

Bees get distracted just like us, hinting at their own awareness

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Credit: Pixabay/CC0 Public Domain

Even tiny insects need to focus. In a recent study, honey bees—usually quick to learn which scent means sugar—completely flubbed the task when a flashing light joined the party. This surprisingly human-like

breakdown suggests that these little buzzers might engage something like awareness when connecting cause and effect. The research is [published](#) in the journal *Proceedings of the Royal Society B: Biological Sciences*.

Bees are famous for their smarts. Prior work has shown that honey bees can learn complex tasks, from recognizing faces to navigating mazes. In the lab, researchers often use classical conditioning to test bee memory: An odor (conditioned stimulus) is paired with sugar (unconditioned stimulus). If the two overlap in time (delay conditioning), bees learn quickly.

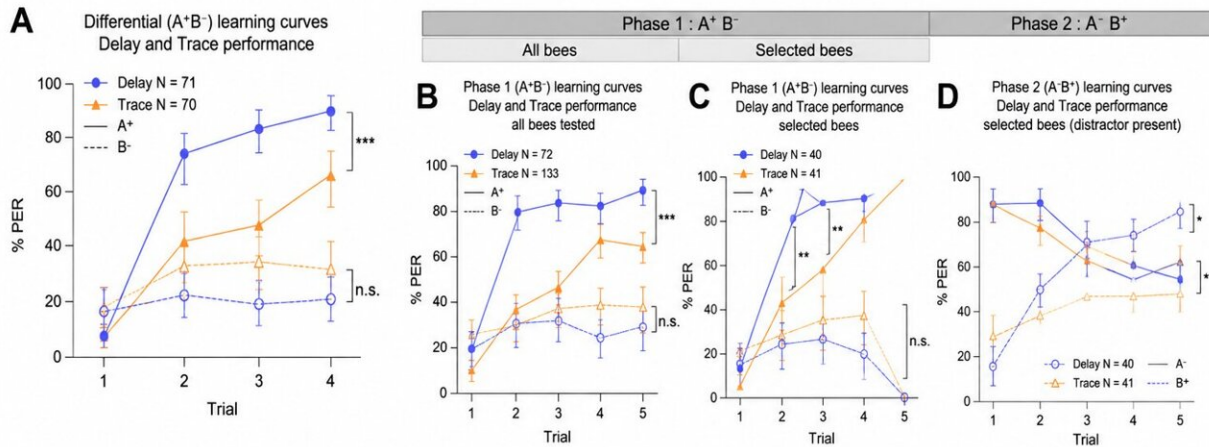
However, if the sugar arrives a few seconds after the smell ends (trace conditioning), the task becomes much harder. In fact, scientists have found that bees can learn delayed tasks easily, but trace tasks falter when attention is disrupted. In other words, linking a scent to a reward across a [time gap](#) seems to need something like attention or "awareness," much as it does in humans.

Flipping the script: Reversal learning in bees

In the new study, researchers took this idea further by adding a twist called reversal learning. First, bees were trained to extend their proboscis (a feeding reflex) to odor A because it predicted sugar (A^+), but not to odor B (B^-). After a few trials, the rule was flipped: Now B would give sugar (B^+) and A would not (A^-). This tested [flexibility](#)—could the bee unlearn A^+ and learn B^+ instead?

The scientists ran this reversal task under two conditions: delay (scent and reward overlap) and trace (reward delayed). In both cases, bees eventually mastered the new rules, but those in the trace group learned more slowly and less reliably. This was expected: Bridging the gap in trace conditioning is tougher.

Distractor differentially impairs delay and trace reversal learning in honeybees



Distractor effects on delay and trace reversal learning in honeybees. Credit: *Proceedings of the Royal Society B: Biological Sciences* (2026). DOI: 10.1098/rspb.2025.2891

