

Grounding Lay Theories of Personality: Proprioception Influences Person Theories

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Abstract

Models of embodied cognition posit that concrete and abstract concepts are represented in sensorimotor systems. The authors investigated the hypothesis that sensorimotor systems might also underlie beliefs, specifically lay theories of personality. Entity theorists believe personality traits to be fixed, whereas incremental theorists believe traits to be malleable. As descriptions of “fixed” and “malleable” also describe proprioceptive sensations of handling objects, the authors predicted that handling malleable objects would lead to a more incremental theory of personality, and that handling fixed objects would lead to a more entity theory of personality. Across seven studies, handling malleable objects led to self-descriptions consisting of more malleable attributes, greater perceived variability in others’ behavior, and greater endorsement of an incremental theory of personality. Handling fixed objects, in contrast, led to more stable attributes in self-descriptions, greater perceived stability in others’ behavior, and greater endorsement of an entity theory of personality. Furthermore, the authors present data that suggest these effects are independent of semantic priming, and that the relationship between proprioception and person theories is reciprocal. These data suggest that beliefs about others’ malleability might be uniquely embodied, and that proprioception influences real-world outcomes relevant to person theories, affecting stereotyping and moral judgments.

Embodiment and Lay Theories of Personality: Proprioception Influences Person Theories

Whether one believes that people can change or not has a host of consequences for perceptions of the self and others. People who hold an *incremental theory* of personality think that people can change, believing personality characteristics to be malleable; whereas those who hold an *entity theory* of personality think that people cannot change, believing personality characteristics to be fixed (Dweck, Chiu, & Hong, 1995). These lay theories of personality are endorsed implicitly, and the theory that individuals endorse has a wide range of consequences for their behavior: from how they respond to failure, to how they view themselves, others, and even groups (Levy, Plaks, & Dweck, 1999). Moreover, this can further impact numerous social behaviors ranging from the amount of punishment given for a wrongdoing, to stereotype endorsement (Levy et al., 1999). Although much research has demonstrated the consequences of lay theories of personality, the present research examines *how* they are cognitively represented.

Lay Theories of Personality

Lay theories of personality significantly impact perceptions of the self, other individuals, and even groups (Levy et al., 1999). Those who hold an entity theory believe that personality characteristics are fixed and immutable, despite one's efforts or motivations to change them. Those who hold an incremental theory, however, believe that personality characteristics are changeable and malleable, and that one's characteristics can be changed or developed with time and effort (see Dweck et al., 1995; Levy et al., 1999). These theories can be domain specific. For instance, an individual with an entity theory of intelligence believes that, despite being able to learn new things, one's underlying intelligence is a fixed trait. An individual with an incremental theory, in contrast, believes in a changeable intelligence—one that can be improved upon with hard work. These theories impact how one responds to failure. For instance, for entity theorists,

failure indicates a lack of ability, leading to negative affect and avoidance. For incremental theorists, however, failure indicates a lack of effort, leading to increased efforts to improve (Dweck & Leggett, 1988).

Lay theories of personality also impact how individuals perceive others. Entity theorists make more dispositional attributions, viewing personality qualities as stable across situations and resistant to change over time. In contrast, incremental theorists make more situational attributions, viewing personality qualities to be the result of a dynamic process whereby contextual psychological variables—such as goals, emotions, and needs—drive behavior (Chiu, Hong, & Dweck, 1997). This difference in thinking about other people is evident in information processing as well. For example, when incremental theorists describe others' behavior they are more likely to use psychological processes and situational factors in their explanations. In contrast, when entity theorists describe others' behavior they are more likely to use trait terms, which imply greater stability or constancy about that behavior (Chiu et al., 1997; Levy, Stroessner, & Dweck, 1998). Entity theorists' focus on trait information leads to greater attention to stereotypic information, while incremental theorists' focus on contextual and situational factors leads to greater attention to counter-stereotypic information (Plaks, Stroessner, Dweck, & Sherman, 2001). This consequently leads entity theorists to act more on existing stereotypes than do incremental theorists, potentially reinforcing those stereotypes as well (Gervy, Chiu, Hong, & Dweck, 1999; Levy & Dweck, 1999). Furthermore, entity, relative to incremental, theorists tend to believe a single behavior is representative of a persons' overall personality, and thus just one negative behavior can elicit greater punishment (e.g., Erdley & Dweck, 1993; Chiu et al, 1997).

