

25 years of explorations in sound

musicworks

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Gordon Monahan's
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furniture music

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spans language,
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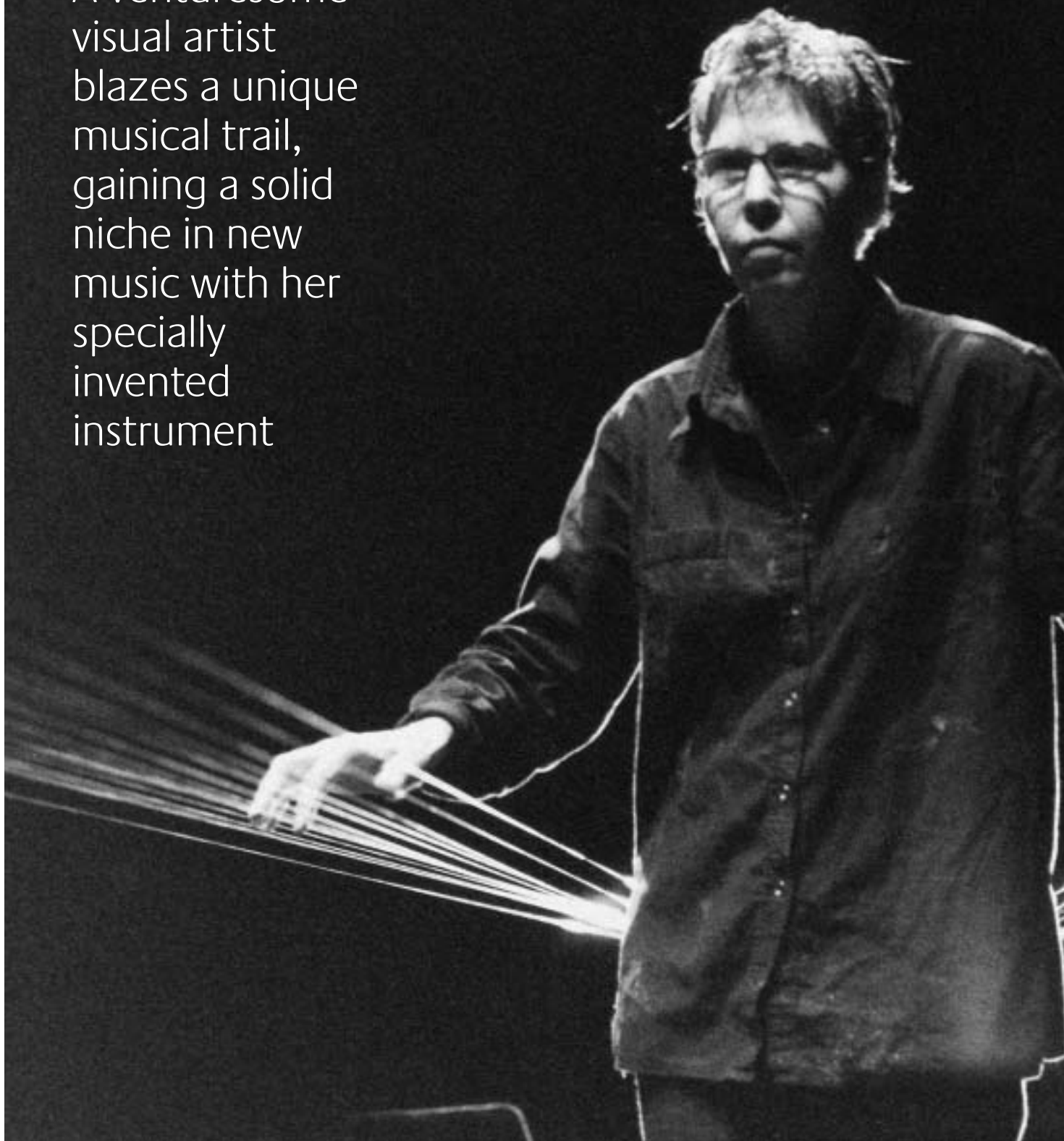
Tim Brady's
composition for
twenty student
guitarists

Ellen
Fullman's

long string instrument



A venturesome
visual artist
blazes a unique
musical trail,
gaining a solid
niche in new
music with her
specially
invented
instrument





the long string instrument

BY ELLEN FULLMAN

for over twenty years, the focus of my musical activity has been the development of a project I call the Long String Instrument (LSI, for short). I have refined the construction of the instrument, established playing techniques, and evolved methods of composition and scoring. The Long String Instrument produces a unique, almost orchestral sound based on the overtones produced by longitudinally vibrating strings attached perpendicularly to acoustic wooden-box resonators (on all other string instruments the strings vibrate transversely, being attached parallel to the soundboard resonator). The LSI strings range in length from about thirteen to thirty metres, usually organized in multiple groupings. Strings are tuned in just intonation by c-clamps placed on each wire, establishing the vibrating length of the strings, much as a capo does on a guitar. The range extends three octaves, from A-55 hertz at thirty-two metres in length (the A below the low C on the cello) to A-440 hertz at four metres in length (the open A on the violin).

