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Supplementary Information for

External Power Amplification Drives Prey Capture in a Spider Web

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References for SI reference citations

Other supplementary materials for this manuscript include the following:

Movies S1 to S6

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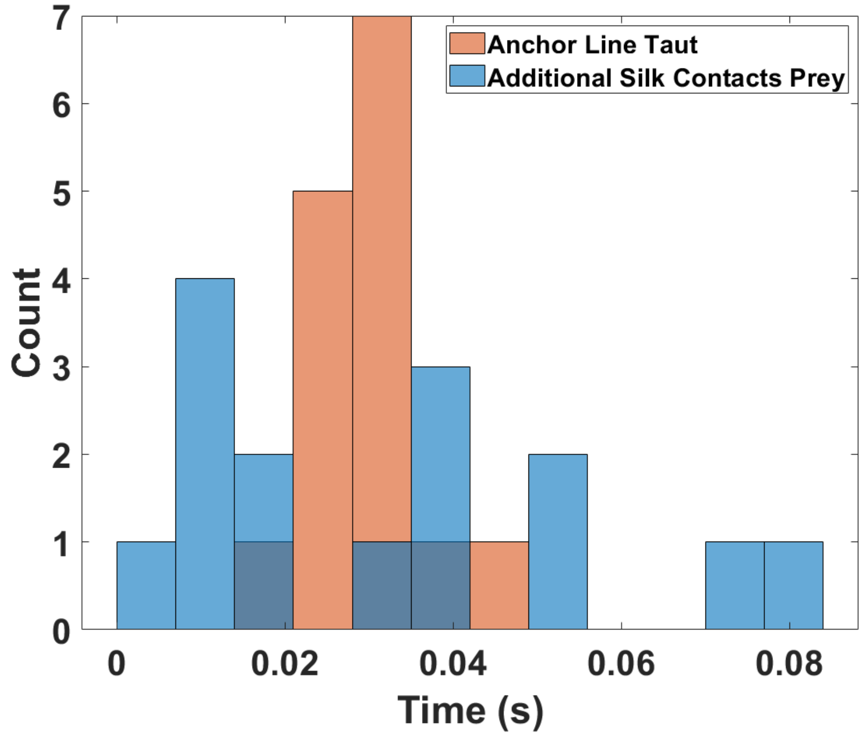

Figure S1. Histogram of time until the first extra strand of capture silk contacts the prey compared to the time for the anchor line to become taut at the end of the first forward cycle of the oscillation. In about half the encounters the initial forward motion of the web brought brought extra silk into contact with the prey within 10-20ms. In later time instances, extra strands of capture silk contacted the prey only as a result of oscillations due to web jerk.

