

## BRIEF REPORT

## The Physical Burdens of Secrecy

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The present work examined whether secrets are experienced as physical burdens, thereby influencing perception and action. Four studies examined the behavior of people who harbored important secrets, such as secrets concerning infidelity and sexual orientation. People who recalled, were preoccupied with, or suppressed an important secret estimated hills to be steeper, perceived distances to be farther, indicated that physical tasks would require more effort, and were less likely to help others with physical tasks. The more burdensome the secret and the more thought devoted to it, the more perception and action were influenced in a manner similar to carrying physical weight. Thus, as with physical burdens, secrets weigh people down.

*Keywords:* secrets, embodiment, metaphor, perception, action

Holding personal secrets is a ubiquitous part of life (Kelly, 2002). However, secrets are stressful and can harm health (Pennebaker, 1989). The damaging effects of secrets have been attributed to mental stress and taxation of cognitive resources (Lane & Wegner, 1995; Pennebaker, 1990). The current work examines an additional negative consequence of secrets. Language used to describe secrets, such as “being weighed down” or “being burdened,” suggests that *carrying* a secret is conceptualized metaphorically as a physical burden. If so, sensorimotor states associated with physical burdens could be activated or simulated when carrying a secret (see Barsalou, 2008). We examined whether secrets would thus be experienced as physical burdens, influencing how people perceive and act in the world.

A growing body of work has suggested that abstract concepts are linked to the bodily experiences that describe them metaphorically (Lakoff & Johnson, 1980, 1999; Landau, Meier, & Keefer, 2010). Sensations of warmth and coldness influence interpersonal warmth judgments (Williams & Bargh, 2008), sensations of hardness and softness influence gender categorization (Slepian, Weis-

buch, Rule, & Ambady, 2011), and sensations of roughness and smoothness influence how smooth social interactions seem (Ackerman, Nocera, & Bargh, 2010). In these and similar experiments, temporary states influence cognitive judgments (e.g., evaluations, attention, memory; see Landau et al., 2010). In addition to examining perception and judgment, the current work examines the influence of embodied metaphor on more complex outcomes: action regulation and prosocial behavior. Moreover, in contrast to previous work that has examined the activation of temporary and briefly held concepts, we examine the effects of a chronic state (a long-held secret) and also consider how individual differences in the psychological burden associated with a secret influence perception and behavior.

### The Present Research

The present article examined whether secrets weigh people down. Across four studies, we examined whether secrets would lead to perceptions, judgments, and actions consistent with those that occur when people carry physical weight. Study 1 examined whether carrying a secret would influence perceived steepness of a hill, which is known to vary with carrying physical weight (Proffitt, 2006). Study 2 examined perceived distance, another measure sensitive to felt weight (Proffitt, Stefanucci, Banton, & Epstein, 2003), using an action-based measure. Study 3 tested whether the frequency of thoughts about a secret predicted the perceived effort required for physical tasks. Study 4 tested whether suppressing a secret would influence helping behavior for physical tasks.

### Pilot Study

Our hypotheses hinged on the assumption that secrets are conceived of metaphorically as burdens. We tested that assumption in

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a pilot study. Twenty participants rated to what extent keeping a secret would make them feel cold, numb, small, low, and burdened on a scale ranging from 1 (*not at all*) to 7 (*very much*). Each control sensation has been linked in prior work to feeling disconnected from others in some way (e.g., DeWall & Baumeister, 2006; Duguid & Goncalo, 2012; Williams & Bargh, 2008; Zhong & Leonardelli, 2008). A repeated-measures analysis of variance (ANOVA) determined significant variation among these sensations,  $F(4, 72) = 11.17, p < .001, \eta^2 = .62$ , and participants reported they would feel burdened more than all other sensations when carrying a secret ( $ts \geq 2.87, ps \leq .01, rs \geq .55$ ; see Table 1). We therefore examined across four studies whether secrets cause people to perceive and act on the world as if they are physically burdened.

