal relationship to the acoustic sound of the instruments while maintaining an autonomous identity. Most importantly, I hoped that in spite of the admittedly traditional and passive means by which the piece would be transmitted – that is, to an audience seated in a

¹⁰ Adorno's use of the term *methexis* in *Negative Dialectics* and *Aesthetic Theory* expands on its usage in theatre (from the Greek, meaning audience participation) to indicate the artwork's participation in history and its capacity to transcend the collective and the individual.

concert hall – the listener might be engaged by this subject in a way that bridges the internal experience with the external, physical phenomena.

4.3 Philosophical, Social, Political

When I first encountered Conrad's music and read the garrulous liner notes he provides for his recordings, the unabashedly political framing of his work exhilarated me. Here was drone music as agitprop, with the audacity to use mathematics and visceral sound to advance ideas of heterophony and radical democracy.

In the lectures on the harmonic series Conrad covers tuning theory, but also illuminates the history of Western music theory and science in the context of socio-political control structures. Conrad makes the case that theoretical models in music, mathematics, and science have historically been used by those in power to maintain control.

His most famous example is one of the progenitors of Western thought – the ancient Greek philosopher and mathematician Pythagoras of Samos. Pythagoras is generally credited with the “discovery” of the harmonic division of a string that led to the one of the earliest known applications of just tuning in the sixth century B.C and, accordingly, his followers were known as the “harmonists.” Ironically, the Pythagorean cosmology prescribes intervals derived exclusively from the third harmonic (the perfect fifth) and this eventually led to the diatonic system and, ultimately, equal temperament. By the time of the Ars Antiqua period European music was based entirely on Pythagorean scales, and thirds and sixths were considered dissonances.

The liner notes to Conrad's 1995 release *Slapping Pythagoras* consist of a scathing polemic against the ancient Greek philosopher. Conrad addresses a mythical version of Pythagoras as his nemesis, and asserts that Pythagoreanism was an anti-democratic movement during a time when nascent democracy was in a fragile stage of early development. According to Conrad, the Pythagoreans ascribed mystical status to Number, and the discovery of proportional harmonics was held up as evidence of a Cosmological Order. To Conrad, this Cosmic Order also implies a social and political order in which the individual must accept his or her place. Conrad writes:

Pythagoras forged our Western arithmetical understanding of musical intervals, comprising (1) an ethical bond between music and the sanctity of Number and (2) the identification of number ratios with Harmonic consonance... The Pythagorean use of numbers as “symbola” (that is, oracular sayings) situated arithmetic in a special realm, between the physical and the abstract. To effectuate and reinforce the Idealization of Number (which is the Pythagorean heritage in music, mathematics, and astrology), Pythagoras substituted a Theology of Number for the pragmatics of counting. – Tony Conrad¹¹

The charges Conrad makes against this mythical Pythagoras – elitism, authoritarianism, the use of secret knowledge as an instrument of control, and the appropriation of other cultures – can be read as a thinly veiled indictment of Conrad's former collaborator La Monte Young. Young and Conrad have had a long-standing

¹¹ Tony Conrad, liner notes to *Slapping Pythagoras* (Table of the Elements, 1995).

dispute over the authorship of the music of their 1960's group the Theater of Eternal Music. Young claims he was the composer of these works and has prevented the public release of the group's recordings. Conrad claims that the Theater of Eternal Music was improvisational and describes the project as "composerless."¹²

On another level these liner notes and the music they support comprise a critique of an anti-democratic cultural hegemony that has been propped up by religious institutions and other power structures. When music is produced under this model it disempowers listeners by presenting them with ideals that, while present in nature – are beyond the human capacity to reproduce. Heterophony, as Conrad defines it, is inherently democratic because it is an act of "doing" rather than "trying."¹³ That is to say, to make heterophonic music is to participate in the act of creation, to use natural phenomena as a guide without the compulsion to strive for a divine ideal. The act can itself be seen as divine rather than an attempt at a model of divine perfection. Conrad's vision of democratic justice and a bit of his dark humor are embodied in the titles on the disc: "Pythagoras, Refusing to Cross the Bean Field at His Back, Is Dispatched" and "The Heterophony Of The Avenging Democrats, Outside, Cheers The Incineration Of The Pythagorean Elite, Whose Shrill Harmonic Agonies Merge And Shimmer Inside Their Torched Meeting House."

I like to think that I maintain a similarly critical stance when developing a new work. Although these concerns tend to be secondary to basic aesthetic considerations such as how the work *sounds* or how it *feels*, I am aware that whatever I project into the

¹² Tony Conrad, "Duration," 2004, <<http://tonyconrad.net/duration.htm>> (30 March, 2009).

¹³ Idem, liner notes to *Slapping Pythagoras*.

social space reflects how I view the spheres of power occupied by the performer and listener. In *Meet me by the pleroma* I attempted to keep the form sufficiently open so that the performers would shape the piece by *doing* rather than by *trying*. And I tried to present the subject in such a way that would engage the audience rather than simply entertain them or lull them into a trance.