PHOTO BY JOHN FAGO



The Long String Instrument is played by rubbing the strings with rosined fingertips while walking along a pathway between banks of strings. Different overtones are emphasized as the performer moves past the harmonic nodes of each string. These overtones emerge as an array of higher-pitched harmonic relationships above the fundamental tone of each string. Sometimes these variations in overtone production seem to transform a single chord into entirely different harmonies. These changes can be heard in my music as motion, almost like a river moving past, always subtly changing, yet also seeming to remain the same. The physical scale of the installation and the interactions of the overtones with the installation space turn the respective room itself into a giant musical instrument.

A little artistic background

My interest in sound grew out of my schooling as a visual artist, in combination with my interest in performance. I began explorations in sound art during my fourth year at the Kansas City Art Institute in 1978, creating soundtracks for my performance art pieces. At that time I built the Metal Skirt Sound Sculpture, a pleated skirt made of sheet metal, with guitar strings running from it to the toes and heels of platform shoes worn in performance. As I walked, these strings were stretched and released, producing simultaneous rhythmic rising and falling pitches, along with a lot of clanking and creaking metal. I amplified the skirt with a contact microphone, and carried a miniature amplifier as my purse.

After graduating from art school, I moved to St. Paul, Minnesota, where a video was made of me wearing the metal skirt while walking the downtown streets that prostitutes worked on. I called the piece *Streetwalker*. I was invited to perform *Streetwalker* in conjunction with the New Music America festival in 1980, which was held at the Walker Art Center in Minneapolis. It was here that I found a context for my work in the new music community, learning for the first time of Alvin Lucier's *Music on a Long Thin Wire*. Embarrassingly, I didn't manage to attend the performance at the time, but a mental picture of long strings, and curiosity about what this could sound like, initiated



my first experiments with the Long String Instrument. Later, after learning more about Lucier's work, I found a major source of inspiration in his aesthetic of basing pieces on the physics of sound.

Developing the long string instrument

The first prototype of the LSI was constructed in St. Paul, in 1980. I attached stretched wires to amplified metal containers filled with water. As I bowed the strings, I changed the angle of the resonators, moving the water to modulate the sound. This produced a wah-wah effect. One day I accidentally brushed against one of these strings where rosin had been deposited from the bow. It made a loud, clear sound. I rubbed it with my hands. I wondered how a string played in this way could be tuned: tightening it or changing the gauge of the wire had no effect on the pitch. My first performance, with the installation in this raw state of development, was at the Walker Art Center in November, 1981. Two weeks later I was offered a gig at the Kitchen in New York City, and I decided to move to New York, though I had only a suitcase and the money I was to earn from my concert.

A year later, two friends, Jennifer Hall and Terry Maxedon, fabricated for me a fifty-foot-long self-supporting structure out of



LEFT SIDE, FROM TOP: PHOTO BY ANN MARSDEN; LONA FOOTE; COURTESY OF ELLEN FULLMAN; SARAH DURY; PIETER BOERSMA



aluminum tubing, which I set up on the roof of my building in Brooklyn. I attached each string to an amplified large-metal-bowl resonator, which I suspended on a large spring. The bowls were filled with water, and moved when I pressed on the strings to play them, the water in the bowls modulating the sound.

I decided then to develop the idea into a stable instrument with a consistent tuning system and the capacity for repeating compositions. Other artists have used long strings, usually in site-specific sound installations, but my decades-long development of an instrument has been a singular and persistent pursuit.

I composed my first piece for The Long String Instrument for the Echo festival, at Het Apollohuis, in Eindhoven, the Netherlands, in November, 1984. *Brushing Out the Tracks* was composed for two performers who were to walk along beside the strings while playing the scored music. My fellow performer on this occasion was composer Arnold Dreyblatt, whom I had first met

shortly after my move to New York, and whose spatially oriented music had helped me find my own direction. For *Brushing Out the Tracks*, we played sustained chords while walking to a designated location, then turning around and walking back to where the strings terminated in the resonator box. Chord changes were staggered: as one performer walked out, the other walked in.

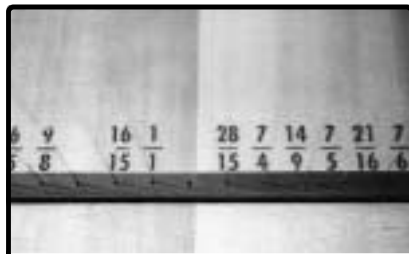
I was in residence at Apollohuis for much of 1985, and presented several installations and concerts in Europe. In between gigs I installed my instrument at Apollohuis to compose and record. I also created the Water Drip Drum, which used tiny, precise valves to control water dripping into an amplified metal pan, thus providing a rhythmic element.

