Arnold Dreyblatt:
MY MUSIC: BEGINNINGS, THEORY AND HISTORIES

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I proceeded from a kind of 'amateur' curiosity about sound and music, and developed a sense that composition begins with a consideration (often a re-consideration) of the dynamic materials of sound creation- e.g. strings and pipes, air and motion. In the development of my music, it has been the instruments themselves which have been my greatest teachers. For me, a composition is not a moment 'frozen' on a piece of paper but rather the result of a workshop in progress. The instrumentation and notations which have been developed for each stage in the history of my ensembles have been themselves a part of the composition, as is the workshop period in which new sections are developed while older pieces are gradually edited or abandoned. It is my hope that some continuity of thought and practice may be discernible within this text as well as in the music itself.In the early 1970's I had been working with video and electronic music at the Center for Media Study at the State University at Buffalo, N.Y. It was through an exposure there to the ideas of Woody and Steina Vasulka that I developed an interest in the physical characteristics of vibration.

In the late 1974, I abandoned my work with electronic images and began making acoustic sound installations. But my interest slowly developed in the direction of a more traditional model of music performance. This model was initiated by a group of American minimal composers in the early 1960's and was largely based on the rock or jazz band-composer who performs with his own ensemble - a small amplified group formed expressly to perform his own composition. I had acquired an elementary level of training in Western and various non-western musics in the search for a language which would be useful to me in realizing my ideas. I looked to a physical description of sound- a definition in acoustic terms. This direction had been somewhat familiar to me through my earlier work in electronic music and image making. On an electronic oscillator (an electronic signal generation device), sound is defined by the variables of frequency and amplitude. This is a description according to the laws of physics as opposed to a definition in cultural terms. An understanding of these acoustic laws has always been understood empirically by musical instrument builders.

The phenomenon of simple and compound vibration might be represented by the structural 'archetype' of a one-string instrument or a tube without finger holes (whether blown as a flute or a brass instrument). In a tube without finger holes the only pitches available are the fundamental tone and the tones of the overtone series. The frequencies of these tones are always related to a given length of pipe; But it was not until the appearance of a one-string instrument (probably the musical bow) that man had an experimental instrument capable of providing both an empirical and theoretical knowledge of sound. The musical bow represents one of the oldest members of the zither family of musical instruments. Zithers are defined as chordophones in which the body of the instrument is also its neck- the strings are stretched across the entire body. Often the body of the instrument functions as a resonator for amplification (although the chest or mouth of the player or an earthen pit may also be used). The necked instrument is a later invention to facilitate faster playing techniques. Zithers are usually played horizontally and since the strings are stretched over the entire body of the instrument, the relationships of pitch to length, tension and thickness of a string are easily deduced through the faculty of hearing and can be correlated visually to simple mathematical proportions. The harmonic overtones can be heard in relation to the fundamental tone and located at the nodal point of the string.It is therefore no accident that monochord and related members of the zither family have had an important mathematical-mystical role in the two great ancient cultural spheres, Greece and China. In both China and Greece the monochord was considered an instrument of acoustic measure- a kind of tuning reference. In China it gave birth to an entire family of instruments which traveled to Korea, Japan and Vietnam. The heritage of Greek musical thinking was kept alive by Arabic musical theorists and was rediscovered by European monks in the middle ages. Medieval music speak often of the monochord and the laws of acoustic and mathematical proportion.The observation and understanding of the physics of string vibration was a kind of 'starting point' in the development of my music. From this 'point of view' I began to sense that the standardization of notation, instrument construction and tuning which was finally accomplished during the 19th century represents a distorted conception of 'progress'. Equal Temperament, and the gradual shift towards atonality, while allowing a greater vertical independence of melodic lines, has resulted in a kind of acoustic 'blurring' - a tuning system which is 'out of focus' and a 'blandness' of instrumental timbre. The instrument families and tuning systems which were discarded in the wake of this standardization are themselves a tribute (within our own tradition) to other realms of possibility.