Conrad frequently refers to “radical democracy,” and although Branden Joseph associates Conrad’s usage of the term with the “ultra-democracy” of Cornelius Cardew’s Scratch Orchestra, Conrad’s politics seem to be more closely related to anarchism than to Cardew’s more orthodox leftism. As a result of his affiliation with filmmaker Jack Smith and his exposure to French writer Georges Bataille, much of Conrad’s aesthetic has been influenced by the idea of *transgression*, described by Joseph as “a violation and temporary suspension of the law in order to enter a realm of experiences outside or beyond it.”¹⁴ Drug use, shoplifting, and other consciously transgressive behaviors were embraced by Conrad’s milieu in the 1960s. This attitude was reflected in the art produced by the community – most notably in the extended duration and volume of Theater of Eternal Music concerts and in the orgiastic rituals depicted in Smith’s films. This posture relates to the anarchist tradition’s view of the oppressive illegitimacy of society’s legal and moral codes, and echoes the activities of the anarchist-influenced Situationists in France during the same tumultuous period.

In early 2009 I happened upon the text of a lecture written in 1896 by Russian anarchist and political theorist Peter Kropotkin titled “Anarchism: Its Philosophy and Ideal.” In this lecture Kropotkin presents breakthroughs across various scientific fields as

¹⁴ Joseph, *Beyond the Dream Syndicate: Tony Conrad and the Arts after Cage*, 268.

providing conceptual models and evidence for an anarchistic – and *radically democratic* - vision of society.

I was struck by a paragraph in which Kropotkin references the work of Fourier. I felt that this passage related to *Meet me by the pleroma* so I included it in the program notes.

The whole aspect of the universe changes with this new conception. The idea of force governing the world, pre-established law, preconceived harmony, disappears to make room for the harmony that Fourier had caught a glimpse of: the one which results from the disorderly and incoherent movements of numberless hosts of matter, each of which goes its own way and all of which hold each in equilibrium. – Peter Kropotkin¹⁵

Interestingly, scholars of this text are not sure if the “Fourier” Kropotkin cites is the physicist Joseph Fourier or the social theorist Charles Fourier. Given the context it is likely that he is referring to the former, but the revolutionary philosophy of the latter would have been a familiar point of reference for Kropotkin and other fin de siècle radicals. In any case, I found this ambiguity compelling, and my own motives are reflected in the dichotomy represented by the two Fouriers – between the realms of the physical / phenomenal and the social / psychological. And I read in it an analogy of how I hoped *Meet me by the pleroma* might be experienced, with the amplified difference tones acting as autonomous entities while holding “each in equilibrium.”

¹⁵ Peter Kropotkin, “Anarchism: Its Philosophy and Ideal,” in *Anarchism: A Collection of Revolutionary Writings* (New York: Dover, 2002), 117-18.

4.4 About the Title

The question I was asked most during the time leading up to the Signal Flow concert would have to be “What’s a pleroma?” My first introduction to this term came from Carl Jung’s *Seven Sermons to the Dead*, an esoteric tract written by the psychiatrist between 1913 and 1916 but not officially published until 1963, and two years after his death. Jung claimed that the piece was written in a mystical state during the time of psychological duress that followed his personal and professional break with his mentor Sigmund Freud.¹⁶ The manuscript is enigmatically credited to Basilides of Alexandria, who was a Gnostic scholar in the 2nd century.

The word *pleroma* has its origins in Gnostic Christian cosmology, where it is used to describe the realm of the divine – fullness and light manifest, separate from and an antithesis to the lower realms of the living, or *creatura*. In *Seven Sermons* the pleroma is a metaphor for Jung’s concept of the unconscious, and the process by which the pleroma penetrates the conscious, living world is analogous to his concept of *individuation* – the individual’s progress towards a state of wholeness and greater consciousness. This writing also contains the earliest reference to a central concern in Jung’s work – the duality of opposites and the therapeutic importance of transcending the bipolar pull of this duality by striving to hold pairs of opposites in balance. From the First Sermon:

You say: What harm does it not do to discriminate, for then we reach beyond the limits of our own being; we extend ourselves beyond the created world, and we fall into the undifferentiated state which is another quality of the Pleroma. We submerge into the Pleroma itself, and we cease

¹⁶ Peter Homans, *Jung in Context: Modernity and the Making of a Psychology* (Chicago: University of Chicago Press, 1995), 34-35.

to be created beings. Thus we become subject to dissolution and nothingness.

Such is the very death of the created being. We die to the extent that we fail to discriminate. For this reason the natural impulse of the created being is directed toward differentiation and toward the struggle against the ancient, pernicious state of sameness. The natural tendency is called *Principium Individuationis* (Principal of Individuation). This principle is indeed the essence of every created being. From these things you may readily recognize why the undifferentiated principle and lack of discrimination are all a great danger to created beings. For this reason we must be able to distinguish the qualities of the Pleroma. Its qualities are the PAIRS OF OPPOSITES, such as

the effective and the ineffective

fullness and emptiness

the living and the dead

difference and sameness

light and dark

hot and cold

energy and matter

time and space

good and evil

the beautiful and the ugly
 the one and the many
 and so forth.

The pairs of opposites are the qualities of the Pleroma: they are also in reality non-existent because they cancel each other out.

