Title
A Pound of Lead Feels Heavier than a Pound of Feathers: A Potential Perceptual Basis of a Cognitive Riddle

Journal
Proceedings of the Annual Meeting of the Cognitive Science Society, 29(29)

ISSN
1069-7977

Authors
Wagman, Jeffrey
Zimmerman, Corinne
Sorric, Christopher

Publication Date
2007

Peer reviewed

A Pound of Lead Feels Heavier than a Pound of Feathers: A Potential Perceptual Basis of a Cognitive Riddle

Jeffrey Wagman (jeffreywagman@ilstu.edu)
Corinne Zimmerman (czimmer@ilstu.edu)
Christopher Sorric (crsorri@ilstu.edu)
Department of Psychology, Illinois State University, Campus Box 4620
Normal, IL 61790 USA

Keywords: perception; naïve physics; motor control

"Which weighs more—a pound of lead or a pound of feathers?" The seemingly naïve answer to this familiar riddle is the pound of lead whereas the correct answer is that they weigh the same amount. The naïve answer may reflect robust misconceptions about weight and mass. For example, children and adults believe that heavier objects fall and sink faster than lighter objects and such erroneous ideas persist even in the face of contradictory evidence. (e.g., Chinn & Malhotra, 2002).

However, the naïve answer may not be so naïve after all. For over 100 years, psychologists have known that two objects of equal mass feel differently heavy depending on the mass distribution of those objects. In particular, given two objects of equal mass, the one with the smaller volume feels heavier. This is the *size weight illusion* (Jones, 1986). Holding a pound of feathers and a pound of lead would be expected to induce such an illusion. Given a smaller volume, the pound of lead would be expected feel heavier. Instead of reflecting a cognitive error, the naïve answer may reflect how the two objects would feel if held in the hands. We explore the potential *perceptual* basis of the naïve answer by investigating whether a pound of lead feels heavier than a pound of feathers.

Method

Twenty-three undergraduate students (22 women and 1 man) participated in this experiment. All but three reported being right handed.

Two cardboard boxes (16 cm x 16 cm x 31 cm) contained either 453.6 g (1 pound) of lead shot or 453.6 g (1 pound) of goose down pillow feathers. The lead shot was sealed in a plastic bag and taped to the inside of the bottom panel of the box (this panel was always placed on the participant's palm). The feathers were sealed in a plastic bag, which was sealed and fit snugly into the box. Each box was taped shut. The total weight of each box (with feathers or lead, bag, and tape) was 637.9 g.

Participants sat in a chair and put on blackened goggles. They placed the palm of their preferred hand up with their fingers relaxed. On a given trial, each box was handed to the participant in succession. The first box was referred to as "Box A;" the second was referred to as "Box B." Each box was gently placed on the participant's hand such that it was centered with the palm. Box orientation was held constant across trials. Participants hefted a given box for as long as they wished and were allowed to alternate between boxes as often as they wished. They reported which box felt heavier ("Box A" or "Box B") on twenty trials—ten beginning with the "lead" box and ten beginning with the "feathers" box. Trial sequence was randomized for each participant. Participants were unaware of how many boxes there were and of the contents of the boxes.

Results

The proportion of trials that the lead box was chosen by each participant was compared to a chance value of 0.5 in a one-sampled, one-tailed *t*-test. This box was chosen at a level above chance (M =.56, SD =.11), $t(22) = 2.36$, d = .55, p = .015. The lead box was chosen as the heavier box more often than the feathers box by 74% of the participants.

Discussion

These results show that, consistent with the naïve answer to the riddle, a pound of lead feels heavier than a pound of feathers. This exemplifies the size weight illusion – a phenomenon that demonstrates that the perception of heaviness is not simply the perception of mass. Our results are consistent with findings that perception of heaviness is perception of movableness (Shockley, Carello, & Turvey, 2004). All other things being equal, the more symmetrically an object's mass is distributed, the easier it is to control, and the lighter it feels. Given that the mass of the feathers was distributed more symmetrically than the mass of the led (the feathers (i.e., the feathers filled the box), the box containing feathers was easier to control than the box containing lead and therefore it felt lighter. The naïve answer to the riddle seems to have a basis in perception. It reflects how the two objects would feel if held in the hands (and not necessarily a cognitive error).

References

Chinn, C. A., & Malhotra, B. A. (2002). Children's responses to anomalous scientific data: How is conceptual change impeded? *Journal of Educational Psychology, 94*, 327-43.

Jones, L. A. (1986). Perception of weight and force: Theory and research. *Psychological Bulletin, 100*, 29-42.

Shockley, K., Carello, C., & Turvey, M. T. (2004). Metamers in the haptic perception of heaviness and movableness. *Perception & Psychophysics, 66*, 731-742.