"Proposition IX: To explain why an open string makes many sounds at once. Proposition XV: To determine if it is possible to touch the strings of an instrument or their keys so fast that the ear cannot discern whether the sound is composed of different sound, or if it is unique and continuous" Marin Mersenne, Harmonie Universelle, 1637" To hear pure tones added to one another up the harmonic series...was an unforgettable experience. Those harmonics which are not attuned to our normal scale did not sound out of tune. They sound (as indeed they are) in tune on some hauntingly elemental system of their own. The chord itself in its higher reaches becomes full of small intervals which in our ordinary system of music are discords. But in their own literally natural tuning, they sound neither concordant nor discordant, but simply satisfying; neither familiar nor unfamiliar, but simply archtypical." Robert Donington, The Instruments of Music, 1949

Excerpt from recorded conversation between Arnold Dreyblatt and Phil Niblock in New York City in the fall of 1977:
AD: I realized at a certain point that when musicians are tuning, they are hearing frequencies in their head which is something that I became interested in - I mean listening for that-
PN: Listening to the harmonic overtones in order to tune the fundamentals...
AD: Right. It depends on what they are tuning. On a simple level, unconsciously, a musician tunes a fifth, and he learns to recognize the interval in his head. The speeds are somehow memorized...PN: It's better than a tuner!
AD: I began to understand that this was music - that this process of signal comparison is a musical activity. This is what a musician does when he tunes -whether it's conscious or unconscious. It's conscious often in people who are interested in tuning systems and scales and so forth. It's unconscious in the majority of musicians who have to learn by hear anyway; and in instrument builders there has been a sort of underground tradition of knowledge about acoustic which is purely empirical...

In the spring of 1977, at my studio on Fulton St. in Manhattan, I built a one-string isntrument according to instructions in Intervals, Scales and Temperaments by Lloyd and Hugh Boyle. The book calls for a 'piece of wood' greater than fifty inches long with a string of extremely thin wire (.008 inches) anchored at one end with a screw and at the other with a zither tuning pin. The wire passes through two steel 'angle piece' bridges between which is fastened a metre stick. The vibrations of this wire are made audible by a medical stethoscope which is attached to the wood with tape. By following

the set of exercises presented for use of this instrument, I passed through a sort of 'initiation', into understanding not only the construction of all string instruments but also the relations between such basic concepts as frequency, pitch, tension, length, division and multiplication.One possible sequence for this process follows: 1. A wire is attached to the monochord. A number of diameters are tried. A thinner wire will break at a higher tension than a thicker one. 2. The nodal points are calculated at whole number divisions of the strings.

3. The wire is set into vibation with a plectrum, bow or hammer. Exciting the string at a nodal point cancels the odd or even numbered overtones, depending on whether an odd or even nodal is chosen. Exciting the string at an antinode imparts more energy to that particular vibrational mode. A narrower excitation agent excites higher harmonics than a wider one.4.The wire is excited and a finger or feather touches the wire lightly at the nodal point. A harmonic is isolated and heard souding above the fundamental (a weight may also be affixed to the nodal point a 'nodal locator').5.The wire is excited and a finger or hard implement imparts strong pressure at a nodal point. The wire is divided intop two independant vibrating sections. Two fundamentals tones are created.6. Calculations are made in the observation of the results of these and other experiments. For instance, in number four (above), what is the frequency relationship between the fundamental pitch and the harmonic isolated at the fifth node? In number five, what is the frequency relationship between the fundamental pitch and the pitch of the two independant vibrating sections thus created? What is the relationship of these two sections to one to another?

1979-81

In the spring of 1978, I began to realize the plans for a larger instrument based on the monochord. I designed and built an instrument with twenty strings of thin steel wire. It was composed of ten monochords (the strings were in pairs), each with its own calibrated meter stick, and angle piece bridge; along its length were grooves at the nodal points to keep hanging 'nodal locators' in position. The strings were all tuned to the same pitch, and the nodal locators isolated a different overtone on each stick. Choruses of overtones were sounded as the strings were plucked. I constructed various sounding boards at one end of the instrument, abandoning the traditional spruce for sheet metal to emphasize the 'metallic' quality of the harmonics that I had achieved with the original monochord. I purchased a number of contact microphones, both dynamic and piezoelectric, but was unable to obtain the

preponderance of the harmonic over the fundamental that I was looking for. The instrument was abandoned as I began working with the small pianoforte and Kay double bass which I had acquired in the fall of 1977. Some aspects of this instrument, which I dubbed "The Long Zither With Hanging Nodal Locators", have been realized in the live opening sections of "Nodal Excitation". I later attempted to adapt the "hanging nodal locators" principle to a harpsichord, so far unsuccessfully.

It is interesting for me to try to trace the development of my technique of performing on the double bass which has since contributed to the character of my ensemble sound. I became attracted to the instrument for its large resonating box and the long speaking length of its strings, which make possible the production of the higher overtones. I purchased a plywood Kay bass for $100, and began tuning open fifths and bowing open strings close to the bridge, which emphasized the high overtones, and overdubbing the result in multiple layers on a tape recorder.