Since we ourselves are the Pleroma, we also have these qualities present within us; inasmuch as the foundation of our being is differentiation, we possess these qualities in the name and under the sign of differentiation, which means:

First – that the qualities are in us differentiated from each other, and they are separated from each other, and thus they do not cancel each other out, rather they are in action. It is thus that we are the victims of the pairs of opposites. For in us the Pleroma is rent in two. – Carl Jung¹⁷

Gregory Bateson expands further on Jung's use of pleroma and creatura in *Steps to Ecology of Mind*. For Bateson, the pleroma is that which can't be differentiated by mind, while the creatura is literally "the world seen as mind."¹⁸ For Bateson, the act of

¹⁷ Carl Gustav Jung and Aniela Jaffé, *Memories, Dreams, Reflections* (New York: Random House, 1989), 379-82.

¹⁸ Gregory Bateson, "Form, Substance, and Difference," in *Steps to an Ecology of Mind: Collected Essays in Anthropology, Psychiatry, Evolution, and Epistemology* (Chicago: University of Chicago Press, 2000), 489-90.

differentiation is intrinsically one of classification and assigning hierarchies. Like in Jung's concept of individuation, material from Bateson's *pleroma* bursts into a system as un-patterned, undifferentiated noise, only to be assimilated by the mind's task of assigning pattern and differentiation. For Bateson it is this breach where new ideas and patterns originate; it is the source of creativity and invention.

The title *Meet me by the pleroma* invokes the idea of approaching the undifferentiated, getting as close as possible to the point where the noise leaks through and becomes mind. I am attracted to the image of a rendezvous suggested by the title, and to the idea that there is an invitation to participate in this encounter with the undifferentiated and not just witness it as an isolated, passive listener. This invitation is made manifest in a sonic structure that is at once static and quite active, a space that can be inhabited and explored either through physical experience or internal reflection. I hope that the listener is drawn to what Hillier describes as the "point" aspect of minimalist music, in which "an isolated musical event and a continuously repeated musical event both force our attention on to the inner details of the event itself, rather than its relationship to a distinctly other event."¹⁹

Ideally, without this concern for the relationship between isolated events the listener is free to consider his or her own relationship to the sound event happening in the present. I intentionally worded the title in a way that invokes connotations with a love song. But despite the romantic undertones of this rendezvous there is something ominous about the invitation, because for Jung to pass into the *pleroma* is to experience the

¹⁹ Hillier, *Arvo Pärt*, 16.

disintegration of the ego. And complete transcendence from the duality of opposites can only be achieved in death.

5. Concept

5.1 Why Difference Tones?

Much of the work that involves just intonation and sustained tones is concerned with how the overtones of harmonically related pitches interact. Ellen Fullman comes to mind here, as does Charlemagne Palestine and Glenn Branca. By working with difference tones I thought I might look at these harmonic relationships from the other end of the spectrum, so to speak. It struck me as a fresh approach to an aesthetic field that has been around since the 1960s.

Conrad's music and lecture provided the initial impetus to work with difference tones. And while I enjoy the visceral effect of the volume and totality of Conrad's live sound – his concerts are usually characterized by the sound of amplified, overdriven, and sustained tones performed on several string instruments - I decided early on that my interests would be best served if I could isolate and concentrate on the difference tone phenomenon, both acoustically and conceptually. Difference tones are present in Conrad's music, but the volume and lack of filtering means that the interactions between overtones and other artifacts are part of the sonic landscape as well. Emphasizing the difference tone seemed to be a focused, aesthetically compelling way to invoke Perkis' "sonic entities" with minimal intervention.

A piece built around making audible a phenomenon that is not consciously heard without amplification seemed to be a way of sonifying the undifferentiated / unperceived

– a gesture analogous to Bateson’s image of the pleroma leaking into the world of consciousness. And in hindsight, I can see that by juxtaposing the difference tones with the acoustic sound of the instruments the piece attempts to hold in balance several conceptual pairs of opposites: acoustic and electronic, clean and distorted, ugliness and beauty, order and chaos, static and mobile.

5.2 Considerations for the Performers

The decision to leave elements of the form open to performer interpretation is one I usually make based on aesthetic preferences, and it also reflects an awareness of how I see my role as “composer” in socio-political sense and my preference for performer autonomy. Although I eventually chose to explicitly score the pitches for the long string instrument and slentem, there are sections in the violin part that allow for free movement between sets of intervals. This gives the violinist the freedom to improvise melodies in the difference tone, and to play with the beating patterns that are heard as the violin dyads move in and out of tune. The drama created by this effect is a core feature of *Meet me by the pleroma*.

Although great care is taken to tune the instruments as precisely as possible, precision was actually de-emphasized in the performance in that the violinist is not expected to stay perfectly locked into the intervals. As long as the performer can occasionally play the intervals well enough to make the difference tone line up in perfect consonance, the effect of the near misses can create a compelling effect in its own right.

The decision to amplify the processed sound using local amplification with speakers on the stage rather than through the concert hall’s sound system had to do in part

with the need for each performer to interact with his or her processed sound. This is especially critical for the violinist, who must hear the difference tone generated by the violin part in order to manipulate it. The ability to generate intelligible difference tones on the long string instrument depends heavily upon bowing technique, so proximity to the amplified signal is important. And the slentem player keeps tempo by counting acoustic beats generated by the sound of the slentem played against a sine tone. So the speaker amplifying the sine tone had to be situated so that this beating was very audible to the performer.

