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Reducing the Gender Achievement Gap in College Science: A Classroom Study of Values Affirmation

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The balance of inertia and gravity yields a prediction for the lapping frequency of other felines. Assuming isometry within the Felidae family (i.e., that lapping height H scales linearly with tongue width R and animal mass M scales as R^3), the finding that Fr* is of order one translates to the prediction $f \sim R^{-1/2} \sim M^{-1/6}$. Isometry or marginally positive allometry among the Felidae has been demonstrated for skull (*20*, *21*) and limb bones (*22*). Although variability by function can lead to departures from isometry in interspecific scalings (*23*), reported variations within the Felidae (*23*, *24*) only minimally affect the predicted scaling $f \sim M^{-1/6}$. We tested this –1/6 power-law dependence by measuring the lapping frequency for eight species of felines, from videos acquired at the Zoo New England or available on YouTube (*16*). The lapping frequency was observed to decrease with animal mass as $f = 4.6\ M^{-0.181 \pm 0.024}$ (f in s^{-1}, M in kg) (Fig. 4C), close to the predicted $M^{-1/6}$. This close agreement suggests that the domestic cat's inertia- and gravity-controlled lapping mechanism is conserved among felines.

The lapping of *F. catus* is part of a wider class of problems in biology involving gravity and inertia, sometimes referred to as Froude mechanisms. For example, the water-running ability of the Basilisk lizard depends on the gravity-driven collapse of the air cavity it creates upon slapping the water surface with its feet. The depth to which the lizard's leg penetrates the surface depends on the Froude number, which in turn prescribes the minimum slapping frequency (*25*). The Froude number is also relevant to swimming, for example, setting the maximum practical swimming speed in ducks (*26*), and to terrestrial legged locomotion. In this respect, it is interesting to note that the transition from trot to gallop obeys nearly the same scaling of frequency with mass as lapping, $f = 4.5\ M^{-0.14}$ (f in s^{-1}, M in kg) (*27*).

The subtle use of the tongue in the drinking process of *F. catus* is remarkable, given the tongue's lack of skeletal support (*28*). Complex movement in the absence of rigid components is a common feature of muscular hydrostats, which in addition to tongues include elephant trunks and octopus arms (*28*, *29*). The functional diversity and high compliance of these structures continue to inspire the design of soft robots (*29*), and a fundamental understanding of their functionality can lead to new design concepts and is essential to inform biomechanical models (*29*, *30*).

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Materials and Methods
References
Movies S1 to S3

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Reducing the Gender Achievement Gap in College Science: A Classroom Study of Values Affirmation

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In many science, technology, engineering, and mathematics disciplines, women are outperformed by men in test scores, jeopardizing their success in science-oriented courses and careers. The current study tested the effectiveness of a psychological intervention, called values affirmation, in reducing the gender achievement gap in a college-level introductory physics class. In this randomized double-blind study, 399 students either wrote about their most important values or not, twice at the beginning of the 15-week course. Values affirmation reduced the male-female performance and learning difference substantially and elevated women's modal grades from the C to B range. Benefits were strongest for women who tended to endorse the stereotype that men do better than women in physics. A brief psychological intervention may be a promising way to address the gender gap in science performance and learning.

The substantial underrepresentation of women in science, technology, engineering, and mathematics (STEM) disciplines has long concerned policy-makers and the educational community (*1*, *2*). In 2006, women earned only 28% of Ph.D.s in physical sciences, 25% in mathematics and computer science, and 20% in engineering in the United States (*3*). Although women made up 47% of the North American workforce in 2009, the percentage of women in lucrative technical professions, such as "computer and mathematical occupations" and "architecture and engineering occupations," reached only 25% and 14%, respectively (*4*). Similar underrepresentation of women in STEM-related professions is also evident in other parts of the world (*5*).

The gender gap in STEM disciplines goes beyond the limited representation of women. In college physics—the field studied in the present investigation—women earn lower exam grades and lower scores on standardized tests of conceptual mastery (*6*, *7*). Students' prior background and preparation in mathematics and physics, iden-

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