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The Burden of Guilt:
Heavy Backpacks, Light Snacks, and Enhanced Morality

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Abstract

Drawing on the embodied simulation account of emotional information processing, we argue that the physical experience of weight is associated with the emotional experience of guilt and thus that weight intensifies the experience of guilt. Across four studies, we found that participants who wore a heavy backpack experienced higher levels of guilt as compared to those who wore a light backpack. Additionally, wearing a heavy backpack affected participants' behavior. Specifically, it led them to be more likely to choose healthy snacks over guilt-inducing ones and boring tasks over fun ones. It also led participants to cheat less. Importantly, self-reported guilt mediated the effect of wearing a heavy backpack on these behaviors. Our studies also examined the mechanism behind these effects and demonstrated that participants processed guilty stimuli more fluently when experiencing physical weight.

Key words: Guilt; Weight; Embodied emotion; Processing fluency

Across cultures, guilt is frequently symbolized as a heavy weight. In one of the Psalms, David's "guilt has overwhelmed [him] like a burden too heavy to bear" (Psalm 38:4). In the Quran, it is repeatedly mentioned that each person bears a heavy burden of guilt (Al-Ankabut 29:13, An-Nahl 16:25, Al-Isra 17:15). In our time, the metaphor of guilt as a heavy weight has been used in popular songs (such as the band Lucero's "the weight of guilt") and sayings (such as "the heavy burden of guilt").

Linguistic metaphors convey human experiences in a rich, vivid way. Generally, they are used to connect an abstract concept (e.g., guilt) to a more concrete one learned earlier in life (weight) that makes the abstract concept easier to understand. Focusing on the "weight of guilt" metaphor, this paper examines whether the physical experience of weight influences the amount of guilt people feel and their subsequent behavior.

Guilt has long been considered the most essential emotion in the development of the affective and cognitive structures of both conscience and moral behavior (Damasio, 1994; Izard, 1977; Tangney & Dearing, 2002). People typically experience guilt when their actions do not conform to a standard (Lewis, 1971). Despite being a negative emotion, guilt can result in positive outcomes by inhibiting non-normative behaviors, stimulating the impulse to make restitution and seek forgiveness after a wrongdoing (Ausubel, 1955; Kugler & Jones, 1992), and motivating socially desirable behaviors (Tangney & Dearing, 2002). Guilt subtly shapes our actions, often by causing us to try to avoid experiencing it altogether.

Darwin's century-old theory proposes that emotions have universally understood expressions and common experiential qualities (Darwin, 1872/1965). Consistent with this theory, research has documented facial expressions of various emotions, including guilt (Ekman, Sorenson, & Friesen, 1969; Izard, 1971). However, experiential qualities and our bodily feelings

can help us better identify guilt than a particular set of facial movements can (Darwin, 1872/1965). Physiological reactions to guilt include an increased heart rate and a bodily state often described as feeling heavy (Davitz, 1969; Izard, 1971; Tangney & Fischer, 1995).

Recent work on embodied emotions suggests that our bodily expressions are closely tied to the processing and interpretation of emotional information (Niedenthal, 2007; Niedenthal, Winkielman, Mondillon, & Vermeulen, 2009). When people adopt emotion-specific postures, for instance, they report experiencing the associated emotions (e.g., Stepper & Strack, 1993). Such findings suggest that the congruency between the body being in a particular state and a particular emotion intensifies an emotional experience. Importantly, the way an emotional experience correlates with bodily experience causes us to adopt certain metaphors and not others. Given the associative link between guilt and weight, we propose that the bodily experience of weight facilitates the experience of guilt. In turn, these temporarily heightened feelings of guilt affect subsequent behavior beyond one's own awareness.

Relying on the work on embodied simulation, we also explore the mechanism explaining these proposed effects. We argue that the experience of guilt inherently has components that resemble those of weight (i.e., they share a similar embodied basis). As a result, when individuals feel heavy, the congruence between their bodily experience of weight and emotional experience of guilt leads to processing fluency and facilitation of the emotional experience of guilt.

In the sections that follow, we first describe embodied approaches to emotion information processing (Niedenthal, 2007) and discuss research on the link between bodily experiences and emotional experiences. Our main interest is the link between physical weight and feelings of guilt. To develop hypotheses regarding such link, we rely on two streams of existing research:

embodied simulation (see Niedenthal, et al., 2009) and conceptual metaphor accounts (see Lakoff & Johnson, 1980). When discussing the embodied simulation account for the relationship between weight and guilt, we introduce the concept of processing fluency.

Emotion Information Processing

Recent models that account for emotion information processing use embodied approaches to both cognition and emotion. These approaches assume that the processing of mental content is represented in modality-specific systems (Barsalou, 1999). That is, the processing of emotional information involves re-experiencing an emotion and partial reactivations of the sensory-motor states that occur during the emotional experience (Niedenthal, 2008). Indeed, emotion is understood through an embodied simulation process that calls upon an individual's motor, cognitive, and emotional representations and the neural systems used for emotion. The modality-specific models of emotion assert that perceptual experiences are partially stored by the brain's association areas (Damasio, 1989), such that the knowledge of an emotion in the memory contains information about the actual experience. Thus, in the embodied simulation account, knowledge of emotional states is not reducible to an abstract, language-like description, but rather is a combination of visual, auditory, somatosensory, and visceral information.

Over the years, empirical evidence has demonstrated the link between bodily experience (e.g., bodily posture, facial expressions) and emotional experience (Niedenthal, 2007). In most studies testing this link, participants are asked to adopt a particular posture or facial expression and then to perform tasks and/or to report their emotions (e.g., Stepper & Strack, 1993). For instance, Duclos and colleagues (1989) had participants adopt poses reflecting specific emotions, such as fear and anger, and found that adopting these postures resulted in corresponding feelings (Duclos et al., 1989). Related research found that participants who read a series of comic strips

judged them to be funnier when they held their facial muscles in a position similar to a smile as compared to a position similar to a frown (Strack, Martin, & Stepper, 1988). Together, these findings indicate that congruence between a bodily state and an emotion may result in or intensify the particular emotional experience.

