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## Heavy-heartedness biases your weight perception

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#### ABSTRACT

Heavy-heartedness (light-heartedness), among more than two hundred metaphors related to the heart, indicates negative (positive) affects. Although these metaphors are generally understood rhetorically, this study explores whether there is any literal connection between either of these two states and one's perception of weight. Participants who recalled a heavy-heartening (vs. light-heartening) past event estimated more weight of an object (Study 1). While watching weightlifting and pole-vaulting competition clips, people in heavy-hearted (vs. light-hearted) states predicted that players' success is less likely (Study 2). However, this result was not observed while people in both states watched non-weight-related games, such as golf-putting and pool. The findings are congruous with embodied cognition theory and the role of metaphors in our life.

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Embodied cognition; heavyheartedness; lightheartedness; metaphor; weight perception

*Heart* refers to more than an organ—the word *heart* has itself become a symbol of the human spirit (Wolff, 1950). Almost every culture recognizes the connection between the heart and human emotion (Loe & Edwards, 2004), such that a number of heart-related expressions exist across languages (e.g., warm-hearted, ein gutes Herz haben, apprendre par cœur, and partir el corazón a uno). According to the review of Loe and Edwards (2004), 221 nonmedical English expressions contain the word *heart*. Further, metaphors such as "in good heart" and "heart of stone" are widely used to pick out a salient detail of a person's disposition (Barcelona, 1952).

As Loe and Edwards (2004) pointed out, metaphors related to *heart* reveal several aspects of human emotions. When describing a happy or satisfied person, one uses "light-hearted," whereas when describing a sad or depressed person, one uses "heavy-hearted." It is known that numerous benefits accompany the state of light-heartedness, while the distress of enduring heavy-heartedness can yield several negative effects on one's psychological well-being. Experiencing frequent positive affects can promote successful outcomes within diverse domains (e.g., health, love) and behaviors (e.g., sociability, creativity) (Lyubomirsky, King, & Diener, 2005). On the other hand, a chronic heavy-hearted mood can be a major predictor of impaired functioning in different roles (Bromberger & Scalea, 2009). Although there is little doubt that feeling heavy-hearted or light-hearted has significant consequences on people's psychological and physical well-being, we ask a different question here: Does feeling heavy-hearted or light-hearted literally feel heavy or light?

Psychological condition and physical weight accompany each other in daily language usage. For example, when something bad happens, one's bodily movement slows down, such as when one feels "heavy-footed," whereas when one unloads the heart, one becomes "light of foot." Furthermore, people frequently describe psychological distress as some invisible weight on the shoulder, so we say people "shoulder" the responsibility or blame for something. This linguistic connection between psychological condition and physical heaviness reveals people's tendency to apply concepts that rest on bodily experience (i.e., weight) to explain abstract concepts (e.g., depression or discouragement) (Lakoff, 1987).

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As Lakoff and Johnson (1980) noted, metaphors are not just words but whole conceptual structures that fundamentally govern how we live (Bargh, 2006). Metaphor most certainly plays a major role in elaborating and construing abstract concepts (Barsalou, 1999). Therefore, a wealth of embodied cognition studies have taken their cue from metaphoric expressions, the lens through which people view and experience the world (Bargh, 2006; Troisi & Gabriel, 2011). For instance, metaphors such as "icy stare" depict the relationship where experiencing social isolation actually induces physical coldness (Zhong & Leonardelli, 2008). And, when we find someone good at self-regulating, we say the person has a strong "will power," which validates the finding that self-control, such as emotion regulation and thought suppression, actually relies on glucose as an energy source (Gailliot et al., 2007). According to Schubert (2005), power involves mental simulation of vertical space (i.e., "power is up") so that people responded to stimuli that are compatible with the power relations (i.e., powerfulness at the top) more quickly and correctly than they did to stimuli that are incompatible (i.e., powerlessness at the top). Moreover, physical cleansing removes traces of the past by metaphorically wiping the slate clean. Hence, a threat to one's moral purity induced the need to cleanse oneself (Zhong & Liljenquist, 2006), and physical washing also reduced the need to justify past decisions (Lee & Schwarz, 2010b). Lastly, recent research revealed that gustatory and olfactory stimuli also go hand in hand with more abstract concepts. As "chicken soup for the soul" depicts, comfort food actually protects people from a threat to one's sense of belongingness (Troisi & Gabriel, 2011), and fishy smells, metaphorically associated with suspicion, enhance performance on reasoning tasks (Lee, Kim, & Schwarz, 2015).