5.3 Considerations for the Audience

The potential psychoacoustic effect of the localized amplification was part of this decision as well. Although I wanted the processed signals to function as Perkis' sonic entities, I felt that they would seem too disembodied if amplified via the sound system in the Mills Concert Hall. The system speakers are suspended high above the audience, and I believed it would be difficult to associate the processed sound with the instruments that create them. I wanted the electronic sound to project like acoustic sound, and I imagined that speakers placed near the instruments and set at a volume that matched the acoustic sound of the instruments might achieve this perceptual balance between cause and effect.

Another consideration for the audience had to do with the form of the piece. Although *Meet me by the pleroma* is essentially a drone piece, I wanted to avoid lulling the listener into a less conscious state. Instead I wanted to see if I could make listeners aware of their emotive responses in the unlikely context of a composition comprised of sustained sounds. I would attempt this by investigating shades of tonality and by using

unexpected gestures in the form, such as the dramatic cutoff that happens at 26'30" after a long, gradual crescendo. I hoped that these elements might transmit a recognizable *pathosformel*. To be clear, it wasn't my intention to manipulate the listener to feel a certain way, but rather to elicit an awareness of feeling and of the dichotomy between feeling / internal experience and physical phenomena / external experience.

This required a way of treating the phenomenon that didn't merely come across as a demonstration. In thinking about how I wanted the audience to experience the piece, I identified with the way Tony Conrad outlined acceptable audience reactions to his landmark minimalist film *The Flicker*. The film consists entirely of alternating white and black frames that oscillate and strobe at precise tempos. This creates certain visual effects – or hallucinations, as Conrad described them – such as the impression of light spreading out from the center of the frame and the perception of colors that aren't there. Conrad intended to completely remove the image and narrative from cinema, leaving only the light and flickering frames that form the inner structure of the medium. By stripping away these elements and applying precise rhythms to the flickering frames he created a space in which the viewer can experience the perceptual “entities” that wouldn't typically manifest in a more conventional film.

Conrad delineated three ways in which he hoped *The Flicker* would be received by the viewer: accepting the experience as a new type of spectacle, questioning the function of cinema as a result of seeing its physical processes revealed, or actively creating their own experience while watching the film.²⁰ My piece isn't exactly analogous to *The Flicker* because I didn't seek to strip away most recognizable elements of musical

²⁰ Joseph, *Beyond the Dream Syndicate: Tony Conrad and the Arts after Cage*, 300.

form. However, *Meet me by the pleroma* echoes Conrad's *modus operandi* in that I was attempting to reveal the inner structure of the sound of the bowed strings. And I believe that I was most successful in evoking the third of Conrad's ideal reactions in which the listener can create their own experience. As a result of being presented with the unamplified sound of the parts written for the string instruments as well as acoustic phenomena magnified with the aid of electronics, the listener is free to engage with the piece on several levels. In a sonic parallel to *The Flicker*'s visual hallucinations, the listener might perceive rhythms, melodies, and harmonies that are not discernible in the unamplified sounds.

I believe that a work that fuses the sound event with the form can facilitate a self-created experience for the listener. For example, in *Meet me by the pleroma*, the difference tones produced by the violin and the long string instrument are the subject at almost any isolated moment within the piece, while a somewhat glacial sense of time and linear movement is created by the beating difference tone resulting from the slentem and 120Hz sine tone. In this way the same acoustic phenomenon provides a temporal container within which to experience the sonic entity, while itself serving as that entity. The protracted sections that focus on one violin interval at a time, with microtonal variants of the interval providing tonal shifts in the difference tones, hopefully provide a space for what Hillier describes as a "confrontation, or meeting point, between the artwork and the viewer, the viewer's experience thus completing the artistic act."²¹

²¹ Hillier, *Arvo Pärt*, 14.

6. Signal Flow Performance

6.1 Staging

A few practical considerations were involved with the staging of *Meet me by the pleroma* at the March 14, 2009 Signal Flow performance. Fortunately, the stage of the newly remodeled Mills concert hall was large enough to accommodate our somewhat expansive setup, but I wanted to make sure that the long string instrument and violin had very separate acoustic and visual identities on stage. I also felt that as electronics performer I should be on stage as part of the ensemble rather than at the mixing station in the hall. Line-of-sight for eye contact between all members of the ensemble was a critical factor in the staging as well. Figure 5 illustrates the arrangement we settled on after a period of trial and error during rehearsals.