Embodied Cognition

Entity theorists believe people's traits to be fixed, whereas incremental theorists view people's traits as malleable, and these different beliefs are responsible for a host of social consequences. We suggest that beliefs in the malleability of personality are embodied in the proprioceptive experience of the malleability of objects. This hypothesis is suggested by recent influential models of embodied or grounded cognition (Barsalou, 1999, 2008; Lakoff & Johnson, 1980, 1999), which assert that concepts are embodied in concrete experience. For instance, consider a hammer. Rather than an amodal symbol representing a hammer and its properties—including a description of what a hammer looks like—a grounded concept of a hammer would actually consist of modality-specific representations such as proprioceptions (e.g., the sense of the weight and balance felt when holding or using a hammer) and motor actions (e.g., the muscles used when reaching out and grasping a hammer) that are experienced when using a hammer. Indeed, just seeing a hammer activates the brain's premotor cortex, the key cortical region involved in grasping manipulable objects (Chao & Martin, 2000). Thus, the sight of a hammer produces a *simulation* of a power grip. A simulation is a partial reactivation of sensory, motor, or introspective states drawn from previous experience (Barsalou, 1999). The simulation of a power grip when seeing a hammer is specific to a hammer (Tucker & Ellis, 2001). Whereas a power grip is needed to handle a hammer, a precision grip is needed to handle a grape. Accordingly, the perception of a grape results in the simulation of a precision grip (Tucker & Ellis, 2001). These examples provide support for a grounded-cognition account of concrete concepts. Representations of concepts can include specific modal states or modalities—usually based on specific sensorimotor experiences. Thus, the mere activation of a concept may produce partial re-enactments of modal states or sensory experiences based on prior experience.

Accounts of embodied cognition are not only restricted to simulations of previous physical experiences but suggest that abstract concepts are also embodied in concrete sensations and experiences. Although abstract concepts are not tangible, and thus have no obvious associated modal states, such concepts are often embodied in concrete experience via metaphors (Lakoff & Johnson, 1980, 1999; Landau, Meier, & Keefer, 2010). For example, the abstract concept “friendly” is described by the metaphor “warm,” and participants who held a hot, relative to light, clipboard judged a target person as being warmer (Williams & Bargh, 2008). Thus, the metaphorical relationship between weight and the concept of importance can be represented by previous sensory experiences: the idea of importance is embodied within physical sensations of weight. Alternatively, experiences of bodily movement and sensations.

Embodied Beliefs

Beliefs about the physical world can also have an embodied basis. For instance, motor predictions and eye movements contribute to mental extrapolations of momentum (Kerzel, 2005), and motor activity facilitates physical inferences (Schwartz & Black, 1999; Wexler, Kosslyn, & Berhoz, 1998). Thus, experience with physical entities might contribute to beliefs about the concrete world. As both concrete and abstract concepts can be grounded in sensorimotor activity, we suggest that not only beliefs about concrete entities, but also beliefs about abstract entities can be embodied in concrete experience. As entity theorists believe people’s traits to be fixed, whereas incremental theorists believe people’s traits to be malleable, we investigated the hypothesis that beliefs about personality might be embodied in sensorimotor activity along the fixed-malleable dimension. We suggest that the experience of handling a fixed, unyielding object underlies the representation of a fixed personality; and the experience of handling a malleable, yielding object underlies the representation of a malleable personality.

Thus, we expected that handling a malleable object would lead individuals to endorse an incremental theory of personality, whereas handling a fixed object would lead to an entity theory of personality.

