Intermediate

If these walls could talk, they would whisper

Scientists wishing to explore sound must first find complete silence, in a noise pollution-free anechoic chamber.

Silence holds a paradoxical place in science and in human consciousness. In science, the quietest conditions that modern technology allow are invariably used to research sound. And our own search for "peace and quiet" never extends as far as wanting no noise at all. Real silence is strange and disturbing, not relaxing. Most people cannot sleep without at least some background sound.

The closest humankind can get to complete silence is the inside of a heavily soundproofed anechoic chamber, a handful of which exist in universities and labs across Britain. These are used for a range of interesting research.

Unpleasant or not, complete silence is incredibly difficult to achieve. Insulate a room, build it within thick brick walls, and vibrations will still get in. Mount the whole thing on springs, and the vibrations will stop - but the echoes won't. Anechoic chambers eliminate this problem by covering walls, ceiling and floor with wedges of fibreglass which stick out 18in into the room. These absorb virtually all the sound, meaning that measurements of sound levels typically weigh in far below zero decibels, the threshold of human hearing. The Bell Labs chamber, the first ever built, featured in the Guinness Book of Records as the "quietest place on earth" after its construction in 1940.

Once you have a silent room, you don't want to ruin it. So the chamber at University College London has specially designed silent air conditioning, and the walls contain coils to cancel out the hum of the substation. The chamber is lit with light bulbs instead of noisy fluorescent tubes. And users must walk on a platform, raised above the soundproofed floor. Even the steel door is covered with a foot and a half of fibreglass.

While most anechoic chambers are used for acoustic research, UCL's is used in phonetics - the scientific study of the human voice. Researchers make precise recordings of voices, using both microphones and laryngographs. This latter device, developed by one of the academics who used this chamber, measures the opening and closing of the voice box while the subject speaks. Linguists at UCL use the recordings to identify the root causes of speech abnormalities in children.

Another device in the crowded control room is a spectrum analyser. The spectrum analyser looks at the different frequencies in a voice. Using high-quality digital recordings, researchers employ the analyser to examine the minute details of speech, furthering our understanding of human expression. Other research in the department has investigated the hearing of people who have had ear surgery.

Elsewhere, scientists and engineers mainly use anechoic rooms for routine acoustic research, such as testing equipment and modelling sound propagation. But one complex technology developed in the chamber features finds a practical application in the nation's living rooms.

"Head-related transfer functions" (HRTFs) underpin the surround sound effects in many computer games. Audio systems using this technology create their 3D sound effects using only a pair of normal stereo speakers. The illusion is created using a detailed acoustic model of the human head, developed in an anechoic chamber, to subtly tweak the sound so as to mimic the realism of five-speaker systems.

The silence of the anechoic room has inspired musicians, too. The American composer John Cage visited Harvard University's facility in the late 1940s. Though he was in a room with no background sound and no echo, Cage discovered that total silence is not actually possible: he claims he heard two sounds, "one high, my nervous system in operation, one low, my blood in circulation". After this experience, he was inspired to write his "silent" piece, 4'33", in which the "music" is made by the ambient sounds of the concert hall alone.

Adapted. Guardian Unlimited © Guardian Newspapers Limited 2005

Intermediate

If these walls could talk, they would whisper

Tasks

Find words or phrases in the text which mean the same as:
1.a small number, as much as can be held in hand
2.a set of different subjects, a scope
3.a sound sent back or repeated
4.very nearly, almost
5.the second one, coming after the first one
6.very small, giving attention to the smallest points
7.really, in fact
8.surrounding

Answer the questions:
9.What´s the biggest problem in achieving complete silence?

10.How are undesired sounds in anechoic chambers eliminated?

11.What´s the purpose of the acoustic model of the human head?

Say whether the following statements are true or false:
12.Silence is always used to investigate sound.

13.Complete silence can be achieved in anechoic chambers.

14.Recordings of voices are used to identify speech abnormalities in children.

15.Spectrum analysers help to examine human expression.

16.Anechoic rooms are often used for modelling sound propagation.

17.Cage wrote a piece of music using two sounds only.