It happened that I broke one of the thick, wound steel strings on the double bass and I didn't have the cash for a replacement, so I attached some of the piano wire which I had recently ordered to restring the miniature piano. The unwound wire raised the fundamental a number of octaves and made possible the production of extremely high upper overtones. The thinner diameter of this relatively long string (42 inches) enabled the wire to vibrate in the shorter and shorter lengths representing the higher vibrational modes. I began working with the bow, striking and bowing in isolated attacks upon this one string, moving closer and farther away from the bridge. I marked the nodal points on the finger board and occasionally isolated overtones with the fingers of my left hand.

In the spring of 1979 I was approached to perform at a downtown performance festival on Warren St. in May. I began organizing my experiments for the fifteen-minute time slot which was allotted to me at the festival. I had already developed a repertoire of isolated percussive and bowed attacks, and these evolved into a continuous rhythmic technique in which I could excite chords of overtones above the fundamental. This technique is a combination of bowing and striking, in which a short portion of the bow is brought into contact with the string in a forward and backward motion. If the striking aspect is emphasized, the inharmonic nature of the attack overwhelms the sound and little resonance is excited. If a long section of bow hair is brought into contact with the string, the resulting sound is lacking in resonance. In daily practice over a two

month period, I gradually learned to make fine adjustments, bringing specific harmonics in and out of the foreground, as times touching a nodal point with my left hand. I taped each of the experiments and was inspired by the clarity and metallic richness made audible through amplification. I structured a didactic performance in which I began with a new one-string instrument which I built with a nodal markings in the manner of a Chinese Ch'in. I performed the most simple operations: plucking at the nodal points of the string. I then switched to the double bass, performing the isolated attacks upon the unwound wire and gradually working my way to the rhythmic technique which I had developed. The monochord was amplified by a contact microphone, the bass with an air microphone.

I prepared the following notes for the performance:

'Nodal Excitation' The vibrational characteristics of music wire with consideration of the location and influence to the nodal regions. The integrity of a fundamental vibration is maintained for each string; all movement of pitch occurs in the overtone structure. A shorter speaking length is never created through "stopping" or "fretting" technique. Harmonic (partial) vibrations are coaxed and occasionally isolated. Long before the May solo performance in 1979 I had been interested in developing an ensemble music, and had been tinkering with a number of instruments with that goal in mind. In the fall of 1977 I bought the miniature pianoforte for 200$ from a piano supply house and brought it home in a checker cab. It had an abbreviated upright action, 41 keys, one string per key, with a range of 31/2 octaves. It seemed the perfect instrument to begin tuning experiments. I attempted a variety of tunings, but it soon became apparent that restricting would be necessary. In March of 1978 I began drawing up plans for tuning a selection of transposed pitches condensed from the harmonic series into the span of an octave on the piano. The transposition process is calculated from a given fundamental as follows:

(fundamental frequency x harmonic #) divided by the power of 2, until desired octave is reached. Example: 340 Hz x 21st harmonic = 7140 Hz + 16 = 446.25

Even numbered harmonics are octaves of the fundamental frequency.I prepared a tuning of odd numbered harmonics up to and including the 23rd harmonic, and ordered wire in a range of diameters. As replacing even one string proved to be difficult and time-consuming, it became apparent that a method for determining the order of diameters was necessary. Robert Bielecki, a friend and

engineer, suppled me with a program for programmable Helwett-Packard Calculator in order to prepare a restringing scale; The program lioads a series of formulas and equations dealing with the important variables of a string vibration. Since the formulas for wound wire are extremely complicated (they must take into account the diameter of the wrap, its tension, etc) I limited myself to unwound wire.The Program:

enter: frequency length diameter read: 1. product of frequency and length 2. percentage of the breaking point 3. tension 4. the inharmonicity of the fundamental enter: numbered partial read: 1. cents deviation from true harmonic 2. frequency of partial

One encounter inharmonicity in a string as it becomes too thick, short and tight to vibrate in perfect harmonic relationships. The three variables of frequency, length and tension are interrelated. Though the lenths were a given in the iron frame of the piano, frequencies could be assigned to varying lengths, keeping in mind a desired tension and diameter for a desired tone colour and degree of inharmonicity. The product of the frequency and the length is a useful figure, utilized by piano and harpsichord builders in determining the degree of inharmonicity. A wire becomes more perfectly harmonic as it approaches its breaking point. In order to equalize tension across the piano, one determines the suitable diameters and frequencies. The extent of inharmonicity may be judged by reading the deviation (in cents) of each harmonic from its true harmonic position.For some times I had been interested in realizing the pitch relationships of the harmonic series on a keyboard intrument. I hope to utilize these pitches to emphasize specific overtones within the texture to the fundamental supplied by the double basses.After weeks of calculations, I settled on 340 Hz as a fundamental, arranging a list of frequencies and diameters accordingly.