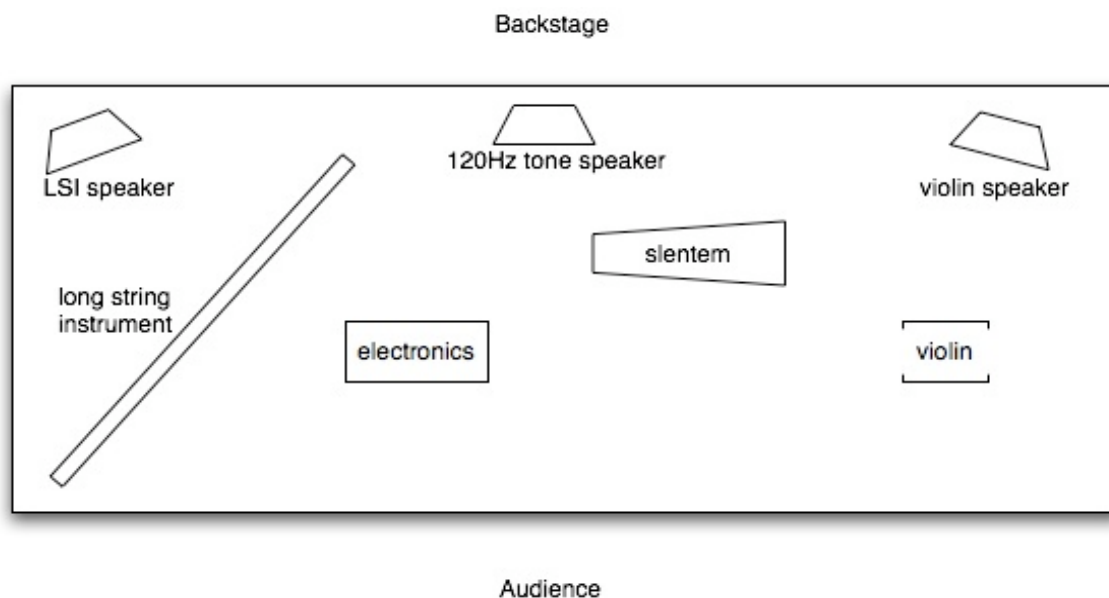


Figure 5. Stage setup for Signal Flow performance of *Meet me by the pleroma*

6.2 Comments on Performance

The performance of *Meet me by the pleroma* in the Mills College concert hall on March 14, 2009 was better than any of the rehearsals, and I was especially pleased with the transitions. The cutoff at 26'30" required intensive rehearsal, and it was flawless during this performance. Figure 6 shows a spectrogram of this transition. You can see the last 20 seconds of the of the loudest section of the piece and the cutoff where the violin, long string instrument, and electronics go from maximum volume to silence, leaving just the slentem striking every 8 seconds, pulsing against the 120Hz sine tone.

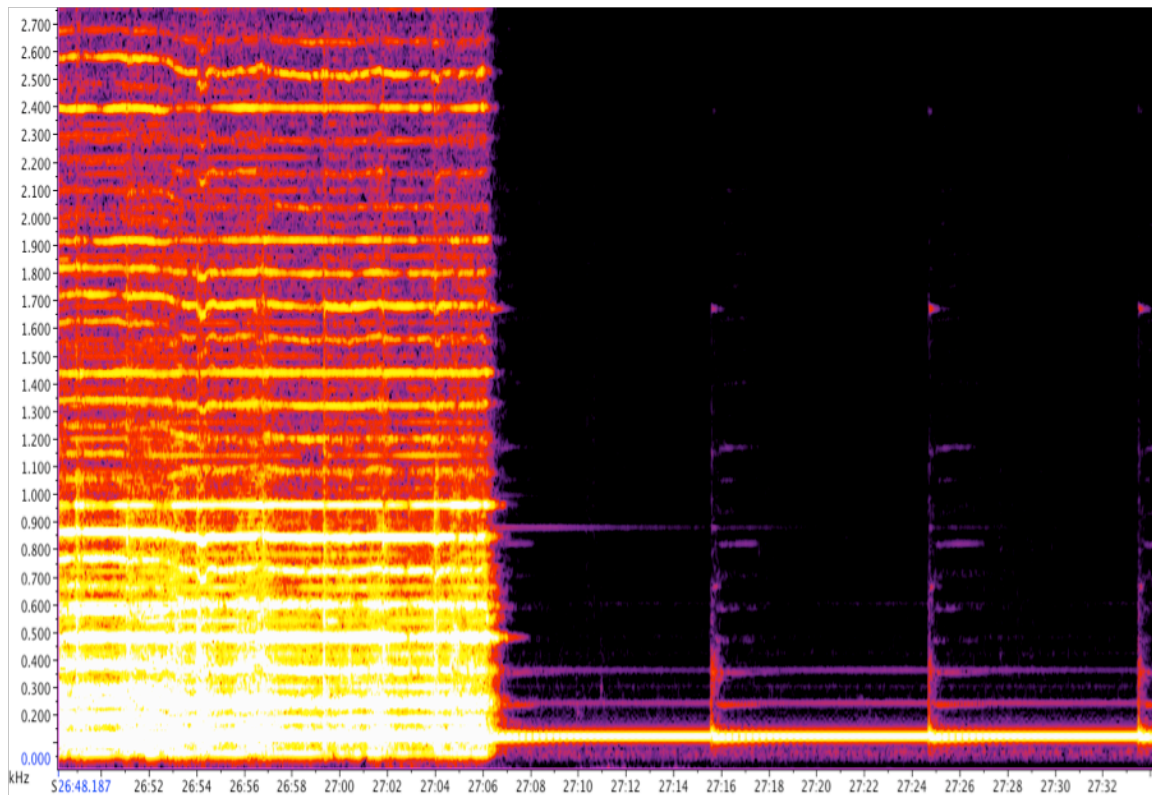


Figure 6. Spectrogram *Meet me by the pleroma* 26'48" to 27'40"