In line with findings above, several pieces of evidence that weight lies in relationship with more abstract concepts have been reported. Metaphors such as "carry great weight" and "lay weight on something" suggest that weight is linked with importance. In fact, holding a heavy object increased the subjective importance of given issues people were simultaneously evaluating (Jostmann, Lakens, & Schubert, 2009). Besides, the activation direction can be reversed: Important information in a book caused participants to perceive the book to be heavier (Schneider, Rutjens, Jostmann, & Lakens, 2011). While a body carries weight, its mind also carries weight, or importance, and vice versa. Moreover, people associate the experience of weight with the increased expenditure of physical and mental effort (Jostmann et al., 2009). Carrying heavy backpacks makes hills appear steeper and distance to targets appear greater (Proffitt, 2006). Further, a recent finding showed that weight perception relates to secrecy (Slepian, Masicampo, & Ambady, 2014), such that people harboring secrets experience being weighed down. Additionally, linguistic connections between weight and potency (Osgood, Suci, & Tannenbaum, 1967) and descriptions of the importance of abstract issues using weight-related metaphors (Vankeerberghen, 2006) have been also found. In short, weight serves as one of the embodied perceptual stimuli.

What do these findings tell us? Weight transcends physical area. It resonates with the nonphysical state of mind. The metaphor "heavy-hearted" does not talk about the actual weight of our organ, but it gives us a crucial hint about embodied psychological weight. Consequently, our intriguing question—"Does feeling heavy-hearted literally feel heavy?"—may promote a deeper understanding of weight embodiment. Experienced mental states can be represented by bodily manifestations just as experienced bodily states influence perceptual representation. Activation of psychological experiences, heavy-heartedness or light-heartedness, may influence weight perception and physical simulation. Concretely speaking, we propose that feeling heavy-hearted may actually induce bodily heaviness, because the two realms are synchronized in dealing with weight.

## The current research

In the current research, we conducted two studies to examine whether psychological heaviness is embodied in perception of physical weight. We tested whether feeling heavy-hearted versus lighthearted induces an actual difference in weight perception by asking participants to estimate the weight of an object (Study 1), and to predict whether weight-related sports players would succeed or fail (Study 2). We hypothesized that feeling heavy-hearted (vs. light-hearted) would lead participants to report a greater weight of the object and to predict that success is less likely.

## Study 1

The first study investigated whether feeling heavy-hearted or light-hearted could induce feelings of physical heaviness, measured by estimated weight of an object. We assume that the estimated weight of the object may well represent the extent to which one's body perceives weight. We thus predict that people would estimate an object to be heavier when feeling heavy-hearted than when feeling light-hearted.

## Method

#### **Participants**

One hundred and nine students ( $M_{age} = 22.4$ , Female 52.3%) from Seoul National University participated for compensation of 5,000 Korean Won (\$4.5).

#### Procedure

In an alleged emotional intelligence test, participants were given one of the two packets of our questionnaires that had been randomly stacked, such that they were randomly assigned to recall their past event that had made them feel either heavy-hearted or light-hearted and wrote an essay for 10 minutes.<sup>1</sup> For an alleged separate experiment, participants moved to the next room where a blind experimenter gave them the instruction. The second session was introduced as a physical perceptual ability test, and participants were asked to touch and lift up a box. They then evaluated the tactile sensation (i.e., "When you were lifting up the box, how slippery was its surface?"), size ("i.e., "How big did the box feel to you?"), and weight of the box (i.e., "What do you think was the weight of the box?"). While the tactile sensation and size perception were rated on 7-point Likert scales, the weight was estimated in an open-ended response. The box was made of paper, 30 cm  $\times$  30 cm  $\times$ 17 cm, 7 kilograms without a handle, and filled with several books. It was covered by plain white paper. Participants did not see the box handled by the experimenter or other participants. Seven kilograms was chosen for the target weight following the pretest where people showed the worst estimation accuracy around this weight.<sup>2</sup>

All participants rated their current mood on five items on a scale from -3 (very unsatisfied, very heavy-hearted, very unhappy, very uncomfortable, very sad) to 3 (very satisfied, very light-hearted, very happy, very comfortable, very pleased). However, the timing of the manipulation check varied. Half the participants received the manipulation check questions right after the essay-writing task, whereas the other half received them at the end of the weight estimation task. Lastly, we asked participants' height, body weight, age, and gender.

