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Special Species

Nature's Nimble Navigators

Discover how hummingbirds use their remarkable sideways and bullet-like strategies to slip through obstacles, showcasing a level of precision and adaptability that outshines the rest.

Analysis by Dr. Karen Shaw Becker

STORY AT-A-GLANCE

- Along with the ability to hover, hummingbirds can fly sideways and backward by rapidly adjusting the patterns of their wing strokes
- However, these adaptations come with a downside — hummingbirds' wings don't bend much during flight
- To fit through tight spaces, hummingbirds flew sideways and moved their wings differently on each side of their body
- They also used a "swept strategy," pulling their wings in close to their body and shooting through the tight space without flapping their wings, similar to a bullet
- The hummingbirds appeared to use the more cautious sideways strategy initially due to the novel environment, then preferred the bullet-like movement once they felt assured there was no danger

Birds are revered for their ability to fly gracefully through the air and adeptly avoid collisions even in tight spaces. But among bird species, hummingbirds may win the award for top agility. Along with the ability to hover — courtesy of their small wing size — hummingbirds can fly sideways and backward by rapidly adjusting the patterns of their wing strokes.

"Together, these abilities may enable hummingbirds to negotiate densely cluttered environments that are inaccessible to other birds," researchers wrote in the Journal of Experimental Biology.[1] However, these adaptations come with a downside — hummingbirds' wings don't bend much during flight, similar to their close relatives, the swifts.

This means if there's a narrow space smaller than the distance between the tips of their wings when fully spread, hummingbirds might not be able to fit, unless they have a special way to tackle such situations.

Researchers with the University of California, Berkeley conducted a set of experiments that revealed hummingbirds' do, in fact, use two "secret weapons" that help them successfully maneuver through tight spaces, like dense rainforests.[2]

Hummingbirds Use Sideways and Bullet-Like Movements

The study involved four Anna's hummingbirds and two fake flowers, which were separated with partitions that had a circular or oval hole ranging from the same size as the birds' wingspan to half the distance. The researchers recorded the birds' movements as they flew through the holes, revealing that they changed their postures accordingly Two primary strategies were revealed:

1. **Asymmetric strategy —** The hummingbirds flew sideways and moved their wings differently on each side of their body. This helped them slip through narrow spots without having to fold their wings.
2. **Swept strategy —** In this approach, the hummingbirds pull their wings in close to their body and shoot through the tight space without flapping their wings, similar to a bullet.

While the birds used a mix of approaches to get through the obstacles, they almost always used the swept strategy to get through the smallest holes. Further, they as the experiments went on, the birds used the swept strategy more often, possibly because they became more confident that there was no danger. The Guardian reported:[3]

> *"[Study author Marc] Badger said it is possible that the birds initially adopt the more cautious sideways strategy to reduce the risk of hurtling through the partition's hole and into danger, adding that as it became clear the setup was safe, they might have switched to the bullet strategy to reduce their risk of breaking feathers."*

"The ability to pick among several obstacle negotiation strategies can allow animals to reliably squeeze through tight gaps and recover from mistakes," Badger added.[4]

Do Hummingbirds Start Out Cautious Then Switch to Faster Movements?

The findings suggest the hummingbirds may have used the more cautious asymmetric strategy initially due to the novel environment. This maneuver involves slower flight, which gives the birds more time to observe and react to any potential dangers. As the experiments went on, however, transit speed increased by 28% while vertical acceleration decreased by 38%.

"The increased speed and reduced vertical acceleration associated with the swept technique necessarily increase post-transit recovery distance, but may allow birds to better negotiate known obstacles," the researchers explain.[5]

In short, the birds seem to change their flying technique based on their environment and other factors. It's not surprising, considering birds also display other intelligent decisions, like **using anti-bird spikes to build nests** and **self-medicating with plants**. According to Berkeley News:[6]

> *"For slit-like gaps too narrow to accommodate their wingspan, they scooch sideways through the slit, flapping their wings continually so as not to lose height. For smaller holes — or if the birds are already familiar with what awaits them on the other side — they tuck their wings and coast through, resuming flapping once clear."*

Typically, the birds hovered briefly before passing through the hole, initially tending to use asymmetrical motion — one that's not typically observed with the naked eye.

"The thing is, they have to still maintain weight support, which is derived from both wings, and then control the horizontal thrust, which is pushing it forward. And they're doing this with the right and left wing doing very peculiar things," study author Robert Dudley said in a news release.[7] "Once again, this is just one more example of how, when pushed in some experimental situation, we can elicit control features that we don't see in just a standard hovering hummingbird."

Understanding Birds' Movements May Lead to Better Drones

The hummingbirds' demonstrated the benefits of shape shifting and task learning when flying through cluttered environments[8] — skills that could also be applied to build better drones.

While remote control quadrotors — flying robots with four propellors — can outperform most birds in open spaces, navigating dense forests and other obstacle-ridden environments may be easier for birds. Badger explained that engineers could likely benefit by learning from nature:[9]

> *"Learning more about how animals negotiate obstacles and other 'building-blocks' of the environment, such as wind gusts or turbulent regions, can improve our overall understanding of animal locomotion in complex environments.*
>
> *We still don't know very much about how flight through clutter might be limited by geometric, aerodynamic, sensory, metabolic or structural processes. Even behavioral limitations could arise from longer-term effects, such as wear and tear on the body, as hinted at by the shift in aperture negotiation technique we observed in our study …*
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> *If we put a bird's brain inside a quadrotor, would the cyborg bird or a normal bird be better at flying through a dense forest in the wind? There may be many sensory and physical advantages to flapping wings in turbulent or cluttered environments."*

Sources and References

[1,2,5,8] Journal of Experimental Biology November 2023, Volume 226, Issue 21

[3] The Guardian November 9, 2023

[4,6,7,9] Berkeley News November 9, 2023