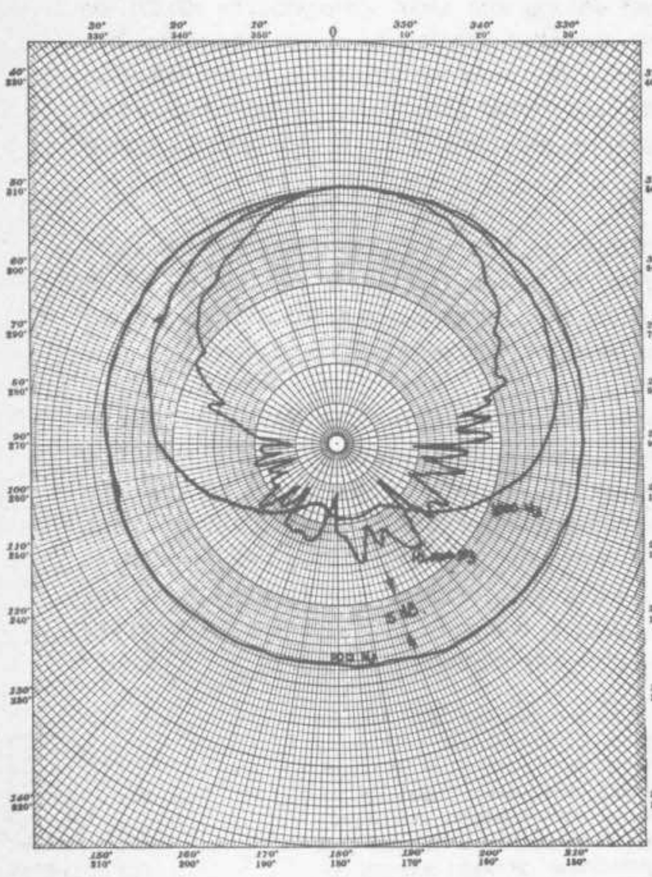
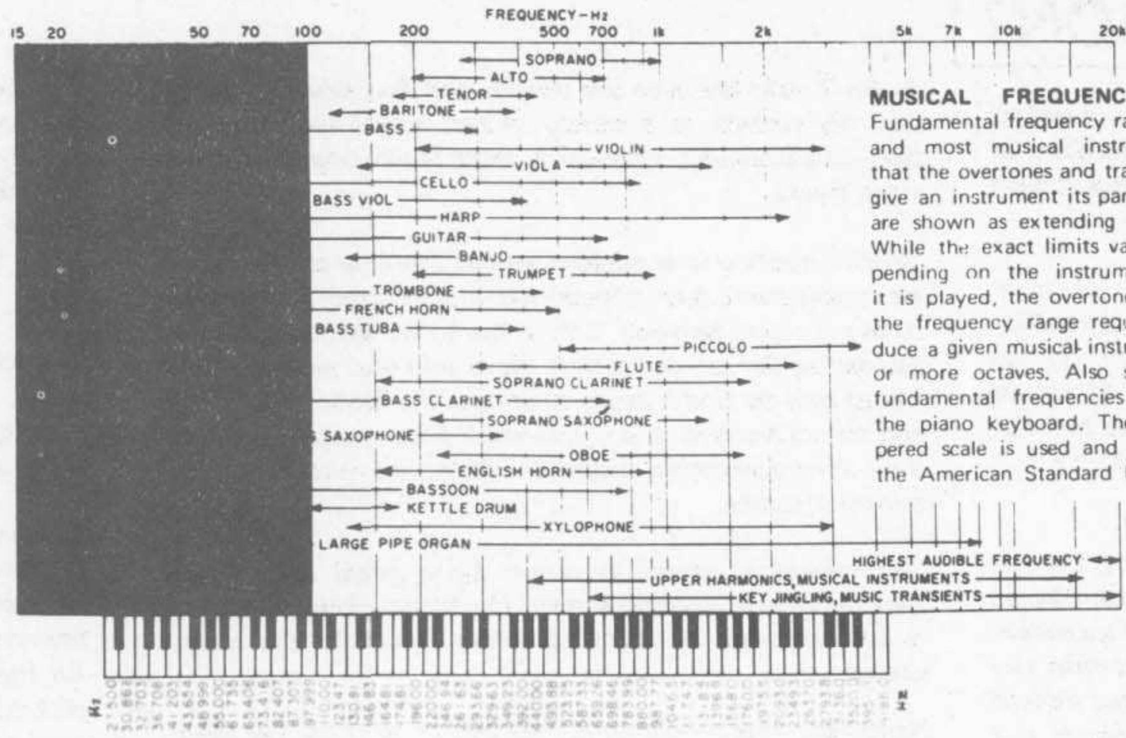
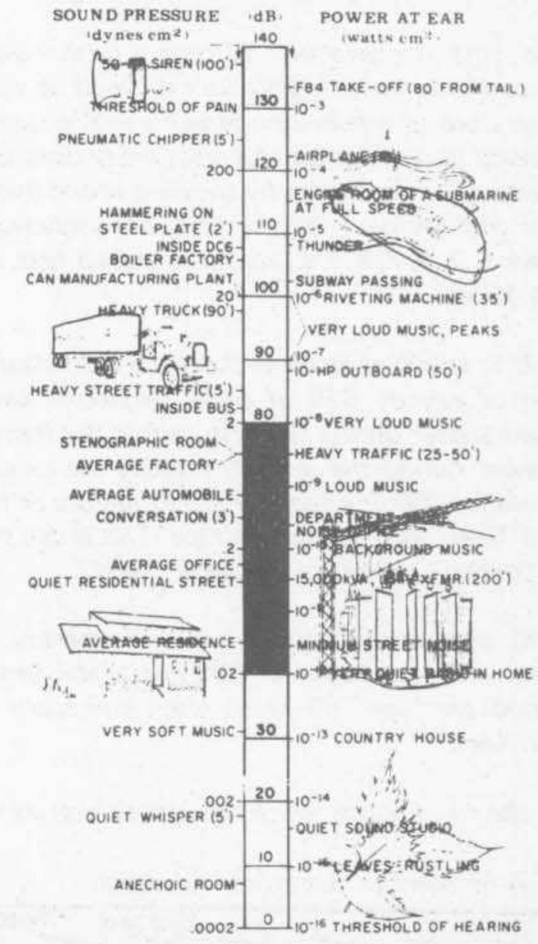