Embodied accounts can explain why emotion congruence occurs. An embodied simulation account proposes that the congruence between an individual's bodily cues, such as facial expressions and posture, and a task, such as judging the valence of a presented word, can lead to processing fluency, or the ease with which people process relevant information (Alter & Oppenheimer, 2009). For example, in one investigation, processing fluency was manipulated by asking participants to adopt a light smile or furrow their brows (Stepper & Strack, 1993). When asked to recollect past episodes of low self-assurance, participants who furrowed their brows experienced this task as more difficult and had greater difficulty remembering exemplars as compared to those who adopted a light smile. Therefore, the ease or difficulty of a task is influenced by bodily expression, and congruent body cues lead to processing fluency. Thus, we expect that when people are asked to recall a guilt-inducing situation while holding something heavy, the physical experience of weight will enable them to more fluently simulate the emotional experience of guilt because of the congruence between bodily cues and the guilt experience, and therefore, the congruence should intensify individuals' experienced guilt.

In addition to the embodied simulation account, a second account can be used to examine the relationship between weight and guilt and, more specifically, to explain the link between carrying something heavy and feeling guilty: the conceptual metaphor account (Lakoff & Johnson, 1980). A growing body of experimental work (e.g., Meier, Hauser, Robinson, Friesen, & Schjeldahl, 2007) investigates the associations between physical metaphors reflecting concrete

domains, such as space and cognitive and affective experience (for a review, see Crawford, 2009). This line of work is based on Lakoff and Johnson's view (1980) that individuals rely on concrete physical dimensions to describe their real-world experiences and make sense of the world (IJzerman & Koole, 2011; Landau, Meier, & Keefer, 2010, 2011). Indeed, people rely on linguistic metaphors to communicate and present concepts that represent complex experiences but do not necessarily reflect nor link to their actual experience. Moreover, contending that information processing is grounded in metaphor, Lakoff and Johnson (1980, 1999) argue that merely thinking about a concept involves activation of the relevant perceptual metaphors.

The metaphor-representation view and the embodied-simulation account both posit that knowledge of abstract concepts such as guilt is grounded in embodied and situated knowledge. The general claim, shared by both views, that representational processes appear embodied in nature and that meanings people give to concepts are connected with their bodily states and interactions with the physical world provides the necessary theoretical background for our predictions.

We suggest that the concept of guilt itself may not be linked to the experience of weight per se, but that the experience of guilt inherently has modality-specific components that resemble those of weight (i.e., they share a similar embodied basis). Therefore, the physical experience of weight activates the concept of guilt. Importantly, given the empirical evidence on situational relevance in embodied cognition and emotion (Lee & Schwarz, 2010), we do not expect weight to be associated with guilt across all contexts; rather, we expect the effect to be moderated by the situation and the experience of weight itself. Research has shown that the effects of engaging in unethical behavior on preference for cleansing products are modality specific, such that lying with one's mouth increases the appeal of mouthwash but not hand sanitizer (Lee & Schwarz,

2010). Based on these findings, we expect our proposed effect to be present when the motor modality of the metaphor-priming task (i.e., weight) matches the motor modality of the emotion (i.e., guilt). More specifically, we suggest that weight on one's back shares a more similar embodied basis with the experience of guilt. Burden on one's back or shoulders are proper linguistic metaphor expressions. Thus, we favor a manipulation of weight that relies on holding something heavy on the back (i.e., carrying a heavy backpack, adopted from Bhalla & Proffitt, 1999) in our examination of the link between the experience of weight and the experience of guilt.

In sum, we predict a link between physical weight and feelings of guilt such that when individuals are asked to recall a guilt-inducing situation while holding something heavy on their backs, the congruence between their bodily experience of weight and the emotional experience of guilt leads to processing fluency and more intensified feelings of guilt. However, stronger feelings of guilt as a result of holding something heavy can be alternatively explained with a cognitive elaboration mechanism. Recent work has showed a link between weight and importance and seriousness (Ackerman, Nocera, & Bargh, 2010; Jostmann, Lakens, & Schubert, 2009), such that the physical experience of weight led people to take a task and activity more seriously and consider it more important than they would otherwise. Jostmann et al. (2009) argued that since dealing with heavy rather than light objects is associated with greater physical or mental effort, dealing with important abstract issues should be associated with more elaborate thinking than dealing with unimportant issues. As a result, an abstract issue should trigger greater investment of cognitive effort and thus more elaborate thinking since it is associated with heavy rather than light weight (Jostmann et al., 2009). Based on this alternative mechanism, our manipulation (carrying a heavy backpack) should lead to higher increased effort and elaboration

rather than processing fluency. We thus empirically examine whether the additional weight held during the guilt-related stimulus affects processing fluency or cognitive effort.

Overview of Studies

Across four studies, we tested our main hypothesis regarding the link between physical weight and feelings of guilt. We found that the physical experience of weight increases people's subjective experience of guilt and reduces their likelihood of engaging in guilt-inducing behaviors. Study 1a-1c tested whether participants who wear a heavy backpack experience higher levels of guilt compared to those who wear a light one. We asked participants to recall a guilt-inducing experience while wearing either a heavy or light backpack. Study 1a used self-report measures of guilt; the other two studies also used a behavioral measure. In Study 1b, we examined the impact of weight on self-punishment. Study 1c tested for the influence of weight on individuals' choice of guilt-inducing snacks. Studies 1b and 1c also tested whether self-reported guilt mediated the effect of wearing a heavy backpack on behavior.

In our studies, participants are asked to recall a guilt-inducing experience while wearing either a heavy or light backpack. We hypothesized that the additional weight would lead to processing fluency and thus facilitate the emotional experience of guilt. However, given the link between weight and importance, as noted earlier, it is possible that people would perceive the immediately applicable task as more important/serious, or that the physical experience of weight would facilitate the recall of particular types of guilt-inducing experiences or more serious ones. Moreover, the physical experience of weight could increase cognitive effort, leading to higher performance. Studies 2-4 examined the proposed processing fluency mechanism and the competing underlying mechanism for our predicted effect. In Study 2, we examined whether the physical experience of weight facilitates the recall of particular types of guilt-inducing

experiences and whether these experiences vary depending on the physical weight being carried. Study 3 investigated the link between the bodily experience of weight, guilt, and cognitive effort on the task at hand. In Study 4, we examined the processing fluency and the cognitive effort/elaboration mechanisms. Across our studies, we used different measures of guilt and dependent outcomes.

