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# Silencing nuisance noise with an acoustic cloak

**Noise pollution is a** key issue facing policy makers in urban areas. In a recent development that might help town planners, researchers have proposed a design for a new sound-proofing device, an acoustic 'cloak', that could be 100 per cent effective. This suggests that, one day, buildings could be adapted to fully protect their inhabitants from external noise.

**An acoustic cloak** is capable of hiding an object from passing sound waves. It works by guiding sound waves around the object to smoothly recombine on the far side, as if the object had not been there. Furthermore, anything inside the object is shielded from sound waves flowing past. Researchers have shown that it is possible to design an acoustic cloaking device made of 'metamaterials' and that this is capable of working in two dimensions. Although the precise material has not yet been fabricated, the researchers have simulated the material's properties with a computer, and suggest that it would be quite feasible to engineer.

Metamaterials are man-made materials, with compositions and properties unlike anything found in nature. The proposed design for the acoustic cloak is a multilayered structure, composed of two different types of metamaterials in alternating layers of equal thickness. Each layer consists of a different type of 'sonic crystal', consisting of metal rods embedded in a medium through which the sound waves pass. The rods are arranged so that they scatter sound waves. The internal structure and composition of the sonic crystals can be chosen to work within the desired range of sound frequencies.

The researchers tested their design by simulating the effects of noise on the cloak, and showed that the design was effective over a wide range of sound wavelengths. They demonstrated that a cloaking shield 200 layers thick could completely protect an object from sound. A cloak of the same thickness but made from only 50 layers was effective in shielding an object from a more limited range of sound frequencies.

It is anticipated that it would be possible to manufacture acoustic cloaks in the future that have properties that could meet almost any requirement and which are thin enough to be of practical use – perhaps a few centimetres thick. It is proposed that such a cloak could be used to shield buildings, and their inhabitants, from noise. Other suggested commercial applications of the cloaks include hiding military ships and submarines from sonar detection and concert hall designs with optimal acoustic properties.

**Source:** Torrent, D. and Sánchez-Dehesa, J. (2008). Acoustic cloaking in two dimensions: a feasible approach. *New Journal of Physics*. Doi:10.1088/1367-2630/10/6/063015.

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