

The Influence of Weight Cues on Product Perceptions

by

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Abstract

In two studies we demonstrate the influence that weight cues have on product perceptions. In Study 1 we examine the effects of visual weight cues on the sensation of physical weight. Participants judged that a CD case with an album cover containing images of heavy objects was heavier than the same CD case with light imagery. In Study 2 we examine the effects of physical weight on metaphorically related judgments. Holding a heavy version of *The Catcher in the Rye* increased participant's ratings of importance when compared to a lighter version. These two findings demonstrate that perceptual inputs can influence the experience of other perceptions and abstract concepts. Study 2 provides findings consistent with the embodied perspective of cognition, suggesting that the abstract concept of importance is grounded in a person's physical experience with the weight of an object.

The Influence of Weight Cues on Product Perceptions

Traditional views of cognition postulate that knowledge exists in a semantic memory system that is independent from the brain's other systems of perception. Following this theory, representations of concepts are converted into amodal symbols that contain different facets of the various involved processes. Grounded cognition rejects this theory in favor of a multimodal representation that integrates knowledge across the areas of perception, action, and introspection (Barsalou, 2008). Although not always identical, most grounded cognition theories focus on the role of simulation during knowledge acquisition (Barsalou, 1999). Simulation is when the perceptual, motor, and introspective states are reactivated in a manner similar to when the knowledge was acquired. For instance, when interacting with an object, such as a football, the brain would capture how the football is being perceived across all of the sensory modalities and combine them to form a multimodal representation (e.g. how the football feels, the physical motions of throwing or catching it, how the person feels while playing football). In the future, when the concept of football is brought to mind, it is represented by the combined activation of all of the cognitive processes and perceptual representations associated with it become activated.

One consequence of the distribution of concepts across different perceptual inputs is that activation of information in one modality can influence the perceptual experience of other modalities. For instance, Krishna and Morrin (2008) found mineral water served in a flimsy cup was rated as being lower quality compared to the same water served in a firm cup. Similarly, colorful food (in liquid and solid form) was rated as being sweeter than the same food without any color (Alley & Alley, 1998). In both of these examples, the physical characteristics of the products affected the subsequent taste perception.

In another series of studies, wearing a heavy backpack caused participants to overestimate distance (Proffitt, Stefanucci, Banton, & Epstein, 2003). Correspondingly, wearing a heavy backpack caused participants to estimate hills as being steeper than those not wearing a backpack. Other bodily states have been shown to affect perceptions as well. For example, physically exhausted participants as well as the elderly viewed steep hills as having a greater incline (Bhalla & Proffitt, 1999). This line of research demonstrates that people will rely on multiple perceptual inputs when forming a representation, incorporating sensations of fatigue and effort and visual perception into their estimates of steepness. Because these various physical and cognitive experiences can influence a person's observations, it allows for the possibility of many different kinds of stimuli having unattended and unconscious control over a person's thoughts and feelings.

Embodiment

Embodiment is a special case of grounded cognition that emphasizes the influence of bodily feelings and sensations on affective and cognitive states (Smith, 2005). For example, contracting the zygomaticus muscles (used to smile) will produce more positive affect (Strack et al., 1988) while having a slumped body position will create negative affect (Stepper & Strack, 1993). Embodiment is also involved in concept activation. For example, extending your middle finger will increase hostility ratings of ambiguous behavior (Chandler & Schwarz, 2009) while moving in a stereotypical manner will activate the corresponding stereotypes. (Mussweiler, 2006).

Metaphors

Metaphors are commonly thought of as being purely linguistic structures. However,

Lakoff and Johnson (1980) note that metaphors are created through the interaction of the physical and social environments and thus reflect the grounding of abstract concepts in bodily sensations and perceptual experience. For example, when a person is thinking about a “weighty” issue it is not meant that their thoughts actually have a physical difference in weight. Instead, this reflects an association between weight and effort based on physical experience. For instance, more physical energy is needed to carry or push heavy objects. Likewise, heavier items that fall will have a greater impact when compared to lighter objects. Important decisions share similar characteristics: they require more mental energy and effort when compared to unimportant decisions and their consequences are often greater. Because of this metaphorical relationship between importance and weight, the embodied perspective predicts that manipulating the weight of an object might influence the related cognitive processes regarding importance.