Following Simmons, Nelson and Simonsohn (2011) recommendations, our sample sizes were determined in advance, prior to data collection. In all our studies we planned to collect at least 25 observations per conditions. We were successful in collecting 25 participants per condition except in study 1a because the study was conducted late in the semester and fewer participants signed up for the sessions. Since participants were scheduled by the week, in some studies we obtained more observations than planned.

Study 1a

Our first study sought to establish that the bodily experience of weight leads to differences in self-reported guilt.

Method

Participants. Participants were 30 undergraduates (17 male) at a university in the western United States who participated in exchange for course credit.

Design and procedure. Participants were randomly assigned to either a heavy or light backpack condition upon arrival. Participants were told that they would be completing several unrelated tasks. Under the guise of having them evaluate the quality of backpacks, we seated participants in separate cubicles with either a heavy (12 pounds) or a light (2 pounds) backpack randomly placed on their tables. We asked participants to put on their backpacks right away. In all studies using the backpack manipulation, participants sat on stools rather than chairs so that

they could better feel the weight of the backpack. Participants started with an introspective writing task in which they were asked to describe one thing they had done or a situation they were part of in the past that made them feel guilty.

While wearing the backpack, participants completed a survey measuring their current mood and emotions. We measured state guilt by using items from the positive and negative affect schedule expanded form, PANAS-X (Watson & Clark, 1994). This subscale includes items such as “guilty,” “blameworthy,” and “angry at self” ($\alpha = .93$). We further measured positive and negative affect using the PANAS (Watson, Clark, & Tellegen, 1988). Moreover, at the end of the survey, while wearing the backpack, participants were asked to rate the following items on a seven-point scale (1 = not at all, 7 = very much): “How important was this task to you?” “To what extent did you feel responsibility for this task?” “How important did you think the task was?” and “How serious did you think the task was?” We included these questions to examine whether the backpack weight affected participants’ general impressions of the importance and seriousness of the task, as suggested by the weight as embodiment of importance and seriousness mechanism. We combined the four importance questions to create a task importance rating measure ($\alpha = .95$).

Results and Discussion

To analyze the data, we ran a Multivariate Analysis of Variance (MANOVA) using participants’ reported guilt, task-importance rating, positive affect, and negative affect as dependent variables and backpack weight (i.e., heavy vs. light) as a between-participants factor. Results show a marginal significance between heavy- and light-backpack conditions based on dependent variables ($F(4, 25) = 2.16, p = .103, \text{partial } \eta^2 = .26$). Results of univariate tests show that participants in the heavy-backpack condition reported greater guilt ($M = 2.57, SD = 1.24$)

than those in the light-backpack condition ($M = 1.78$, $SD = .87$), $F(1, 28) = 4.08$, $p = .053$, partial $\eta^2 = .13$.¹ However, the weight manipulation did not influence positive affect ($M_{heavy} = 2.54$, $SD = 1.17$ vs. $M_{light} = 2.27$, $SD = 1.02$, $F < 1$, partial $\eta^2 = .01$) or negative affect ($M_{heavy} = 1.90$, $SD = 1.01$ vs. $M_{light} = 1.74$, $SD = .67$, $F < 1$, partial $\eta^2 = .01$). Moreover, participants wearing a heavy backpack did not differ significantly from those wearing a light one on the measure of task importance ($M_{heavy} = 3.82$, $SD = 1.27$ vs. $M_{light} = 4.39$, $SD = 1.25$, $F(1, 28) = 2.45$, $p = .22$, partial $\eta^2 = .05$). Study 1a offers the first empirical evidence of the relationship between bodily experience of weight and self-reported guilt. The marginal multivariate effects suggest that, as we predicted, weight does not globally affect affective ratings, but rather it is specific to the emotion of guilt. Task seriousness and importance appear to be unaffected by the weight manipulation, casting doubt on the possibility that weight signaled task importance and thereby influenced self-reported guilt. The results did not replicate the seriousness and importance effects shown in previous papers (Ackerman et al., 2010; Jostmann et al., 2009). This is not surprising given the operational difference between our manipulation (wearing heavy objects) and those of past studies (holding heavy objects). As noted earlier, based on a modality-specific hypothesis (Lee & Schwarz, 2010), there could be important differences.

Study 1b

Our next study is designed to extend the effect found in Study 1a to behavior, testing whether the increased guilt as the result of the weight translates to behavior (in this study, self-punishment). In addition, we test whether that the impact of extra weight on subsequent behavior is mediated through self-reported guilt.

¹ Participant gender did not significantly influence the analysis. Likewise, in none of studies did the results depend on gender. As a result, gender effects will not be discussed further.

Method

Participants. Ninety students and staff members at a university in the Southeastern United States (32 male) participated in the study for a payment of \$7.

Design and procedure. Participants were randomly assigned to wear either a heavy backpack (15 pounds) or a light backpack (5 pounds). The study used the same type of procedure used in Study 1a. Participants were randomly assigned to wear either a heavy or light backpack, and they wore it throughout the entire study. They first engaged in the introspective writing task, and we then measured state guilt using items from PANAS-X ($\alpha = .86$). To assess self-punishment, we asked participants at the end of a 20-minute study to choose whether they wanted to solve Sudoku puzzles for the remaining ten minutes (an engaging task) or whether they preferred entering data for the same amount of time (a rather boring task). A pilot study on a separate, non-overlapping group of participants from the same population ($N = 49$) confirmed that solving puzzles was considered a significantly more engaging, interesting, and fun task ($\alpha = .90$) compared to entering data ($\alpha = .84$), $F(1, 48) = 109$, $p < .001$, partial $\eta^2 = .69$.

Results and Discussion

To analyze the data and test the mediation hypothesis, a bootstrap analysis using Preacher and Hayes's (2004) guidelines was conducted. Results of the analysis (with 5,000 samples) showed a significant direct effect of weight manipulation on task choice, $b = 1.77$, $SE = .51$, $p < .001$, such that 50% of the participants wearing a heavy backpack (21/42) chose to engage in the boring task at the end of the study, while only 15% of those wearing a light backpack did (7/48). The effect of weight on task choice was reduced to nonsignificance, $b = .68$, $SE = .66$, $p = .31$, when controlling for the mediator self-reported guilt, which still had a significant impact, $b = 1.85$, $SE = .42$, $p < .001$; 95% bias-corrected CI, [1.21, 4.26]. The 95% bias-corrected confidence

interval for the size of the indirect effect excluded zero, suggesting a significant indirect effect (MacKinnon, Fairchild, & Fritz, 2007). Participants' answers to the post-experimental questions revealed they were clueless about any link between the backpack, the survey questions, and the subsequent task. In sum, wearing a heavy rather than a light backpack led to greater guilt and guilt-reducing choices. When feeling guiltier because of the heavy backpack, participants were more likely to engage in a self-punishing task versus an interesting one.