Embodied Theories of Personality: The Current Research

In seven studies we tested the influence of malleable versus fixed proprioception on perceptions of the self, others, and groups. In Study 1, we examined whether malleable or fixed proprioceptions influence endorsement of person theories and, consequently, perceptions of others' malleability and fixedness. In Studies 2 through 5, we examined whether such proprioceptions would also influence self-perceptions and, furthermore, examined the mechanism behind the influence of proprioception on person theories. Studies 2 through 4 provide critical tests for an embodied cognition hypothesis by testing for the role of semantic priming in the influence of proprioception on person theories. Study 5 examines whether the relationship between proprioception and self-perception is reciprocal.

In Studies 6 and 7 we examined real-world consequences of the experience of malleable and fixed proprioception. Specifically, in Study 6, we tested whether proprioceptive input would influence stereotype endorsement by impacting perceptions of groups as malleable or fixed. Lastly, in Study 7, we examined whether proprioceptive influences on person theories might affect related behavioral outcomes in another domain influenced by person theories: morality.

We predicted that malleable proprioception would lead to more malleable perceptions of others (as exhibiting more variable behavior) and the self (as more changeable). Conversely, we predicted that fixed proprioception would lead to more fixed perceptions of others (as exhibiting behavioral consistency) and the self (as more stable). Moreover, we predicted that these effects would be driven by the physical experience of handling a malleable or fixed object while

considering the self or others, and not via traditional semantic priming. Finally, we predicted that the influence of proprioception on lay theories of personality would have consequential outcomes in the domains of stereotyping and morality, influencing both stereotype endorsement and the punishment given to a wrongdoer. If so, lay theories about people might be embodied in sensorimotor states, and thus beliefs about abstract entities might have a bodily basis.

Study 1

Entity theorists believe people's traits to be fixed, whereas incremental theorists view people's traits as malleable. Thus, we predicted that fixed proprioceptions would lead to greater perceived stability in others' behavior and more endorsement of entity theories of personality. In turn, we predicted that malleable proprioceptions would lead to lesser perceived stability in others' behavior (more variability) and more endorsement of incremental theories of personality.

Method

Participants. Eighty-two undergraduates (61% female) from a private university in the northeastern United States participated in partial fulfillment of a course requirement.

Procedure. Framed as a study on multi-tasking, participants were instructed to continuously squeeze either a malleable or fixed ball, similar in all respects except density, while observing 24 faces. The malleable ball was a standard polyurethane-foam stress ball, whereas the fixed ball was made of latex and filled with millet. The faces were grayscale images of males displaying neutral expressions, sized at 300×300 pixels (presented on a 1024×768 pixel computer monitor). Each face was paired with behavioral descriptions (half positive, half negative). For instance, one negative behavior was "stole money from his mother's purse," whereas a positive behavior read, "helped his brother study for an important test." Participants' task was to indicate how typical they believed this behavior to be of the person onscreen from 1

(Not typical) to 7 (Typical). Participants were informed that while they only had the one image to rely upon to make each judgment that they should do the best that they can and just “go on your first instinct.” These instructions served to encourage participants to not deliberately overthink each judgment. Subsequently, participants put the ball aside and answered the three-item implicit person theory measure (Levy, Stroessner, & Dweck, 1998): 1) “The kind of person someone is, is something basic about them, and it can’t be changed very much.” 2) “People can do things differently, but the important parts of who they are can’t really be changed.” and 3) “Everyone is a certain kind of person, and there is not much they can really do to change that.” Participants responded on a scale from 1 (Strongly agree) to 6 (Strongly disagree). Lower scores on this measure indicate a more entity theory, whereas higher scores indicate a more incremental theory.

Results

A 2 (ball-type) \times 2 (sentence-valence) mixed-model analysis of variance (ANOVA) with repeated measures on the second factor, and typicality ratings as the dependent measure revealed that participants rated negative behaviors as more typical ($M = 4.62$, $SD = .72$) than positive behaviors ($M = 4.42$, $SD = .71$), though this effect did not reach significance, $F(1, 80) = 2.41$, $p = .12$. More critical to the current hypothesis, participants handling the fixed ball rated the presented behaviors as more typical of the person onscreen ($M = 4.61$, $SD = 0.32$) than did those handling the malleable ball ($M = 4.44$, $SD = 0.44$), $F(1, 80) = 3.92$, $p = .05$, $r = .20$. There was no interaction between ball-type and sentence-valence, $F(1, 80) = 0.17$, $p = .68$.

