Title: Does Container Weight Influence Judgments of Volume?

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ABSTRACT

This study replicates and extends Krishna’s (2006) work on the cross-modal interaction effect of vision and touch on elongation bias by investigating whether container weight exerts an influence on elongation bias. We found that there is no elongation bias when participants perceive tall and short containers as being the same weight. Moreover, information about container weight can be used as a heuristic cue when one is estimating volume.

Keywords: Container weight, Elongation bias, Estimating volume
Elongation bias refers to taller, thinner containers having a greater volume than shorter, wider containers of equal volume (Holmberg, 1975). Krishna (2006) explored the interaction of the haptic sense and the visual sense in terms of judgments of volume. The findings showed that elongation bias operates when people touch a glass while looking at it, but there is no such bias when people touch the glass without looking at it.

However, when people hold a container, they perceive not only the geometric properties of the container but also its weight. Lederman and Klatzky (1993) showed that holding an object enables individuals to obtain information about its weight; therefore, container weight may influence estimations of volume. The purpose of the present paper is to replicate and extend Krishna’s (2006) work by investigating whether, given two containers of different weights but equal volume, consumers will base their estimations of volume on weight.

Amazeen (1999) suggested that variations in size can affect the perceived heaviness of an object. People judge the weight of an object based on its appearance, and they expect a larger object to be heavier (Murray et al., 1999). Following this same argument, the current research proposes that variations in weight may affect perceived volume. When people see a container and handle it, and then perceive its heaviness, they may use the information about its weight as a heuristic cue to simplify the process of estimating volume. Consequently, when they estimate the volume of tall and short containers of equal volume and heaviness, their estimations will not differ. This will result in the elimination of elongation bias. Moreover, this study also expects that a heavier container will be perceived as having a greater volume.

1. **Study 1:** We expected that when the weights of a tall and a short container of the same volume were perceived as equal, estimates of the volumes of the containers
would not differ; therefore, elongation bias would be eliminated. Study 1 used a 2 (heaviness/ yes or no) × 2 (container shape/ tall or short) design in which the first factor was between subjects, and last factor was within subjects. It should be noted that no heaviness means that the weight of the container was in no way manipulated.

**Volume estimates.** The results showed an interaction of container weight and container shape, \( F(1,65) = 15.11, p < .01, \eta^2 = 0.19 \). Elongation bias was observed in the no heaviness condition, \( F(1,33) = 38.94, p < .01, \eta^2 = 0.54 \) (\( M_{\text{tall}} = 496.32, SD_{\text{tall}} = 33.81 \) vs. \( M_{\text{short}} = 387.06, SD_{\text{short}} = 22.32 \)). In the heaviness condition, however, the perceived volumes of the two containers did not differ, \( F(1,32) = 1.92, p = .175 > .05, \eta^2 = 0.06 \) (\( M_{\text{tall}} = 581.82, SD_{\text{tall}} = 33.20 \) vs. \( M_{\text{short}} = 561.52, SD_{\text{short}} = 35.53 \)). Elongation bias was thus eliminated in the heaviness condition.

2. **Study 2:** The aim of study 2 was to test whether information about weight would be used as a heuristic cue to simplify the process of estimating volume. This study expected that a heavier container would be perceived as larger than a lighter container. Study 2 used a 2 (weight consistency/ consistency or inconsistency) × 2 (container weight/ light or heavy) × 2 (container shape/ tall or short) design, with the first two as between-subject factors and the last one as a within-subject factor.

**Volume estimates.** As predicted, the tall heavy container (\( M = 732.14, SD = 47.51 \)) was perceived as having a greater volume than the short light container (\( M = 389.29, SD = 21.88 \)), \( F(1,27) = 57.95, p < .01, \eta^2 = 0.68 \), whereas the tall light container (\( M = 404.00, SD = 45.18 \)) was perceived as having less volume than the short heavy container (\( M = 652.00, SD = 55.86 \)), \( F(1,24) = 30.69, p < .01, \eta^2 = 0.56 \). This finding indicates that individuals use information about the weight of a container as a heuristic cue to simplify the process of estimating volume and that a heavier container is perceived as being larger.
Krishna’s (2006) research focuses on visual input against haptic input in terms of container appearance in judging volume; in contrast, this research highlights visual input and haptic input in terms of container weight in judging volume. The results in current research showed that when the participants perceived the tall and short containers as having the same weight, their estimations of the volumes of the two containers were no different. Elongation bias was eliminated. Moreover, participants tended to use information about the weight of a container as a heuristic cue to simplify the process of estimating volume. In this case, the heavier container is judged as having the greater volume.

Prior research on packaging has established that visual extrinsic cues of the package, such as shape, price, and color, affect judgments of volume (Krishna, 2007). The findings of the current study demonstrate that when consumers perceive the heaviness of a container with their hands, the haptic cue (weight) overrides the visual cue (shape) in estimations of volume. The visual bias of container shape (elongation bias) is thus attenuated by container weight.

Studies on judgments of volume have documented that container shape influences perceived volume, which in turn influences consumption behavior (Madzharov & Block, 2010; Raghubir & Krishna, 1999; Van Ittersum & Wansink, 2012). In fact, when people drink from a container, they may feel its weight decreasing as they do so. The perceived degree of weight change may also vary by container material. The potential relationships between weight change and expectancy disconfirmation on consumption and pouring behavior may be an issue worth investigating.

References