Intermediate

If these walls could talk, they would whisper

Key

Find words or phrases in the text which mean the same as:

1.a small number, as much as can be held in hand **handful**
2.a set of different subjects , a scope **range**
3.a sound sent back or repeated **echo**
4.very nearly, almost **virtually**
5.the second one, coming after the first one **the latter**
6.very small, giving attention to the smallest points **minute**
7.really, in fact **actually**
8.surrounding **ambient**

1 point each

Answer the questions:

9.What´s the biggest problem in achieving complete silence?
eliminating echoes
10.How are undesired sounds in anechoic chambers eliminated?
by covering the walls, ceiling, floor and doors with fibreglass wedges, using specially designed air-conditioning, coils in walls, light bulbs, springs, platforms
11.What´s the purpose of the acoustic model of the human head?
to change sound to create 3D sound effects using stereo speakers **2 points each**

Say whether the following statements are true or false:

12.Silence is always used to investigate sound. **T**
13.Complete silence can be achieved in anechoic chambers. **F**
14.Recordings of voices are used to identify speech abnormalities in children. **F**
15.Spectrum analysers help to examine human expression. **T**
16.Anechoic rooms are often used for modelling sound propagation. **T**
17.Cage wrote a piece of music using two sounds only. **F**

1 point each
Total 20 points

Intermediate

Strange behaviour

Particles that exist only fleetingly help make everyday matter magnetic

IN THE world of particle physics, there is no such thing as nothing. Particles of matter, and their anti-matter counterparts, are forever flitting in and out of existence. Theorists have predicted that the presence of such transient visitors has little effect on everyday life. However, a group of experimental physicists has just shown this view to be mistaken.

Atomic nuclei are bundles of protons and neutrons which, along with electrons, are the basis of matter. But protons and neutrons themselves are made of more fundamental particles called quarks. These quarks have fractional electrical charges and combine to give each particle its overall electric charge, whether positive in the case of protons or neutral in the case of neutrons. They also give each particle its magnetic properties.

As well as possessing electric charge, quarks come in one of six “flavours”: up, down, strange, charm, bottom and top. A proton, for example, consists of two up quarks and a down quark, while a neutron consists of two down quarks and an up quark. But besides these permanent quarks, quantum theory predicts that so-called virtual quarks, together with their anti-matter partners, are continuously emerging from the vacuum of space and then disappearing again as a result of Heisenberg's uncertainty principle. So, while a proton has three resident quarks, it also plays host to a lot of short-term visitors. These are mostly up and anti-up, or down and anti-down, but also, occasionally, strange and anti-strange quarks. These guests add their properties to the mix.

A team of physicists at the Thomas Jefferson National Accelerator Facility in Virginia decided to investigate just how much of a contribution the visitors make. They did so by probing the interior of protons (in the form of the nuclei of hydrogen atoms) with fast-moving electrons. By analysing the subsequent trajectories of the particles, they could pinpoint the effect of the visitors. The results showed that this was far greater than had been predicted. In particular, some 5% of a proton's magnetism is contributed not by the host quarks but by visiting strange quarks that have popped out of nowhere.

The magnetism of protons is exploited in the medical technique known as magnetic-resonance imaging (MRI). Patients are placed in a strong magnetic field that aligns the magnetic fields of the protons in their bodies. The protons are then stimulated by radio waves which “unalign” them, and the energy they release as they return to their original alignments gives away their position. Since different tissues have different compositions (and thus different densities of protons), this signal can be turned into a picture of what is going on inside a body. So, next time you have an MRI scan, remember that part of the picture depends on something that isn't really there. Strange, eh?

Adapted. The Economist 2005

Intermediate

Strange behaviour

Tasks

Find words in the text which mean the opposite to:
1.resident
2.visitor
3.disappear
4.overall
5.often

Find words in the text which mean the same as:
6.to have
7. to arrange
8.the thing or person of the same purpose
9.a number of parts tied or held together

Say whether the statements are true or false:
10.Particles of very short existence do not affect the properties of matter.
11.Each particle gets its electric charge from the quarks it is made of.
12.A proton contains permanent and transient quarks.
13.The magnetism of a proton mainly comes from the visiting particles.
14.In magnetic resonance imaging the picture depends on the density of protons.

What do the words in bold refer to?
15.They **did so** by proving the interier of protons with fast-moving electrons.

16.The results showed that **this** was greater than had been predicted.

17.Remember that part of the picture depends on **something** that isn´t really there.

Intermediate

Strange behaviour

Key

Find words in the text which mean the opposite to:

1.resident	**transient**	
2.visitor	**host**	
3.disappear	**emerge, pop out**	
4.overall	**fractional**	
5.often	**occasionally**	**1 point each**

Find words in the text which mean the same as:

6.to have	**possess**	
7. to arrange	**align**	
8.the thing or person of the same purpose	**counterpart**	
9.a number of parts tied or held together	**bundle**	**1 point each**

Say whether the statements are true or false:

10.Particles of very short existence do not affect the properties of matter.	**F**
11.Each particle gets its electric charge from the quarks it is made of.	**T**
12.A proton contains permanent and transient quarks.	**T**
13.The magnetism of a proton mainly comes from the visiting particles.	**F**
14.In magnetic resonance imaging the picture depends on the density of protons.	**T**

1 point each

What do the words in bold refer to?

