Echo tube

More Details

What's behind it

Clapping compresses the air between your hands, accelerating the air particles. Since the neighbouring air particles cannot escape quickly enough, they are compressed. This is followed by a dilution of the air particles because the number of particles remains the same. This creates a wave that travels from air layer to air layer through the tube, whereby the individual air particles only vibrate in their place. When a flap is closed, air particles hit its hard, smooth surface – and are thrown back (=reflected). The sound wave travels back as an echo.

When the flaps are open, some air particles swing out over the tube's end and leave it. This creates a temporary negative pressure that sucks other air particles into the tube. The new game of compression and dilution leads to a new but weaker sound wave that spreads in the opposite direction – and which you hear as an echo. The process repeats itself several times so that you can hear multiple echoes until the echo is too quiet for your ears to hear.

From clapping to howling

Did you notice that the echo sounds like a howl? Why is that?

Sound travels in all directions and therefore enters the tube at different angles (Fig. 1 (a)). The most direct path is through the tube's middle. The echo comes back the same way from the end of the tube. Since this is the shortest path, the sound takes the least time. The sound waves entering the tube at an angle hit the wall at different angles and are reflected with varying frequency: the more oblique the

angle, the more frequently – and the longer the sound waves travel through the tube. Thus, the echo of the sound wave that enters the tube at the most oblique angle is the last to return. Thus, the echo of the sound wave that enters the tube at the most oblique angle is the last to return. The original clapping is distorted as a stretched echo (Fig. 1 (b)).

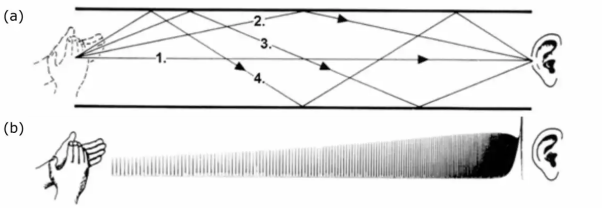

Fig. 1: Sound waves hit the ear via different paths (a) whereby the initial clap can be heard as a stretched echo (b).