### Study 1

In an initial test, we examined whether bearing a secret could cause hills to seem steeper, a consequence of carrying physical weight. When a person carries a physical burden, the cost of scaling hills increases, and therefore hills appear steeper (Proffitt, 2006; see also Schnall, Harber, Stefanucci, & Proffitt, 2008). We examined whether secrets have a similar effect. We also investigated whether secrets would vary in felt weight, much as physical burdens do. Secrets vary in how big (i.e., serious) they are (Vrij, Nunkoosing, Paterson, Oosterwegel, & Soukara, 2002). A secret about an infidelity is bigger and weightier than a trivial secret, such as having told a white lie. Therefore, we expected that serious secrets would be more burdensome and would lead to greater perceived hill steepness than would trivial ones.

### Method

Forty participants (65% female;  $M_{\text{age}} = 32$  years) were recruited online (from Amazon Mechanical Turk; see Buhrmester, Kwang, & Gosling, 2011) and participated for monetary compensation in what were ostensibly two different studies. Participants were informed that the first study concerned the psychology of secrets. Participants were randomly assigned to recall either a meaningful personal secret or a small personal secret. They were instructed, “Without revealing specific details about your secret, we are curious what it pertains to. Please write about your big [small] secret in the provided box.” This encouraged participants to recall secrets without revealing them (cf. Pennebaker, 1989).

Subsequently, participants completed an ostensibly separate study concerning judgments about workplace items. Participants provided numerical estimations on four dependent measures: three control items—sturdiness of a table, durability of a water bottle

from 1 (*not*) to 7 (*very*), and temperature in degrees Fahrenheit of a park—and the critical measure, the steepness in degrees of a hill shown face-on (i.e., not a cross-section). Public domain images served as stimuli.

### Results and Discussion

The four dependent measures were transformed into standardized scores, and the three control items were averaged to create an index of control numerical estimation. We calculated an estimate of the aggregate reliability of the control numerical estimation index using the Spearman-Brown formula, which revealed acceptable reliability ( $r = .55$ ; see Rosenthal & Rosnow, 1991). For ease of interpretation, untransformed slant estimates are presented in text (see Figure 1 for standardized means).

A 2 (condition: big secret, small secret)  $\times$  2 (measure type: hill slant, control estimates) ANOVA revealed no main effects of condition,  $F(1, 38) = 0.01, p = .94$ , or of measure type,  $F(1, 38) = 0.69, p = .41$ , but did reveal the predicted interaction,  $F(1, 38) = 13.99, p = .001, r = .52$  (see Figure 1). Hill steepness was estimated to be greater by those recalling big ( $M = 46.05^\circ, SD = 16.40^\circ$ ) relative to small ( $M = 32.90^\circ, SD = 17.98^\circ$ ) secrets,  $t(38) = 2.42, p = .02, r = .37$ , whereas estimates of controls did not differ ( $M_{\text{big}} = -0.11, SD = 0.57; M_{\text{small}} = 0.21, SD = 0.81$ ),  $t(38) = 1.47, p = .15$ . One possibility is that demand characteristics produced these findings (cf. Durgin et al., 2009; Proffitt, 2009), yet this seems unlikely because the manipulation and measure were presented in ostensibly different studies and the manipulation moved only the critical item. Big secrets, relative to trivial ones, affected perceived hill steepness but not estimations unrelated to physical effort. These results suggest that the metaphorical link between secrets and physical burdens influences perception. Secrets affected judgments as physical burdens do: The larger the secret, the steeper a hill seemed.

### Study 2

Study 1 demonstrated that carrying a secret is experienced as if carrying a physical burden, with the magnitude of the secret corresponding to how physically burdensome it was. Big secrets caused hills to appear steeper. In Study 2, we examined whether burdensome secrets would influence another perceptual measure known to vary with carrying a physical burden: distance perception (Proffitt et al., 2003; Witt, Proffitt, & Epstein, 2004). When a person carries a physical load, the cost of walking across any distance becomes greater, and therefore distances appear farther. We used an action-based measure of perceived distance. If secrets are physically burdensome, then big secrets should cause people to overestimate distance, thereby causing people to overthrow when tossing an object at a target.

