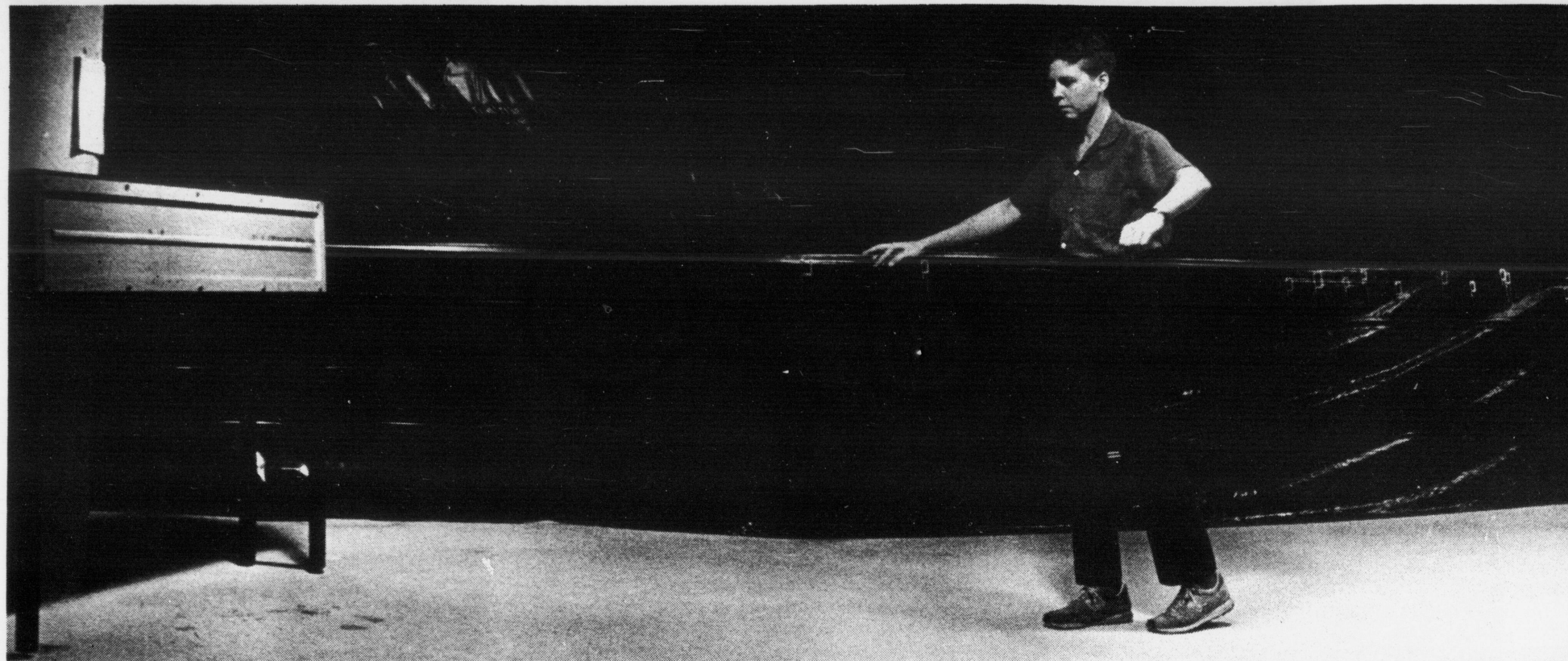




# THE LONG STRING INSTRUMENT

Ellen Fullman performs with her self-designed Long String Instrument and Water Drip Drum. She has toured the United States and Europe, where she was artist-in-residence at Het Apollohuis in Eindhoven, The Netherlands, releasing her debut LP on Apollohuis Records. Gordon Monahan spoke with Ellen following her performance at the 1986 New Music America festival in Houston, Texas.

**Gordon:** Could you describe the *Long String Instrument*?

**Ellen:** It's a set of long harpsichord strings which span from wall to wall, so that distance changes depending on the room. I like the distance of about 65 feet — that puts it in the Key of F. For example, coming up to 50 feet, it's in the Key of A but I don't like to go any shorter than that as the frequencies get a little too high. These strings are attached to a wooden box resonator which is about 4 ft. by 1 ft. by 1 ft. The strings run along at waist height and are parallel to each other, about 3/4 of an inch apart. There's a grouping of about 25 strings together; it's tuned in just intonation. I adjust the pitch of each string by positioning a small clamp at a point along the wire which determines its length of vibration. The instrument is played by stroking the strings with rosin-covered hands. The strings are also covered in rosin.

**Gordon:** The particular phenomenon of how these strings vibrate is called *longitudinal vibration*. Could you explain what that means?