Study 1c

So far, we have demonstrated that wearing a heavy backpack heightens participants' self-reported guilt and influences their subsequent behavior in the form of self-punishment. In Study 1c, we provide further evidence for the link between weight and guilt by examining another type of behavior, namely guilt-inducing behaviors. We expected that the greater guilt triggered by a heavy backpack would reduce the likelihood people would engage in guilt-inducing behaviors.

In addition, Study 1c includes a measure of an emotion similar to guilt: shame. Previous research on shame has linked the emotion to blushing and a warm face (Lewis, 1993) but has not made any associations between bodily experience of shame and weight. Thus, we expect that the physical experience of weight will lead to higher guilt but not shame.

Method

Participants. Participants were 57 undergraduates (32 male) at a university in the western United States who participated in exchange for course credit. Three participants were excluded for not completing the writing task. This left data from 54 participants for our analysis.

Design and procedure. Participants were randomly assigned to either a heavy (12 pounds) or light backpack (2 pounds) condition upon arrival. The procedure was similar to that of our previous studies. All participants wore the backpack during the entire study and started

with an introspective writing task. They completed a survey that included the PANAS-X measure of guilt ($\alpha = .93$). To further test the robustness of our main hypothesis, we included a second measure of state guilt and shame (Marschall, Sanftner, & Tangney, 1994) with items such as “I feel like apologizing, confessing” ($\alpha = .93$) for guilt and items such as “I feel like I am a bad person” for shame ($\alpha = .84$).

After completing the survey, participants were informed that they would receive a snack as additional thanks for their participation at the end of session. They could choose between a 100% Natural Fruit Strip (i.e., a healthy and less guilt-inducing option) and a Premium Chocolate Square (i.e., an unhealthy and more guilt-inducing option). A pilot study on a separate, non-overlapping group of participants from the same population ($N = 22$) confirmed that the fruit strip was considered a significantly healthier snack ($\chi^2(1, N = 22) = 6.55, p = .011$) as compared to the chocolate square. At the end of study, participants were given their snack choice; they also completed a form asking them to guess the experimenter’s hypothesis, and they received a full debriefing, which included probes for suspicion of the purpose of the study. None of the participants was able to guess the hypothesis of the study, and none expressed suspicion during the debriefing about the link between different parts of the study. Therefore, there is no evidence that participants were aware of the “burden of guilt” metaphor, guessed the hypothesis, and rated their level of guilt accordingly.

Results and Discussion

For data analysis, we ran a MANOVA using participants’ reported guilt, as measured by PANAS-X and state-guilt scales, and state shame as dependent variables and backpack weight (i.e., heavy vs. light) as between-participants factor. Results show a marginal significance between heavy- and light-backpack conditions based on dependent variables ($F(3, 50) = 2.62, p$

= .061, partial $\eta^2 = .14$). Results of univariate tests show that participants in the heavy-backpack condition reported greater guilt as measured by the PANAS-X ($M = 1.81$, $SD = .91$) than those in the light-backpack condition ($M = 1.33$, $SD = .69$), $F(1, 52) = 5.05$, $p = .029$, partial $\eta^2 = .09$. The other state-guilt measure showed the same results ($M_{heavy} = 2.59$, $SD = 1.60$ vs. $M_{light} = 1.73$, $SD = 1.11$), $F(1, 52) = 5.69$, $p = .021$, partial $\eta^2 = .10$. However, as predicted, we found no significant differences for state shame as a function of backpack weight ($M_{heavy} = 1.98$ vs. $M_{light} = 1.62$, $F(1, 52) = 1.26$, $p = .27$, partial $\eta^2 = .02$), confirming our assertion that there is an association between weight and guilt but not between weight and other related emotions.

Next, to test the mediation hypothesis, a bootstrap analysis using Preacher and Hayes's (2004) guidelines was conducted. Results of the analysis (with 5,000 samples) showed a significant direct effect of weight manipulation on snack choice, $b = -1.25$, $SE = .61$, $p = .039$, such that a larger percentage of participants chose the healthy option in the heavy-backpack condition (78%, 21/27) than in the light-backpack condition (48%, 13/27). This effect was reduced to nonsignificance, $b = -.92$, $SE = .64$, $p = .15$, when controlling for the mediator self-reported guilt, which still had a significant impact, $b = .64$, $SE = .32$, $p = .046$. A bootstrap analysis showed that the 95% bias-corrected confidence interval for the size of the indirect effect excluded zero [-1.65, -0.05], suggesting a significant indirect effect.

So far, we have provided support for the association between the physical experience of weight and the psychological experience of guilt. In Studies 1a-1c, we demonstrated that wearing a heavy backpack while recalling a past guilty experience heightens participants' self-reports of guilt and influences their behavior. Indeed, based on the embodied simulation account, because of congruency between the bodily experience of the backpack weight and the induced guilt, the extra weight intensifies the emotional experience and leads individuals to report greater feelings

of guilt and to act accordingly. In our next studies, we test for the proposed embodied simulation account as the mechanism driving the effects we observed in Studies 1a-1c.

Study 2

In Study 2, we examine whether the physical experience of weight facilitates the recall of particular types of guilt-inducing experiences. It is possible that the experiences recalled by participants differ in content and that, as a result, we observe these differences in levels of self-reported guilt. The weight as an embodiment of importance and seriousness mechanism supports the prediction that the extra weight leads to differential recall, namely that people recall more serious and otherwise important violations—that is, differences in content. On the other hand, the embodied-simulation mechanism we argued for does not predict a differential content recall for the seriousness of the offense and the amount of energy spent on the task or for cognitive effort.

Method

Participants. Participants were 51 undergraduates (32 male) at a university in the western United States who participated in exchange for course credit.