As seen above, the transposed harmonics fall into a new order in the span of an octave.Since the wide felt hammers dampen many of the higher harmonics, I removed the hammerfelt from all the hammers. I snipped the dampers off so that the wires would resonate sympathetically. I found that the thick steel wires, when hit by the pointed hard wood hammers, supplied an unusually rich and piercing timbre. These frequencies were tuned on the piano strings in a unison relationship to a sine wave generator hooked up to a frequency counter.As the tuning was accomplished, tonal relationships became apparent. The prime numbers, which include 3,5,7,11,13,17,19 and 23, represent new and unique pitches identities. In other words, proceeding from 1 (the fundamental),

each prime number has neither a mathematical nor a tonal relationship to a preceding number in the series. It is factorable only by itself and one. Odd-numbered harmonics which are not primes are tonally and mathematically related to a lower prime root. I was able to hear tonal relationships between the following simple multiples:

1 prime (fundamental) 3 prime 5 prime 7 prime 9 11 prime 13 prime 15 17 prime 19 prime 21 23

When groups, or "families", of these pitches which are simple multiples of one another were sounded simultaneously with the fundamental tone, a distinct series of tonalities resulted. I rethought the scale in order to utilize these relationships more effectively. I eliminated prime-numbered identities above 11 in order to include more multiples of the lower primes. A compromise was arrived at, which included the following pitches:

1 3 5 7 9 11 3 9 15 21 27 5 15 25 35 7 21 35 49 11

In the process of transposition, these pitches fall in the span of one octave in the following order (the pitches added in this second tuning are identified by their frequencies):

1 35 371.875 9 5 21 11 3 49 520.625 25 531.250 27 286.875 (lower octave) 7 15 1

It must be remembered that this numerical language represents actual intervallic relationships extracted from within the harmonic series. Thus, the numeral five denotes a specific interval which is known in the western musical world as a major third, and which appears in the series of harmonics in the fifth position (where its distance from the fundamental is two octaves and a major third). When these pitches are transposed from their positions in the series, their original octave relations are erased. One might argue that by not recognizing the identity of the octave, the transposition process has radically altered these intervals such that they bear little relation to their position in the series. I have felt that the octave determines the acoustic power which a particular pitch may have as it is placed somewhere in the spectrum. It is only in intervals containing odd numbers that any tonality other than an octave is expressed. Though the "weight" of a pitch is altered when it is transposed from the series, its tonal relationship to the fundamental or any of the octaves of the fundamental remain unchanged. Furthermore, it is only through the transposition

process that the higher-numbered relationships may be realized for use in the audible range.

In October of 1979 I bought a second Kay double bass. I extended the neck eleven inches since higher overtones are capable of being generated from longer strings. I experimented for a number of months in the uese of sympathetic strings on this instrument. I ran twelve sympathetic strings from a pinblock on the neck through the underside of the bridge. I corresponded with makers of early western instruments which were fitted with sympathetic strings. These strings were removed when I learned that the resonance created by my performance technique overwhelmed the acoustic power that sympathetic wire of this type could provide.In December of 1979, I received a fellowship in music composition from the New York State Council of Arts, based on my solo performances on the double bass. In the spring of 1980, I secured a date for a performance by my ensemble (which I called "The Orchestra of Excited Strings") at The Experimental Intermedia Foundation in downtown Manhattan. Performing in the original ensemble were Tracy Kirchenbaum, Michael Hauenstein, and composer Peter Phillips. During our months of rehearsal with an ensemble composed of the two basses and the midget pianoforte, a model of performance was determined. Peter Pillips aided me in leading an ensemble. Rhythmically, a pulse was derived from the steady striking of the basses, with no accent or sense of phrase or pattern. I intuitively believed that the perception of texture would be clouded by rhytmic complexity; I was looking for complexity built of resonance and vibration. We reheased with the instruments amplified, mixed, and monitored through stereo headphones. I insisted on composing for the amplified sound which the audience would hear in performance. Through careful adjustment of the mix we were able to achieve a delicate balance between the basses and the piano. If the fundamental supplied by the basses were allowed to dominate the texture, then the "tonal families" would not be heard. If the pitches supplied by the piano were too strong, the passage through each family would be heard as a modulation, rather than being heard in the context of the fundamental. Making this kind of relationship clear was an important aspect of creating the music.