The embodied nature of metaphors can lead physical sensations to influence the abstract ideas that they are used to metaphorically represent. In a study by Williams and Bargh (2008), participants were requested to hold a hot or cold cup of coffee and asked to make personality judgements of another person. It was found that the temperature of the coffee affected the personality ratings, with the participants holding the hot cup of coffee evaluating the person as being friendlier and socially warmer than those holding the cup of cold coffee. Also, it was found that social exclusion could influence a person’s perception of the temperature of the room. Participants who recalled a time of being socially excluded rated the room temperature lower than participants who thought of a time of inclusion (Zhong & Liljenquist, 2008). Returning to the example of estimating hill steepness, in another study it was found that climbing up a steep hill can be perceived as less difficult when good friends are around or even merely thought of, reflecting peoples perception that “many hands make light work” (Schnall, Harber, Stefanucci, &

Proffitt, 2008). This suggests that the social support can be thought of as a physical and psychological resource.

Present Research

In the present research, we conducted two studies relating to the influence of weight cues. Previous research has shown that the activation of perceptual inputs can influence the experience of other perceptions (Krishna & Morrin 2008; Meyers-Levy, Zhu, & Jiang, 2009). Extending this, in Study 1 we tested to see if visually experiencing heavy and light images influenced a person's perception of how much an object weighs. We manipulated the album cover on a CD case to have an image depicting either heavy or light objects and metaphors. We predicted that holding a CD with heavy imagery would cause the participant to perceive the CD as weighing more than the CD with the light imagery.

In Study 2, we examined whether changing the physical weight of an object could influence a person's perception of its importance. Previous research has demonstrated that a person's judgment of importance is grounded in their experience with weight (Jostmann, Lakens, & Schubert, 2009). Specifically, we manipulated the weight of the book *The Catcher in the Rye* into a heavy and a light version. We predicted that people would rate the heavier version of the book as more important than the lighter copy.

Study 1

Method

Participants. Fifty-seven University of Michigan students (35 male, 22 female; mean age = 20.53 years, $SD = 1.63$) were recruited from around campus computer labs. Participants were told that they would be entered in a raffle to receive a \$20 gift card to Amazon.com if they were able to correctly guess the weight of an empty CD case. Participants were randomly

assigned to either the heavy image ($n = 30$) or the light image ($n = 27$) condition. No participants were suspicious about the study.

Procedure. Participants were approached and asked if they would be willing to guess the weight of two objects for an experiment on weight perception. If the person agreed to do so, the experimenter explained that the purpose of the study was to see who could most accurately guess the weight of an empty CD case. The experiment consisted of a 2 (Condition, between subjects; heavy CD condition vs. light CD condition) X 2 (Object, within-subjects; check book vs. CD) mixed-model design. The first object presented for its weight estimation was a black checkbook. This was done to control for potential individual variability in weight estimates. Participants were instructed to hold the object in their dominant hand, examine it and then hand it back to the experimenter before guessing the objects weight. Participants marked their weight estimation using a vertical dash on a 10 cm straight line. The beginning of the line was marked 0 ounces and the endpoint 10 ounces. Participants were then presented with an empty CD case and asked to answer whether or not they owned that particular CD before guessing its weight using a similar procedure. Participants were randomly assigned to either the heavy or light image condition. Both CDs were fictitious albums by an artist named “John Robinson”. The artist’s name was chosen because of its neutrality and was kept as a constant. The image in the heavy condition contained a picture of large weightlifting dumbbells with an album title “With a heavy heart, I say goodbye”. The image in the light condition contained a picture of a kite floating in the sky with “Float” as the album title.

Results and Discussion

To assess the weight estimations, we measured the distance of the participant’s vertical dash from the beginning of the scale. Because the scale is 10 cm long, each centimeter

corresponds to 1 ounce. We then averaged the scores for each condition. A 2 (Condition, between subjects; heavy CD condition vs. light CD condition) X 2 (Object, within-subjects; check book vs. CD) mixed-model ANOVA was used for analysis. Not surprisingly, weight estimates of the checkbook differed from weight estimates of the CD, $F(1, 55) = 8.35, p = .006, \eta^2_p = .10$. More importantly, the mixed-model ANOVA revealed a significant interaction between Condition and Object $F(1, 55) = 5.91, p = .018, \eta^2_p = .10$. Univariate ANOVAs comparing each object across conditions revealed that participants in the heavy-image condition estimated the CD case as weighing more ($M = 3.99, SD = 1.93$) than those in the light image condition ($M = 2.79, SD = 1.6$), $F(1,55) = 6.47, p = .014$. However, there was no difference in participant's initial estimates of the checkbook in the heavy CD ($M = 4.08, SD = 1.94$) and light CD ($M = 3.80, SD = 1.77$) conditions, $F(1,55) = .741, p = .39$. We can therefore rule out that initial weight estimations of the checkbook had any effect on the subsequent weight estimations of the CD case.

