

de Cheveigné, Alain. "Pitch Perception Models."

i. the definition of pitch

The task of defining pitch is a difficult one, and de Cheveigné himself introduces the efforts he explains in the paper as "models and metaphors that we use to *make progress* in understanding pitch" (*italics mine*). But, were one pressed to answer, there are several routes one could take:

- 1) quoting de Cheveigné: "Pitch-evoking stimuli usually are periodic, and the pitch usually is related to the period."
- 2) de Cheveigné quotes the American National Standard Institute, which defines pitch as "that attribute of auditory sensation in terms of which sounds may be ordered on a scale extending from low to high," but he notes that this definition "doesn't mention the physical characteristics of the sounds." de Cheveigné classifies this as a "psychological" definition.
- 3) de Cheveigné mentions that AFNOR (the French equivalent of ANSI) "adds that pitch is associated with frequency and is low or high according to whether this frequency is smaller or greater." de Cheveigné classifies this as a "psychophysical" definition.
- 4) de Cheveigné notes that these definitions, in their assumption of "a single perceptual dimension," are limited to pure tones where "other perceptual dimensions such as brightness might exist, but they covary with pitch."
- 5) In other circumstances, for instance formant signals, the perceived dominance of the periodicity pitch (F0) or the spectral pitch is listener dependent.
- 6) de Cheveigné concludes that "the pitch attribute is thus more complex than suggested by the standards, and further complexities arise as one investigates intonation in speech, or interval, melody and harmony in music."

ii. place theory

The monochord of Pythagoras "is an early example for psychophysics, in that a perceptual property (musical interval) is related to a ratio of physical quantities. It is also an early example of a model." Aristoxenos, Arab music theorist Safi al-Din, Marin Mersenne and Galileo Galilei all dealt with pitch in their own way, either theoretically, in definition, or through experimentation. According to de Cheveigné, Du Verney "offered the first resonance theory of pitch perception," in his idea that the spiral lamina in the human ear acted as resonators for sound, and different parts of it corresponding to different musical sounds (something de Cheveigné refers to as "selective response."). These ideas lead directly to the "concept of tonotopic projection to the brain." The cochlea filters audio using a comb effect, in their case "narrow at low frequencies and wide at high," with "teeth" at multiple fundamentals. de Cheveigné states, "Rather than combs with sharp teeth, other regular patterns may be used, for example, sinusoids."

iii. time theory

Once again, the Pythagorean school was on top of it, early on (in the second century), theorizing that pitches were composed of not one sound, but many percussive sounds encompassing each other to such a degree that “no interval of silence is perceived, and it comes to the ears as if one pitch.” However, these early thinkers “did not clearly distinguish between rate of vibration, speed of propagation, amplitude of vibration, and the speed (or rate) at which one object struck another to make a sound.” Still, they were exploring the relationship between pitch and pulse, which is the essence of time theory. Additionally, “the notion of overlap between successive elementary sounds prefigures the concept of impulse response and convolution.