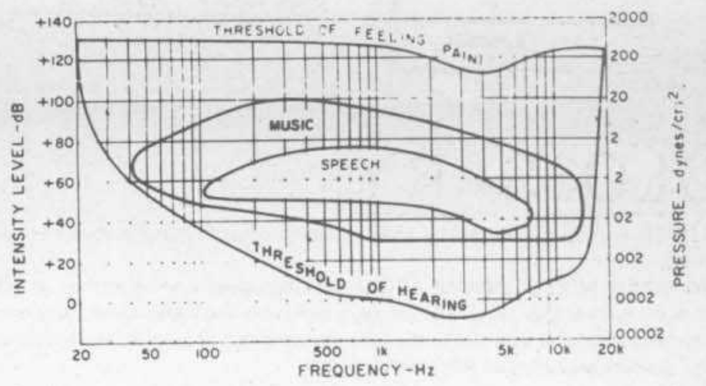



**MUSICAL FREQUENCY RANGES.** Fundamental frequency ranges of voices and most musical instruments. Note that the overtones and transients, which give an instrument its particular timbre, are shown as extending to 20,000 Hz. While the exact limits vary widely, depending on the instrument and how it is played, the overtones may extend the frequency range required to reproduce a given musical instrument by two or more octaves. Also shown are the fundamental frequencies for notes on the piano keyboard. The equally tempered scale is used and it is based on the American Standard Pitch (A=440).