Design and procedure. Participants were randomly assigned to one of two conditions (heavy, 12-pound backpack vs. light, 2-pound backpack). We used a similar procedure as used in previous studies. We asked participants to wear the backpack right from the start to complete a set of unrelated tasks. All participants started with an introspective writing task, in which they were asked to describe one thing they had done or a situation they were part of in the past that made them feel guilty. While wearing the backpack, participants completed a survey with our measures of interest, the state-guilt items ($\alpha = .86$) from PANAS-X. At the end, participants were asked to guess the experimenter's hypothesis, and they received a full debriefing, which included

probes for suspicion of the purpose of the study. There was no evidence of suspicion of the manipulation, and none of the participants correctly guessed what was being studied.

Results and Discussion

As predicted, participants in the heavy-backpack condition felt more guilt ($M = 1.61$, $SD = .72$) than did those in the light-backpack condition ($M = 1.24$, $SD = .36$), $t(1,49) = -2.37$, $p = .025$, $d = .65$.

The goal of this study was to shed light on the experiences of individuals engaging in the task. Thus, we examined whether there were differences in participants' essays as a result of our backpack weight manipulation. Two independent coders who were blind to the conditions and the study hypotheses coded participants' essays on various dimensions. First, they categorized the type of relationship between the participant and the other people involved (e.g., strangers with no expectation of future interaction, strangers with whom some future interaction was expected, acquaintanceships and work-based relationships, intimate/close relationships). They also recorded the time that the situation/event being described took place (e.g., past month, past year, more than three years) and who or what was responsible for what happened (situational factors, someone else, the participant herself/himself). Inter-rater agreements for the categorization questions ranged from 90% to 98%, which indicates that the coding was highly reliable. Discrepancies were resolved through discussion with one of the researchers. We performed multinomial regressions with weight condition as the independent variable and the categorical codings as the dependent variables. Condition was not a significant predictor of the categorical variables.

The coders also rated the essays on each of the following dimensions using a 7-point scale (1 = not at all; 7 = extremely): (a) the extent to which the essay was emotional, (b) the

extent to which the individual felt bad about what he/she had done, (c) the extent to which the situation/event being described was serious, (d) the extent to which the situation/event being described was important, (e) the extent to which the individual felt responsible for the situation/event being described, (f) the extent to which the individual felt guilty about what he/she had done. The inter-rater reliabilities on the dimensions (a) through (f) were high; they ranged from .80 to .92. Thus, we averaged the two coders' ratings on each item.

To analyze the data, we ran a MANOVA using the coders' average ratings on each of the six dimensions (a through f) as dependent variables and backpack weight (i.e., heavy vs. light) as between-participants factor. Results show that weight condition does not significantly predict the entire set of dependent variables, $F(6, 43) < 1$, partial $\eta^2 = .08$. This is an important finding, as it provides evidence that the essays written by participants in the heavy- and light-backpack conditions were comparable.

Moreover, as noted, the alternative mechanism – that being asked to wear a heavy backpack makes participants construe the study as more serious and important – would predict that participants may take the task at hand more seriously, spend more effort on it, and write more extensively while carrying a heavy backpack as compared to a light one.

Therefore, we ran a one-way ANOVA to compare the number of words written as a measure of effort across conditions. We did not find significant differences for the number of words written across conditions, $F(1, 49) = 1.53$, $p = .22$, partial $\eta^2 = .03$; thus, we were unable to provide evidence that the alternative mechanism predicts the effect.

Study 3

In Study 3, we examined whether the effects of embodied guilt extend to the sphere of morality by testing whether wearing a heavy backpack rather than a light one while recalling and

writing about a past bad deed makes people more honest in a subsequent task. We predicted that burdened individuals respond to the experience of physical weight by becoming less willing to assume additional burdens (e.g., by engaging in dishonest behavior). The task used in this study was a problem-solving task where participants had the opportunity to cheat. This task allowed us to measure both actual performance and self-reported performance. By comparing participants' actual levels of performance across the heavy- and light-backpack conditions, we were able to examine the alternative interpretation, namely that wearing a heavy backpack makes participants devote more cognitive effort to the task, leading to higher levels of performance.

After completing the tasks, participants were asked to write down their guesses about the experimenter's hypothesis and purpose of the study. None of the participants were suspicious of any part of the study, and no one correctly guessed the purpose of the study.

Method

Participants. Seventy-one students and staff members from a university in the southeastern United States (31 male) participated in the study for a maximum payment of \$14. Participants received a \$4 fee for showing up and had the opportunity to earn an extra \$10.

Design and procedure. Participants were randomly assigned to one of two conditions (heavy, 15-pound backpack vs. light, 5-pound backpack) upon arriving at the laboratory. Similar to previous studies, they began by wearing the backpack and then writing about a guilt-inducing situation; next, we measured guilt; finally, we measured cheating as an outcome of interest by giving participants the opportunity to overstate their performance on a problem-solving task and thus earn undeserved money.

For the problem-solving task, we gave participants an envelope that contained \$10 (nine \$1 bills and four quarters) along with two sheets of paper. The first paper was a worksheet with

20 matrices, each consisting of 12 three-digit numbers (Mazar, Amir, & Ariely, 2008). The second paper was a collection slip on which participants were to report their performance. On the back of the collection slip, we included instructions for the task and a different matrix as an example. Participants had five minutes to find two numbers in each matrix that added up to 10. For each correctly solved matrix, they could keep \$0.50 from their supply of money; they were also asked to leave the unearned amount in the white envelope and drop it in a designated box along with the collection slip. All participants received the same matrices to solve, except that a single number was unique to each participant, so that we could match the collection slip and the test sheet. However, in the eyes of the participants, the procedure seemed anonymous.

After the five-minute task, participants in both conditions wrote down on the collection slip the number of matrices they had solved correctly. They dropped the collection slip and the remaining money in one box and the matrices sheet in another box located in a different corner of the room. For each participant, we computed the difference between self-reported and actual performance and used this difference as our main dependent variable. Positive-difference scores indicate that participants over-reported their performance and thus cheated on the task.

At the end of study session, we asked participants to write down whether they were suspicious of any part of the study and guess the purpose of the study. Participants did not realize that the backpack and the problem-solving tasks were linked, and none of the participants correctly guessed what was being studied.