### Method

Thirty-six undergraduates (75% female;  $M_{\text{age}} = 19$ ) recalled a meaningful or trivial personal secret, based on random assignment, while tossing a beanbag at a target 265 cm away (Balcetis & Dunning, 2010; Rieser, Pick, Ashmead, & Garing, 1995). The dependent measure was the distance thrown in centimeters, with distances underthrown recorded as negative values, accurate tosses

Table 1  
*Sensations Experienced When Keeping Secrets*

Sensation	<i>M (SD)</i>
Cold	1.89 (1.10)
Numb	2.05 (1.31)
Small	2.16 (1.54)
Low	2.37 (1.42)
Burdened	3.68 (1.73)

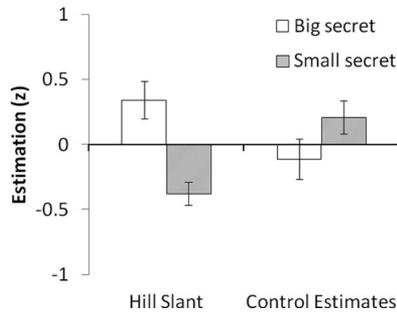


Figure 1. Estimated hill slant and control numerical estimate magnitude as a function of secret type in Study 1. Error bars denote standard error of the mean.

as zero, and distances overturned as positive values (see Figure 2 for actual distances thrown).

## Results and Discussion

Because the distance data were nonnormal (Shapiro-Wilk's  $W = .83, p < .001$ ) and skew could not be corrected, we used the Mann-Whitney  $U$  test to test for differences between the two conditions. This test treats data as ordinal and is more appropriate than a  $t$  test for nonnormal data (Mann & Whitney, 1947). Participants thinking of big secrets ( $M = 17.03$  cm,  $SD = 27.5$ ) relative to trivial secrets ( $M = 1.32$  cm,  $SD = 18.44$ ) overthrew more (Mann-Whitney  $U = 90.5, p = .02$ ). Thus, thinking of burdensome secrets led participants to overthrow a beanbag at a container more, suggesting they perceived greater distance to the target. Big secrets can therefore cause hills to appear steeper (Study 1) and distances to seem farther away (Study 2).

## Study 3

Studies 1 and 2 demonstrated that secrets can affect perceptions of hill slant and distance as if they were physically burdensome. Study 3 offered three innovations. First, it examined an important and common secret (Vrij et al., 2002): committing an infidelity (Blumstein & Schwartz, 1983). Second, it examined perceptions of everyday physical tasks. If bearers of secrets are weighed down, they may perceive common physical tasks as more effortful. Third, it examined whether individual differences in self-reported frequency of thoughts of the infidelity would predict greater apparent weight. The more burdensome the secret, the more it may serve as a physical burden.

## Method

Participants, who were recruited online as in Study 1, first completed a form to determine eligibility. Forty participants (55% female;  $M_{\text{age}} = 27$ ) who recently committed an infidelity were invited to participate.<sup>1</sup> They were asked "How much do you think about your infidelity?" "How much does it affect you?" and "How much does it bother you?" on a scale ranging from 1 (*not at all*) to 7 (*very much*). They were then asked how much effort and energy six tasks required on a scale ranging from 1 (*not at all*) to 7 (*very much*), half involving physical effort (carrying groceries upstairs,

walking a dog, helping someone move) and half not (giving someone change, donating, giving directions).