In preparation for the approaching concert I had been working on another new instrument, "The Long Zither With Magnetic String Drivers". This intrument utilized magnetic string drivers called "E-Bows", which were commercially made for electric guitars. I purchased six of these devices from their designer in California, and designed a string intrument for their use. I found that when the

wire is magnetically excited, a harmonic node may be touched by a finger and the wire will remain in that vibrational mode, sustaining that harmonic even when the finger is removed. I designed an instrument which had six long strings with six "E-Bows" spring mounted on sliding tracks beneath each string. The strings would all be tuned to the same fundamental pitch and a different overtone would be sustained on each string. In practice, however, the "E-Bows" were unstable in sustaining high frequencies. The instrument was rebuilt a number of times, and used in performance, before joining a number of other unusable prototype instruments in storage for use at a later date.In february of 1980 I purchased a small hurdy-gurdy. The tangents which stop the gut strings were adjustable, so that a diatonic scale could be adjusted for my tuning. Only one of the two drone strings was used to emphasize the brilliance of the stopped pitches. The drone string sounds the fundamental (1), while the stopped string (tuned to 5) sounds 11/3/7/1/35/3/21/3/49/27.The ensemble version of "Nodal Excitation" begins with and returns to sections which feature the isolation of harmonics in the vibration of the long bass strings. Out of this context is developed exploration of the "tonal families", sounded by the piano and hurdy-gurdy above the fundamental tone sounded by the double bass technique. The infinite harmonics of the fundamental may be considered the largest "domain", while each of the "tonal families" are "subsets", built from a lower prime-numbered harmonic, but related also to 1, the fundamental. As these "families" are built on primes which are less or more distant from 1, tensions are created. As we explored these families, we sounded above the fundamental pitch.

Wesleyan University 1981-82 In the summer of 1980 I moved to Middletown, Connecticut to begin a two-year graduate study at Wesleyan University at the invitation of Alvin Lucier. I began re-thinking the limitations of the tonal system. I was interested in expanding into "eleven family" of pitches. By adding these six new pitches, and completing the other groups, I would now reach twenty tones in one octave. In the diagram below, the underlined pitches are those which were added in the fall of 1980:

1 3 5 7 9 11 3 9 15 21 27 33 5 15 25 35 45 55 7 21 35 49 63 77 9 27 45 63 81 99 11 33 55 77 99 121

Utilizing the Helwett-Packard program I rearranged the stringing scale of the piano, replacing the required guages of wire. The fundamental pitch was moved to equal-tempered "F" - 349 Hz. This was done to make possible the inclusion of certain western wind and brass instruents at a later date. The twenty pitches, when

transposed, fall in the span of an octave in the following order (the frequencies used on the piano appear next to each pitch):

1 349.0 33 359.9 35 381.7 9 392.6 77 418.89 5 436.25 81 441.7 21 458.06 11 479.87 45 490.78 3 523.5 49 534.4 99 539.85 25 545.31 27 294.46 55 299.92 7 305.37 15 327.18 121 329.91 63 343.54 1 349.0

The addition of eight new pitches to the scale raised the necessity of creating a written notation. In the early performances of "Nodal Excitation", the two or three chords used in each family were improvised. Now that the tonal resources were expanded it became interesting to me to specify the unique subtleties of the pitches available in each family. With the expansion of the scale to twenty pitches, I was able to differentiate between the pitches comprising each tonal family. The relations between them are understood through an examination of the factor which result in that particular pitch. For instance, the pitch (35), being divisible by five and seven, is a member of both the Five and the Seven families. In the tonal context of the Five Family, the pitch (35) carried a tonal weight of a seven (there is an interval of a minor seven from (5) to (35), or, in other terms, 35:5=7:1). When, on other hand, (35) is sounded in the context of the Seven family, we hear it as a five in relation to (7). Each family contains two pitches which can only be related within that family. These are the "root pitch" and its square. In the Seven family these are (7) and (49), which are both divisible only by seven.