6.3 Audience Reaction

Judging from feedback I received from audience members, I feel as though I achieved much of what I had intended. More than one person told me that they don't typically enjoy drone music, but that they felt moved in some way by the piece. One colleague was kind enough to write about her experience of listening to the performance. This person knew nothing about the aesthetic or philosophical motivations behind *Meet me by the pleroma*, other than that it was "about" an acoustic phenomenon. But in her response she touches upon many of the concerns that I believe relate to the piece – the experience of being drawn into an active state of listening and transcending opposites of cerebral / emotional, external phenomena / internal experience. She even uses language that mirrors Jung's connection between death and the pleroma. I read in her reaction a conscious assessment of her relationship with the sound that goes beyond mere analysis of form or tonality. Perhaps most importantly, there is a point in her account where the sense of differentiation, of separateness between the listener and the work, dissolves. And from what I can tell, this was empowering for her. All told, this is the best response I could have imagined for this or any other work. And I can move forward knowing that the piece connected with at least with one person, and that my intentions were realized.

As it began, I recalled what you had once mentioned to me about your aim to bring out difference tones. I tried to listen for this. Of course, I hardly know what difference tones are, let alone what they sound like. The lull of the long, sustained tones carried me through, and I gave up to trying to grasp any of the unfolding sonic phenomena. I became interested in the

form. When will Danishta enter? How long will Chad drum out that steady pulse on the pelog? Is Brendan playing the same pattern he played previously? Why do they stop and start when they do? What will this amount to? These are the sorts of questions I generally ask myself when listening to most new music pieces as their form is most often not a recognizable entity, but rather, some kind of fundamental challenge or experiment. Then the sounds themselves began to take over. I stopped thinking about the form because it began to seem so inherent or immanent that it required no deciphering. This is a meditation, I said to myself. I have to go with all the vibrations that are surrounding at me. And then I became frustrated. It felt like it would go on forever, and I refused to succumb to an antiseptic state of civilized contemplation. What am I to make of all this unemotional sound, I couldn't help but think? All I ever try to do is give out and take in emotion. How can I reconcile my artistic aims with those of all these cerebral composers? They are so impersonal while I crave intimacy. They are precise, and I am messy. They push at frontiers like obsessive explorers while I am get off on stage like an animal. All of these vibrations are external, I realized. They result in repeating fractals of sound. They create a space, a landscape, and they outline the organization of nature. Chuck must perceive so much beauty in the external world, I reasoned. This is his emotion. All I sense is the internal. I am self-centered while he is outward looking and selfless. I was almost going to leave it that, resigned to our essential differences and

almost certain that your kind of beauty was more enlightened than mine. But then something happened. I can't tell you how the shift came about, but something happened. As I started giving up on finding a place for myself in your piece, I became overwhelmed with feeling. It may have been a magical accumulation in the form; a tipping point. I think it had something to do with the (slentem) pelog. That low frequency cycling resonated through my bones. I felt it in my stomach. As it most often introduced a break in density, a clearing of the air, it led me back to my body. It moved me from the external landscape to the internal one. My heartbeat went out of whack. I thought of the nervous system, the circulatory system, fluids, hormones, cells multiplying, and neural synapses firing. It's just the same inside and out, I silently gasped. The most vast geography is akin to the most miniscule atom, and human emotion resonates on the same frequencies as do long string instruments, violins, pelogs and machines. You managed to connect the cerebral to the visceral, and for me, this was an astonishing revelation. This is why I cried. I suffer from this disconnect in myself. I struggle with the tension between my thinking and feeling selves. Your music evoked a universal unity, and in this sense, it was like experiencing Utopia. At the moment when it all stopped in perfect synchronicity, I was further astounded. I thought this was the end, and it truly felt like The End of Everything, as in death, a black hole, the silence of nothingness and resting in peace. I cried

some more. And then sound returned. The beginning of creation. It was beautiful and wholly spiritual. – Zeina Nasr, Mills graduate music student.

Appendix A

Score for *Meet me by the pleroma*

Meet me by the pleroma

C. Johnson

Violin (diff)

Long string instrument (diff)