## Results and Discussion

The three questions regarding infidelity were reliable ( $\alpha = .83$ ) and were therefore averaged to create a burdensomeness index. Effort and energy questions ( $\alpha_{\text{physical}} = .69$ ;  $\alpha_{\text{nonphysical}} = .88$ ) were also averaged together. To determine whether burdensomeness interacted with task type, a repeated-measures general linear model was used, with the burdensomeness index as the predictor for the repeated-measure of task type. This revealed no main effect of task type,  $F(1, 38) = 0.12, p = .73$ , but did reveal an interaction between task type and the burdensomeness index,  $F(1, 38) = 9.88, p = .003, r = .46$  (see Figure 3). Regression results revealed that the more participants thought about their infidelities, the greater effort and energy they estimated would be required by physical tasks ( $\beta = .46$ ),  $t(38) = 3.19, p = .003, R^2 = .21$ , but not by nonphysical tasks ( $\beta = -.13$ ),  $t(38) = 0.79, p = .43$ . The more burdensome their secrets were, the more participants perceived everyday behaviors as if they were carrying a physical burden.

One alternative explanation for these results is that keeping a secret is a negative experience, which causes people to avoid additional aversive situations. If the physical tasks were seen as more negative than the nonphysical tasks, participants whose infidelities were particularly bothersome might have wanted to avoid them, leading to perceptions of those tasks as more effortful. Twenty separate participants evaluated the physical and nonphysical tasks on effort, with a scale ranging from 1 (*not at all*) to 7 (*a lot*), and on valence, with a scale ranging from 1 (*very negative*) to 7 (*very positive*). A 2 (task type: physical, nonphysical)  $\times$  2 (rating: valence, effort) repeated-measures ANOVA revealed an interaction between the two factors,  $F(1, 19) = 53.84, p < .001, r = .86$ . Physical tasks ( $M = 5.17, SD = 1.21$ ) were rated as more effortful than nonphysical tasks ( $M = 1.92, SD = 1.00$ ),  $t(19) = 11.09, p < .001, r = .93$ . However, the physical tasks were not rated as more negative ( $M = 6.20, SD = 0.68$ ) but rather as marginally more positive than nonphysical tasks ( $M = 5.85, SD = 0.90$ ),  $t(19) = 1.85, p = .08, r = .39$ . These results therefore support a burdensomeness explanation for the outcome of Study 3; they do not support a valence-based one.

## Study 4

In Study 4 we examined whether people burdened by a secret would be less willing to help others with physical tasks. The more individuals are weighed down by a secret, the less likely they should be to help another with physical tasks. Study 4 also examined the suppression of another commonly kept secret: sexual orientation (Vrij et al., 2002).

<sup>1</sup> It is not known whether these infidelities were secrets, yet there is reason to suspect they were for most of our participants. We conducted another study wherein 40 participants were surveyed regarding the disclosure of their infidelity: 42.5% told no one, 37.5% told a friend, and 20% told their partner. Thus, approximately 80% of participants from this pool have not told their partners about their infidelities—most remain a secret.

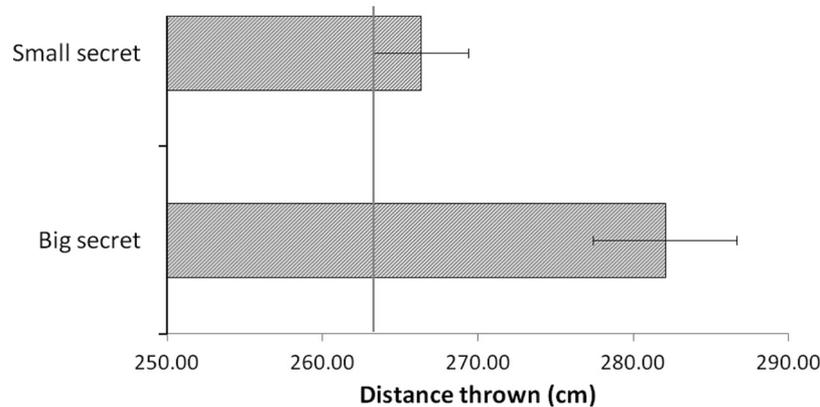


Figure 2. Distance thrown when aiming a beanbag at a target in Study 2 as a function of secret type. The vertical line marks the target's location, and error bars denote standard error of the mean.