In a version of the piece which we performed at Alain Bihaud Gallery in Manhattan in February of 1981, I began notating a series of sections passing through each of the tonal families; we called these sections "Slow Changes". The basic structure of the earlier piece was maintained, but the sections relating to the development of the tonal families were radically transformed.For some time I had been interested in the ability to sustain the pitches which had been provided by the pianoforte. The hurdy-gurdy was only able to sustain a few pitches and not simultaneously. In the fall of 1980 I began corresponding with makers of portative organs. Harold Westover, of Walpole, New Hampshire, invited me to design and build a portable pipe organ at his workshop. I began work on this instrument in January of 1981 and it was finished just in time for performances by the ensemble in May. Under Westover's direction, I designed an organ with mechanical pin action and an electric blower for an air supply. It had forty-seven pipes - two full octaves of the twenty-pitch scale and the six root pitches of each family in a third lower octave. During the of 1981, six krummhorn-type reeds

replaced the six wood pipes which originally had constituted the lower octave. The pipe organ was incorporated into the piece in time for the performance by the ensemble at Wesleyan University and in New York in May. Sustained organ pitches were scored for the long "Slow Changes" section in the first half. Two new sections featuring the organ in prominant role were developed for the second half of the piece. A new keyboard was designed for this instrument, compressing the twenty-note octave into a normal handreach for twelve notes and incorporating raised appendages in a pattern which visually suggest the tonal families and their locations in my tonal system. The organ comes apart for transport and all its keys are capable of being locked down in the 'on' position.

During the summer of 1981, I began working on a third bass which supply the root pitches of each of the families. Ten strings in doubble courses would be tuned to 1/3/5/7/11. I completly rebuilt the body of the bass, and ran a 1/2" threaded steel rod through the body to reinforce the neck. We began rehearsing with this instrument in the fall, in preparation for performances at The Kitchen in New York City and at Real Art Ways in Hartford. After months of frustrating experimentation, I sensed that the presence of these root pitches tended to confuse the perception of the fundamental. As the root pitch became stronger, the relationships between the families and the original fundamental was blurred. Exept for a short section with three basses, this new bass was put aside until further experimentation could be carried out. Experimentation with this bass confirmed my suspicions about the importanceof maintaining the acoustic presence of the fundamental pitch. All tonal resources utilized in "Nodal Excitation" are inherent in the choice of a permanent fundamental.

In the fall of 1981 Bob Cummins of India Navigation Records invited me to record my ensemble for an LP which should be part of a new music series which should include Yoshi Wada, Phil Niblock and Tom Johnson. Sections of the piece which was prepared for a concert at the Kitchen in NYC in November were recorded in an eight track studio in December. The recordings were mixed in January of 1982 and the Record was released in May. In the spring of 1982 I began working with a French Horn in the ensemble. I had been studying the development of brass instruments in early western music and I understood that blown tubes could produce accurately the harmonic series of a given fundamental (which is related to a given length of pipe). The first performances of the ensemble with Eric Feinstein on French Horn were given at Wesleyan University and in NYC in May of 1982.In August I moved back to NYC into an abandoned bar on

the Brooklyn waterfront in Williamsburg. During the following winter I formed a new ensemble and began experimenting with new rhythmic combinations. The music had always been based on the "even" striking of the basses. Over a period of months we worked out a section in which each of the basses and the piano played part of a rhythm related to 3 or its multiple. Tones of the harmonic series were sustained by the french horn. This new piece was first performed in public as part of a larger work at the Mudd Club in May of 1983.After this performance I invited a trombonist, Peter Zummo, to perform with the ensemble on trombone and trumpet. I then developed a notation for the brass instruments in which the denominator of a fraction represents the fundamental pitch of the tube (chosen by a valve on the french horn or the slide on the trombone), and the numerator denotes the harmonic which is chosen by the embrocure of the performer. I wrote out chords for the two horns in relation to the progression on the pianoforte. The breath attacks on the horns signalled changes among the other instruments. The addition of the brass instruments greatly enhanced the texture and tonal possibilities of the ensemble. Peter Zummo also performed on trumpet in some sections of the piece during a tour by the group in the fall of 1982.

During the winter of 1983-1984 I made a solo tour of Eastern and Western Europe in which I gave 16 solo performances. My improvisation on the modified contrabass developed into a piece on its own, independent of the ensemble compositions. In Transsylvannia in Romania I observed Gypsies performing on a 'gardon'- (a cello-like instrument) with a percussive technique not unlike my own performance technique on the contrabass. In September of 1984, under a grant from the Overbrook Foundation, I took up residence in Künstlerhaus Bethanien in West Berlin where I began a new ensemble which included percussion and violin. During a concentrated rehearsal period in the early spring of 1985, violonist Wolfgang Mettler learned to play many of the tones of the scale system on the violin. The instrument was tuned as follows: G-9, D-27, A-5, E-15. There is no perfect fifth between the D and A string; it is sharp by the interval of 81/80. Some new tones were found which are related to the basic scale system: 75, 243, 4/3, 125. A set of percussion instruments were also added to the ensemble at this time: two snare drums, small and large tom tom, and a copy of the 'gardon' string drum which is mentioned above. The addition of percussion to the ensemble has stimulated a new rhythmic complexity in the music. The range and tone colour of the violin blend excellently with the combination of basses and piano. This ensemble performed extensively in Europe between 1985 and 1987. In the spring of 1986, Künstlerhaus Bethanien released an LP

of the first European Orchestra of Excited Strings entitled, 'Propellers in Love', which was re-released as a CD by Hat Hut Records in Basel, Switzerland in 1987. This ensemble has performed extensively in Europe.