However, since there was a possibility that the mood manipulation could prime "heaviness" and "lightness" without necessarily inducing the feelings of heavy-heartedness and light-heartedness, we employed another condition in which participants were exposed to the words *heavy* and *light* but not asked to write their experiences of heavy-heartedness and light-heartedness. The procedure was identical except that the participants read an explanatory passage about either iron or aluminum and summarized the text in no more than two sentences laying stress on "the heavy (light) feature of iron (aluminum)." In other words, we explicitly exposed them to the word *heavy* or *light*, and then asked them to estimate the weight of the same box. All participants rated their current mood at the end of the estimation task and indicated if they could guess the purpose of the study. Consequently, the design was a 2 (heavy vs. light) × 2 (metaphor vs. literal) factorial design.

## **Results and discussion**

#### Manipulation check

A 5-item psychological state index was computed as the mean of all items ( $\alpha = .92$ ). Within the metaphor condition, participants in the heavy-heartedness condition (M = -.99, SD = 1.21) reported they felt less positive than the light-hearted condition (M = 1.28, SD = 1.32), F (1, 105) = 58.7, p < .001,  $\eta^2 = 0.359$ . Since there was no such difference within the literal condition, (M = .66 vs.

M = .42), F(1, 105) = .78, p = .406, it yielded a significant interaction effect, F(1, 105) = 36.88, p < .001,  $\eta^2 = 0.216$ . On the other hand, the order of the manipulation check within the metaphor condition had no effect on the current mood. Whether it was rated before or after lifting up the box made no difference, t(51) = .848, p = .401. The interaction effect between the weight condition and rating order was not significant, either, F(1, 53) = 2.33, p = .134. Therefore, we combined the two rating timings for the following analyses.

## Weight perception

To begin with, we found that gender was equally distributed ( $\chi^2 s < 0.93$ , ps > .332) and the average height, body weight, and age were not different (ts < 1.12, ps > .266) across the heavy vs. light conditions, in both metaphor and literal conditions. None of these factors had influences on the results below so it won't be further discussed.

There was a significant interaction effect between the weight condition (heavy vs. light) and the word usage (metaphor vs. literal), F(1, 105) = 4.66, p = .033,  $\eta^2 = 0.042$  (see Figure 1). In accordance with our hypothesis, but not with the priming hypothesis, the weight estimates were significantly different between the heavy-heartedness and the light-heartedness condition, F(1, 105) = 5.51, p = .021,  $\eta^2 = 0.049$ , but not between the literal "heavy" and "light" condition, F(1, 105) = .51, p = .489. Specifically, the estimated weight was heavier in the heavy-hearted condition (M = 4.59 kg, SD = 2.47) than the light-hearted condition (M = 3.25 kg, SD = 1.61). However, there was no such difference in weight estimate between the literal "heavy" and "light" conditions (i.e., 3.4 kg vs. 3.79 kg).

Moreover, the heavy and light conditions did not differ in size estimation, either in the metaphor conditions (F = 1.93, ns) or in the literal conditions (F = .77, ns). The tactile sensation of the box also made no difference between the conditions, either, Fs < .1. In other words, the manipulation of heavy/light-heartedness affected only weight perception, not size nor tactile perception of an object. Further, there was no one who managed to guess the purpose of the study.

This pattern of the results supports our hypothesis that when people feel heavy-hearted (vs. lighthearted) they would perceive an object to be heavier. It is noteworthy that this effect was not merely a priming effect.



Word Usage

Figure 1. Weight estimation of a box as a function of word usage (metaphor vs. literal) and weight (heaviness vs. lightness) in Study 1.

## Study 2

The physical consequence of being heavy-hearted or light-hearted was revealed in Study 1. To reaffirm the influence of psychological weight beyond weight perception of an object, we sought to expand this result to the perception of others' movement in Study 2. Specifically, we had participants watch sports in which players' performances are critically related to weight (i.e., weight-lifting and pole vaulting). We expected that participants feeling heavy-hearted would transfer their psychological states to the weightrelated sports players' physical activity so they would predict that success is less likely, as opposed to those feeling light-hearted. Our hypothesis is in line with the existence of mirror neurons, which allow an observer to experience psychological synchrony with an actor. Mirror neurons are fired both when executing certain kinds of actions and when perceiving the same actions being performed by another (Decety & Grèzes, 2006). By automatically matching the actor's observed action onto its own motor repertoire without executing it, the firing of mirror neurons in the observer's brain simulates the actor's action. Therefore, we expect that the observers (participants) will mentally simulate the actors' (players) action and that the observers' psychological states (feeling heavy-hearted vs. light-hearted) will affect their mental simulation. Hence, the observers who are feeling heavy-hearted would predict that actors' success is less likely, contrary to those feeling light-hearted. Another feature of Study 2 is the addition of a control condition, which was absent in Study 1.