In December, 1985, I moved to Austin, Texas, where I began the first of many collaborative projects with choreographer Deborah Hay. Deborah's assistant, Sherry Goodman, soon found a rehearsal space for me in Republic Plaza, an unfinished office tower in Austin. At that time, Texas was in a recession, and there were many new, empty, unfinished office towers, known as "see-throughs." In Austin I was able to work rent-free from 1986 to 1989. I stayed in the city for eleven years in semi-isolation, as there was no new music community. I found stimulation and support in the strong dance and performance community that had formed around Deborah Hay.

composing for the LSI

The motivation for my music is the sound itself. It is through interaction with materials that my work develops. I seek a balance of opposites in my compositional process, looking for some degree of serendipity mixed with control, or for a pure emotional expression based on rational patterns.

My approach to composition is similar to the editing of film: one event on a timeline dissolves or cuts into the next. I also think



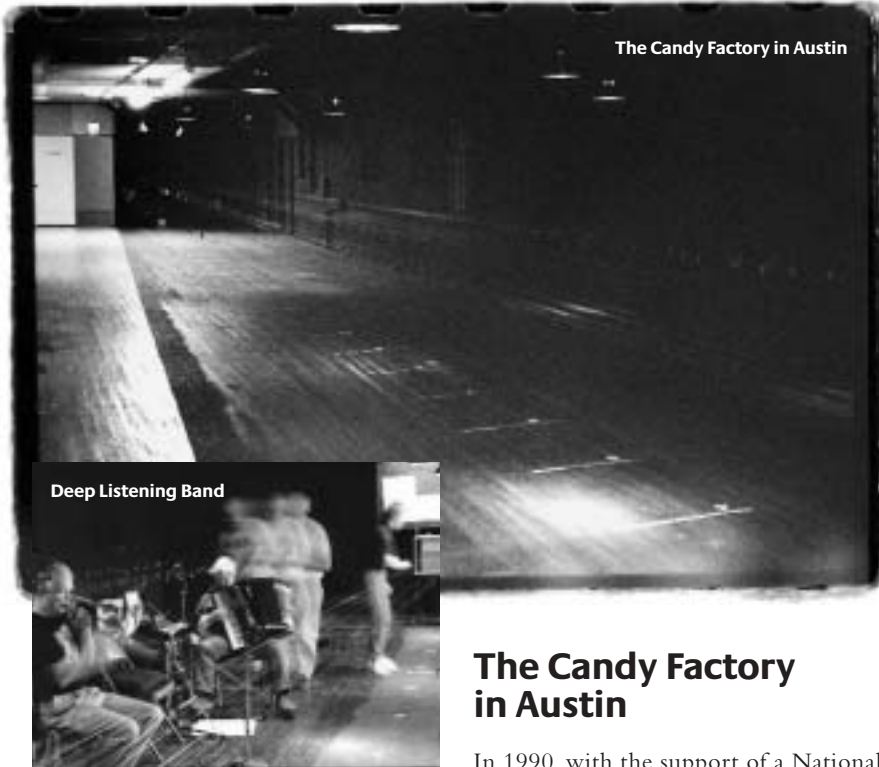
designing the resonator

The resonator design has been a key factor in getting more warmth into the sound. Over the years I tried out several different types of resonator design. The strings vibrate in the *longitudinal* mode rather than the usual *transverse* mode, where the strings are positioned parallel to the soundboard. In order for these waves to couple with a resonator the string needs to be attached to the soundboard perpendicularly.

In the late 1980s I further improved the resonator design, working with instrument builder Stephen Wise. Four variations in the design have been built so far. The soundboards are now tapered precisely and have a hardwood bridge where the strings terminate using a loop around a small wooden dowel. The best resonance is achieved when all the elements are stressed just under the breaking point.

The most recent resonator design was in 1993—the double-sided resonator, developed for my collaboration with Pauline Oliveros's Deep Listening Band. With the LSI's three-octave range, the effective string lengths in the key of A vary from thirty-two meters to about four meters. The bass octave is suspended from a separate bass resonator, running the entire length of the space. The low A for the middle octave is sixteen meters, eight meters for the high. When all three octaves were suspended from a single point, a lot of unused string was left behind the stops in the higher tuned strings. In order to use the space more efficiently, I decided to place resonators in the center, with soundboards on either side and strings suspended in both directions.





