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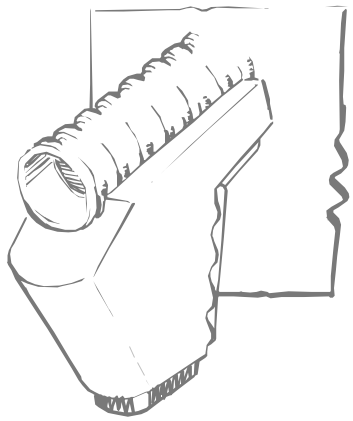


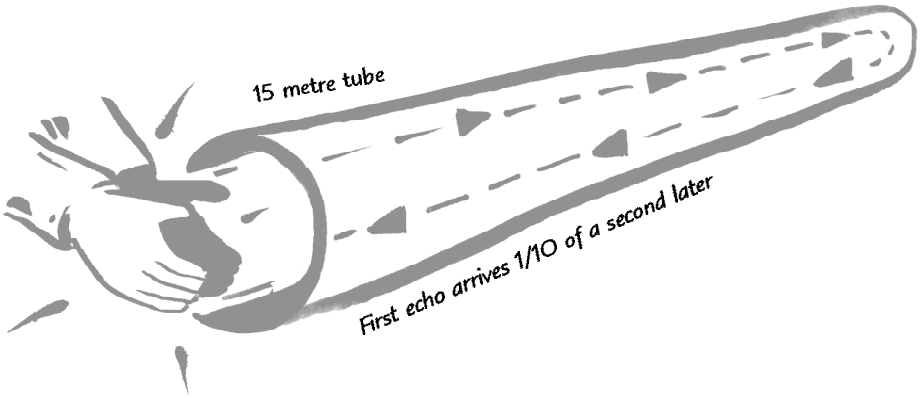
Echo Tube

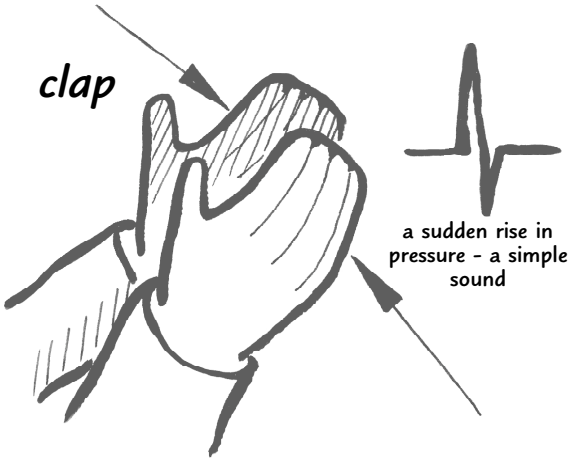
What to do: Clap your hands together or shout near the end of the tube.

What happens: You hear several echoes of the sound, each echo fainter than the previous one.

HOW IT WORKS

1. When you clap your hands, you suddenly compress the air between your hands. This compression travels through the air and when it reaches your ear, makes the ear drum move.
You hear this as a sudden loud noise - a sudden compression is the simplest sound you can have!



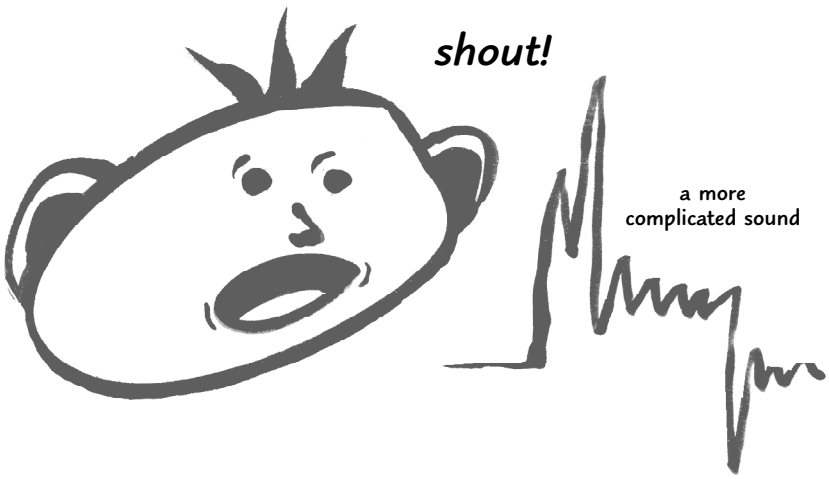


2. When you clap near the end of the tube, part of the compression in the air goes down the tube. When it gets to the other end, the compression bounces off the closed end of the tube and comes back again. When this arrives at your ear, you hear the first echo.