## Method

## Participants

Ninety undergraduates ( $M_{age} = 21.9$ , Female 51.1%) from Seoul National University participated for course credit. The experiment consisted of a 3 (condition: heavy-hearted vs. control vs. light-hearted) × 2 (sports event: weightlifting vs. pole vault) mixed design, with sports events being the within-participants factor.

## Procedure

Upon arrival, two groups of participants were led to a computer and told that the experiment aimed to measure their affect maintenance ability, which was a fabricated concept for the cover story. First, they were asked to recall a past event that had caused them to feel heavy-hearted or light-hearted as vividly as possible and to write about the experience for 10 minutes. They were further told that they were required to maintain their post-writing-task mood during an irrelevant in-between task, and that they would be asked to report how successfully they managed to keep their recalled affect from being interrupted by the irrelevant stimulus later on. We presented the sports video clips as the irrelevant task and asked them to predict whether each player would succeed or fail. On the other hand, participants in the control condition were asked to write a description of a certain route indicated on a campus map for 10 minutes. They then moved on to the video clip experiment for an allegedly separate session. After watching all of the clips, they answered three questions about how successfully they managed to maintain their affect while watching the clips, and then they indicated their current mood.

#### Material

The 10-second video clips were composed of eight clean and jerk attempts and eight pole vault attempts, consisting of four success and four failure attempts, respectively. The clips came from the 2008 Beijing Olympic Games and the world championship games. The clean and jerk clips started with the players grasping the bar and stopped just before they lifted it up over their head. The pole vault clips started with the players' sprint and stopped just after their body was extended toward the sky by the bar. We intentionally opted for unfamiliar players to prevent any unexpected interference. The gender of players was mixed, and the clips were randomly mixed with four different orders.

#### Measure

Participants were asked to guess, within 3 seconds after each clip stopped, whether each player would succeed or fail. To measure how successfully they managed to maintain their affect, we asked three questions (i.e., "To what extent are you currently feeling in the same way you felt while recalling your past event?," "To what extent is your current feeling similar to what you felt while recalling your past event?," and "To what extent did you try to maintain your feeling while watching the sports clips?") on 7-point Likert scales (i.e., 1 = not at all, 7 = very much). Finally, all participants rated their current mood as in Study 1, and indicated age and gender.

## **Results and discussion**

#### Manipulation check

Both age and gender were equally distributed across conditions, ps > .6, and didn't have any influences on the results. The five subscales of current mood achieved satisfactory internal consistency ( $\alpha = .94$ ), so a 5-item psychological condition index was computed as the mean of all items. An ANOVA reveals a significant main effect of affect condition, F(2, 87) = 89.49, p < .001,  $\eta^2 = 0.675$ . Specifically, participants in the heavy-hearted condition (M = 2.48, SD = 0.82) reported they felt significantly less positive than the control condition (M = 4.14, SD = 0.93), t (56) = 7.24, p < .001, d = 1.9 and those in the light-hearted condition (M = 5.49, SD = 0.86) felt significantly more positive than the control condition, t (58) = 5.79, p < .001, d = 1.49.

The affect maintenance score was created by collapsing three items ( $\alpha = .736$ ), and its mean was significantly higher than the midpoint (M = 4.53, SD = 1.03), t (58) = 3.92, p = .000, d = 1.03, and the median was 4.67. There was no difference in this score between the heavy-hearted and light-hearted condition, t (57) = 1.36, p = .178. This shows that participants made an effort not to lose track of their current feeling during the in-between task in general.