In 1987 I disbanded the ensemble to embark on a series of collaborations with other composers and musicians. The first, with Paul Panhuysen, a visual artist who works extensively with sound installations, formed "Duo Geloso" was partially documented on an extra piece with E-Bows entitled "High Life" which found its way onto the "Propellers in Love" CD. Duo Geloso performed a series of concerts utilizing an Italian Public Address System (made by the Firm, "Geloso") with radiating loudspeaker horns. I performed with Paul on a number of electronic and acoustic strings instruments including: electric guitar, pedal steel guitar, electric violin, etc., with signal processing through noise gates, digital delays, compressors, etc. Around the same time I performed in another duet situation with Tibor Szemzö from Budapest. I played again on various electric string instruments, and Tibor played feedback through the resonating cavity on his flute, a technique that he later developed further.

In 1987 I had moved from Berlin to Liege, Belgium and was commissioned by Ars Electronica to create a sound and visual work. For the sound component I built a small piano, using a primitive plastic toy piano action and building a wood frame. I had some high-band range magnetic pickups especially wound for the instrument. I worked with a sustaniac guitar sustain system, in which an extra transducer mounted on the head stock, and the signal is fed back (through body vibration vibrating the strings) back to the pickups, re-amplified through a foot pedal. I routed this guitar through a stereo pitch shifter, in which the pitches of my scale were programmed. Both the piano and the guitar was run though noise gates, in which the key (drive) signal was derived from recordings I had made from malfunctioning escalators on the Rue Ansbach in Brussels. By experimenting with different threshold settings, a polyrhythmic effect was achieved. I performed on this system as a kind of "one-man band" at Ars Electronic in Linz, and later at Het Apollohuis in Holland. In Liege I met the percussionist-composer-sound installation artist Pierre Berthet, with whom I've collaborated for many years. We began a project together entitled, "End Correction", which toured in 1988. I developed my "Dynamic Processing System" further and purchased a Drawmer M-500 in which I could store threshold settings as programs. I added various devices to the system, including a Peter Drake designed "Talk Box" with which I could modify the overtones of the electric guitar signal

by using my mouth as a resonating cavity; a midi mixing system and a complicated foot pedal system which controlled all variables and switched all devices for each musical sections, including even chord changes. This system enabled me the utilize midi and digital technology without giving up the acoustic amplified string sonorities which formed the core of my music from the beginning.

I was invited by the Prime Foundation in Groningen for a three-day workshop in 1987 with a small string orchestra which resulted in a composition which was included within a program entitled, "Other Tunings". The first section utilized the entire ensemble in just intonation, progressing through the first 11 odd overtones, in each case contrasted with the addition of the fundamental. It is a reformulation of an earlier piece for my ensemble, entitled "Slow Changes". In the second section, a quartet performed in a bowing technique which mirrors the striking fundamentals of the excited strings basses.In a residency at the STEIM Electroacoustic Research Facility in Amsterdam in 1988, I attempted to develop the "one-man band dynamic processing system" concept further. In upgrading the pitch-shifting aspect, I bought a Eventide Harmonizer, only to find that the tuning resolution was only 1/64th of a semitone, too low for my use. The staff at STEIM programmed a prototype for midi mapping system which would re-map the midi outputs of the digital gates to various attributes, so that the entire system could be run off of one clock.

In 1989, however, I returned to Berlin, only to begin a new acoustic ensemble, abandoning this concept until a later date.In early 1990, René Block of the Berliner DAAD Program, commissioned me to create a proposed work for the Inventionen Festival for April 1991. This work became "Who's Who in Central & East Europe 1933" a "hypertext opera" based on my reworking of a book of the same name. (see www.uni-lueneburg.de/memory/) For this purpose, I formed a new ensemble. I wanted to experiment with new instrumentation, and retained only one of the excited strings double basses, adding saxophone, cello, electric and acoustic guitar, and readapting the miniature piano as a cimbalom played with wood hammers horizontally. The electric guitar was adapted with built-in magnetic driver-sustainers for each string and new frets have been installed in the just intonation scale which I have developed. The "Basque string drum" is an acoustic guitar outfitted with snares and which is played percussively with sticks. It is functionally a copy of a traditional Basque instrument. For the opera performances, which developed from 1991- 1997, vocalist Shelley Hirsch from New York worked out some parts with the ensemble. It was the first use of voice in my ensemble context.

