Pitch and frequency

Clip: T234_05_clip1

Transcript:

Professor Keith Attenborough

The frequency of those progressive waves that you hear is much higher, something of the order of hundreds or thousands of cycles per second. The number of cycles per second is measured in hertz, so we're talking about hundreds or thousands of hertz. And of course, the frequencies vary all the time.

That's my voice you're looking at right now, a continuous varying of the pressure.

But now let's look at a pure tone.

Steadily increase the frequency...

And the pitch of the sound goes up. But in what way? Can we describe the relationship between pitch and frequency?

We come back again to the subjective. Listen to this.

Those three notes are a musical octave apart. In musical terms, they're equal intervals apart. But what would you say about their frequencies?

For each octave, we've increased the frequency by a factor of 2. What we heard as equal intervals have produced frequencies that are arithmetically double and four times the one we started with. One thing is certain: the ear is not linear in its response to frequency.

But noise is not made up of sweet, pure tones – anything but. Noise is almost by definition a jumble of many frequencies. But the factor most influencing how we perceive noise and how it can damage our hearing is loudness.

It's easier to see the effects of loudness with a pure tone. Look what happens to the pressure as I increase the volume.

Now, sound is a form of energy transfer. How much energy is transferred per second – or power – is measured in watts. Sound intensity is measured in watts per square metre.

So, what sort of sound intensities are our fragile ears expected to cope with? Well, it turns out in energy terms they don't seem that fragile. Imagine an instrument that has to weigh a flea on one hand, and an elephant on the other. What you'd require is an instrument of extreme sensitivity on one hand, and extreme ruggedness on the other. Well, that's what we expect from our ears. This means, not surprisingly, that they are very non-linear. We can cope with very low-intensity sounds, as well as pretty loud ones.