## Percentage of predicting success

An ANOVA examined the effect of feeling heavy-hearted or light-hearted on the percentage of predicting success out of the total number of clips, which is normally distributed with skewness of -.008 (SE = .254) and kurtosis of -.727 (SE = .503). As hypothesized, while watching weight-related sports games, participants who were feeling heavy-hearted predicted success the least frequently (M = 52.58%, SD = 11.25) and those who were feeling light-hearted predicted success the most frequently (M = 60.89%, SD = 12.39) while the control condition stands in the middle (M = 57.66%, SD = 11.43), F (2, 87) = 3.882, p = .024,  $\eta^2 = 0.082$ . Neither participants' gender nor players' gender effect was observed. Planned contrast analyses revealed that the heavy-hearted condition chose success less frequently than the light-hearted condition by approximately 8% points, t (87) = 2.77, p = .007, d = 0.7, while either the heavy-hearted condition, t (87) = 1.66, p = .1, or the light-hearted condition, t (87) = 1.07, p = .289, did not differ from the control condition.<sup>3</sup>

Intriguingly, the mean percentage of the control condition was greater than 50%, t (28) = 3.66, p = .001, d = 1.38, as the light-hearted condition was, t (30) = 4.89, p < .001, d = 1.78, indicating that participants were already biased toward success. It seems feeling heavy-hearted washes away such optimism—the average percentage in the heavy-hearted condition was not different from 50%, t (29) = 1.44, p = .161.

In sum, while watching sports competitions, participants in the heavy-hearted state expected the players to be less likely to succeed in lifting up or jumping over the bar, compared to those in light-hearted state.

Nevertheless, some might raise the possibility that the findings from Study 2 are the result of general optimism, not of embodied cognition. Specifically, participants in the light-hearted condition felt positive emotions, which might have boosted their optimism. This alternative view suggests that participants in the light-hearted condition would predict success more in *any* tasks, not only in weight-related tasks, than those in the heavy-hearted condition. To test this, we conducted an

additional experiment (N = 90,  $M_{age} = 21.1$ , Female 50%) in which participants went through the identical procedure except that they watched non-weight-related sports—golf putting and pool. These non-weight-related video clips were made out of five short golf putting games and four pool games, each approximately 5 seconds long. Short putting trials came from several PGA championships, and pool-shooting trials were taken from pool player Max Eberle's YouTube channel. The short golf-putting clips began with the first sequence of player's gauging the distance. Once players hit the ball, clips stopped leaving the last half path of the ball unrevealed. The pool clips began with player's cue moving back and forth before hitting. The target colored ball was the only one left on the table to be hit by a white ball, precluding possible disturbance of other colored balls. Finally, the clips stopped right after the last ball was hit by the white ball. In both events, players' faces hardly come in sight. Theses clips were randomly mixed with two different viewing orders.

The optimism explanation predicts that participants in the light-hearted condition would predict success more in both games than those in the heavy-hearted condition. This, however, was not the case, F(2, 87) = .74, p = .481. Those who were assigned to feel heavy-hearted (M = 53.03%, SD = 18.6) and light-hearted (M = 57.69%, SD = 12.58) reported a similar percentage of predicting success to the control condition (M = 57.06%, SD = 14.85). Neither of the two conditions differed from the control condition, ps > .307. Therefore, the result of Study 2 cannot be explained in terms of the general optimism account. Age and gender were equally distributed across conditions, ps > .8, and did not have any influences on the results either.

## **General discussion**

In two studies, we found that when people feel heavy-hearted versus light-hearted, they perceived an object to be heavier (Study 1) and predicted that success of athletes playing weight-related sports is less likely (Study 2). Psychological heaviness affected physical perception such that an object feels heavier compared to psychological lightness. This tendency was substantially transferred to the observation and perception of physical movement of others.

These findings are consistent with embodied cognition theory and suggest that human conceptual system is a product of human experience, which comes through the body (Lakoff, 1987). They also support the argument that metaphors are not just linguistic elements people use for communication (Zhong & Leonardelli, 2008). The way we think, what we experience, and what we do every day is very much a matter of metaphor (Lakoff & Johnson, 1980). "Heavy-heartedness" is one of the metaphors whose poetic value and communicative expressiveness partly arises from its roots in people's ordinary, felt sensations of bodies in action (Gibbs, Lima, & Francozo, 2004). Our studies showed that felt heaviness of body can be a consequence of individuals' psychological heavy-hearted states, confirming empirical evidence on the embodied ground of "heavy-heartedness."

It is noteworthy that the present research took the metaphor itself as the manipulation wording. 'Heavy-hearted' and 'light-hearted,' in practice, connote several kinds of emotion such as sadness or feeling of guilt and happiness or joyfulness, respectively. Therefore, it is difficult to pinpoint which specific emotion is associated with the expression. It is important to note that the current research is interested in the metaphor itself, not its emotional components. It is beyond the scope of this study to investigate which specific emotion is induced or not induced by the heavy-heartedness metaphor. Nonetheless, it would be necessary to see whether specific emotions such as sadness and happiness would produce the same effect in future research. By doing so, the differentiated effect of metaphor (vs. emotion) could be further tested, as one would be able to unequivocally tease apart the consequences of heavy-heartedness (light-heartedness) and sadness (happiness).