# SOUND




**RELATIVE SOUND LEVELS** Some of the most common sounds and noise—from the threshold of hearing out to beyond the threshold of pain.




## MICROPHONES

Much of the information here was obtained from the *Sennheiser micro-revue* 69/70 and friendly assistance from one of their personnel at Sennheiser Electronic Corp., 10 West 37 Street, New York 10036, Tel. LO4-0433.

*SOUND in physical terms means vibration of air particles, small fluctuations of air pressure which spread like waves from a source of sound. A space in which this is occurring is referred to as a sound-field. It is the purpose of a microphone to convert sound-waves into electrical energy. The quality of a microphone is its ability to effect this conversion accurately.*

*DYNAMIC CONDENSOR*
*omnidirectional*
*cardioid*
*unidirectional*

*A DYNAMIC microphone is basically a small loudspeaker designed to work in reverse. It consists of a magnet, a coil and diaphragm. The coil moves and produces an inductance; therefore producing a signal that can be fed directly into an amplifier. It needs no current and has a narrow frequency range. Sensitive to Sound. Good Fidelity. Relatively Low Cost. Can withstand high sound pressure levels. PROBLEM: Any microphone has frequencies at which its diaphragm prefers to vibrate. The favored frequency in a dynamic microphone usually lies in the middle of the audio range. When the microphone picks up the favored frequency from a sound source, the resonance of the diaphragm will emphasize that frequency and the overall frequency response will be uneven. The trick is to compensate for that condition. This is accomplished with dynamic microphones with greater and lesser success.*

*The FREQUENCY RESPONSE of a microphone includes two characteristics: the range of frequencies the microphone can reproduce, and how evenly it reproduces them.*

*The QUALITY of a microphone is determined by its capacity to convert sounds into electrical vibrations equally well, over the whole audio spectrum. The pitch of a sound, its frequency, is measured in hertz (Hz) = cycles per second. The higher the pitch, the higher is the frequency. The human ear can perceive sound vibrations from approximately 16 Hz up to 15,000 Hz.*

*The IMPEDANCE of a microphone is a measure of its total resistance to the flow of both direct and alternating electrical current, as measured in ohms usually at a frequency of 1,000 Hz.*

*Low IMPEDANCE ranges from about 30 to 600 ohms. It permits a microphone to be used with a long cable—from about 200 feet to perhaps several hundred feet.*

*At HIGH IMPEDANCE a microphone begins to lose treble at cable lengths over about 20 feet.*

*You can change the impedance on most microphones by making a simple change in a soldered connection, rotating the plug or changing a pair of connections inside the microphone.*

*All low-impedance microphones have balanced output connections. That means there are two signal wires and one ground wire.*

*The SENSITIVITY of a microphone is a measure of its capacity to translate acoustical sounds into electrical impulses/ or/ a measure of its electrical output for a given sound-level input; the higher the sensitivity, the greater the output for a given input.*

*The purpose of a DIRECTIONAL microphone is to suppress unwanted sounds. The Directivity is a measure of the relative sensitivity of a microphone for sound approaching it at varying angles. The response pattern varies with frequency. The directivity index is related to acoustical power, and the acoustical power decreases as the square of the speaking distance.*

*A CONDENSOR or CAPACITOR microphone has two main parts: (1) a condensor element which receives sound waves and transmits to a coil, (2) oscillator circuit which produces high frequency. Audio is transformed to high frequency to amplifier then to another amplifier. Needs current and has a wide frequency range. It has a thin, tightly stretched diaphragm that resonates outside the major part of the audio spectrum so that no one major frequency is given a boost.*

*An OMNIDIRECTIONAL microphone picks up sound from all directions. Uses: Conferences, Record Music, Chorus or Orchestra. However, it may pick up unwanted sounds in some locations.*