## Method

Thirty gay men ( $M_{\text{age}} = 20$ ) concealed either their sexual orientation or extraversion while answering questions in front of a video camera. The study was ostensibly concerned with impression formation and self-presentation. After participants completed a demographic form including questions regarding sex, age, ethnicity, sexual orientation, and personality, the experimenter informed participants that they should conceal a certain trait while being videotaped. Participants were asked not to express in any way, but rather conceal, either their sexual orientation or extraversion (based on random assignment). All participants but one indicated more extraversion than introversion (but that participant was randomly assigned to conceal sexual orientation). While concealing, participants answered control questions not pertaining to help

(from Study 1, see Appendix) and how likely they would be to help with three nonphysical favors (loaning a car, loaning \$20, and letting someone use their shower). Before the session ended, the participant was asked to perform a physical favor (moving books) because the lab was ostensibly relocating. The books were immediately next to the participant on a nearby shelf, and the lab appeared to be in the process of relocating, being mostly empty except for a few remaining stacks of books. The number of book stacks (from one to six) that participants moved was recorded.

## Results and Discussion

A 2 (concealment: sexual orientation, extraversion)  $\times$  2 (helping: physical, nonphysical) ANOVA revealed main effects of condition,  $F(1, 26) = 4.88, p = .04, r = .40$ , and of helping,  $F(1, 26) = 9.28, p = .005, r = .51$ . These were qualified by a near-significant interaction,  $F(1, 26) = 3.83, p = .06, r = .36$  (see Figure 4).<sup>2</sup> Paired tests revealed that participants concealing their sexual orientation, a more burdensome secret, moved fewer book stacks ( $M = 1.86, SD = 1.79$ ) than did those concealing extraversion, a smaller secret ( $M = 3.93, SD = 2.50$ ),  $t(26) = 2.52, p = .02, r = .44$ , whereas the measure of willingness to engage in nonphysical helping yielded no difference between conditions ( $M_{\text{sexual orientation}} = 4.26, SD = 1.59$ ;  $M_{\text{extraversion}} = 4.45, SD = 1.36$ ),  $t(26) = 0.34, p = .74$ . Thus suppressing a secret seemed to physically weigh participants down, leading to less prosocial behavior regarding physical tasks.

## General Discussion

Across four studies, people seemed physically burdened when instructed to think about or to hide meaningful secrets. Bearing secrets influenced visual perception and action, made physical tasks seem more effortful, and decreased willingness to provide physical help. These findings support the hypothesis that carrying

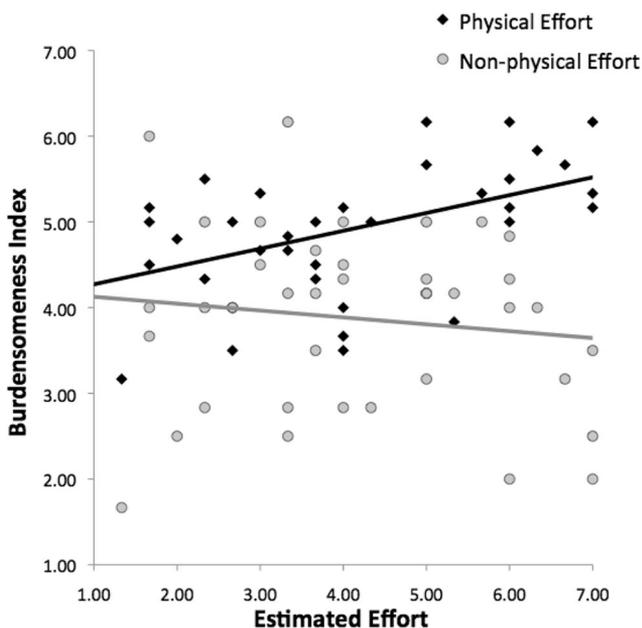


Figure 3. Estimated effort required of physical and nonphysical tasks plotted with the burdensomeness of a recent infidelity in Study 3.

<sup>2</sup> During debriefing, two participants indicated suspicion and were therefore excluded from the analysis. We also compared groups on the control items, unrelated to helping. These did not differ (Spearman-Brown  $r = .56$ ),  $t(26) = 0.04, p = .97$  (see Appendix).