Our use of the metaphor itself may inevitably raise concerns about the demand effects, especially in Study 1, in that the use of metaphor in the instruction could have made participants try what they were asked—to feel pressed-down. Since participants might have reported heavy-heartedness in the manipulation check as a result of the demand effect, they might have cooperated with the experiment and reported a heavy weight of the box in a later

task accordingly. Although this seems plausible, there are reasons to believe that the demand effect is not as serious as it appears. First of all, for half of the participants, the manipulation check was conducted after, not before, the weight estimation task. And there was no order effect of the manipulation check. Second, Study 2 is relatively more free of the demand effect than Study 1. Participants were directly asked how heavy the box was in Study 1; therefore, the word *heavy* was used both in the manipulation and in the dependent variable. The task of Study 2, however, was not to estimate the weight of a player per se. Third, after all of the experiment procedures, we asked them to guess the hypothesis of the experiment, but no one suspected the relationship between two tasks in Study 1. Therefore, although we cannot completely rule out the possibility of the demand effect, there are some reasons to believe that the demand effect is not the driving force.

Across two studies, we observed consistent patterns where the effects seem to be primarily driven by heavy-heartedness rather than equally driven by heavy/light-heartedness. We suspect that one possible account can be found in the negativity bias (e.g., Baumeister, Bratslavsky, Finkenauer, & Vohs, 2001; Rozin & Royzman, 2001). Negativity bias refers to negative potency, or greater psychological impact of negative events than equivalent positive events. It has been known that our cognition is more complex, elaborated, and fine-tuned when it comes to negativity (vs. positivity) (e.g., Czapinski, 1985). Probably because people are innately more attentive to negativity to the extent that their cognition is embodied toward negativity rather than equivalent positivity, we observed the consistent patterns where heavy-heartedness seems to be a driving force of the effect.

When it comes to practical implications of the current research, we suggest a managerial implication. Marketers for the products whose attraction resides in their lightness (e.g., lightweight running shoes) may need to be cautious about the timing of advertising. If their commercial follows a TV program that covers a grave social issue that may have induced heavy-heartedness, the subsequent advertisement where a model is enjoying lightness of the running shoes would not be able to exert the expected advertising effect, compared to when it follows a fun entertaining show.

Zhong and Leonardelli (2008) found that social exclusion portrayed as an "icy stare" literally feels cold, while we found that psychological weight described as "heavy-heartedness" literally feels heavy. Along with these findings, other metaphors may also function as an insightful bridge where psychological attributes and physical manifestations remain deeply intertwined. The effort to further investigate unrevealed embodiments will contribute to a better understanding of human cognition and emotion.

As we have argued in the current research, *heart* may be more than just a word for a vital body organ designed to pump blood. As a linguistic metaphor, it can reflect the way we think about the entire human body, which affects our perception of objects in the surrounding environment. Thus, when one feels heavy-hearted, the body containing the heart and the whole world may also feel heavy.

#### Notes

- 1. We used Korean metaphors equivalent to "heavy-hearted" and "light-hearted." They literally say "one's heart is heavy" and "one's heart is light." The dictionary definitions are "one's heart is unpleasant, depressed and serious," and "one's heart is pleasant and carefree," respectively.
- 2. We pretested a few different weights (e.g., 3 kg, 5 kg, 7 kg, and 10 kg) while we observed a consistent pattern in which people tended to underestimate the weight.
- 3. We also looked at the accuracy of prediction and found that the heavy-hearted condition was the least accurate (M = 41.8%, SD = 11.4), the control condition was in the middle (M = 45.5%, SD = 10.7), and the light-hearted condition was the most accurate (M = 50%, SD = 11.9), F(2, 87) = 3.92, p = .023,  $\eta^2 = 0.083$ . Accuracy wasn't interacted with in either age or gender. However, it seems that accuracy has little to do with our dependent variable. First, accuracy is not correlated with the predicted likelihood, r = .043, *ns*. Also, more importantly, the difference in the predicted likelihood across conditions remains significant controlling for the accuracy of prediction, p = .025,  $\eta^2 = 0.082$ , while accuracy becomes nonsignificant, p = .702.

## Notes on contributors

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