Small birds have more efficient wing strokes than bats

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A first-year Penn State College of Information Sciences and Technology doctoral student spent four months observing birds in an effort to learn what it would mean to design technologies from a more-than-human perspective. Her autoethnographic study contributes to addressing the challenging research problem of how to operationalize posthuman concepts into practice for human-computer interaction. House finchnigel. Credit: Wikimedia Commons

Small birds are more energy-efficient than bats when flying. Researchers previously believed this was due to air resistance created by the bats' ears. However, biologists at Lund University in Sweden have now discovered another reason.

When in their most elevated position, the wings of small birds interact in a completely different way compared to the wings of bats. As the birds flap their wings downwards, they create a single large air vortex ring behind themselves rather than two small ones.

"This makes the airflow slower and the aerodynamics less energy-demanding. This in turn means that birds are more suitable for flying long distances than bats," says Christoffer Johansson, biologist at Lund University.

According to him, the new results should be incorporated into existing models of how much energy birds consume when they fly. Among other things, these models are used to calculate how far birds can migrate.

The results are based on studies of the European pied flycatcher flying in the Lund University's wind tunnel while the researchers studied the movements of the air behind the bird.

Although the researchers have shown how the interaction of the small birds' wings makes them efficient flyers compared to bats, the birds are far from being perfect little "flying machines." The researchers found that European pied flycatchers (and probably all other small birds as well) tilt their bodies backwards when flying at low speed. The tail is lowered and the head is raised. This leads to increased energy consumption.

"The technique increases the force generated by the wings – as when aeroplanes go in for landing. For birds, which don't have any engines,

tilting the body is also about having the resulting force point in the right direction. This results in more body resistance and increased energy consumption," says Christoffer Johansson.

More information: L. Christoffer Johansson et al. Mechanical power curve measured in the wake of pied flycatchers indicates modulation of parasite power across flight speeds, *Journal of The Royal Society Interface* (2018). DOI: 10.1098/rsif.2017.0814

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