**Ellen:** Well, most traditional string instruments use the *transverse* mode of vibration. That's where the string moves in a kind of waveform, an up-and-down kind of movement. The *longitudinal* mode is more of a back and forth movement which is excited along the length of the string, travelling back and forth between the resonator, out to the clamp, and back in. In that way the frequency is controlled by the length, by how far that wave has to travel.

**Gordon:** How did you discover this phenomenon and how did you develop the instrument?

**Ellen:** It all began when I was building and amplifying metal objects with contact microphones. I attached strings to these objects and bowed the strings to excite the pieces of metal. I had a very large studio space so I just left these strung up. I also lived in the same space where I worked and one day I was walking along and accidentally brushed against a string and it made this very loud clear sound. That's how it all began.

I realised that if the parameters around this phenomenon were controlled then the sound could be manipulated. The kind of sound that I wanted was a warm rich kind of sound but at first I was getting a harsh metallic *screechy* sound. Also I wanted to be able to tune it and I wanted to have lots of strings and play chords. In the beginning I

was using 3 or 4 strings and attaching them to these pieces of metal and just playing one string at a time. It kind of sounded the way a *raunchy* electric guitar sounds.

This is when I was living in Minneapolis. I felt frustrated there as no one around seemed to know enough technically to help me; at least no one that I was in contact with. I used to see new music performances imported mostly from New York City and was usually very impressed by the technical expertise and the integration of art and technology. That's what I knew I needed also and so I decided to move to New York. I figured there must be engineers there who were really interested in art, as the kinds of things I was seeing had to take some co-operation between engineers and artists, although it was never talked about.

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It took me a couple of years to get hooked up with people who could help me. A very important friendship for me has been the composer **Arnold Dreyblatt**. He introduced me to **Bob Bielecki**, who is an engineer. He's really behind a lot of work by composers who are working with technology; he's very good. We had a meeting where I showed him what I was doing and he immediately understood the elements that I was working with. We tried several things, like attaching the string to a piece of wood itself and we used vise grips to stop the string at different points and found that that actually changes the frequency; also we had some brass wire which produced a lower frequency — harpsichord makers use it to get a lower frequency. At the time I was using all steel wire. So all these characteristics that I wanted were covered in this one meeting and from that point on it was just a matter of fine tuning it you know, finding ways to use these answers.

Stroking a string excites the longitudinal mode of vibration. In a longitudinally vibrating string, the soundwave travels back and forth along the length of the string. The material the string is made of determines the speed of the wave. In tuning, only string length changes affect the frequency.

Plucking or bowing across a string excites the transverse mode. The length, thickness and tension are all factors in determining pitch in transverse vibration.

**Gordon:** How do you compose and notate your pieces?

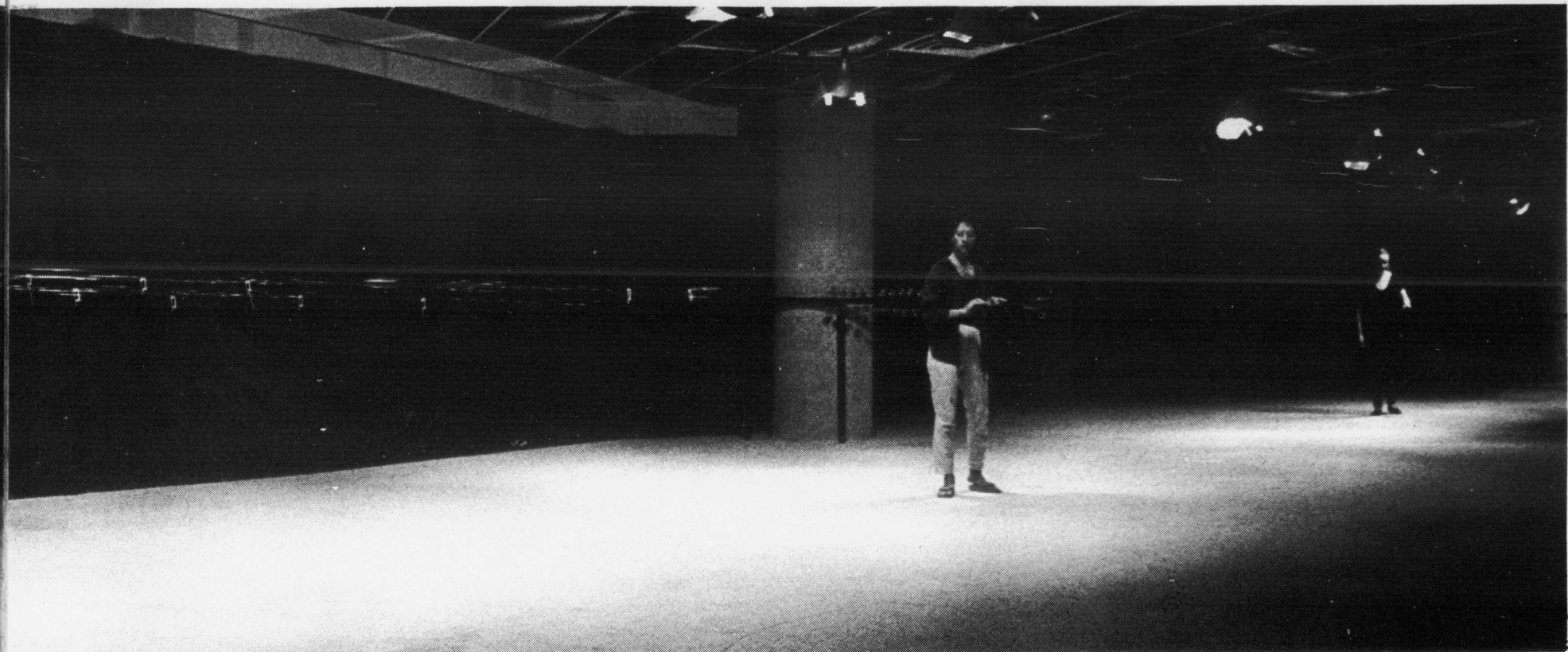
**Ellen:** I began right at the beginning with everything. It's like the instrument began out of noise-making and then the tuning system began with major chords. I learned the things step-by-step right from the simplest elemental place. So the composing began with a list of chords. What I did was I just blocked it out, since we play by travelling. We have to stroke the string and move; we walk towards and away from the resonator. This was a list of walking: maybe I would designate the amount of footsteps to walk out, and then move back in, change to a new chord, move out, move back in. That was the first composition. More recently I've gotten slightly more complex in that we are counting now and also designating a manner of touching the string. I use graphic symbols to indicate different ways of exciting the string, so we're getting a more varied texture than just a constant sustained tone.