Silentem Pelog

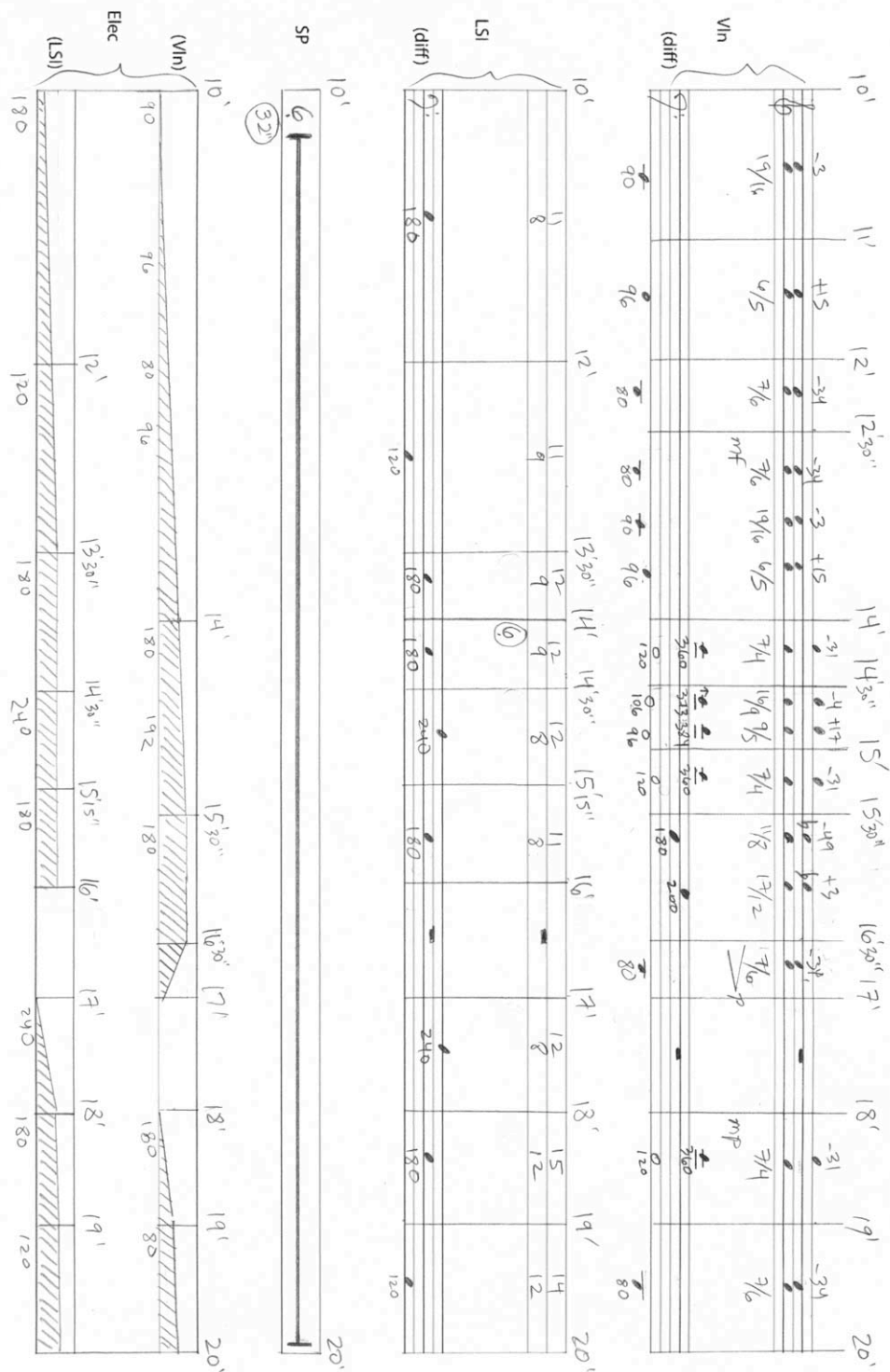
Electronics (Min)

(LSI)

⑥ - Single long bow following decay of each silentem tone

③② - strike once every 32 beats (against 120Hz sine tone)

(2)



Handwritten musical score for guitar, featuring a complex arrangement of notes, rests, and dynamic markings across multiple staves. The score includes a key signature of one sharp (F#) and a time signature of 4/4. The notation is dense, with many notes beamed together and various articulation marks. The score is divided into sections by bar lines and includes a large section of repeated notes (pedal point) in the lower staves. The final measure of the score is marked with a double bar line and a repeat sign.

Appendix B

Technical Details

As I mentioned before, I made the choice early in the development process to use analog electronics rather than software because I preferred the sound of the artifacts created by analog distortion. In January of 2009 I started experimenting with different distortion circuits. This led me back into the world of that most humble of electronic sound processors – the guitar distortion pedal. Like many musicians, the guitar pedal was my introduction to electronic music, and the enabler of my early obsession with feedback. Based on my years of experience with the different flavors of distortion, I suspected that the “overdrive” variety would best suit my needs. In my experience, overdrive circuits such as the Ibanez Tube Screamer and circuits using preamp tubes have a sound rich in even-order harmonics and characterized by soft clipping. This would suggest that the artifacts created by the distortion would consist mostly of the fundamental pitch and octaves thereof. And since I would essentially be boosting low frequency difference tones, the overdrive pedal’s propensity for good low frequency response made it the most suitable candidate.

I acquired an early 1980s Tube Works “Real Tube” pedal, one of the first pedals built around a 12AX7 preamp tube. When followed by a low pass filter this pedal produced a very intelligible difference tone from both the violin and the long string instrument. Eventually I chose the Real Tube for the long string instrument. When amplified, this instrument was very prone to feedback due to the size and thinness of the soundboard. The fact that I was amplifying low frequency harmonics of the open strings

contributed to the feedback problem. I replaced the 12AX7 preamp tube inside the pedal with a 12AU7. The 12AU7 has a much lower gain factor and swapping these tubes gave me a little more headroom on the pedal's gain control. The Real Tube pedal, with the headroom furnished by the lower gain 12AU7, was the best option for the providing maximum gain while avoiding feedback.