*The UNIDIRECTIONAL microphone is more sensitive to sound from certain directions. Uses: Public Address, Pinpoint Soloists. It can minimize the pickup of background noise and tame reverberation.*

*The CARDIOID microphone has the acceptance pattern of a kidney and picks up direct, not too distant, sounds. It has a maximum sensitivity in the forward direction with a minimum pick-up of random sounds reflected from the walls of a room. Uses: Pin-pointing short distances—cuts out surrounding noises.*

*HIGH FIDELITY results mainly from two factors. (1) Range of frequency response (ideally should encompass the whole audio-frequency band—at least 50 to 15,000 Hertz). Smoothness with which the microphone reproduces the various tones.*

*The purpose of a WINDSCREEN is to lower the microphone's wind susceptibility and, in some cases, its pop susceptibility. Wind blowing over a microphone may produce a bassy rumble. A foam-rubber or foam-plastic windscreen will usually reduce this rumble considerably.*

*PROXIMITY EFFECT When the sound source is within two feet or less of a microphone, there may be a boosting of the bass called proximity effect. Unidirectional microphones often have that characteristic, while omnidirectional microphones do not.*

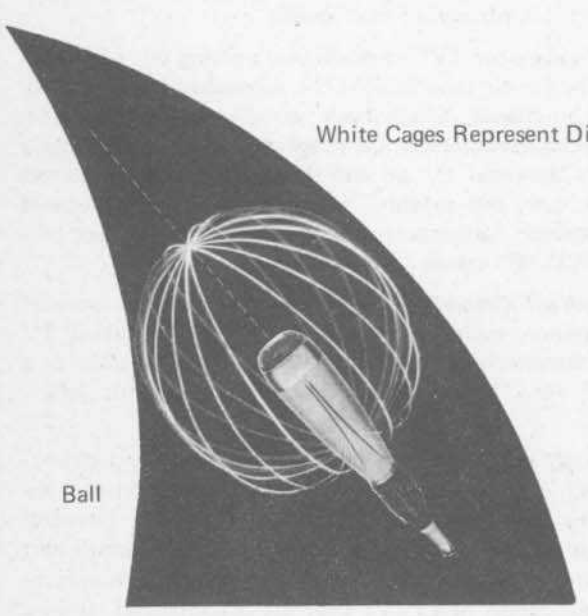
*CRISPNESS EFFECT A high frequency response that is undesirable for fidelity in recording music, but for speech it can be a virtue because much lack of speech intelligibility in noisy situations is due to relatively weak high frequency components in sibilants and other consonant sounds.*

*WIND blowing over a microphone may produce a low, rumbling sound that can be very undesirable, especially if you have an audio system that reproduces low bass well.*

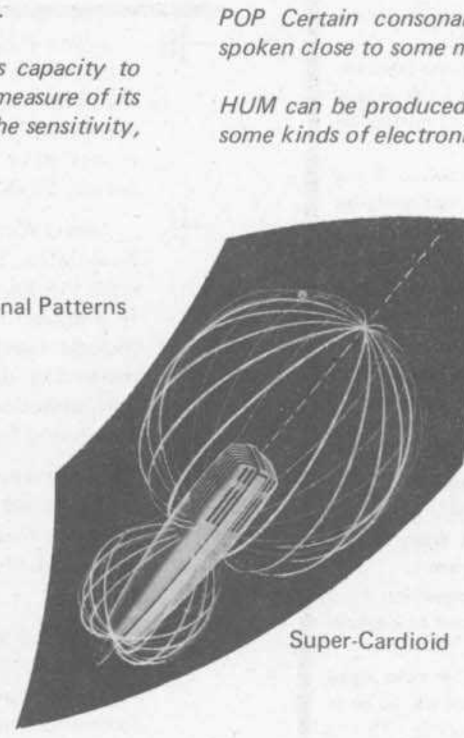
*POP Certain consonant sounds such as "p," "ch" and "k," when spoken close to some microphones, produce a thumping sound.*

