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Bats slam into buildings because they can't 'see' them

Smooth, vertical structures such as steel and glass buildings appear invisible to bats' echolocation system.

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“I heard a thud behind me,” says zoologist Stefan Greif, recalling the first time he noticed a bat crash into a metal plate propped up against a wall in his lab’s flight chamber. Now, in a study published on 7 September in *Science*[1], a team led by Greif — of the Max Planck Institute for Ornithology in Seewiesen, Germany — explains why bats often slam into vertical panes, such as glass windows.These smooth surfaces interfere with bats’ echolocation by reflecting sound away from the creatures.

Bats rely on echolocation to navigate in the dark. They locate and identify objects by sending out shrill calls and listening to the echoes that bounce back. Greif and his colleagues tested the echolocation of 21 wild-caught greater mouse-eared bats (*Myotis myotis*) in the lab. The researchers placed a featureless metal plate on a side wall at the end of a flight tunnel. The bats interpreted the smooth surface — but not the adjacent, felt-covered walls — as a clear flight path. Over an an average of around 20 trials for each bat, 19 of them crashed into the panel at least once. The researchers also put up smooth, vertical plates near wild bat colonies, and saw similar results.

The animals became confused owing to a property of smooth surfaces called ‘acoustic mirroring’. Whereas rough objects bounce some echoes back towards the bat, says Greif, a smooth surface reflects all echolocation calls away from the source. This makes a smooth wall appear as empty space to the bats, until they are directly in front of it. Only once a bat is facing the surface are their perpendicular echoes reflected back, which alerts the bat to its mistake. This explains why some bats attempted to swerve out of harm’s way at the last second — but often too late.

Sound over sight

Gareth Jones, a behavioural ecologist at the University of Bristol, UK, says researchers can rule out the possibility that the bats were visually confused, because the experiments were done under infrared light, which bats can't see, and so they would have been relying entirely on echolocation. The results highlight how unaware humans are of the sensory problems faced by other species, says Christian Voigt, who studies bats at the Leibniz Institute for Zoo and Wildlife Research in Berlin.

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In a 2010 study[2], Greif investigated the animals' response to smooth horizontal surfaces. When his team placed smooth plates on the ground, bats descended and attempted to drink from them. In nature, bats encounter this type of acoustic mirroring from the surfaces of lakes and ponds. They seem adapted to interpret the perpendicular echoes that they hear when they fly over smooth planes as a cue for the presence of still water.

Echolocation-fooling vertical structures have appeared only in recent decades, notes Jones. Although the bats tested experimentally were not injured, because the size of the test room constrained their flying speed, bats flying much faster in the wild may be under threat from human structures, according to Grief. It's not uncommon to find dead or injured bats near buildings, but their toll on bat populations isn't known.

If human-made structures are found to be a serious threat, the authors suggest mitigating damage near important bat colonies and migratory highways by, for example, avoiding the use of smooth materials in construction. A more feasible solution may be the use of acoustic deterrents — small bundles of speakers that emit ultrasound near buildings in these ecologically important sites, says Greif. "We have to be realistic."

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References

1. Greif, S., Zsebők, S., Schmieder, D. & Siemers, B. M. *Science* **357**, 1045–1047 (2017).
2. Greif, S. & Siemers, B. M. *Nature Commun.* **1**, 107 (2010).