

Water striders learn from experience how to jump up safely from water surface

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You probably do not find it surprising that humans, dogs or cats, can adjust their behavior based on the experience. For instance, we all move more slowly after we slide and fall on the ice when we learn ice-skating.

A new study shows that water striders can do that too.

It was known that [water striders](#) jump upwards from the water surface without breaking it. But how can they do it? How do they know when the water surface would be broken? A multidisciplinary team of scientists from Korea, U.S. and Poland found that water striders adjust their jumping behavior by modifying the leg movements based on the experience acquired during frequent jumping, and that this modifications from experience depend on the [body weight](#) of the animal.

Biologists from Korea and Poland led by Sang-im Lee (Laboratory of Integrative Animal Ecology, DGIST, Korea) and Piotr Jablonski (Laboratory of Behavioral Ecology and Evolution, Seoul National University and Museum & Institute of Zoology, Polish Academy of Sciences) teamed up with biologists from U.S. led by Hangkyo Lim (Notre Dame of Maryland University) and engineers lead by Ho-Young Kim (Seoul National University) and provided an experimental proof, at least for female water striders.

The scientists used high-speed video to measure jumping behavior of males and females of a common Korean water strider species, *Gerris latiaabdominis*. They compared individuals with experimentally added weight (heavy individuals) with control individuals (light individuals). Half of the heavy and half of the light individuals were prompted to jump every day for three days by frequently poking them gently during several hours per day, while the other half did not experience frequent jumping during this period. Then the scientists measured their jumping behavior at the very beginning of the experiment and after those three days, and found that the heavy females (those with the added additional weight) changed their jumping behavior differently than the females without any extra weight.

Additionally, the adjustments to light vs. heavy body were only

detectable for individuals who experienced frequent jumping. "We observed adjustments in the speed of leg movements and in the jump velocity—final outcome of the jump," says Minjung Baek, the first author of the study. Females experiencing lighter body weight during the three days of frequent jumping moved their midlegs more slowly than those not prompted to jump frequently. On the other hand, females experiencing heavier body weight during frequent jumping moved the legs faster, as if they "knew" that in order to produce a fast jump they need to "work harder" due to the added weight. But they made these adjustments "carefully" so that the surface tension of the water was not broken. Males did not show such a clear difference in adjustments of their jumping behavior to their body weight.

A question arises: Why do we see this difference between males and females? "In water striders including this species, mating males may ride on top of females for hours or even for days, and this means that during mating a female must sustain the weight of the mating male in addition to her own body weight on the water surface," says Dr. Piotr Jablonski, who studied mating behavior of water striders in the past. "Males do not experience such repeated temporary increases in the perceived body weight and therefore they did not need the ability to use their experience to adjust their jumping behavior," adds Dr. Sang-im Lee, who seeks ecological explanations to biological phenomena by integrating biology, physics and engineering.

This interesting result shows how the plastic responses of animals can evolve depending on the environmental condition; in this case optimal behavioral adjustments were made through personal experience. There are many examples of animals, including insects, adjusting their behavior to changing environmental conditions through developmental or behavioral plasticity but this study clearly shows that they can do it through personal experience, just like we do.

More information: Minjung Baek et al, Water strider females use individual experience to adjust jumping behaviour to their weight within physical constraints of water surface tension, *Scientific Reports* (2020).

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