15.They **did so** by proving the interier of protons with fast-moving electrons.
investigated the contribution of visitors

16.The results showed that **this** was greater than had been predicted.
the effect of visitors

17.Remember that part of the picture depends on **something** that isn´t really there.
transient particles

2 points each

Total 20 points

Intermediate

Changing gear

The self-driving car comes closer—but difficulties remain

IT IS an old chestnut—a car that drives itself—but General Motors, the world's largest car manufacturer, has become the latest company to claim to be building one. The car uses updated technology combined with several existing innovations and, according to the manufacturer, could be in production by 2008. But, while the technology takes some of the boring bits out of driving, it falls far short of an automatic taxi service and, anyway, various legal, technical and social barriers to its introduction remain.

The latest prototype currently being tested is based on an Opel Vectra, a mid-sized family car. The car has automatic cruise control of the sort fitted to many expensive cars such as Jaguars and BMWs. These use either radar or infrared beams fitted to the front of the car to measure the distance to the car in front. That distance is kept constant by automatic acceleration and braking.

But conventional automatic cruise control fails at speeds of less than 30kph (20mph). To circumvent this problem, the new car uses lidar—short for "light detection and ranging"—a measuring technology similar to radar but which uses laser beams rather than radio waves to measure distance and determine the speed of other vehicles. As light waves have shorter wavelengths than radio waves, the technology works at shorter distances and lower speeds. Indeed, the prototype has a distance-keeping system that will brake to a standstill, and move off again when the car in front moves.

This advanced version of automatic cruise control works alongside a system that corrects the car when it drifts out of its lane. Almost two million accidents a year worldwide are thought to be caused by drivers inadvertently changing lanes, frequently caused by drowsiness.

At present, only a few cars have lane-departure warning systems. In America, the technology is available on the FX45 model from Infiniti, Nissan's luxury car division. In Europe, the Citroën C4 and C5 models have it while, in Japan, some Toyota models are fitted with it. These systems use camera images or near-range radar to determine the direction and position of the vehicle in relation to lane markings. When the system recognises that a lane departure is imminent, it bleeps or flashes to alert the driver. Some systems even try to rouse the driver by making the steering wheel or the seat vibrate.

Again, the new car takes this a step further. A camera mounted on the windscreen behind the rear-view mirror gives a clear view of the road ahead, picking up the white lines even in poor visibility or where the paint has faded. The camera works in conjunction with laser beams mounted in the headlamp unit. There is a second advantage to using lasers in preference to radar: while they have a similar range, laser sensors have a significantly wider field of vision. Existing systems can see only straight ahead and the nearside lane marking. The prototype can see more than twice as widely as this. Together, the camera and laser sensors monitor the white lines and, if the car strays out of its lane, an electronic control unit attached to an electric power-steering unit corrects it.

The system is unlikely to have a smooth ride into production, however, despite achieving what General Motors says is a very high level of reliability during the development stage. Several obstacles stand in the way.

For example, self-steering cars are currently illegal in most European countries. Carmakers want the law changed to allow them, but they are also keen not to be held legally responsible for any accidents which result. Drafting legislation which would make it attractive for

carmakers to introduce the technology, but still allow some recourse for those hurt if something goes wrong, could prove tricky.
In addition, most people relish driving. One reason why people feel safer in their cars than on public transport is because they are in control of the vehicle.
Moreover, whether in the stop-go traffic of the daily rush hour or on the motorway, the system relies on having a car in front that is travelling to the same destination. On the open road, the driver must drive.

Adapted. The Economist 2005

Intermediate

Changing gear

Tasks

Find words in the text meaning:
1.more modern
2.a condition of no movement
3.together with
4.a light sleep
5.going to happen very soon

Explain the meaning of the following phrases:
6.the prototype is currently being tested
7.the distance is kept constant
8.which would make it attractive
9.they are keen not to be held responsible
10.use laser beams rather than radio waves

Find appropriate verbs in the text:
11.failure
12.recognition
13.achievement
14.reliability

Choose the part which best completes the sentence:
15.In contrast to radio waves, light waves are used
a) to measure short distances
b) to measure low speeds
c) not to rely on radars only
d) for automatic cruise control at higher speeds

16.The new cars cannot be produced because
a) they are not reliable
b) accidents cannot be avoided
c) they are not attractive for producers
d) there are legal obstacles

17.People would not buy the self-driving cars because they
a) like driving
b) would not feel safe
c) would have to take the same route as other vehicles
d) don´t like driving on the open road