When a flashing light scrambles the bee

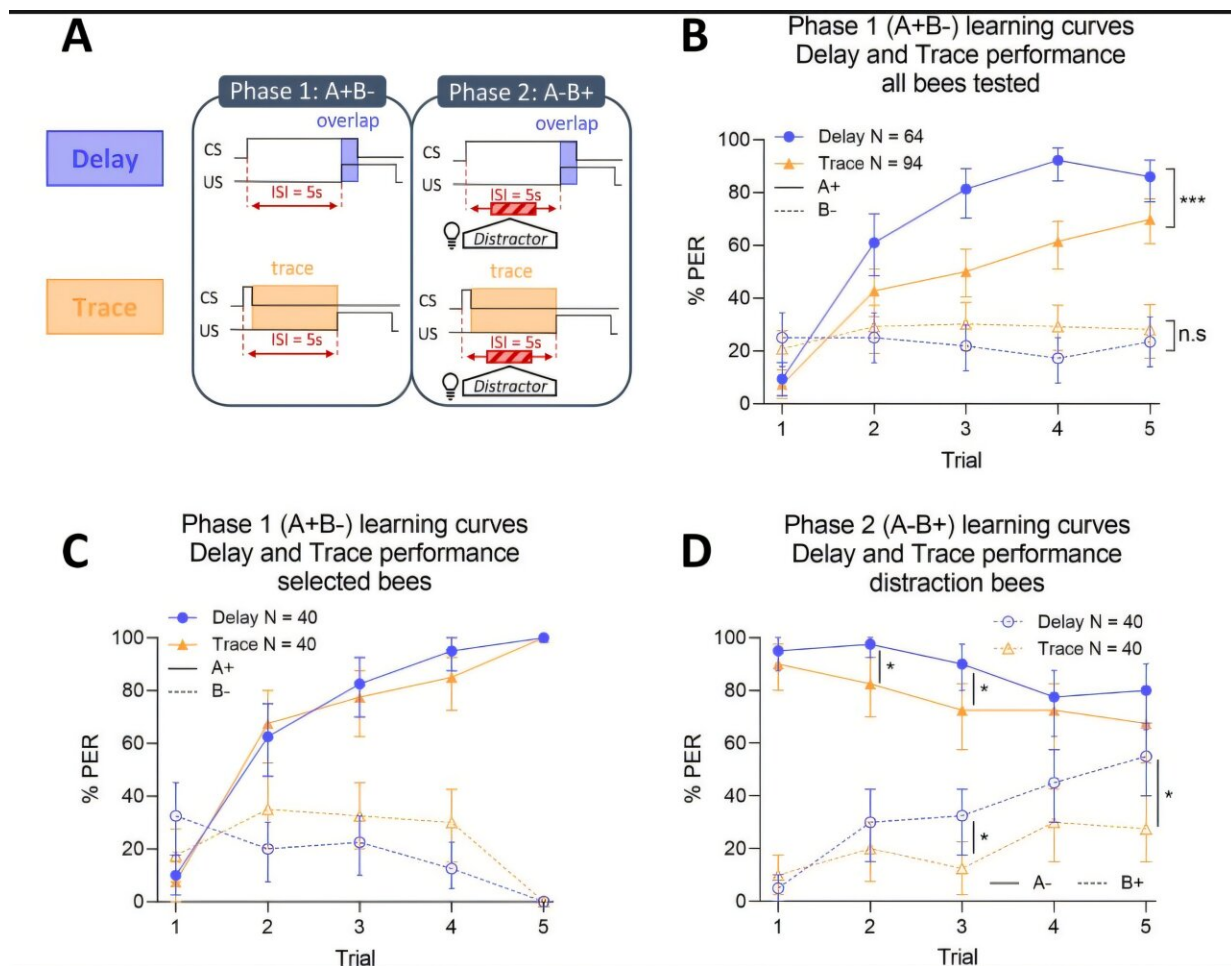
Next, the team introduced a visual distractor, a simple flashing light, during the reversal phase. The effect was dramatic and different for each group. Delay-conditioned bees under the light started responding to both odors (an A⁺B⁺ pattern), as if they had stopped telling the scents apart. Trace-conditioned bees did the opposite: they responded to neither odor (an A⁻B⁻ pattern). In essence, the distraction caused one group to over-generalize and the other to freeze.

This split result is telling. In humans, losing awareness of the link between events can cause similar failures: either broad overreaction or blanking out, depending on the task.

The researchers explain, "Awareness of stimulus contingencies appears

necessary for solving reversal learning under a trace-conditioning regime."

In other words, when the bee needs to link scent and reward across time, something like awareness is needed to keep track. The flashing light likely scrambled that process, so the bees' responses collapsed in opposite ways.



A distractor impairs delay and trace reversal learning performance. Credit: *Proceedings of the Royal Society B: Biological Sciences* (2026). DOI: 10.1098/rspb.2025.2891

Beyond instinct: Signs of cognition?

The way these bees behaved under distraction hints at more than automatic learning. As the authors state, "These findings provide evidence that bees engage [awareness-like processes](#) during trace reversal learning, highlighting cognitive processing in an insect."

That's a bold claim. It suggests that bees aren't just Pavlovian robots, but can flexibly apply attention when tasks demand it. Importantly, the experiment measured only reflexive feeding responses, not anything directly like a verbal report of awareness. Still, the binary failure patterns (respond to all vs. none) align with the idea that trace learning invokes something akin to consciousness.

Of course, caution is needed. Bees can't tell us what they feel, and all we have are behavior scores. The scientists note they didn't record bee brain signals or thought patterns, so they stop short of claiming bees are "conscious" in our sense. And the proboscis extension (yes/no) is a simple measure—there might be subtle changes it missed. But the unexpectedly human-like breakdown under distraction strengthens the case that insects, at least, employ more than simple reflexes when they are learning tough tasks.

These results add fuel to debates on animal minds. If a bee shows "awareness-like" learning, does it have an inner experience? Even if it doesn't think as we do, the study reveals surprising flexibility in a tiny brain. In practical terms, a better understanding of bee cognition could help beekeepers and ecologists. For example, it suggests that [environmental distractions](#) (pesticides, lights, noise) might interfere with a bee's learning in the wild, affecting foraging or navigation. It also shows a model for designing AI and robots: even small neural networks can use attentional gating to solve temporal puzzles.

The study's authors emphasize that it's just a start. Future work could look at bee brain activity during such tasks or test other species to see how widespread these effects are.

For now, a striking quote from the paper stands out: "Our findings in honey bees echo [human] results: awareness of stimulus contingencies appears necessary for solving reversal learning under a trace-conditioning regime."

Bees, with minds smaller by orders of magnitude, might solve puzzles the way we do. That's a discovery sure to keep scientists buzzing.

More information: Catherine Macri et al, Attention, awareness and flexibility in honeybees: divergent effects of distraction on delay versus trace reversal learning, *Proceedings of the Royal Society B: Biological Sciences* (2026). [DOI: 10.1098/rspb.2025.2891](https://doi.org/10.1098/rspb.2025.2891)

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