Also in 1991, I began a second collaboration with a soloist when Edek Bartz from Vienna asked me to do two Klezmer interpretations with my ensemble for a compilation CD on the Extra Platte Label (EX-316 155 CD). I collaborated with my old friend Andy Statman, one of the most famous Klezmer clarinetists in the States. Andy performed with the ensemble live only once in Berlin in 1995. Also in the same year, The Orchestra of Excited Strings played in the USA for the first time since my period of exile began in 1983. The event, which took place at the Bang in A Can Festival at La Mama in New York, was partially supported by the Goethe Institute in New York, who treated me as a "German" composer. The performance was a very moving homecoming for me.

In 1992 and then again in 1993 I re-instituted the Dynamic Processing System and integrated it within the Orchestra framework. For a commission in 1991 for a performance with text, music and light at the East Berlin Planetarium, I composed "Star Trap". Instrumental parts were written for the ensemble which performed together with percussionist Pierre Berthet, who performed in tandem with the gate system. Another piece was composed for a commission from a Gallery in Bernau in Brandenburg in the following year, in which samples where also generated from the midi output of the digital gates. I then began working intensively on a number of large installation/theater production in which hundreds of persons participated in simultaneous communal readings from the text materials found in "Who's Who in Central & East Europe 1933". This piece, entitled "Memory Arena" (see again: www.uni-lueneburg.de/memory/) took place in Hamburg and Munich in 1995 and in Copenhagen in 1996. The Orchestra of Excited Strings functioned within these events as musical interruptions of the endless readings. Yet, I became more and more interested in collages of voices, both live and recorded in my current work, which is part of an ongoing process entitled, "The Memory Project". During this period I also began composing my music using a midi system incorporating a sampler tuned in cents, which represented a great departure from the long and often grueling workshop periods in which the music had been developed for so many years. As before, I have avoided the use of sampled or synthesized sounds within the music itself.

After many years of silence from the States, (the ensemble had only performed once in New York at the Bang in A Can Festival in 1991), Michael Gordon contacted me in 1996 about composing a piece for the Ban in A Can All-stars for a performance in New York at Lincoln Center. From the program notes: "This system was

triggered with recorded machine tracks and interacts with acoustic instruments. It's basis are recordings of the rhythms produced by a number of malfunctioning escalators on the Blvd. Ansbach in Brussels which I made in 1987. In this version of "Escalator", composed in 1995, for my own ensemble, I notated repetitive rhythmic patterns found in these recordings and scored them for piano, prepared electric guitar and cello, later adding layers of percussion, saxophone and prepared "excited strings" bass in collaboration with the musicians". It was a new experience to conceive of the "Excited Strings" sound for another ensemble, especially since the rehearsal time would be minimal. Fortunately, the instrumentation of the All-Stars was almost exactly the same as my ensemble in Berlin at the time. A second electric guitar was fretted in my intonation in New York, and tunings were prepared for a sampler to substitute as a keyboard instrument, while Robert Black and Maya Beiser both immediately understood and expanded their roles. The composer and performer Evan Ziporyn was enormously helpful in realizing the piece, which was performed later in Darmstadt and Turin. I was very stimulated by the experience, and both pleased and surprised at the result. A new way was paved, both for working in the States and for being open to working with new musicians and in new situations.

Also in 1996, I was surprised to receive a fax from Jim O'Rourke in Chicago inquiring about re-releasing "Nodal Excitation" on his "Dexter's Cigar" label. I had never been happy with the original disc, somehow feeling that within the recording and mastering process, the essence of the first ensemble sound had been lost. Few records had originally been sold, and the boxes of stored records served as a curiosity item to be given away to olleagues as presents if nothing else. Little did I know that the fax hich I received in Berlin that day represented merely the first sign of a generational change in which a re-interest in the musical concerns of the sixties and seventies had taken place after some years of relative silence. Upon hearing the master tape for the first time in fifteen years in Jim's studio in Chicago, it became apparent to me that the mastering technology of the time was just not capable reproducing the wide bandwidth of the original recording, which after all these years (and extensive baking) was still there for all to hear. Meeting Jim and the subsequent collaborations and contacts which have since developed have inspired a "looking back" at the context and ideas from which my music began. It's always good to re-experience the essentials a second time, in order to move on.

Arnold Dreyblatt, Berlin 1997