Noise Pollution

Noise Levels

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We're going to look at several sources of noise pollution. To start with though, we'll look at the common receiver, the ear.

Imagine a device that has to weigh a flea on one hand, and an elephant on the other. We'd need something capable of extreme sensitivity, yet at the same time extremely rugged. This is what we expect of the human ear. The ear detects sound intensity, which we measure in watts per square metre. At the two ends of the sound intensity scale, we can cope with the sound intensity of one watt per square metre. Quite a loud sound on one hand, and a million millionth of a watt per square metre, the minutest sound on the other. A million millionth of a watt per square metre, is a sound intensity which might just be detectable to the human ear. A sound intensity a thousand times greater than that, is what we might find in a quiet bedroom. Ten times noisier, a quiet office. and ten times noisier still, a conversation at about a metre's distance, the sort of level you're hearing me at now in fact. Already ten million times louder than the original threshold sound. A vacuum cleaner three metres away, an alarm clock one metre away. A road drill seven metres away. A very noisy factory. A submarine engine room. and a hundred times greater still, twenty five metres away from a jet aircraft taking off. This range is vast, in fact to show it all at once we need a TV screen of cosmic proportions. For each of the steps in loudness that you've seen, the sound intensity increases by a factor of ten. In other words the ear's response is non linear, or logarithmic. So it's more convenient to use a different scale, one based on this logarithmic characteristic, the decibel or dB for short. An alarm clock one metre away. A road drill seven metres away. A very noisy factory. A submarine engine room, and a hundred times greater still, twenty five metres away from a jet aircraft taking off. It's these really loud sound levels that cause most problems for our hearing. The outer ear collects sound waves, and directs them via the ear canal onto the eardrum. Like all drums it vibrates, and these vibrations are picked up by three bones, the malius the incus and the stabese. These are the smallest bones in the human body, they're more commonly known as the hammer anvil and stirrup. These three bones in turn vibrate the cochlea, where they're converted to nerve impulses, which then travel along the auditory nerve to the brain. So, how does our hearing become damaged. The answer lies deep within the cochlea. Attached to the auditory nerve are some twenty five thousand receptor cells, each of these cells is covered in tiny hairs. It's these hairs which response to the movement of sound waves. As you might imagine, the process is complex. The nearest analogy is the behaviour of trees in the wind. When the sound is loud, the hairs are blown backwards and forwards. If it's very loud, they're blown right over. The result of all this violent activity is damage to the receptor cells. The cell's response, is to repair themselves, but in so doing they tend to fuse together. With fewer hair cells to detect the incoming sound waves, our ability to hear is diminished. Loss of hearing may only be temporary, it depends on the level and length of exposure. But, unlike these trees, damaged hair cells will not regrow. So once the ability to hear has gone, it's gone forever.