Results and Discussion

To analyze the data, we ran a MANOVA using participants' reported guilt, the amount of over-reporting, and the total number of correctly solved matrices as dependent variables and backpack weight (i.e., heavy vs. light) as a between-participants factor. Results show that the

backpack conditions are significantly different based on dependent variables ($F(3, 67) = 2.93, p = .040$, partial $\eta^2 = .12$). Results of univariate tests show that, consistent with our predictions and the results of our previous studies, participants in the heavy-backpack condition reported higher levels of guilt ($M = 2.71, SD = 1.57$) than did those in the light-backpack condition ($M = 1.96, SD = 1.14$), $F(1, 69) = 5.32, p = .024$, partial $\eta^2 = .07$. Moreover, the amount of over-reporting was greater for participants in the light-backpack condition than it was for those in the heavy-backpack condition ($M = 1.94, SD = 2.99$, vs. $M = .58, SD = 1.93$), $F(1, 69) = 5.21, p = .026$, partial $\eta^2 = .07$. Mirroring this result, a higher percentage of participants cheated by over-reporting their performance on the task in the light-backpack condition (34%, 12/35) than in the heavy-backpack condition (11%, 4/36), $\chi^2(1, N = 71) = 5.46, p = .019$. However, the univariate test for the total number of correctly solved matrices shows no significant difference between the heavy- and the light-backpack conditions ($M_{heavy} = 7.22$ vs. $M_{light} = 7.14$, $F(1, 69) < 1$, partial $\eta^2 < .01$), indicating that the manipulation of weight we employed did not affect performance as an indicator of cognitive effort.²

Next, a bootstrap analysis using Preacher and Hayes's (2008) guidelines to test for multiple mediations was conducted to test for the indirect effect of each of the variables, self-reported guilt and actual performance, on amount of over-reporting, each controlling for the other one. Thus, the unique specific indirect effect of each variable was tested to determine whether one accounts for more of the relationship between weight manipulation and over-reporting than the other. The bootstrapping procedure revealed that the indirect effect of self-reported guilt on over-reporting was significant and that the 95% bias-corrected confidence intervals did not include zero [-.923, -.045], while the 95% bias-corrected confidence intervals

² Previous research using the backpack manipulation showed that heavier people perceive more effort in certain tasks than do lighter people (e.g., climbing a hill; Proffitt, 2006). Even though we used a similar manipulation of weight, we measured actual performance and effort rather than perceived effort, and we found no effect.

for indirect effect of actual performance did include zero [-1.059, 1.154]. This suggests that self-reported guilt mediated the effect of wearing a heavy backpack on reduced dishonesty. Together, these results show that wearing a heavy rather than a light backpack increased participants' experienced guilt and their honesty.

Study 4

Study 4 sought to examine our proposed underlying mechanism of processing fluency as a result of weight derived from the embodied simulation account of emotion information processing.

In Study 4, we used writing time and number of words as an indication of cognitive effort and elaboration (e.g., McGill & Anand, 1989). The fluency literature has used the ease with which people process a stimulus as a measure of fluency (e.g., Zitek & Tiedens, 2012; see Alter & Oppenheimer, 2009 for a review). Thus, all else being equal (e.g., topic of writing task), the ease of writing (i.e., the number of words divided by the writing time) provides an appropriate measure of fluency. We predicted that greater backpack weight would lead to greater fluency and ease of writing, but not necessarily more cognitive effort.³

Method

Participants. Participants were 124 undergraduates (90 male) at a university in the western United States who participated in exchange for course credit.

Design and procedure. Participants were randomly assigned to one of four conditions of a 2 (backpack: heavy vs. light) by 2 (content of writing task: guilt vs. neutral) between-subjects design. We used the same backpack manipulation of weight as in our previous studies. Different

³ It is important to note that we used actual fluency (the number of words divided by the writing time) in producing guilt-related thoughts rather than subjective fluency (the subjective feeling that working on the task was easy) in our studies.

from Studies 1-3, however, half of participants wrote about their last visit to the grocery store (a neutral topic). Participants completed the writing task on a computer, thus allowing us to record how much time they spent on the writing task and how many words they typed. We used writing time and number of words written as indications of cognitive effort and elaborative thinking and used the number of words divided by the writing time (i.e., ease of writing) as an indication of processing fluency.

When the study had ended, participants were asked to guess its purpose and to indicate whether they were suspicious of any part of it. There was no evidence of suspicion, and none of the participants correctly guessed the purpose of the study.

Results and Discussion

We compared the ease of writing (i.e., number of words in a second) across conditions to test for differences in processing fluency. A 2 X 2 ANOVA revealed a main effect for content of the writing task ($F(1, 120) = 72.05, p < .001$, partial $\eta^2 = .38$). Fluency scores were significantly lower when participants wrote about a guilty past experience ($M = .24, SD = .11$) than when they wrote about a neutral topic ($M = .46, SD = .17$). Importantly, this main effect was qualified by a significant interaction between our two manipulations ($F(1, 120) = 3.87, p = .051$, partial $\eta^2 = .03$). The results are depicted in Figure 1.

Looking at the simple main effects, we found that the results are consistent with our predictions; namely, the fluency score for guilt-inducing essays was higher in the heavy-backpack condition ($M = .27, SD = .10$) than in the light-backpack condition ($M = .21, SD = .12$), $F(1, 120) = 3.05, p = .084$, partial $\eta^2 = .025$. However, for the neutral essays, processing fluency did not differ significantly based on whether participants were wearing a heavy backpack ($M = .44, SD = .17$) or a light one ($M = .48, SD = .18$), $F(1, 120) = 1.08, p = .30$, partial $\eta^2 = .01$.

As noted earlier, we predicted that weight would affect fluency scores for guilt-inducing essays and would not necessarily affect cognitive effort operationalized as number of words or time spent on writing. Thus, we also ran a MANOVA using the overall number of words written and the time participants spent on the writing task as dependent variables, and backpack weight (i.e., heavy vs. light) and content of writing task as between-participants factors. Results revealed a main effect for the content of the writing task ($F(2, 119) = 26.26, p < .001, \text{partial } \eta^2 = .31$). However, the results of the MANOVA show that there is no main effect of backpack weight ($F(2, 119) = 1.83, p = .17, \text{partial } \eta^2 = .03$) on the overall number of words written and the time participants spent on the writing task. Also, there was no significant interaction between backpack weight and content of writing task ($F(2, 119) = 1.74, p = .18, \text{partial } \eta^2 = .03$). These results show that cognitive effort and elaboration did not significantly differ across weight conditions.⁴

The results of Study 4 provide evidence consistent with the processing fluency mechanism, showing that the physical experience of weight led to the ease of processing of guilt-related information and greater processing fluency rather than increased cognitive effort. As we suggested, the link between weight and guilt only leads to processing fluency when individuals process guilt stimuli. Once again, we were unable to provide evidence that the alternative mechanism of cognitive effort/elaboration predicts the effect.