I experimented with different distortion circuits for the violin signal path. In the end I made a choice that I would not have initially considered. The “Wylo” is a boutique fuzz pedal designed and manufactured by Glenn Wyllie. It is a germanium transistor distortion loosely based on the Colorsound Tonebender pedal from the 1960s. I had owned this pedal for several years and recalled that Wyllie's design has features not usually associated with fuzz pedals, such as an impressive low frequency response and the capacity to provide a subtle overdrive effect. Surprisingly, I was able to use quite a bit of gain on the Wylo without unwanted artifacts.

The violin part in *Meet me by the pleroma* calls for sustained dyads for most of the piece, so feedback was less of an issue for the violin. Feedback only occurred when Aanes stopped bowing, and as electronics performer it would be my responsibility to quickly pull down the volume of the violin signal path during the rests in the violin part.

In order to achieve the desired sonic effect I needed to follow the distortion in each signal path with a low pass filter. Filtering out unwanted high frequencies would allow me to isolate the difference tones in the range of 60Hz – 300Hz for the long string instrument and 80Hz – 200Hz for the violin. For the long string instrument I chose a filter module from my analog modular synthesizer – a Doepfer A-101-2 Vactrol Low Pass Gate. This module, based on the Buchla low pass gate design, can function as either a

voltage controlled amplifier or low pass filter. Like most filters in the analog synthesizer world, the A-101-2 is designed to impart a specific tonal color. However, for this application I wanted simple low pass filtering and wasn't concerned with the tonal characteristics of the module, so I used it with the resonance control at its minimum setting. From a performance perspective, one challenge with using a synthesizer filter is that the cutoff control doesn't typically indicate the frequency value, but rather shows a range of 0 to 10. Some practice was required find the correct range for filtering the long string instrument.

I had some difficulty acquiring another filter module for the violin due to some noisy anomalies with my systems' power supply. Although the Doepfer A-101-2 seemed unaffected by this problem, two of my other low pass filters were unusable for this application due to the noise. In the end the best solution was a pair of low-cost Alesis Micro EQ parametric equalizers. I connected the two EQ's in series and was able to effectively create a low pass filter by attenuating most of the signal in the midrange (250Hz – 6kHz) and high (1.5kHz – 20kHz) bands. Although it was a bit more cumbersome than adjusting a single potentiometer on a low pass filter, I was able to adjust the cutoff by using the low frequency band (20Hz – 1kHz) on the first Micro EQ, while leaving the same control on the second Micro EQ at a fixed setting. Fortunately the range for violin's difference tone was relatively small and in the performance it wasn't necessary to make many filter adjustments on the violin signal.

The violin and long string instrument signal paths were each routed into a channel on a Mackie 1402 mixer. This allowed me to control the volume of the processed signals using the channel faders and attenuate even more unwanted high frequencies via the

Mackie channel EQ's. These two channels were panned hard left and right and sent out to Mackie powered stage monitors through the mixer's main left and right outputs. The 120Hz sine tone, provided by a recording of the tone played back on an Apple iPod, was routed into a third channel on the mixer and sent to a third Mackie monitor via a group send independent of the other signals.

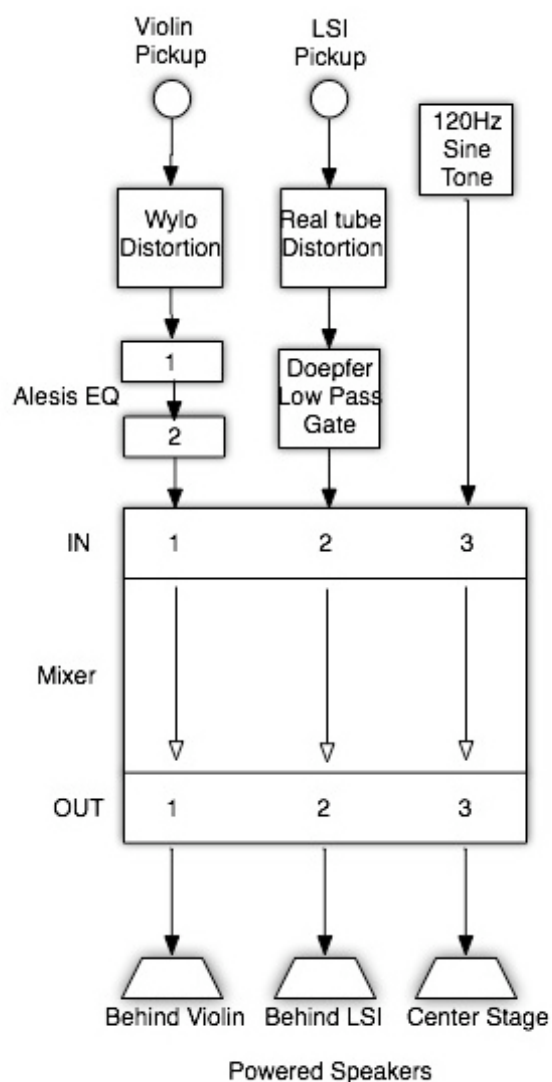


Figure 7. Signal routing for *Meet me by the pleroma*

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