Alvin Lucier, "Music 109: Notes on Experimental Music,"
(Middletown, CT: Wesleyan University Press, 2012): 144–146.

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LONG STRING INSTRUMENT

Ellen Fullman said something beautiful about her piece, *The Long String Instrument* (1980). She said that the activity of its composition had become her personal music school. It led her to read and study as the information she sought got put to use in very practical ways, and that the piece is a microcosm for the history of music. Why did she say it's a microcosm of the history of music? One of the earliest examples of writing we've got about music is by Pythagoras, a mathematician in fifth-century B.C. Greece. He invented the monochord, a single string, which when plucked and bowed allows one to observe its modes of vibration. Pythagoras was interested in the nature of sound, making him the first experimental composer.

The first thing one observes is that the string vibrates as a whole. You can see it moving up and down its entire length. The sound it produces as it vibrates as a whole is the fundamental pitch. That's the tone you hear and identify. Its pitch is determined by the tautness, weight, mass, and length of the string. Any mechanical system that moves periodically faster than sixteen times a second makes a musical sound. The pitch of an organ pipe is determined by how long it is; the column of air is vibrating in that length. All things being equal the longer the vibrating medium, the lower the sound; the shorter, the higher. That's why the piccolo sounds higher than the tuba. At the same time the string vibrates as a whole, it vibrates in half, producing a sound an octave higher than the fundamental. The string also vibrates in thirds, fourths, fifths and so on. Each mode of vibration produces a tone that is heard at the same time as the fundamental, but so quietly that you don't hear it individually. You hear it as timbre. That's why musical sounds are so interesting and have such beautiful timbres, they're composed of so many overtones. At first, Ellen worked with long strings in a haphazard way, then she got interested in tunings and trying to figure out what the basic principles were. She was relearning the history of acoustics.

It's difficult to understand how something can vibrate in half at the same time it's vibrating as a whole and in thirds. It's hard to believe that strings vibrate simultaneously in all these ways. The overtones contribute to the timbre of the

sound. Just because I move my arm one way, doesn't mean my elbow can't be moving at the same time. There's a myth about basketball superstar Michael Jordan. Some people think that when he's in mid-air he can jump up even higher. That's why he's called "Air Jordan." But that's physically impossible. He would have nothing solid to jump against. They discovered that he simply changes his center of gravity. He can move his body while he's up in the air in a way that makes it seem as if he were jumping higher. Physical systems are hard to explain. Every physics book I've ever read never quite explains these things enough. How can you explain the magic of sound? Every model is too simple. I think the question has to do with whether there are certain innate properties, perhaps universal properties, that have to do with acoustics. I don't think that this phenomenon is ever adequately explained. It just happens.

Several years ago Ellen Fullman did a beautiful performance of *The Long String Instrument* in the old Field House at Wesleyan. She extended her strings all the way down the basketball court. Regulation length for a college court is ninety-four feet so her wire must have been close to that. The strings were tuned to sound boxes positioned under the baskets. During the performance she and an assistant walked forward and back down the court between the strings, stroking them with rosined fingers. The pitch stays the same no matter where they are on the wire but the timbre changes. She tuned the wires by putting clamps at certain points on the wire to shorten the lengths of the strings. It's similar to the way a violinist stops a string. Let's bow any open string. If you stop it with your first finger a perfect fourth above, it produces a harmonic two octaves higher because the sounding part of the string is shorter. A flutist, a wind player, will press a key down shortening the length of the air tube. A brass player does the same thing with valves.

The two performers slowly walked forward and backward as in a dream, stroking the strings on either side of them. Before the concert I asked her how long she was going to play and she said an hour. I thought that seemed too long, but it wasn't. Everyone was mesmerized.