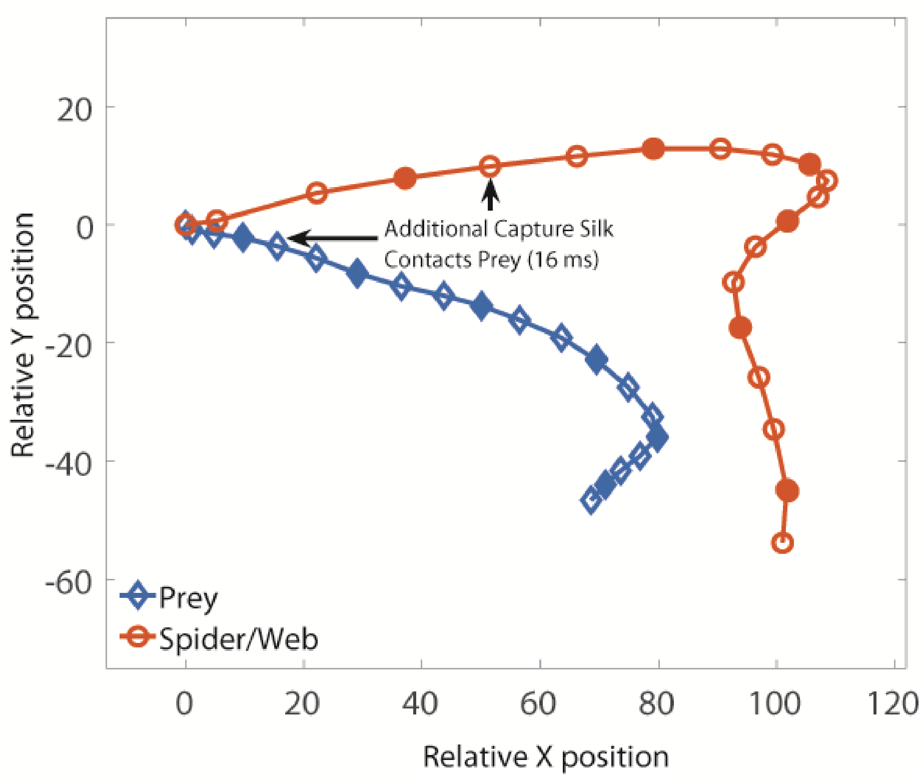

Figure S2. Relative position of prey and spider through time for a nearly horizontal web. Each mark indicates 4ms with filled marks at 12, 24, 32, 40, 48, 66, and 74 ms. 16 ms after release additional capture silk comes into contact with the prey. The spider and web initially move much further and faster in the X direction relative to the prey, due to their large inertial differences. The movement in the Y direction is mostly due to gravity, and occurs largely after the first forward cycle of the web.

Table S1. Comparison of power-amplified accelerations and velocities. *Hyptiotes* ranks midway in acceleration for whole body movements in arthropods.

Event	Max Acceleration	Max Speed	Source
Mantis Shrimp Strike	104000m s¯2	23m s¯1	Patek et al. 2004
Trap-Jaw Ant Jaws	12988 m s¯2	64.3m s¯1	Patek et al. 2006
Froghopper Jump	5400m s¯2	4.7m s¯1	Burrows 2006
Flea Jump	1600m s¯2	1.9m s¯1	Sutton and Burrows 2011
Hyptiotes Release	771m s¯2	2.15m s¯1	Current paper
Chameleon Tongue	486m s¯2	5.41m s¯1	Anderson 2016
Grasshopper Jump	180m s¯2	3.2m s¯1	Bennet-Clark 1975
Bush Cricket Jump	114m s¯2	2.1m s¯1	Burrows and Morris 2003

Movie S1. Close-up of *Hyptiotes* release movement: abrupt braking (slowed 200x)
Hyptiotes abruptly brakes at time ~4s without releasing any noticeable silk. Due to the center of mass of the *Hyptiotes* being out of line with the anchor and trap line the excess translational energy not stored in the anchor line elastically is converted to rotational energy. The rotation of the body causes the web to recoil out of phase with the translational motion.

Movie S2. Whole web view of *Hyptiotes* prey capture (real time)
After a fly impacts its web, *Hyptiotes* performs five extremely rapid sequential release events to capture its prey. The entire web is mostly collapsed by the fifth release. After the fifth release *Hyptiotes* further collapses the web by lengthening the anchor line without a release event.

Movie S3. Whole web view of *Hyptiotes* prey capture (slowed 8.3x)
One slowed-down release movement from Supplementary Video 2 as *Hyptiotes* catches and tangles a fly.

Movie S4. Close-up of prey being flung into silk during release movement (slowed 25x)
Hyptiotes (off-screen left) releases the anchor line, causing the web to spring forward. This causes capture threads to cross the fly's body, further adhering it as it is simultaneously flung into additional sections of the web.

Movie S5. Close-up of *Hyptiotes* release movement: unspooling and braking (slowed 200x)
Video demonstrating the unspooling behavior of *Hyptiotes*. Once the anchor line becomes taut (~3s), *Hyptiotes* releases more silk, allowing the spider to continue moving forward. The extent of unspooling can be inferred by comparing the location of the *Hyptiotes* at ~3s to the location at the end of the video (9s).

Movie S6. Simulated release motion of a simplified *Hyptiotes* system using MATlab
Simulation is analyzed by tracking the position and rotation of the body and web. The shape and mass distribution and initial energy are the working variables of the simulation.

References

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