⁴ At first glance, this finding may look statistically impossible, but that is not the case. Ratio variables carry unique information that cannot be gleaned from each component variable in isolation. We have a situation in which there is a significant difference between conditions in a ratio variable, while neither of the ratio's components individually shows a significant difference, even though the components go in the right directions. That is, in our data, participants in the heavy-backpack condition wrote more words ($M = 44.55$) than did those in the light-backpack condition ($M = 41.48$), though the result is not statistically significant ($p = .46$), and those with heavy backpacks spent less time on the writing task ($M = 194.91$ seconds) than did those with light backpacks ($M = 248.47$), again with no statistical significance ($p = .24$). In brief, those in the heavy-backpack condition tend to write more and in less time. As shown, words divided by time (our measure of fluency) is statistically significant.

General Discussion

In four studies, we demonstrated that the physical experience of weight is associated with the psychological experience of guilt. In Studies 1a-1c, we found that participants wearing a heavy rather than a light backpack who recalled situations where they had experienced guilt reported experiencing greater guilt. In addition, relative to people wearing a light backpack, people who wore a heavy backpack were more likely to choose boring tasks over more fun and engaging tasks, and healthy snacks over unhealthy ones. Additionally, self-reported guilt mediated the effect of wearing a heavy backpack on these behaviors.

Our studies also investigated the underlying mechanism explaining this effect. Studies 2-4 found support for processing fluency derived from the embodied-simulation account as the driving mechanism: participants in the heavy-backpack condition processed the guilty stimuli more fluently than did participants in the light-backpack condition. Moreover, the results demonstrated that the weight of the backpack had no impact on the content of the recalled experience and that the heavy backpack did not facilitate the recall of particular types of guilt-inducing experiences. Furthermore, we found no differences in terms of cognitive effort and performance as a result of the weight of the backpack. Essentially, our findings suggest that, as we argued, weight does not globally influence affective ratings, but rather it is specific to the emotion of guilt.

In sum, using different procedures, measures of guilt, and dependent outcomes, we found a robust association between the physical experience of weight and the psychological experience of guilt (See Table 1). Together, these results indicate that because of congruency between the weight and induced guilt, the extra weight intensifies the emotional experience of guilt.

Theoretical Contributions

More generally, our findings contribute to the embodiment literature, not only by identifying a specific phenomenon and showing its consequences but also by highlighting the mechanism involved. To date, most of the research on embodiment has focused on identifying interesting, novel, and surprising findings rather than on establishing theoretical mechanisms and boundary conditions (Landau et al., 2010). We started with the phenomenon of interest (link between weight and guilt) and examined multiple mechanisms that could be theoretically responsible for the effects. Theoretically, we focused on an embodied-simulation account as the underlying mechanism responsible for the effect. Based on our findings, we conclude that the processing of information related to guilt is partially based upon the bodily experiences and actions involved in guilt experiences, and that facilitating these bodily experiences increases feelings of guilt. Thus, we provided support for our theoretical argument of embodied emotion processing.

Our findings make a number of important contributions to theories of embodied emotion, which demonstrate that the body is closely tied to the processing of emotional information (Niedenthal, 2007). We contribute to the emerging literature on the embodied simulation account of emotional processing (Niedenthal et al., 2009). First, our findings show that the congruence between the bodily experience of weight and the emotional experience of guilt leads to processing fluency and the facilitation of the emotional experience of guilt. Individuals process guilt stimuli easier when wearing a heavy rather than a light one. Moreover, the fact that no other reports of a specific positive or negative emotion (e.g., shame) were influenced by the weight manipulation suggests that certain metaphors and not others were adopted because of the way emotional experience correlates with bodily experience. Indeed, we suggest that when

individuals experience guilt, a sense of heaviness is associated with the experience; when individuals feel heavy, the bodily experience of weight leads them to feel guiltier.

Second, it is worth highlighting how our stimuli differ from those used in earlier studies of the embodiment of emotion. In most of the prior research, the stimuli consisted of words (e.g., smile), facial expressions (e.g., frown), or body postures (upright). These stimuli have explicit emotional meanings. For instance, most people can easily associate a smile with happiness. Thus, the instruction to adopt a given facial expression or a particular posture may cause people to attempt to interpret the expression or posture's underlying emotion. This is likely, since thinking and imagining emotionally relevant events have been found to influence self-reports as well as feelings. Thus, it is possible that the observed effect is mediated by participants' interpretation of the stimuli. In this research, we used physical weight as the primary stimulus. Importantly, individuals were unaware of the link between the weight they were holding and their feelings of guilt. The stimulus responsible for the responses, then, must have been the feeling of heaviness and its association with guilt rather than participants' interpretation of the stimulus itself.

Another novel contribution of our research is the finding that self-reports and behavioral responses resulting from the experience of physical weight were emotion specific. This specificity is important, as it demonstrates that the physical experience of weight is only linked to the fluency of guilt-processing stimulus, rather than being generally linked to placing importance, effort, or fluency of thought in any situation. Note that the results of our studies showed that participants experiencing more weight did not spend more cognitive effort on the task and, more importantly, they more easily processed the guilt stimuli, and not other stimuli, thus supporting the congruency hypothesis derived from the embodied-simulation account.

Finally, this research contributes to the work of emotion researchers on the defining characteristics, functions, and distinctiveness of different emotions. Assuming that the internal aspects of emotions are quite distinct, researchers have investigated different emotions' perceived antecedents, underlying attributions, phenomenological experience, and nonverbal and physiological displays. For instance, considerable attention has been paid to facial expressions and nonverbal displays of emotions. Although most research has investigated basic emotions (Ekman, 1992), such as fear or disgust, some have tried to investigate phenomenological experiences and nonverbal displays of more complex, "self-conscious" emotions, including shame, embarrassment, and guilt (e.g., Keltner, 1995). Our studies demonstrate that concrete physical experiences establish the emotional concepts with which they are co-experienced. This research extends this prior body of work on the phenomenological experience of emotions by indirectly establishing that the experience of heaviness may be an integral part of our experience of guilt, thus providing insight into how people feel when they experience guilt.