The Candy Factory in Austin

of it as sculpture: sound waves moving through space. In the late 1980s I developed a notation system that reflects these processes, which I still use as the basis for scoring my work. The scores are outlines of the pieces; reminders to the performers of the structure, including details worked out during rehearsals. The original inspiration for my notation came from looking at hand-dyed Guatemalan fabric in which strips of geometric designs are repeated. I thought of these horizontal strips as timelines. Because a performer walks while playing my instrument, time can be determined, to a certain extent, by distance walked. I place numbers on the floor at measured intervals corresponding to a grid in the score. I am able to coordinate harmonic changes among parts based on synchronizing the performers' walking. The first piece in which I used this system was *Work for 4 Players and 90 Strings*, performed at Ohio State University in December, 1987. This piece is focused on the crescendo of the highest partials that occur at the edges of the strings.

In 1990, with the support of a National Endowment for the Arts Fellowship, I was able to rent a former candy factory in Austin as a studio. I painted the interior black and lit only the suspended strings of the LSI. The effect was stunning: the strings seemed to float in a void. Visually, this has been my favourite installation: being in the room felt like being inside the instrument. The Candy Factory was a studio, but also a performance space. I designed a bass resonator and installed it at this time, and got performance artist Scott Lehman to play bass parts.

The first major performance in the Candy Factory was *22 Songs*, presented in November of 1990. With this piece I extended the dynamic range and introduced techniques to extend the LSI's timbral vocabulary. The principal sound produced when first working with the longitudinal mode is loud and continuous, which is what my earliest pieces were like. I wanted now to find ways to work with dynamic shape, and with quiet sounds. I found that in order to achieve a plucked sound, the only way to get an audible tone was by plucking the strings very close to the resonator bridge. Around this same time,

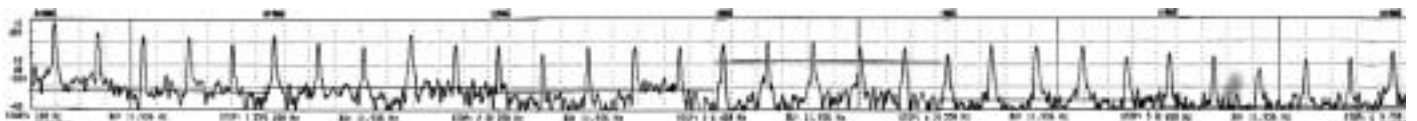
I began playing simple modal melodies: while playing a continuous chord I could sound different strings while walking. The effect was like that of a hurdy-gurdy, a chordal drone with a simple melody. Another technique was to stand at one of the nodes of a string, a proportionately located position where a large number of the overtone waves line up and cancel each other out. A slow pulse can be created by rubbing the string an arm's length back and forth over this area, stroking from the silent spot out through the unfolding cascade of various partials, and reversing back to the node.

further refinements and compositions

From fall 1993 to August 1997, I studied North Indian vocal music in the Kyall tradition with Anita Slawek in Austin. Through working with Anita, I developed more sensitivity to tuning. She said to me, "When you are really in tune, the music plays itself." In teaching a raga scale, she would sing phrases for me to copy, starting in the low range and gradually moving to higher pitches. With such intense focus and precision, Anita's singing could move me to tears through the sheer beauty of hearing a new note introduced. This work confirmed that the art most interesting to me contains some kind of spiritual depth. By this, I mean simply work that requires a deep level of concentration and that has a sense of purpose beyond individual expression. Another example of this for me was a recent performance by cellist Frances-Marie Uitti (about whom I will write more, further on here) of Giacinto Scelsi's *Triologia*, especially the last two movements.

The study of Indian music has made me more aware of the shapes of sounds, the edges. It also started me thinking more about timbre, and led to my choosing to string my instrument with bronze wire. Bronze has a warmer, more muted sound. I decided to centre my tuning in the key of A, the key for the female voice in Indian music. I like having the tuning oriented to my vocal range, because I sing while rehearsing on the Long String Instrument.

TOP PHOTOS BY TODD WOLFSON; PHOTO OF COMPOSITE WAVES BY KRYS BROBROWSKI



I developed a method of applying rosin to the strings of the LSI, and have experimented with various rosins. I have also worked extensively on performance technique. I concluded that to get a string to speak most clearly in the longitudinal mode, it must be rubbed at some multiple of the speed of the wave that is moving through it. I also became convinced that it is humanly impossible to be in perfect sync with a constant wave speed for a long period of time.

While working in Seattle a few years ago, I started to develop a technique of applying slightly more and less pressure while in continual contact with the string in order to articulate the overtones. I feel that I am able to get in sync with the speed of the longitudinal wave only for a short period of time. I periodically let go, and allow the resonance to decay. I feel this lets the ear rest for a moment, as well. This technique corresponds with one I learned in my study of North

Indian vocal music: making sounds with shapes like strings of beads by producing smoothly tapered envelopes in both the attacks and decays.