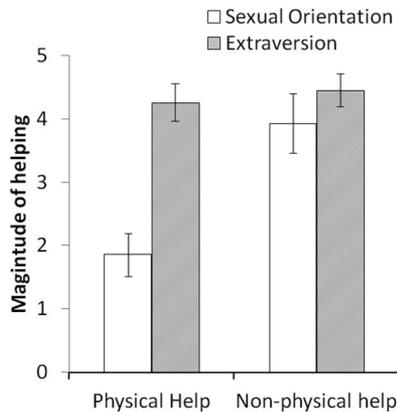


Figure 4. Magnitude of helping as a function of trait concealed in Study 4. Error bars denote standard error of the mean.

a secret leads to the experience of being weighed down. Furthermore, we demonstrated that individual differences in the experience of the psychological burden of a secret predict the physical burden experienced. The more chronic thoughts were about a secret, the more participants indicated being weighed down.

Alternative mechanisms were considered as well. The effects of bearing secrets do not seem a mere consequence of mental depletion or cognitive load. The default response when estimating hill slant is overestimation (Proffitt, Bhalla, Gossweiler, & Midgett, 1995), whereas for estimating distance it is underestimation (Loomis, Da Silva, Fujita, & Fukusima, 1992; Norman, Todd, Perotti, & Tittle, 1996). Because cognitive load causes greater reliance on default responses (e.g., Wood & Neal, 2007), cognitive load should lead to overestimation of hill slant and underestimation of distance. This pattern was not observed. Although bearers of big secrets perceived greater hill steepness (Study 1), they did not perceive shorter distances—a distant target seemed farther rather than closer (Study 2). The present results therefore cannot be accounted for by a cognitive load explanation. An explanation involving burden, on the other hand, seems to explain the results across studies quite well. Future work is needed to examine the role of cognitive load and whether cognitive loads can in some cases themselves seem physically burdensome. In the present work, however, secrets affected perceptions and judgments above and beyond any effects of cognitive load.

This research extends prior work on the link between weight and importance (e.g., Jostmann, Lakens, & Schubert, 2009; Schneider, Rutjens, Jostmann, & Lakens, 2011). For instance, learning that a book is important leads perceivers to judge that book as heavier (Schneider et al., 2011). The current work is similar but distinct from the literature on importance and weight. Whereas that work examined the perceived weight of external objects (important objects seem weighty), the present work examined whether individuals themselves would feel physically burdened when carrying secrets. Indeed, the specific pattern of findings (greater perceived hill steepness and distance, physical tasks seeming more effortful, reduced helping behavior for physical tasks) implicate being physically burdened rather than the weightiness of external objects.

These results may have health implications. Concealment of stigmas and life traumas damages health, an effect that has been

attributed to mental burdens and impairment (Pennebaker, 1990). We suggest that concealment also leads to greater physical burden and perhaps eventually physical overexertion, exhaustion, and stress. In sum, important meaningful secrets, including those regarding infidelity and sexual orientation, affected individuals across numerous domains, as if they were physically burdened.

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## Appendix

### The Influence of Secrets on Measures Sensitive to Physical Burden

Table A1  
Mean Values for Measures in Studies 1, 2, and 4<sup>a</sup>

Study and measure	Big secret	Small secret
Study 1		
Nonphysical		
Table sturdiness	4.48	5.37
Water bottle durability	5.00	5.42
Ambient temperature (degrees)	68.00	65.62
Physical		
Hill slant (degrees)	46.05	32.90
Study 2		
Physical		
Distance beanbag overthrown (cm)	17.03	1.32
Study 4		
Nonphysical		
Table sturdiness	5.67	5.73
Water bottle durability	5.20	4.87
Ambient temperature (degrees)	70.21	70.33
Loaning a car	3.27	3.33
Loaning \$20	4.53	4.40
Letting someone use one's shower	5.07	5.80
Physical		
Moving book stacks	1.86	3.93

<sup>a</sup>See Figure 3 for Study 3 values.