ANIMAL BEHAVIOUR

How to confuse thirsty bats

Echolocating bats have a legendary ability to find prey in the dark — so you'd think they would be able to tell the difference between water and a sheet of metal. Not so, report Greif and Siemers in *Nature Communications*. They have found that bats identify any extended, echo-acoustically smooth surface as water, and will try to drink from it (S. Greif and B. M. Siemers *Nature Commun*. doi:10.1038/ncomms1110; 2010).

The way in which bats locate point objects has been studied extensively, but how they recognize extended objects, such as pools of water, isn't known. As pictured here, bats drink while on the wing. Greif and Siemers hypothesized that, when searching for a drink, the animals look for the echo-reflection signature of water surfaces — the only extended, acoustically smooth surfaces in a bat's environment.

When a bat sends an echolocation beam at a glancing angle to a water surface, most of the beam bounces off the surface away from the animal, like light off a mirror. But a small part of the beam travels vertically down from its source, and is reflected right back to the bat. This reflection pattern could act as a flag for water.

To test this idea, the authors conducted experiments on 15 species of wild bat, placing them in a room that had two large plates on the floor. The plates were made of one of several materials: wood, metal or plastic. Each of the surfaces was either smooth or textured. The smooth surfaces reflect echolocation beams in the same way as water, and, sure enough, thirsty bats repeatedly tried to drink from these surfaces, but ignored the textured ones (see movie at http://go.nature.com/pnpal8). The authors thus concluded that bats use echolocation to recognize bodies of water.

When Greif and Siemers trialled juvenile bats that had had no previous contact with ponds, the animals also tried to drink from the smooth plates, thus revealing the water-location mechanism to be innate. What's more, the authors found that echolocation overrides conflicting sensory stimuli such as vision, chemoreception and touch. For example, if a smooth surface was placed on a table, the bats tried to drink from it even if they had already flown under the table. The authors suggest that innate water recognition in bats could be used to study the neural basis of habitat recognition. **Stefano Tonzani**

D. NILL

FUNDAMENTAL CONSTANTS

Big *G* revisited

Measuring Newton's constant of gravitation is a difficult task, because gravity is the weakest of all the fundamental forces. An experiment involving two simple pendulums provides a seemingly accurate but surprising value.

RICHARD DAVIS

Newton's law of universal gravitation[1] is a pillar of classical physics. Here's a quick textbook example: the gravitational force between any two spherical objects is proportional to the product of their masses and inversely proportional to the square of the distance between their centres. If you know the value of each mass in kilograms and the distance between them in metres, the Newtonian constant of gravitation, *G* (aka big *G*), lets you calculate the gravitational force between the masses in units of ... newtons! Big *G* is one of the fundamental constants of physics[2]. Its value, which is roughly 6.674×10^{-11} m^3 kg^{-1} s^{-2}, can be established only by measurement. However, experiments with the potential to yield a highly accurate value of *G* are notoriously challenging. In a beautifully written article in *Physical Review Letters*[3], Parks and Faller describe an experiment carried out at the JILA institute in Boulder, Colorado, that has allowed them to measure *G* with an uncertainty of 0.0021%, or 21 parts per million (p.p.m.). This is among the smallest uncertainties ever achieved, but the derived value of *G* is a surprise.

The basic idea of Parks and Faller's experiment can be illustrated by a simple pendulum (Fig. 1a). When a 'source mass' is brought near the pendulum's bob (the 'test mass'), the gravitational attraction between the two masses causes the bob to move a small distance, *z*, from its usual rest position. Of course, the design and analysis of the real experiment are much more sophisticated than this simple depiction. The authors' experiment has two pairs of tungsten source masses and two identical pendulums, the copper bobs of which are pulled in opposite directions, and a host of other clever features.

The distance each bob moves is small: *z* is of the order of 50 nanometres. Yet the authors show that such small displacements can be

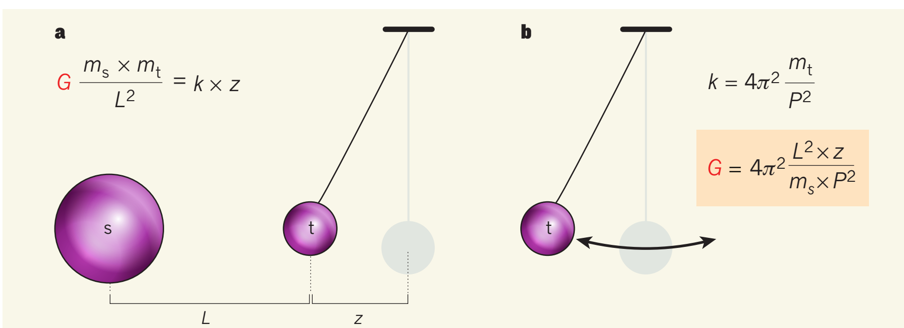

Figure 1 | The basic principle of Parks and Faller's experiment[3]. **a**, A spherical 'source mass' (m_s) is brought near a pendulum's spherical bob (the 'test mass', m_t) and causes the bob to move a small distance *z* from its usual resting position (grey). The gravitational force between the two masses (left side of equation), which depends on Newton's constant (*G*), can be obtained from a measurement of *z* provided that *k* is known (see **b**). **b**, The value of *k* is found by measuring the period (*P*) of the freely swinging pendulum. To compute the value of *G*, we need measurements of *L*, *z*, m_s and *P* (but not m_t). Parks and Faller's experiment was based on four cylindrical source masses of 100 kilograms each, two pendulums and many other refinements.

© 2010 Macmillan Publishers Limited. All rights reserved