Moreover, as expected, participants who had handled the fixed ball endorsed a more entity theory ($M = 3.67$, $SD = 0.97$) than those who had handled the malleable ball ($M = 4.11$, $SD = 0.98$), $t(80) = 2.05$, $p = .04$, $r = .21$ (see Figure 1).

Discussion

Sensory feedback consistent with fixedness versus malleability influenced ratings of behavioral stability. Those handling the fixed, relative to malleable, ball rated both positive and negative behaviors as more typical of a presented target. We hypothesized that proprioceptive fixedness or malleability might underlie the representation of fixed or malleable traits. Indeed, providing participants with the experience of handling fixed or malleable objects impacted how fixed or malleable (i.e., stable) they believed others' behaviors to be. Furthermore, the balls had a later influence on the person theory that participants personally endorsed: previously handling the malleable ball led participants to endorse a more incremental personality theory, whereas handling the fixed ball led participants to endorse a more entity theory of personality.

This first study provides evidence for our claim that beliefs about personality are embodied in bodily sensations. Personality is an abstract concept; it is not actually visible, but only manifests itself in behavior (Heider, 1958). Understanding how personality, then, can change through time (also an abstract concept) seems especially abstract. Yet the experience of proprioceptive malleability appears to influence this abstract belief. The experience of proprioceptive fixedness/malleability impacted lay theories of personality, as indicated by explicit endorsement of person theories, and also perceived stability in others' behavior. Fixed proprioception led to endorsed entity theories and perceived stability in others' behavior. Malleable proprioception led to endorsed incremental theories and perceived variability in others' behavior. Drawing from concrete experience of physical malleability thus might aid representations of mutable personalities.

We sought to examine the breadth of the influence of proprioception on lay theories of personality and also to examine the mechanism by which the reported effects occurred. First,

people do not only apply lay theories to describe others' personalities, but also apply lay theories of personality to the self (Dweck et al., 1995). Might proprioception also ground theories about how the self changes through time? Second, by what mechanism does the experience of fixedness/malleability influence person theories? We sought to answer these two questions in Studies 2 through 4.

Study 2

Rather than the sensorimotor system underlying beliefs about people, it is possible that participants' experience of fixedness/malleability led to a semantic labeling (whether conscious or unconscious) of that experience. That is, the experienced fixed/malleable proprioception could have led to semantic activation of fixed/malleable concepts, which subsequently impacting lay theories of personality. Thus, proprioceptive influences might merely serve as semantic primes. To distinguish between these two potential routes of influence (embodiment versus semantic priming), we tested whether semantic primes mediated the effect of proprioception on held person theories.

In Studies 2 through 4, we sought to investigate the impact of proprioception on a different indicator of entity and incremental theories: the perceived stability of one's own self. We propose that malleable, relative to fixed, proprioception will lead to greater perceptions of a dynamic self. In Studies 2 through 4, we sought to test this hypothesis and also examine the causal chain behind it. As discussed above, proprioception could semantically prime concepts of fixedness/malleability, and this could potentially mediate the effect of proprioception on person theories.

As incremental self-theories suggest that self-attributes can be changed and entity self-theories suggest that self-attributes cannot be changed, we hypothesized that experiencing

proprioceptive malleability or fixedness while considering the self would lead individuals to describe the self in malleable or fixed terms, respectively. In Study 2, we examined the relationship between proprioception and the priming of semantic concepts in the domain of fixedness and malleability. In Study 3, we then tested whether proprioception would influence perceptions of the self's malleability. Finally, in Study 4, we examined whether the effects of proprioception on held person theories were contingent on semantic priming. We examined this casual chain across three experiments rather than in one experiment because introducing the measurement of the mediating variable (semantic activation) could itself serve as a semantic prime, which if so, would not meet the assumptions of a statistical test for mediation (e.g., measurement of a mediating process cannot influence the process itself; see Spencer, Zanna, & Fong, 2005 for a discussion on when *experimental-casual-chain* designs are superior to *measurement-of-mediation* designs).

