

Meeting Hans Jenny

rev 1, 21 March 2023

In February 1972 I met Jenny, shortly before his death. This meeting had a profound effect on my career in mathematics. This is my story.

The lead-up

In the academic year 1971-72 I was a visiting professor at the University of Amsterdam, teaching catastrophe theory. At the same time, I had a visiting position at the Institut des Hautes Etudes Scientifiques (IHES) at Bures-sur-Yvette outside Paris. I used to commute weekly on the train, which I loved. At this time, IHES was newly formed, and had only two permanent professors, David Ruelle and René Thom, both of whom were superb. Thom was one of the great mathematicians of the 20th century, and had received the Fields Medal at the International Congress of Mathematicians in 1956 for his work in differential topology. I had met him in 1960 in Berkeley, where we began working together on the foundations of catastrophe theory.

Early in 1972, René and I were both stymied in our work and were browsing the borderlines of science looking for clues. On arriving at IHES one day, I asked René what he was working on. He pulled a book from his desk and began showing me photo after photo of familiar forms from nature: spiral galaxies, cell mitosis, sand dunes, and so on. These forms, he said, had been photographed in vibrating water. The book was *Kymatik*, or *Cymatics*, by Hans Jenny (1904 – 1972), a medical doctor from Dornach, a suburb of Basel, Switzerland. I was thunderstruck to see images from my meditations on the pages of a book, especially in support of

Jenny Memoire

the vibration metaphor of the Pythagoreans. I immediately called Jenny in Dornach, and he agreed to meet me.

The Anthroposophic ambiance

The Anthroposophy movement was founded by Rudolf Steiner (1861-1925), the esoteric Christian follower of the *Secret Doctrine*, the basic text of Theosophy, written by Madame Blavatsky around 1900. Among Steiner's contributions to alternative culture were eurythmy (harmonious movement, 1911), Waldorf education (1919), Anthroposophic medicine (1921), spiritual science (1923), and biodynamic agriculture (1924).

The meeting

I took the train to Basel, and was met at the station by Jenny's son-in-law, Christiaan Stutten, who drove me to Dornach. Along the way I learned that Dornach was the world headquarters of the Anthroposophy movement. Jenny was a follower of Steiner, and lived and practised medicine in Dornach. Jenny greeted me in his home, showed me part of his lab, and an animated film of some experiments in progress. I collected his papers and books and went home to Amsterdam, inspired.

The aftermath

In Amsterdam, while teaching catastrophe theory, I had time to carefully study the photos and English text of Jenny's first book, *Cymatics*. In the introduction, entitled Problems of Cymatics, he gives examples of periodic

systems in Nature, including: circulation, respiration, the heart beat, the nervous system, and the muscle system. It was clear from the start that Jenny's motivation came partly from his medical training.

Jenny followed in the footsteps of the cymatic pioneers:

- 1490, Leonardo da Vinci observed patterns formed in the dust on a tabletop on which he drummed with his hands.
- 1787, Ernst Chladni, the founder of acoustics, used patterns of sand (*Chladni patterns*) on vibrating glass plates to design better sounding glass harmonia.
- 1831, Michael Faraday observed standing wave patterns on the surface of beer on the tops of barrels being transported by a horse-drawn wagon.

Leaving Amsterdam in the Summer for India, I continued my learning and thinking about vibrations, and determined to begin a formal program of research on sound vibrations on returning to UC Santa Cruz in the Fall. I offered a seminar on vibration in Winter 1974, and began construction of a laboratory for vibrations in fluids, based on Jenny's lab, in the following Summer.

The Jenny Macroscopic at UCSC

With the aid of students from my UCSC seminar, I reproduced Hans Jenny's kymatic device in my lab. Our device was larger and less precise than Jenny's. We used a four-inch dish for the water/glycerol solution, four-inch telescope mirrors loaned by Lick Observatory, and a color Schlieren filter developed by Gary Settles. An analog electronic tone synthesizer was built especially for the device, and an

Jenny Memoire

industrial xenon arc lamp provided the illumination. When finished, I aligned the optics, approximating by eye, turned everything on, and glanced at the screen. I was astonished to see a perfect Jenny-style Chladni pattern, in full color. The experience overwhelmed me, and I retired to the corridor outside the lab to recover my composure.

An official opening was planned for the lab, renamed the JENNY FOUR-INCH MACROSCOPE, in July, 1974. On impulse, I asked my Indian music guru, S. D. Batish, to sing at the opening. We attached a microphone to the amplifier that vibrates fluid in the dish, in place of the pure tone generator. This event provided my first experience of visual music based on Chladni patterns, the essential forms of vibration in three dimensional media. It connected, all at once, my experience with Indian music, Thom's catastrophe theory, and the light shows of the Sixties. Math, music, mysticism — all are one!

Subsequently, we made systematic use of the instrument (with the tone generator, not my master's voice) to study the bifurcations of chaotic motions of vibrating waves until 1979.

The experimental arrangement for the study of Faraday crispations is shown in the figure. An electrical wave delivered to a transducer (loudspeaker) creates a sound wave in the air beneath a plastic plate, inducing and maintaining a pattern of vibration. This in turn activates a related pattern of vibration in the thin layer of liquid resting on the plate, and thus a pattern of greg vortices in the layer of air over the plate. Air, plastic, liquid, air: four layers of coupled pattern formation processes.

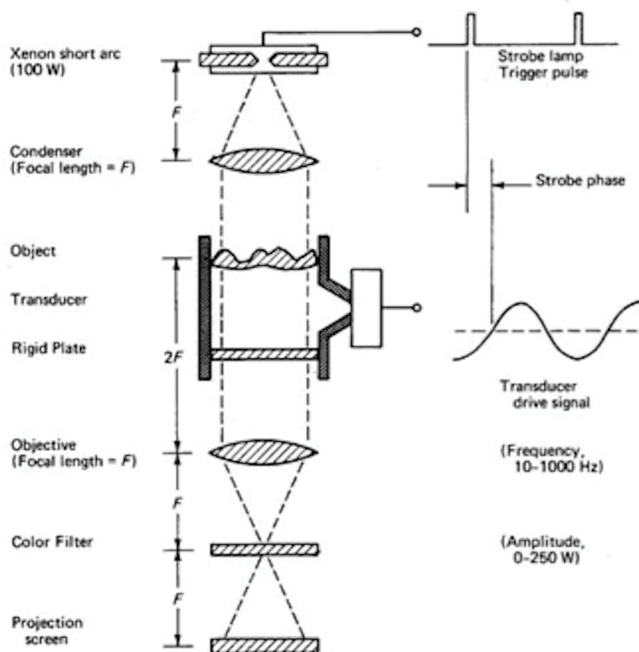


FIGURE 6.1. Schematic view of the four-inch macroscope of the University of California, Santa Cruz. (Diameter, 4 in.; F , 48 in.)