By the late 1980s I had recognized that it is possible to make a staccato sound by rubbing an LSI string back and forth, using only distances as short as a centimetre. I was also fascinated with hocket patterns and began to study Afro-Cuban drumming.

In the spring of 1993 I received a commission from the Pauline Oliveros Foundation to compose a work for the combined forces of the Long String Instrument ensemble (myself, Elise Gould, and Nigel Jacobs) and the Deep Listening Band (Pauline Oliveros, Stuart Dempster, and David Gamper). In order to do this, I extended the vocabulary of the LSI and formalized my techniques by creating symbols for scoring. A fluttering, picked-mandolin-like texture is achieved with “Twine Pluck,” for which



Rosin

fishing-net twine is wrapped around a string that is dragged along a string of the LSI. “Zoom” is achieved by walking briskly with very delicate contact with the strings. This produces an airy, wispy resonance. “Plucking” is the plucking of strings close to the resonator bridge. “Walk-pulse” is created by rhythmically alternating pressure changes in contact with the string (firmer pressure produces a louder sound). A more subtle version of “Walk-pulse” is the technique described two paragraphs back, and is one

expanding the LSI’s harmonics and refining its timbre

Around 1987 I began consciously working with Pauline Oliveros’s concept of the performer as listener and thought of the performer as the facilitator of the acoustic phenomenon that is naturally produced by longitudinally vibrating strings. From spring 1988 through 1990, I toured a duet version of *Work for 4 Players* with Danièle Massié. We developed our performance technique to achieve a smoothness in our sound together.

During one memorable recording session a train whistle sounded in the hall. The complexity of the whistle’s pitch combined with our performance to evoke a mood that I have been striving to recreate ever since. I realized through this experience that I needed to investigate more complex intervals. I therefore began experimenting with expanding the harmonic material, incorporating the eleventh and thirteenth overtones, but I was often dissatisfied with this material. In my earlier pieces, I had worked with familiar-sounding five-limit or diatonic intervals in just intonation. Despite the relative simplicity of the harmonies, the LSI added so many overtones to the basic pitches that the overall sound was quite complex. In retrospect, I think the instrument’s timbre needed to be smoother before the more complex intervals I’d been using could sound good.



Rehearsal of *Work for 4 Players* with Danièle Massié and Jane Botkin.

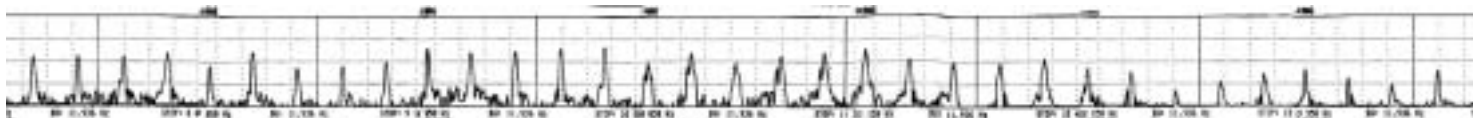
Over the years I have improved the LSI’s timbre by adjusting various parameters. Pitch is determined by the speed of the sound wave moving lengthwise through the string, and therefore it is affected by the density of the metal used in the string. Timbre is also affected. For example, brass wire produces a lower pitch and more muted timbre than will steel wire. I experimented

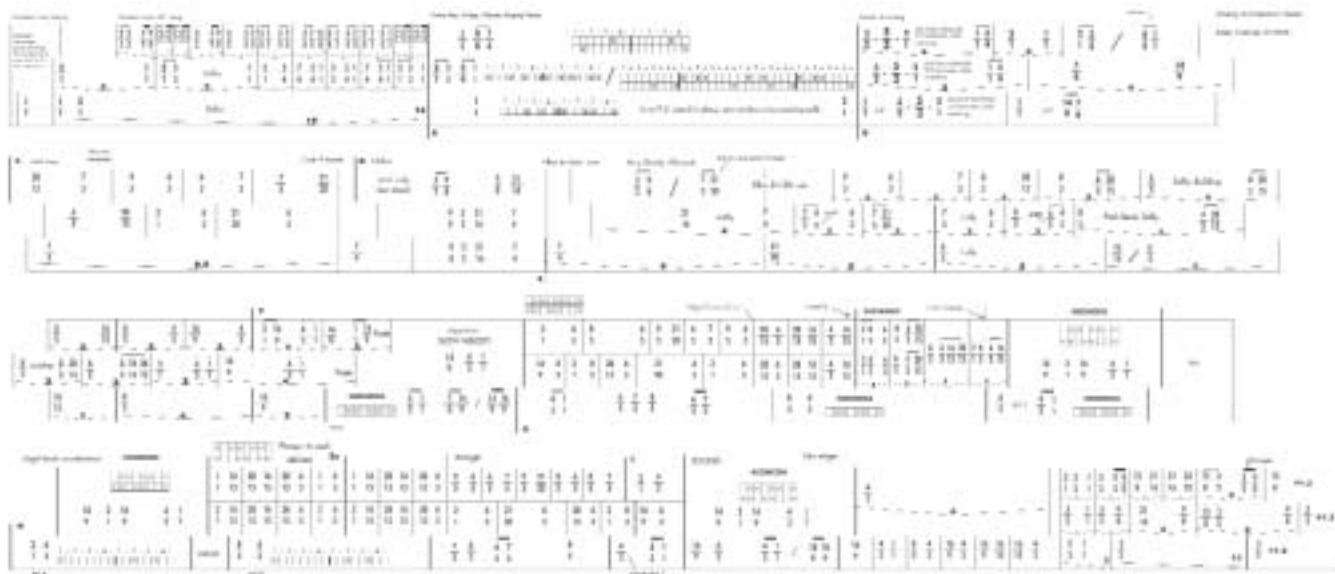
with various string gauges and different materials, finally settling on .014-inch (0.45mm) bronze wire.