Method

We first examined whether the manipulation used in Study 1 would prime concepts of fixedness/malleability. If the demonstrated effect in Study 1 was contingent upon semantic priming, then the act of squeezing either a fixed or malleable ball should prime fixed- and malleable-related concepts, respectively.

Participants. Forty undergraduate-volunteers were given one of the two balls from Study 1 based on random assignment.

Procedure. As part of a cover story on multi-tasking, they were asked to continuously squeeze the ball while completing a word-fragment completion task (Tulving, Schacter, & Stark, 1982). In this task, participants were given 20 word fragments and asked to fill in the blanks to create the first word that comes to mind. Of the 20 word fragments, four could be completed

with “fixed” words (stable, rigid, unyielding, resistant) and four could be completed with “malleable” words (pliable, malleable, adjustable, flexible). For example, ___ istant could be filled out as assistant, or the critical word, resistant.

Results and Discussion

Because overall fragments were filled out (marginally) more often with “fixed” words ($M = 1.42$) than “malleable” words ($M = 1.02$), a likely result of different word-stem difficulties and frequencies of word usage, $t(39) = 1.82$, $p = .08$, we examined the relative difference between “fixed” and “malleable” semantic activation. Fragments completed with “fixed” and “malleable” words were positively and negatively coded, respectively. Scores on this “fixed-index” were higher for individuals handling the fixed ball ($M = 0.90$, $SD = 1.45$) than for those handling the malleable ball ($M = -1.00$, $SD = 1.17$), $t(38) = 2.41$, $p = .02$, $r = .36$. Thus, handling fixed and malleable balls differentially primed concepts of fixedness and malleability (see Figure 2).

Study 3

Having established that experiencing proprioceptive fixedness and malleability might prime fixed and malleable concepts, we next sought to provide converging evidence that proprioceptive fixedness and malleability would influence person theories, here in a new domain: self perceptions.

Method

Participants. Forty-two undergraduates (62% female) from a private university in the northeastern United States participated in partial fulfillment of a course requirement.

Procedure. Framed as a study on multi-tasking, participants were instructed to continuously squeeze either the malleable or fixed ball from Study 1 while completing 10 open-ended “I am” statements. This was a shortened version of the Twenty Statements Test (Kuhn &

McPartland, 1954) that has been used successfully in a number of studies for eliciting self-descriptions (e.g., James & Greenberg, 1989; Trafimow, Triandis, & Goto, 1991).

Results and Discussion

Two condition-blind raters ($\alpha = .94$) coded each item as a fixed, stable attribute (e.g., “I am a girl.”) or a changeable, temporary attribute (e.g. “I am tired.”); ambiguous items (e.g., “I am confident.”) were excluded. The proportions of fixed and changeable attributes constituted the dependent measure.

A 2 (ball-type) \times 2 (attribute-type) mixed-model ANOVA with repeated measures on the second factor revealed the predicted ball-type \times attribute-type interaction, $F(1, 40) = 4.17, p = .048, r = .31$; there was no main effect of ball-type, $F(1, 40) = 0.002, p = .97$, nor attribute-type, $F(1, 40) = 1.14, p = .29$. When thinking about the self, malleable proprioception encouraged more changeable ($M = .23, SD = .26$) than fixed self-attributes ($M = .10, SD = .10$), and fixed proprioception encouraged more fixed ($M = .19, SD = .15$) than changeable ($M = .15, SD = .20$) self-attributions (see Figure 3).

Proprioceptive malleability impacted self-perceptions in line with our hypothesis that beliefs in people’s malleability are embodied in proprioceptive malleability. That is, while considering one’s self-concept, proprioceptive malleability or fixedness impacted traits attributed to the self. The experience of fixedness led participants to consider more stable attributes as central to their self-concept, as these attributes came more readily to mind for participants squeezing a relatively fixed ball. In contrast, the experience of malleability led participants to consider more changeable attributes as central to the self, as these traits came to mind more readily for participants squeezing a relatively malleable ball.