**Gordon:** What are the different ways to excite the strings through touching?

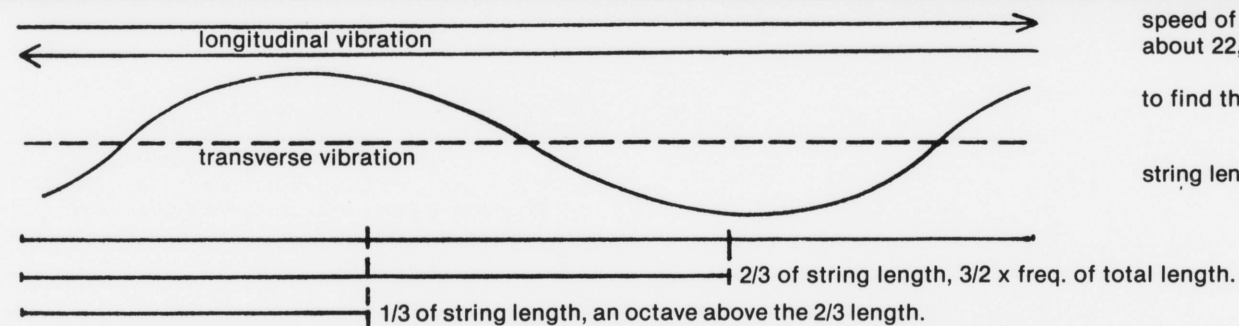
**Ellen:** Well for instance, one thing I call a *run-pulse*, which means that instead of using a constant pressure of the hands, it's squeezing, releasing, squeezing, releasing as we move. Another way of exciting the string is by keeping a constant pressure with one hand with a constant kind of pinch on the string, and then slightly beating it with the other hand. That's another way of getting a pulse but what's interesting is that with each tap of the hand different overtones are coming out because your position is different. The various overtones just ring out for a moment — clearly, like a bell. There are other ways but they're a little bit difficult to describe in words.

**Gordon:** Your instrument seems to draw attention to the relationship between gesture and music: from arm and body movements used to play most instruments to large, graceful movements of dance. In fact I noticed in your performance that you were even keeping step-time as you walked.

**Ellen:** That's right. I have to do that because it's necessary for me to count and I have to move my body to do so. I've always had a consciousness of this involving dance from the beginning. It's just that now it's getting more specific. At the beginning I wanted to make a physical gesture-sound and I was doing other things like making costumes



Ellen Fullman performs with Heloise Gold and Beverly Bajama.



speed of longitudinal wave through bronze wire is about 22,990 ft./sec.

to find the length for a given frequency:  $\frac{22,900}{\text{freq.}} = \text{length}$

string length is inversely proportionate to frequency.

that when you move it makes a sound. I was not a musician and I wanted to do things that were not virtuosic but rather used ordinary movements to make a sound. What I liked about the strings as they were developing is that ordinary movements could make a virtuoso kind of sound. You know, it's like a big kind of orchestral sound yet it's just a simple body movement producing it, although there is technique involved, more technique than I realised at first.