Limitations and Directions for Future Research

The research presented here has some limitations that should be considered for future research. First, given that participants were randomly assigned to heavy and light backpack conditions, we did not account for individual differences in fitness and body strength. Future studies could determine the weight of the backpack relative to a certain percentage of participants' body weight. In addition, all our studies used college students and staff, a population for which the weight of backpacks might have a particular meaning. For college students, a full backpack may be a reminder of the need to study, which could prompt guilt. Future studies should examine the association between weight and guilt in non-student samples. Moreover, if we had collected a baseline measure of guilt from participants before having them

wear their backpacks, we could have determined how much the weight increased their sense of guilt. We did not measure feelings of guilt before the backpack manipulation to avoid making participants aware of the link between the weight and the backpack. Given that the only difference across conditions was the weight of the backpack, and because participants were randomly assigned to conditions, we argue that the difference in self-reported guilt can be attributed to our manipulation.

Another limitation consists of the way we coded participants' essays in Study 2. We found no objective differences between backpack conditions. However, future research could investigate whether weight cues produce subjective effects; having participants evaluate their own essays could test this. Additionally, in all our studies we used self-reports of guilt; future research could measure whether wearing the heavy backpack leads to quicker recognition or categorization of guilt-relevant words in a speeded-response task, using response latency as a dependent measure. Furthermore, future studies exploring individuals' phenomenology and the attributions/explanations they offer for their behavior and self-reports would shed light on the proposed phenomenon.

Our results provide support for the processing fluency mechanism. However, one may argue that the physical experience of weight primed the concept of weight and that our reported pattern of results can be explained by conceptual accessibility, as theorized by the associative network model. Researchers rely on semantic network models of emotion to understand how individuals perceive, learn, understand, represent, and use emotional information (i.e., emotion-information processing; for a review, see Niedenthal, 2008). In a semantic network model of emotion, emotion concepts are stored as interlinked nodes in a memory network. Each emotional state is represented by a central node, and all associative information, such as the situation or

bodily experience, are conceptualized as nodes linked to the central node in memory. Within this model, the activation of a node spreads to other nodes via their associative connections. For instance, when one feels fear, memory nodes related to fear become activated; thus, an individual might experience a heightened accessibility to words associated with fear as well as an increase in heart rate and tightening muscles. In addition, activation of an emotion's associated information in the network can generate the emotion itself. Although there is certainly room for a semantically driven explanation, such explanation is unlikely to account for the results of our studies. The associative network model can explain the hypothesized effects, but it cannot predict our results. Thus, we maintain our contention that the embodied simulation account, rather than the associative network model, is the underlying mechanism that accounts for the effect. Nonetheless, future research could further investigate this alternative explanation.

Finally, there is a clear operational difference between our research and previous work on weight and importance (Ackerman et al., 2010; Jostmann et al., 2009). While in previous studies, participants held heavy objects with their hands, in the current studies, participants wear heavy objects on their back. Given the recent work on the modality of the experience (e.g., Lee & Schwarz, 2010), there will be meaningful differences between external cues to heaviness (e.g., what you hold) and cues to heaviness that are representative of one's own body (e.g., what you wear). Additionally, we did not find support for the link between our manipulation of weight and importance; therefore, future studies should investigate the operationalization of weight as a potential moderating factor.

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Figure 1. Mean fluency score (number of words written per second) by weight condition and type of essay in Study 4. Error bars represent standard errors.

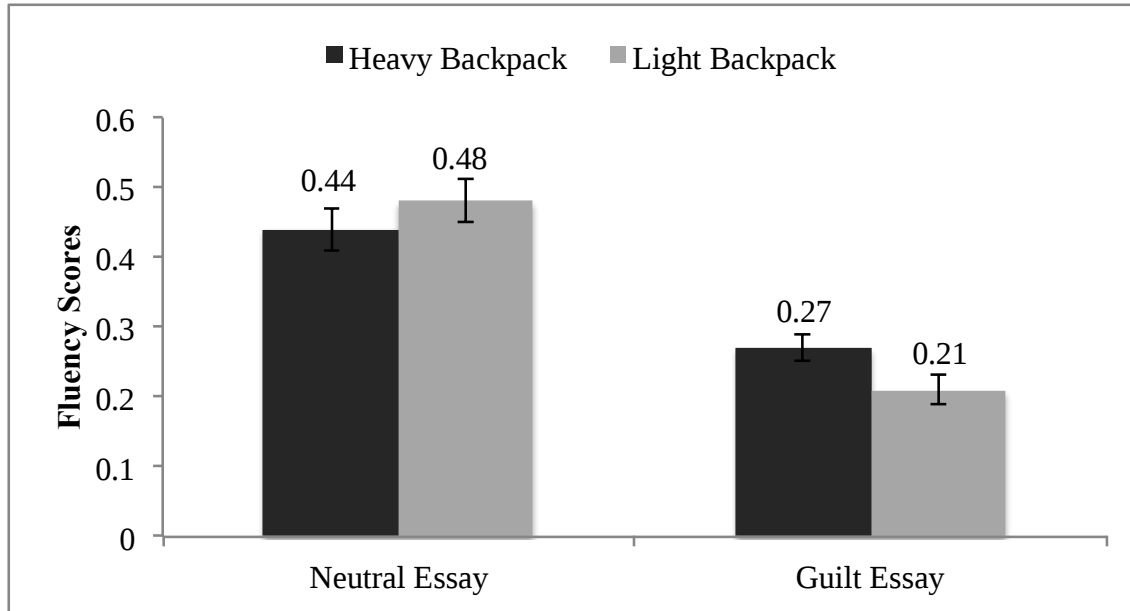


Table 1. Mean values for measures in Studies 1a-1c, 2, and 3

Study and Measure	Light-Backpack	Heavy-Backpack
Study 1a		
PANAS-X guilt	1.78	2.57
Study 1b		
PANAS-X guilt	1.75	2.83
Choice of boring task	15%	50%
Study 1c		
PANAS-X guilt	1.33	1.81
State guilt	1.73	2.59
Choice on healthy snack	48%	78%
Study 2		
PANAS-X guilt	1.61	1.24
Study 3		
PANAS-X guilt	1.96	2.71
Over-reporting	.58	1.94