

The Secret of Supertweeters

is that they present very high frequency sound in a coherent manner, so that your senses receive the high frequency content that is 'hidden' in most playback systems but which are essential to create the ultimate acoustic reproduction from all studio and live recordings.



Coherent high frequencies affect the brain both **physiologically** and **psychologically**.

'**The hypersonic effect**' a phrase coined by Tsutomu Oohashi [1], a Japanese scientist and musician and used to describe the effect of high frequency components on the brain's activity using EEG monitoring. In short, listeners hearing music with high frequency content in combination with low frequency content, much preferred the music with the high frequency content.

You can read the full research of this projects at:
<http://jn.physiology.org/content/83/6/3548.full>
http://www.tinnitusjournal.com/detalhe_artigo.asp?id=109

1. Oohashi T, Nishina E, Honda M, et al. Inaudible high frequency sounds affect brain activity: Hypersonic effect. J Neurophysiol 83(6): 3548-3558, 2000.
 2. Lenhardt ML. EYES as Fenestrations to the Ears: A novel mechanism for high-frequency and ultrasonic hearing. International Tinnitus Journal, vol 13,1,3-10 2007.

Research by Professor Martin Lenhardt introduced a radical concept that describes **how acoustic energy that passes through the eye may also serve as a source of auditory perception:**



*"Clearly, the eye, with its ultrasonic pass band of 25-60kHz, could transmit energy from instruments with ultrasonic energy, e.g. cymbals, and serve as an acoustic window to the ear via the intracranial soft tissues. The frequency response is in the low ultrasonic range, and this type of hearing is termed **eye conduction** (see graph below). Auditory and vestibular coding is postulated...this could explain the perplexing phenomenon that ultrasonic energy influences judgment of music quality that induces changes in electro-encephalographic and positron emission and would activate both the auditory thalamus and other nuclei in the auditory pathway."*[2]
"In regard to music recording and reproduction, more than doubling the sampling rate (96kHz/24bits) will extend the audible frequency range that can be coded on the eighth nerve and will result in a gain in linearity and reduction in quantizing errors, factors that will improve music quality."

Professor Lenhardt's mentioned phenomenon describing the eye as the ultrasound ear seems to make sense.

A recent experiment to try to verify this was done with a young concert pianist who wore glasses. We played a modern SACD piano concerto and we asked her to take her glasses off to see if there was any change in the sound. She was shocked to be able to hear the performance more intimately without the glasses, which she much preferred.

Supertweeters alone are barely, if at all audible when played on their own. It's when they are added to the main body of the sound, that their effect becomes unmistakable, even for people with age related hearing loss. All listeners describe the same effect.

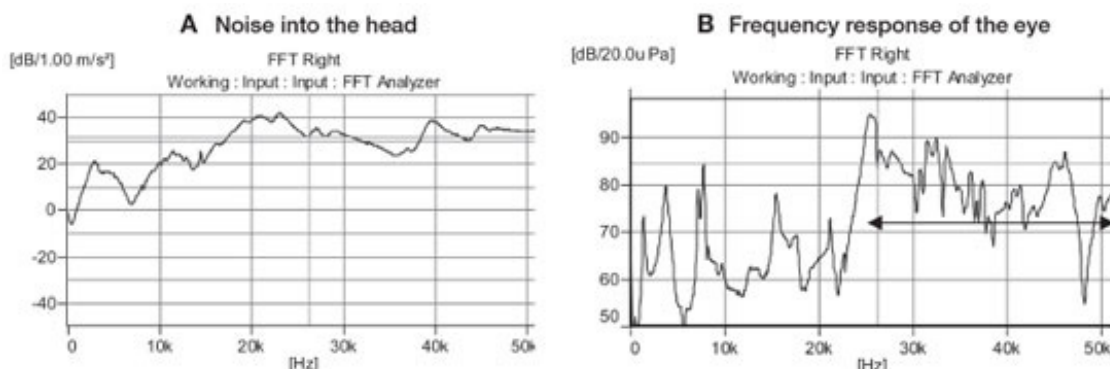


Figure 1. Ultrasonic skull-brain stimulus, eye response. (A) Noise spectrum delivered to the head. (B) Transfer function of the eye. The effective band of eye frequency response is from 25 to approximately 60 kHz (double-headed arrow). Both graphs are referenced to acceleration at 1 m/s².