The awesomeness of bats

December 22 2015, by Roli Roberts

Just how awesome are bats? It's easy to forget that one in five species of mammal on this planet have wings capable of delivering spectacularly acrobatic flying abilities. Equally incredibly, two-thirds of these 1,200 species of flying mammal can fly in the dark, using exquisite echolocation to avoid obstacles and snatch airborne prey with stunning deftness.

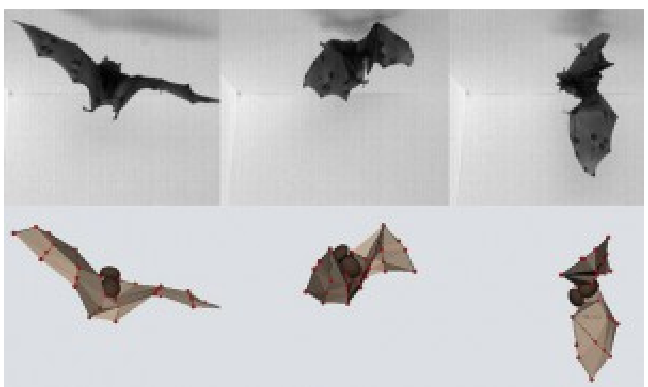
These amazing feats have helped make bats the focus not only of folkloric fascination, but also of biological enquiry and mimicry by human engineers from Leonardo da Vinci onwards. Recent research in *PLOS* journals continues to add surprising new findings to what we know about bats, and how they might inspire us to engineer manmade machines such as drones to emulate their skills.

Bats, unlike most birds and flying insects, have relatively heavy wings – something that might appear disadvantageous. But a recent study in *PLOS Biology* by Kenny Breuer and colleagues shows that bats can exploit the inertia of the wings to make sharp turns that would be near-impossible using aerodynamic forces alone. The authors combined high-speed film of real bats landing upside-down on ceiling roosts with computational modelling to tease apart aerodynamic and inertial effects. While evolution has minimised the weight of the largely aerodynamic wings of birds and insects, it seems that bats rely on their wings' mass, retracting them to turn rapidly, as figure skaters retract their heavy arms to spin faster.

The other bat skill that humans envy – their ability to avoid obstacles while flying at speed in complete darkness – was recently dissected in a PLOS Computation Biology paper by Dieter Vanderelst and colleagues. They used spatial simulations to demonstrate that bats are able to negotiate complex environments without making full 3D reconstructions of their surroundings. All they need is the difference in intensity and travel time of the echo received in their two ears – a pared-down functionality that might help drones deliver your internet orders without hitting a lamppost.

Sometimes these two prime skills – echolocation and acrobatic flight – seem to be in conflict; echolocation benefits from large ears and complicated "noseleaves," but these features would appear to disrupt the streamlining needed for efficient flight. This *PLOS ONE* paper, also from Vanderelst and co-authors, put this notion to the test by making 3D models of the heads of seven bat species and sticking them in an air tunnel. Surprisingly, while these facial oddities do increase drag, they also contribute substantially to lift, meaning that they confer little net disadvantage, and so the trade-off between bat abilities is minimal.

Other recent *PLOS* studies of bats reveal how some species direct different echolocation signals upwards and downwards to avoid detection by tasty moths, how they combine vision and sonar information when flying in the light, and how pairs of foraging bats coordinate their flight over water. Of course the story of bats is not always good news, and recent papers in *PLOS* have also addressed their susceptibility to diseases like white-nose syndrome and influenza, and their conflicts with humans for living space. Despite the wealth of knowledge presented here, there is still much to learn about bats, their amazing lifestyles… and their overall awesomeness.



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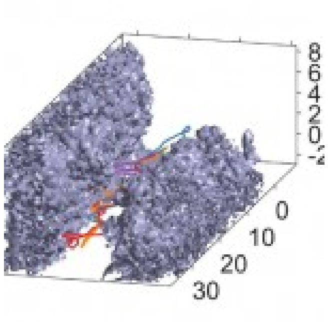

Dodging trees – simulated bats avoid trouble in a simulated forest. doi: 10.1371/journal.pcbi.1004484

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