

# Cymatics

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**Cymatics** (from κύμα "wave") is the study of visible sound and vibration, a subset of *modal phenomena*. Typically the surface of a plate, diaphragm, or membrane is vibrated, and regions of maximum and minimum

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*Kunstformen der Natur* (1904) by Ernst Haeckel

displacement are made visible in a thin coating of particles, paste, or liquid. Different patterns emerge in the excitatory medium depending on the geometry of the plate and the driving frequency.

The apparatus employed can be simple, such as the old Chinese spouting bowl, or Chinese singing fountain, in which copper handles are rubbed and cause the copper bottom elements to vibrate. Other examples include the Chladni Plate and the CymaScope.

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# Etymology

The generic term for this field of science is the study of *modal phenomena*, retitled Cymatics by Hans Jenny, a Swiss medical doctor and a pioneer in this field. The word *Cymatics* derives from the Greek 'kyma' meaning 'billow' or 'wave,' to describe the periodic effects that sound and vibration have on matter.

## History

On July 8, 1680, Robert Hooke was able to see the nodal patterns associated with the modes of vibration of glass plates. Hooke ran a bow along the edge of a glass plate covered with flour, and saw the nodal patterns emerge.

In 1787, Ernst Chladni repeated the work of Robert Hooke and published "*Entdeckungen über die Theorie des Klanges*" ("Discoveries in the Theory of Sound"). In this book, Chladni describes the patterns seen by placing sand on metal plates which are made to vibrate by stroking the edge of the plate with a bow.

Throughout the 1960s, up until his death in 1972, Swiss medical doctor and Anthroposophist, Hans Jenny took a methodological and exhaustive approach to documenting Cymatic phenomena. He coined the term "Cymatics" in his 1967 book, *Kymatik* (translated *Cymatics*) Inspired by systems theory and the work of Ernst Chladni, Jenny delved deeply into the many types of periodic phenomena but especially the visual display of sound. He pioneered the use of laboratory grown piezoelectric crystals, which were quite costly at that time. Hooking them up to amplifiers and frequency generators, the crystals functioned as transducers, converting the frequencies into vibrations that were strong enough to set the steel plates into resonance. He made the resultant nodal fields visible by spreading a fine powder lycopodium spores of a club moss, as well as many other methods and materials. He documented much of his work in still photos which were compiled into two volumes published in 1967 and 1972, and republished in 2001 as a single hardcover edition (see above reference). He also documented his experiments in 16mm films which have since been re-released on a DVD entitled Cymatic SoundScapes: Bringing Matter to Life with Sound.

## Influences in art

Hans Jenny's book influenced Alvin Lucier and, along with Chladni, helped lead to Lucier's composition *Queen of the South*. Jenny's work was also followed up by Center for Advanced Visual Studies (CAVS) founder György Kepes at MIT. His work in this area included an acoustically vibrated piece of sheet metal in which small holes had been drilled in a grid. Small flames of gas burned through these holes and thermodynamic patterns were made visible by this setup.

In the mid 1980s visual artist, Ron Rocco who also developed his work at the Center for Advanced Visual Studies (CAVS) employed mirrors mounted to tiny servo motors, driven by the audio signal of a synthesizer and amplified by a tube amp to reflect the beam of a laser. This created light patterns which corresponded to the audio's frequency and amplitude. Using this beam to generate video feedback and computers to process the feedback signal, Mr. Rocco created his "Andro-media" series of installations. Rocco later formed a collaboration with musician David Hykes, who practiced a form of Mongolian overtone chanting with The Harmonic Choir, to generate cymatic images from a pool of liquid mercury, which functioned as a liquid mirror to modulate the beam of a HeNe laser from the sound thus generated. Photographs of this work can be found in the Ars Electronica catalog of 1987.

Contemporary German photographer, philosopher and Cymatic researcher, Alexander Lauterwasser has brought the work of Hans Jenny into the 21st century using finely crafted crystal oscillators to resonate steel plates covered with fine sand and also to vibrate small samples of water in Petri dishes. His first book, *Water Sound Images*, translated into English in 2006, features imagery of light reflecting off of the surface of water set into motion by sound sources ranging from pure sine waves, to music by Ludwig van Beethoven, Karlheinz Stockhausen, electroacoustic group *Kymatik* (who often record in surround sound ambisonics), and overtone singing. The resulting photographs of standing wave patterns in both sand on steel plates and standing wave patterns in water, are striking. In this book, Lauterwasser particularly

focused on creating exquisitely detailed visual analogues of patterns found in nature, ranging from the distribution of spots on a leopard, to the geometric patterns found in plants and flowers, to the shapes of jellyfish, and most amazingly, the intricate patterns found on the shell of a tortoise.

Composer Stuart Mitchell and his father T.J. Mitchell claim that Rosslyn Chapel's carvings contain references to Cymatics patterns. In 2005 they created a work called *The Rosslyn Motet* realised by matching Cymatics/Chladni patterns to the 13 geometric symbols carved onto the faces of 213 cubes emanating from 14 arches. Like many claims in the cymatics community, the hypothesis that the carvings represent Chladni patterns is not supported by scientific or historical evidence. One of the problems is that many of the 'box' carvings are not original, having been replaced in the 19th century following damage by erosion.

Artist Björk created projections of cymatical patterns in collaboration with Evan Grant by using bass frequencies on the tour for her album *Biophilia* by . Evan Grant has also given lectures and talks on the subject of cymatics for among other TED talks and Wired 2013.

Artist Nigel John Stanford creates electronic music with cymatics videoclips.

## Influences in engineering

Inspired by periodic and symmetrical patterns at the air-liquid interface created by sound vibration, P. Chen and coworkers developed a method to engineer diverse structures from microscale materials using liquid-based templates. This liquid-based template can be dynamically reconfigured by tuning vibrational frequency and acceleration.

## See also

- Cymatic therapy
- Oscillon
- Music visualization
- Visual music
- Sand art and play
- Patterns in nature

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