Study 4

In Studies 2 and 3, handling a fixed versus malleable ball led to more activation of “fixed” versus “malleable” concepts and also more fixed versus malleable self-descriptions. In this next study we sought to determine if the effect of proprioception on self-perceptions was mediated by semantic activation. If so, priming participants with words activated by the manipulation of fixed/malleable proprioceptions should also influence self perception.

Method

Participants. A power analysis based on the results of Study 3 indicated that 78 participants would be needed to attain a power level of .80 for the dependent measures used. Thus, 78 undergraduate-volunteers filled out the ten “I am” statements as in Study 3.

Procedure. Rather than handling the fixed or malleable ball while filling in the statements as in Study 3, participants completed one of two word-scrambles prior to the “I am” statements task. In this task (Srull & Wyer, 1979), which has successfully primed many constructs and related behaviors in previous studies (e.g., Bargh, Chen, & Burrows, 1996; Fitzsimons & Shah, 2008), participants are presented with five words in a scrambled order and must use four of those words to construct a grammatically correct sentence. We created two versions of the task. In one version, four of twelve sentence scrambles contained words related to fixedness (the same words used in the word-fragment task in Study 2: stable, rigid, unyielding, resistant). In the other version, four of twelve sentence scrambles contained words related to malleability (again, the same words used in the word-fragment task in Study 2: pliable, malleable, adjustable, flexible). The other eight sentences in both conditions were controls.

Results

Two condition-blind raters ($\alpha = .84$) coded each item from the “I am” statements task as a fixed, stable attribute or a changeable, temporary attribute as in Study 3. The proportions of fixed and changeable attributes constituted the dependent measure.

A 2 (prime-type) \times 2 (attribute-type) mixed-model ANOVA with repeated measures on the second factor revealed no main effect of prime-type, $F(1, 76) < 0.001, p > .99$, no main effect of attribute type, $F(1, 76) = 1.80, p = .19$, and no interaction between these two variables, $F(1, 76) = 0.56, p = .50$ (see Figure 4).

Discussion

Although handling the fixed versus malleable ball in Study 2 activated “fixed” concepts, and also led to more fixed self-perceptions in Study 3, when those same words were used as primes, using a well validated priming procedure and a sufficient sample size, they did not influence self perception here. By examining the causal chain experimentally, rather than through a statistical mediation analysis, we were able to circumvent the problem that measurement of the mediating process here might actually prompt the process we were attempting to measure (see Spencer et al., 2005). By using an experimental-causal-chain design, and by taking care to use (a) a sufficient sample size, (b) a well validated semantic priming paradigm, and (c) the same concepts proprioception activated, we can be confident that—taken together—these data suggest that the proprioceptive experience of fixedness/malleability influenced conceptual activation and lay person theories about the self, rather than mere conceptual activation being responsible for the self-perception effect. This is not to say that semantic priming is not involved in these effects, but that proprioception appears to have a unique role in influencing person theories in the studies reported here.

Studies 1 through 4 demonstrated that the experience of malleability or fixedness influenced lay theories of personality. The experience of squeezing a fixed, relative to malleable, ball led individuals to perceive others' behavior as more stable; that is, less variable or malleable. This has special relevance to attributions made about others' behaviors. Believing others' personalities are immutable leads people to heavily weight a single behavior in one's impression of another (Levy et al., 1998; Levy & Dweck, 1999; Plaks et al., 2001). Thus, perceiving one negative behavior might unjustly lead to a negative impression of that person when, in reality, that negative behavior was actually not typical of the person in question. Simply squeezing a fixed, relative to a malleable, ball leads to this very phenomenon. Experiencing malleable proprioception, however, leads to less dispositional attributions from a single behavior; therefore, a greater willingness to consider psychological and situational factors. Furthermore, we demonstrated that this influence of proprioception upon lay theories of personality applies to the self as well. Participants described themselves in more stable, unchanging terms when experiencing fixed proprioception, and more malleable terms when experiencing malleable proprioception.