*HUM can be produced by nearby power lines, by transformers and by some kinds of electronic equipment.*

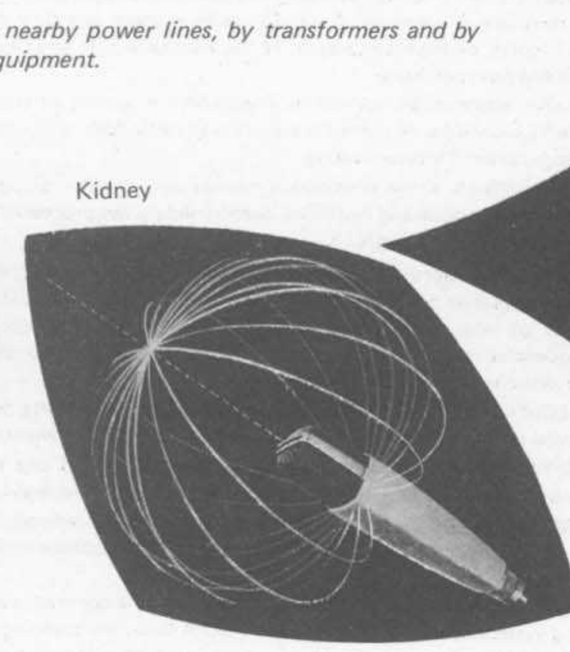
White Cages Represent Directional Patterns



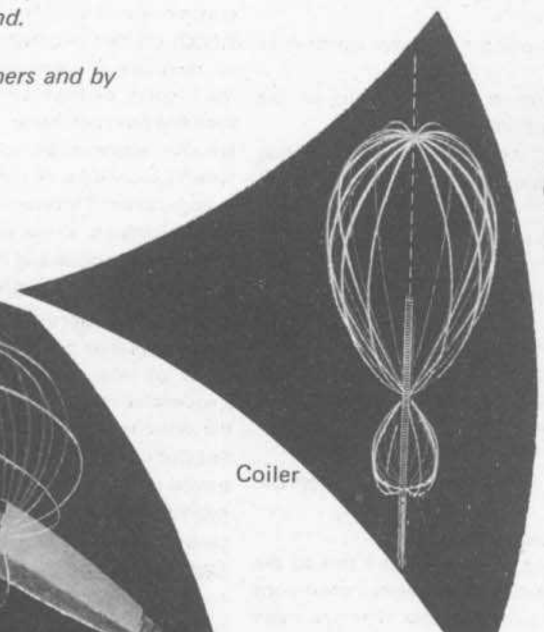
Ball



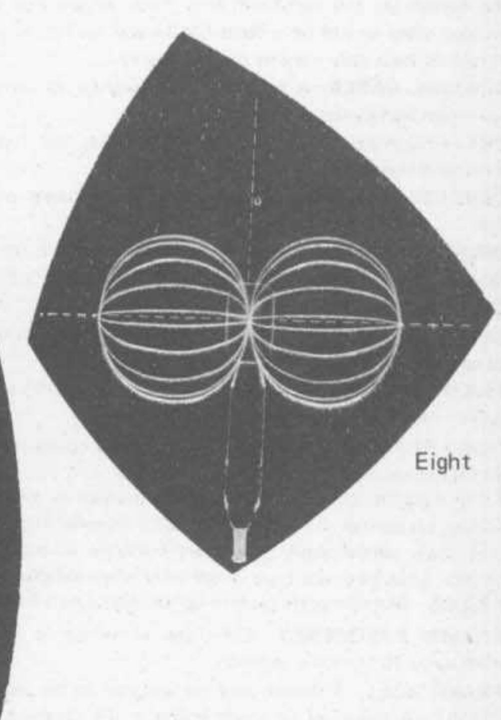
Super-Cardioid



Kidney



Coiler



Eight