As predicted, participants who held and viewed a CD case containing a heavy-image estimated the case as weighing more than the participants with a light-image. This suggests that visual perceptions of heavy and light stimuli can effect a person's perception of how much an object weighs even when they have the opportunity to hold the object in their hands.

Study 2

Study 1 demonstrated that people would incorrectly use perceptions in one domain as a diagnostic tool for making inferences in an unrelated domain. Specifically, visually experiencing heavy or light images influenced a person's perception of how much an object weighed despite the availability of more diagnostic sensory information provided by holding the object. In Study 2 we turn to testing whether a person's perception of a book's importance can be influenced by

the weight of the book. Both studies include studying the effects of cross-modal perception; however Study 2 seeks to confirm that a person's abstract concept of importance is grounded in their physical experience with weight.

Method

Participants. Sixty University of Michigan students were recruited from around campus computer labs. Participants were randomly assigned to either the heavy book ($n = 30$) or the light book ($n = 30$) condition. No participants were suspicious about the study.

Procedure. Participants were approached and asked if they would be willing to participate in a study on product perception. If the person agreed to do so, the participant was asked to hold onto the book *The Catcher in the Rye* while the experimenter recorded the participant's answers. While holding the book participants were asked to rate, on a scale from one to ten, the importance of *The Catcher in the Rye* influence on American literature (1 = *not important*, 10 = *very important*). Participants were then asked whether or not they had read the book and how many years in the past they had read it. The heavy version of the book contained weights that increased its weight to 605 grams while the light book weighed 403 grams.

Results and Discussion

A one-way ANOVA comparing importance ratings in each condition revealed that participants holding the heavy book rated *The Catcher in the Rye* as being more important ($M = 7.22$, $SD = 1.60$) than participants holding the light book ($M = 6.37$, $SD = 1.30$), $F(1, 58) = 5.12$, $p = .027$. Additionally, participants who had read the book rated the book as more important ($M = 7.34$, $SD = 1.35$) than those who had not read the book ($M = 6.08$, $SD = 1.35$), $F(1,58) = 12.34$, $p = .001$. Finally, both of these findings were qualified by a significant interaction between Condition and Read $F(1,56) = 4.48$, $p = .04$. Participants who had not read *The Catcher in the*

Rye did not differ in their importance ratings between the heavy condition ($M = 6.00$, $SD = 1.79$) and the light condition ($M = 6.13$, $SD = 1.13$), $t(58) = .233$, $p = .82$. However, importance ratings for participants who had read *The Catcher in the Rye* did differ between the heavy ($M = 7.92$, $SD = .95$) and light ($M = 6.60$, $SD = 1.45$) conditions, $t(58) = 3.20$, $p = .003$. Conversely, the importance rating of readers differed from non-readings only when the book was heavy $F(1,58) = 14.96$, $p = .001$ compared to when it was light $F(1,58) = .966$, $p = .334$.

As predicted, participants who held the heavy version of the book rated it as being more important than participants who held the light version. However, this effect was solely driven by participants who had read the book. The emergence of a weight effect shows that a person's perception of importance can be influenced by their bodily experience with the weight of an object. However, the observed interaction highlights a previously unknown contingency to which I return below.

In addition, participants who had read the book rated *The Catcher in the Rye* as more important than those who had not read it. However, this effect was solely driven by those who held the heavy edition of the book in their hands. While it is not clear why this is the case, several theories can be offered. One explanation is that those who had or had not read the book made an inference about their behavior and applied it to their rating of importance (Bem, 1967). Accordingly, those who had read the book might think that because they had read the book, it must be important. Similarly, those who had not read the book might infer that if the book had been important than they would have read it. While this explains the main effect of whether the participants read the book, it does not explain the interaction with the weight of the book. Another possibility is that when forming an importance judgment about the book, people reconstructed a memory of reading it or inferred how it might have influenced them personally.

The weight of the book could have influenced the autobiographical memories that come to mind when thinking about it, leading people to construe prior experiences as reflecting the importance of the work or to overestimate its importance in their personal understanding of the world (Ross, 1989).