Harry Partch coined the term “utonality” for sub-harmonic intervals or intervals arrived at by division, and “otonality” for intervals arrived at by multiplication. Utonality can be thought of as a mathematical mirror image of the overtone series, or as the “undertone series.” With overtone series chords, you can hear the upward projection of tones stacked on top of one another. Utonality

seems to be oozing downward. Overtone series chords sound locked in and stable because the overtones of the root pitch in the chord are projected into the other intervals of the chord. With sub-harmonically based chords, the intervals between the fundamental pitches may have the same simple mathematical relationships; but their projected overtones do not always line up. This produces an effect, especially with the LSI’s strong overtone presence, of the overtones *playing more songs*.

TOP PHOTOS THIS PAGE BY TODD WOLFSON; CENTRE PHOTO BY WILLIAM KOLBERG





Score for *Change of Direction*.

that I always use in recent years, because I feel it allows the string to speak most clearly. “Ring-pulse” is executed by standing in place and rubbing the string with a swooping gesture, letting go of the string completely to allow the resonance to ring out.

The new piece, *Texas Travel Texture*, was composed using the LSI parts as an underlying fabric for the Deep Listening Band’s structured improvisation. Pauline’s piece, *Epigraphs in the Time of AIDS*, was also a structured improvisation. We performed at the Candy Factory in Austin in November, 1994, and again at the Low Library Rotunda at Columbia University in New York in September, 1998. Herb Levy released both my piece and Pauline’s on his Periplum label in 1997, calling the CD *Suspended Music*.

I worked with the same harmonic content and ideas as are in *Texas Travel Texture* for pieces for the LSI ensemble, *Change of Direction*, which was performed at the Walker Art Center in Minneapolis in the summer of 1995, and music to accompany the *Movement Meditation Project* by choreographer Pat Graney in the summer of 1996 in Seattle. At the Walker, we installed the instrument in the greenhouse area of the Sculpture Conservatory. We were enclosed in a long glass corridor, with the sound system and audience outdoors. In Seattle, the installation itself was outdoors (and carefully amplified) for the first time. The *Movement Meditation Project* was choreographed for 120 woman martial artists. It was thrilling for me to perform as part of a live theatrical event.

I moved to Seattle in August of 1997 to experience the stimulation that a larger city offers and to be more in touch with a music scene. It took a year for me to find a studio space in Seattle—and I found one just in time, because I was invited to perform *Suspended Music* with the Deep Listening Band in New York in September of 1998, and to compose new music for Donaueschinger Musiktage and Frau Musica Nova in October and November of that year. I built a twenty-four-meter-long wall, installed the instrument, formed and trained a Seattle-based ensemble, revised an old work, and composed a new full-length work, and negotiated all of the arrangements for the performances—all within a three-month period.

In Seattle I became friends with composer Phillip Arnautoff, from whom I gained a fascination with the sub-harmonic series.

residency in Berlin

I was a guest of the DAAD Artist-in-Berlin Program for a year starting in September 2000. I was looking for a way to work with tunable samples in order to work on parts in just intonation for a piece for the Kronos Quartet. A tunable version of the software-based sampler, Unity DS-1, had just come out in the fall of 2000, and I used it to work on a study called *Transmission*, in preparation for the project with the Kronos Quartet. I began composing in ProTools by editing real-time recordings of the LSI mixed

with midi tracks using the sampler. Using this method I composed parts in just intonation for trumpet, cello, and trombone, providing melodic phrases for the players to work with as jumping-off points for improvisation. I streamlined the installation process for the LSI with pre-rosined strings and pre-built stands that were used in touring to three venues in Germany. By the last concert, in Erfurt, the other musicians and I were able to complete the installation in only ten hours—down from the five days it took at first.

