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Who is calling? Bats outsmart deception by solving sensory conflicts

Would you answer someone's cry for help if that someone is sitting unharmed in front of you? Most probably not – and bats have similar reservations, according to a new study published in Current Biology. Researchers from the Museum für Naturkunde Berlin and the University of Naples Federico II show that bats can reconcile what they see or smell with what they hear to assess the reality of a situation.

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When bats are caught by predators, they produce distress calls, loud, harsh vocalizations that may startle the predator into releasing its prey or alert conspecifics to the situation at hand. Often, bats approach conspecifics calling in distress, probably to assess the danger or provide help in the form of predator mobbing. The scientists used this scenario to test whether bats can recognize group members individually based on voice cues.

The research team, consisting of Mirjam Knörnschild, Martina Nagy, and Danilo Russo, first analyzed the acoustic properties of distress calls from wild Greater Sac-Winged Bats, Saccopteryx bilineata, in Panama. They discovered that distress calls carry distinct vocal signatures, allowing individuals to be statistically discriminated by their voices alone. To confirm that these vocal fingerprints are meaningful for the bats, the researchers confronted them with playbacks of distress calls from group members. Broadcast from around the corner of their day-roost, these playbacks mimicked a group member in immediate distress. The scientists used a violation-of-expectation paradigm, providing information about group members that aligned or conflicted with one another. This approach allowed them to test how bats respond to conflicting sensory cues.

In the plausible scenario, bats heard distress calls from a group member that had just left the day-roost. In the impossible scenario bats heard distress calls from a group member that was still present in the day-roost while another bat had left the group. Remarkably, bats only reacted to the plausible scenario – in the impossible scenario, when the caller's voice came from a different location than the caller's current roosting spot, the bats ignored the distress call playbacks entirely. This means that the bats can reconcile sensory inputs and reject contradictions, a hallmark of advanced cognition.

"Our findings demonstrate that these bats possess a high level of cognitive sophistication," says Mirjam Knörnschild. "By integrating information from multiple senses, they can interpret social signals and respond appropriately, which is critical for their social interactions."

The study provides new insight into how vocal individuality supports complex social structures in bats. "Greater sac-winged bats live in stable social groups where individual recognition is probably crucial for social interactions. We observed that dominant males were the first to respond to distress calls, reflecting their crucial role in colony defense.", Martina Nagy notes. The team further found that larger groups reacted stronger, suggesting that larger groups may exhibit greater collective responsiveness.

The results underscore the importance of multisensory integration in social animals, enriching our understanding of animal communication and cognition. “The ability to integrate sensory information for individual recognition is a hallmark of advanced cognition, seen in species like primates and elephants,” explains Danilo Russo. “Our study contributes to the growing body of knowledge on animal communication and highlights the cognitive capabilities of mammals with complex social lives.”

The research was conducted with wild bats on Barro Colorado Island, a field site of the Smithsonian Tropical Research Institute in Panama. The project was supported by grants from the Baden-Württemberg Foundation and the European Research Council under the European Union’s Horizon 2020 Programme (2014–2020)/ERC GA 804352.