Alternatively, it is possible that those who had read *The Catcher and the Rye* made an inference about it before they held the book. Because they had read the book, the participants were able to appreciate its contributions to American literature. However, because they felt justified to make a judgment on the book the participants unknowingly relied on a multitude of perceptions, such as the weight of the book, when considering its importance. Those who had not read the book were not able to take part in this process that lead to appreciating its importance and therefore had already formed an impression of the book before holding it and were not susceptible to being influenced by the weight. This suggests that a person's perception of importance can only be influenced by physical weight when they are familiar with the item. Though the reason behind this remains unclear, the observation bears a resemblance to the findings in the "social judgeability" literature (Leyens, Yzerbyt, & Schadron, 1991; Yzerbyt, Schadron, Leyens, & Rocher, 1994). There, people are more likely to rely on irrelevant information when they have some superficial familiarity with another person than when the other person is completely unknown. In the latter case, they are presumably aware that they better refrain from judgment. Similarly, it is possible that if a person is aware that they lack adequate knowledge about a given item then they will disregard any sort of present cues because they realize they should refrain from judgment. Accordingly, they would ignore any sort of bodily sensations, such as the physical weight of the item, when assessing the target. Conversely, participants who had read *The Catcher in the Rye* might rely on a multitude of cues when

assessing its importance because they do not have a reason to disregard them due to their familiarity with the book, which licenses them to offer judgment. This finding is similar with current research that discovered bodily sensations induced by the rigidity of floors a person stands on do not have any effect when a person is far away from a target and thus cannot make an adequate evaluation (Meyers-Levy, Zhu, & Jiang, 2009).

From the present research it is not clear which theory is responsible for explaining why the weight of the book only influences participants who had read the book because both make identical predictions in this particular case. Future research could address this issue of which process best explains when body movements can influence judgments by dissociating prior experience from other kinds of information that may make people feel as though they have enough information to make an informed decision.

General Discussion

In Study 1 we obtained evidence that visually experiencing light and heavy images influenced a person's perception of how much an object weighed. While holding a CD case with a picture of a floating kite, participants rated it as weighing less than the same CD case with an image of a weight lifting dumbbell. This suggests that visual perceptions can be incorporated into a person's estimates of weight. This finding supports the aspect of grounded cognition theory that suggests experiences in one domain of perception can influence related domains.

In Study 2 we were able to replicate previous findings that a person's understanding of importance is linked to the physical experience of weight (Jostmann, Lakens, & Schubert, 2009). This is consistent with the embodied perspective that states a person's understandings of abstract concepts are connected with sensorimotor experiences (Barsalou, 2008). This supports research

in other areas that show additional concepts, such as anger, can influence a person's physical experience with temperature (Wilkowski, Meier, Robinson, Carter, & Feltman, 2009).

For Study 1, future research should address the question of what specific aspects of the image are causing the differences in weight estimations. For instance, it is supposed that the color, image and words of the CD cover all influenced the weight judgment; however, it is unclear which component exerted the most influence. Isolating the cause of the effect would provide further insight to the relationship between a person's perception and bodily experience of an object. Future research should also address the directionality of cross-modal priming. Particularly, would changing the weight of the CD case influence a person's perception of the weight of the object in the image of the album cover?

For Study 2, it is important for future research to focus on whether the relationship between weight and importance is bidirectional. Specifically, does priming importance influence perceptions of how much an object weighs? Metaphors are usually thought to be unidirectional (Bargh, 2006; Lakoff & Johnson, 1980). For example, it was found that priming spatial information affected how time was perceived, but influencing temporal information did not change how people perceived space (Boroditsky & Ramscar, 2002). However, recent research suggests that some "metaphors" may be bidirectional. For instance, Zhong and Liljenquist (2006) found a bidirectional relationship between physical and moral purity. They demonstrated that threatening one's sense of morality increased participant's desire for physically cleansing products as well as making them more likely to physically cleanse themselves. Conversely, the act of washing one's hands was shown to lessen the effects of unethical behavior and diminish threats to a person's moral self-image.

Linguistically, metaphorical comparisons seem to be nonreversible whereas literal comparisons tend to be (Glucksberg, McGlone, & Manfredi, 1997). Accordingly, one would expect that the findings in Study 1 would be bidirectional (i.e. a heavy CD case would cause higher weight estimations of the objects on the album cover and vice-versa) while the findings in Study 2 would not be reversible. However, the bidirectional nature between embodied experiences with metaphors is not clear because only a few studies have addressed the topic. Therefore, it is difficult to find a commonality that could explain the phenomenon. Discovering when metaphors have a bidirectional relationship between mental and physical experience would enhance our comprehension of how we interpret and experience metaphors and our subsequent actions.

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