3. The tube is about 15 metres long, so the trip down the tube and back takes about 1 tenth of a second, because sound travels at about 300 metres per second through the air in the tube.

magnifying glass

Looks all white to me!

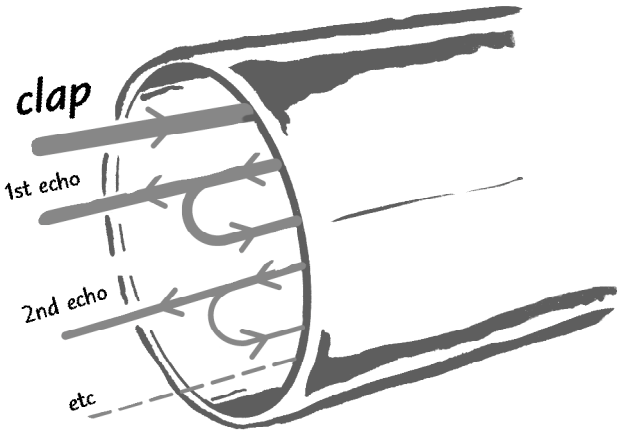


4. If you shout instead of clapping, the sound is more complicated than a single compression, but travels at the same speed, so you can also hear a shout echo after one tenth of a second.

5. When this first echo gets back to the open end of the tube, part of the sound gets reflected back again to produce another echo. This seems perplexing, because there is nothing obviously there to cause reflection. However, the sound travels faster as it comes out of the tube into the open air, and it is this speed change that always sets up a reverse wave as well as the forward one.

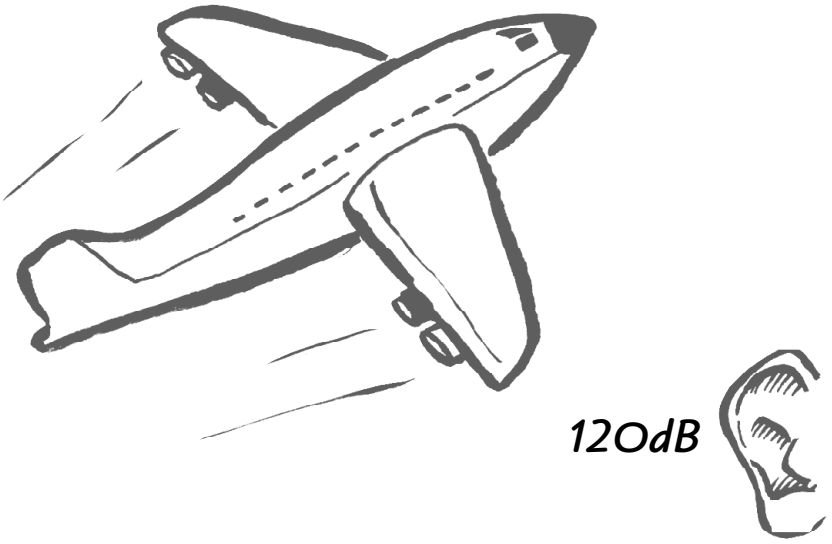
6. This process gets repeated every time the sound comes back to the open end: most of the wave comes out, but part of it gets reflected back. This is why you hear a sequence of echoes at intervals of a tenth of a second.

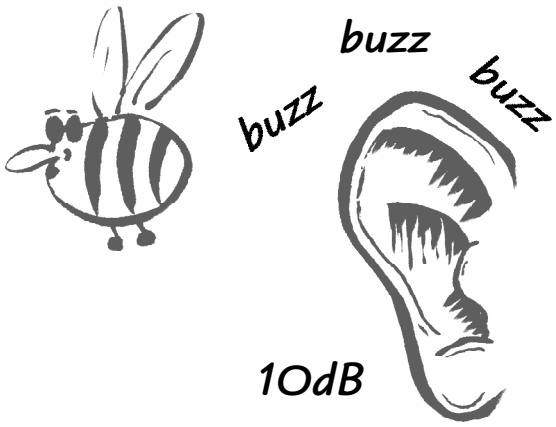
7. Each echo is softer than the previous one because only a small proportion of the sound energy gets reflected at the open end to produce the next echo.



DID YOU KNOW?

- *About 10% of the sound reflects back at the open end and you can hear about 8 echoes before they are too quiet to hear. This means that the quietest sound you hear is 100 million times quieter than the original sound entering the Tube!* (10% of 10% repeated eight times makes 100 millionth).





- *The human ear can hear an even greater range of sound intensities than this - if the original sound were as loud as we could bear, we would hear about 12 echoes.*

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