Over the years, I had explored the use of variously shaped tools and sticks for rubbing the strings of the LSI, but had never found the clarity of timbral quality I was looking for. The most successful staccato technique I had developed involved striking the strings with the palm of my hand held taut, the fingers arched back. This produced the best timbre thus far, but the sound wasn’t consistent enough. While on my DAAD residency in Berlin in 2001, I mimicked the mechanics of this gesture with wood, making a tool with a hollow block handle mounted on a ski-like surface. I showed this to Stefan Beck, an instrument builder in Berlin and, the next time I saw him, Stefan presented me with a refined version of the tool. He told me how to finish it off, based on the hurdy-gurdy wheel. I call it the “box bow.” Stefan calls it “das Saitenbügeleisen!” (string-iron). With it, I am at long last able to truly replicate the sound of a harmonica.

While in Berlin, I improvised regularly with Werner Durand and Eliza Slavet.

Werner played his PVC tube instruments, tuned to ratios of my scale. With the tube horns, Werner can produce overtones of the root pitch extending as far as twenty-one. On her oboe, Eliza played multiphonics exclusively, sliding between pitches. She investigated ratio equivalents of what the oboe was doing by building elaborate spreadsheets. In this way we could relate these pitches to my tuning in an extended way. I also experimented in retuning my instrument in more extended intervals. At its best, the music from these sessions felt to me like it was dimensional rather than linear, with projections of overtones and weavings between instruments, so that the source instrument for sounds was no longer clearly identifiable. We made several recordings in a wonderfully resonant studio on Klausenerplatz. The speed and ease of plugging numbers into the spreadsheets that Eliza and I created has given me an expansive feeling of fluidity in pitch material choice.



das Saitenbügelseisen

recent developments

Arnold Dreyblatt talked with me in Berlin about the songs I had composed and recorded in the early 1980s, a time when I worked with homemade instruments as sound sources—bowed long strings, metal containers, etc. The pieces were constructed using multitrack tape and *musique concrète* techniques. I used large tape loops running between two machines, or covered over the recording head to build up a residue of layers. As a teenager growing up in Memphis, Tennessee, I was able to hear some of the original blues artists in person, and Delta blues music has somehow remained an underlying influence in my work. I love to work with the shapes of words and phrases. Arnold told me he had always wanted to do a cover of Woody Guthrie's *I Ain't Got No Home*. This project coincided with Jörg Hiller's fascination with Harry Smith's *Anthology of American Folk Music*. Jörg's band, Twang, has done minimalist covers of this recording. With the impetus from Arnold, Jörg and I began recording tracks of *No Home*.

Before leaving for Berlin I was awarded a commission by Other Minds for a full-length work for the LSI with the Kronos Quartet for the March 2002 Other Minds Festival in San Francisco. I had first met Kronos's David Harrington in 1996, and had invited him to my studio in Austin. David told me that the LSI sounded to him like the blues, and he recommended that I listen to *Last Kind Words*, a delta blues song recorded by Geeshie Wiley in 1930. I got to hear the song, and it has haunted me ever since.

After the summer concert tour of *Transmission* in Berlin, I began to work on *Stratified Bands: Last Kind Words* for the Kronos Quartet. My process began by singing fragments of vocal phrases from Wiley's recording while playing chord sequences on the LSI. I am fascinated by the extended harmony that is possible in just intonation, where chords exist somewhere outside of the definitions of major or minor. The piece is structured in nine movements as a series of songs, each built around the mood of a single chord. The harmony uses seven-limit intervals in just intonation. The harmonic seventh interval in just intonation is known popularly as the *blues seven*, or *flatted seven*. The melodic structure reflects phrases that I hear in the overtones produced by the LSI, as well as the vocal phrases from *Last Kind Words*. One chord melts into the next, some pitches remaining the same. The string quartet parts are also in just intonation, and use Harry Partch's single-finger technique of playing phrases on only one string, using glissandi, with no vibrato. Since the overtones produced change along the string length, my intention was to map precisely the choreography of the LSI part in relationship to the harmonic content of the string quartet parts. I had not finished this at the time of the performance. This was the first piece I composed using standard musical notation. I enjoyed working with Kronos so much: they understood exactly what I was looking for. We plan to perform the piece more, and to record it.

Jeff Gerson helped me to design a freestanding installation of the LSI for the Other Minds performance at the Palace of Fine Arts Theatre. Curtis (he has no other name), manager of exhibition support at the Exploratorium in San Francisco, elegantly

Achieving Dimensional Effect

When working with traditional instruments, I have struggled with the tendency to have the droning LSI sound function merely as some kind of giant tambura, providing a background for the other instruments. My intention has been to weave my sound into the mix and somehow create a dimensional effect. In ensemble playing, it is necessary to leave holes for the other instruments to come through. This has led me to work on the edges of my sound—the attack, the decay—and to gain greater control of my dynamics.

