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Unsteady flow challenges tracking performance at vortex shedding frequencies without disrupting lift mechanisms MEGAN MATTHEWS, SIMON SPONBERG, Georgia Institute of Technology — Birds, insects, and many animals use unsteady aerodynamic mechanisms to achieve stable hovering flight. Natural environments are often characterized by unsteady flows causing animals to dynamically respond to perturbations while performing complex tasks, such as foraging. Little is known about how unsteady flow around an animal interacts with already unsteady flow in the environment or how this impacts performance. We study how the environment impacts maneuverability to reveal any coupling between body dynamics and aerodynamics for hawkmoths, *Manduca sexta,* tracking a 3D-printed robotic flower in a wind tunnel. We also observe the leading-edge vortex (LEV), a known lift-generating mechanism for insect flight with smoke visualization. Moths in still and unsteady air exhibit near perfect tracking at low frequencies, but tracking in the flower wake results in larger overshoot at mid-range. Smoke visualization of the flower wake shows that the dominant vortex shedding corresponds to the same frequency band as the increased overshoot. Despite the large effect on flight dynamics, the LEV remains bound to the wing and thorax throughout the wingstroke. In general, unsteady wind seems to decrease maneuverability, but LEV stability seems decoupled from changes in flight dynamics.

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