**Gordon:** It seems like a great deal of technique really, as much as any instrument, because of the delicacy of touch involved and the attention to pitch orientation of the strings. Does the ordering of the pitches change?

**Ellen:** Yes, that changes from piece to piece. I've found a kind of set-up that I can use for several pieces; a kind of more universal pitch arrangement. But the actual tuning is totally flexible; I could use any kind of system. Also, the other question is *where to put these strings*? You know, I'm not limited to putting them next to each other like in a chromatic scale; I can do any kind of layout that I need. I have some grouped together in chords so that the strings can be touched or grabbed with the flat of the hand, brushing across many strings at once to produce a big chord. The whole thing has been laid out in these groupings of chords so that I can just practically *bat-away* at the strings with the flat of my hand. Actually those kinds of rhythmic things work best with a shorter situation, more like 30 feet or something, and it starts sounding like a harmonica. But I can't sustain tones at that length because it's really piercing you know, it's really bright, so I pulse; I use a more pulsing kind of thing.

**Gordon:** When you talk about a 65 ft. string being in the Key of F, is that a fundamental pitch that we're hearing?

**Ellen:** It's the fundamental, but on top of that is the overtone series. The overtone series is *swept-through* as the performer moves from end to end. It sweeps down when you move towards the middle where it's at the fundamental, and then it starts sweeping back up.

**Gordon:** How much tension are the strings under?

**Ellen:** Each string is under about 15 pounds tension. They can't go any more than that or they'll

break; that's about the limit. But the tension has no bearing on the frequency produced — only the length determines that. That's another odd fact about this longitudinal mode.

**Gordon:** Do you break a lot of strings?

**Ellen:** Well I do, especially now that we're starting to play it more actively. You know, the first ways of playing were very gentle, it was just a stroking. Now, at some points, to get these loud bursts of sound we actually come down hard on the strings and lift the hand back up, which is really hard on them. I think that I can find ways to deal with that: one thing is using a larger diameter string; and there might be something to do with the vibration clamps, to somehow soften that so it's not so rough on the strings themselves.

**... because the instrument is so large, you feel like you're inside it. It's like you're walking along on a violin ...**

**Gordon:** In your performance the other night you had three other people with you playing the instrument. Do you always involve others in your performances?

**Ellen:** Actually, all of my performances have involved one other person. This composition list form I was telling you about was always a duet: each person playing two strings so we made four-tone chords. I've always had a dream with this instrument of forming a band, it's been a dream for a long time. Up to now it's been a slow accumulation of elements, of getting one problem solved after another, but now it's finally to the point where I can start involving other people. It's really important to me in that regard because I'm interested in a very big complex sound and one person can only really manipulate two or three strings at once; so it's really necessary to have some more hands in there.

**Gordon:** But you've also augmented your sound by adding another instrument. Could you describe it?

**Ellen:** The other instrument is the *Water Drip Drum*. I use the sound of water dripping as a percussion element. I've learned some things about water containers and I've found that it's possible to tune them, which I hadn't realised before. I tune the dripping to a frequency that I use in the strings, so I use it like a tuned drum.

**Gordon:** Could you describe the technical aspects of the instrument?

**Ellen:** I have a container of water above, which has miniature valves from a fish tank attached to it, so that I can control the rates of the dripping. So there's the possibility of a polyrhythm: slow and fast rates at the same time. And they drip into a container of water below. This container can be tilted, and the tilting tunes the drum. If a droplet falls on the bare metal container pan, it produces a *tinny* kind of sound; and if it falls into the pool of water, it's a rich low sound. So I get these different textures of sound happening simultaneously.

**Gordon:** And then I noticed that you've attached a bass drum pedal from a drum kit?

**Ellen:** That's right. This pedal is used to manipulate the angle of the pan, which changes the tuning. For example, as I was describing a droplet falling on metal being a *tinny* sound, well if the pan was tilted to a very far angle, I would get this very high sound, with some droplets falling into the water to produce a low sound as well; and if I tilt that angle so that the first droplet is now falling in the pool of water and the others are falling on the metal, well that changes where the high tone is. And there's all kinds of variations in between that.

**Gordon:** How many valves have you got?

**Ellen:** There are actually eight, so they produce a kind of random element which is different from a drum machine. I like the fact that I can get a random quality.

**Gordon:** yes. Listening to it the other evening, it seemed to take on a life of it's own; it sounded like a distant percussion group that was keeping a very intricate polyrhythm for you. And you had it amplified?

**Ellen:** Yes. I'm using a pick-up stuck to the bottom of this container of water and I'm putting it through a short delay. I'm using an *octaver* which will divide the frequencies and give me a lower sound mixed in. It's like a *chorus box*.