Recording the LSI has been challenging. One of the most successful recordings took place in the summer of 2000. It was an improvisation session with me on the LSI, John Butcher on soprano sax, Gino Robair on percussion, and Matthew Sperry on double bass. Al Swanson recorded the performance, using a twenty-four-bit digital four-track Nagra, with four omnidirectional microphones. In this recording one can actually hear the sound waves moving through space. This is my favorite recording of the LSI to date. I realized that even if you compress a twenty-four-bit recording down to the sixteen bits of a CD, the twenty-four-bit resolution can still be experienced as a smoother sound. I also now prefer to record my instrument with omnidirectional microphones.

fabricated it. I plan to tour with this installation when future performances require a freestanding version.

In March 2002, in conjunction with my performance in the Other Minds Festival, I began a residency at the Exploratorium to develop an interactive exhibit of the Long String Instrument. Using a spectrum analyzer, Ray Gruenig, composer Krys Bobrowski, and I discovered that every whole number multiple of the fundamental frequency is represented at nearly equal volume to the fundamental, spiking up at regular intervals, and continuing up through the range of hearing.

I had already intuitively based my compositions on the implications of this kind of



waveform. First of all, it is completely unique in the music world. All tonally based musical instruments show a pronounced spike in the fundamental frequency and a quick drop-off in partial content. It has seemed almost that the voicing of a chord as a compositional element is not as much of an issue with the LSI as with instruments that have less overtone content. The LSI waveform looks like a kind of evenly spaced comb. A different fundamental frequency would also produce evenly spaced spikes, but with a spacing between the spikes different from the first frequency. I visualize combinations of these waveforms, as if combs with differently spaced bristles were overlaid. If a frequency an octave lower were played, this would add one octave of spikes below, but all of the rest of the wave would be identical to a pitch played an octave above. I feel one doesn't sense so much an up and down movement when changing from one string to another, but more of a shifting from side to side. Also, since the really high overtones are still really loud, then when multiple strings with different tunings are played at once, the intervals between the extended overtones are really close—or so-called dissonant. Hence, the necessity of precise tuning in pure intervals; otherwise there is really a chaotic clatter up there. What I am looking for in my composition, in working with more extended tuning in just intonation, is to create in the overtones interesting melodic movement that has a logic to its complexity.

future plans

Frances-Marie Uitti and I are planning to begin a collaborative project in summer 2003. Frances is a “USAan” cellist who has been living in Amsterdam for many years.

She has developed a method of playing with two bows, sounding more like a string quartet than a single instrument. She has an amazing ear for minute colorations in intonation. She was close to the composer Giacinto Scelsi, and was able to play pieces of his that he defined as impossible. One of these that I have heard in concert, *Triologia* (referred to earlier in this article), involves playing four-staff notation, one staff for each finger. Frances is eager to learn more about ratio-based tuning systems. She is fascinated by just intonation and by the partials that she hears in the LSI. Her virtuosity and inventiveness fascinate me. We don't know where this will lead, but we will begin by exploring various tunings as a series of structured improvs. We feel our instruments will merge, intersect, and camouflage each other. (The mid-range of the LSI is cello range.) The idea of music with consideration of dimension is what inspires me. I am really interested in making music in a larger context, in relation to other artforms. When both sound and image are contained in an artwork, something can happen beyond the individual elements.

résumé français

Ellen Fullman a construit son « Long String Instrument » (LSI) au début des années 1980. La longueur de ses cordes s'étend de treize à trente mètres. Pour en jouer, les interprètes se déplacent le long des cordes tout en les frottant avec leurs doigts, préalablement enduits d'arcanson. Les vibrations longitudinales des cordes qui sont attachées à des résonateurs en bois produisent des sons riches en harmoniques. L'instrument est accordé selon le tempérament juste (just intonation) et couvre un registre de trois octaves, du la-55 Hz au la-440 Hz. Dans cet article, Fullman décrit la mise au point et les modifications ultérieures de l'instrument ainsi que le processus de développement des modes de jeu de l'instrument et des rapports d'interaction avec d'autres musiciens.

Ellen Fullman would like to thank those who helped her with the resonator designs, and with other practical and technical issues: Bob Bielecki, Steve Cellum, Stephen Wise, Stefan Beck, Curtis, Krysz Brobrowski, Jeffrey Gerson.

[**Editor's Note:** An earlier version of this article was published in German in the periodical *Musik Texte*.]

sonography

- Transmission Particle 1* (with Eliza Slavet).
Zeitenwechsel, 35 Jahr Berliner
Künstlerprogramm, DAAD, ed. RZ, Parallele
20002.
- "Margaret Tuned the Radio in Between Two
Stations" on *Immersion*. Starkland S-2010.
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