Study 5

We propose that the influence of proprioception on perceptions of the self and others is a consequence of lay theories of personality being, in part, embodied in proprioception. The concrete experience of being able to shape (or not shape) an object might provide a rich source for understanding others' personalities by means of metaphorical extension or simulation (Barsalou, 2008; Lakoff & Johnson, 1999; Landau et al., 2010). Forming beliefs about the attributes of abstract concepts (the mutability of psychological dispositions) might be aided by drawing from this concrete experience. Studies 2 through 4 provided evidence for this embodied

hypothesis by demonstrating that the reported effects seemed to not be mediated by semantic activation. Experiencing malleability and fixedness did prime “malleable” and “fixed” concepts, but these semantic activations did not influence lay theories. This is not to suggest that beliefs about others cannot occur by means of semantics and language, because they clearly can, but only that there is an embodied understanding of people’s malleability. If as we suggest, the *experience* of malleability aids representations of incremental theories of personality and, conversely, that the *experience* of fixedness aids representations of entity theories of personality, then thinking about a dynamic and changing self, relative to a stable self, might lead to a simulation of proprioceptive malleability. This activation of proprioceptive malleability could then guide the judgment of how malleable a physical object is, making it seem more malleable. We tested this hypothesis in Study 5 to provide converging support for the claim that person theories are embodied in proprioception. Participants were asked to describe a time that they attempted to change something about themselves, either successfully with effort or unsuccessfully despite effort, and then judged how malleable a ball was.

Method

Participants. Forty undergraduates (65% female) from a private university in the northeastern United States participated in partial fulfillment of a course requirement.

Procedure. Participants were asked to write a short narrative about a time they tried to change something about themselves. In one condition they were asked to “write about a time that you wanted to change something about yourself, and with effort you were able to change this thing about yourself.” In the other condition they were asked to “write about a time that you wanted to change something about yourself, but despite your best efforts you were unable to change this thing about yourself.” Participants were provided with three minutes to write their

narrative. After three minutes had passed, they were asked to pick up a ball (latex filled with gel—neither especially malleable nor fixed) and to judge how malleable the ball seemed from 1 (not at all malleable) to 11 (very malleable).

Results and Discussion

Participants who wrote about a time they successfully attempted to change themselves judged the ball as more malleable ($M = 7.73$, $SD = 1.61$) than participants who wrote about being unable to change themselves, their efforts notwithstanding ($M = 6.44$, $SD = 2.09$), $t(31.46) = 2.14$, $p = .04$, $r = .33$ (see Figure 5).¹ This finding supports the hypothesis that person theories may be embodied in proprioception and that people might simulate or draw upon proprioceptive experience to aid representations of theories of personality.

In Study 3, experiencing malleable, relative to fixed, proprioception led to more malleable self-descriptions. Here we observed the reverse effect: Participants who thought about a time that they were able to successfully change something about themselves, relative to failing to do so, perceived a ball as being more malleable. Thus, Studies 2 through 4 demonstrated a unique influence of embodiment upon person theories that was independent of semantic priming, and the current study demonstrated the reciprocal relationship: that person theories influence physical perception. These two phenomena provide good support for embodiment (Barsalou, 1999, 2008; IJzerman & Koole, 2011; Williams, Huang, & Bargh, 2009), suggesting that person theories may be embodied in the sensorimotor system via proprioception.

Having established that proprioception can influence lay theories of personality, impacting both perceptions of others and the self, we next sought to examine if proprioception would have downstream influences for consequential behaviors. For instance, lay theories of personality impact perceptions of the self, others, and even groups. Therefore, in Study 6, we

sought to examine if fixed/malleable proprioception might have an influence in the domain of group perception, namely, stereotyping. Additionally, one's theories of personality have special relevance for passing judgments on others' behaviors. If one holds an entity theory, for instance, then one assumes that another's behavior is a consequence of a disposition, whereas an incremental theorist would give more weight to the situational factors behind another's behavior. In other words, these theories, in part, influence whether people believe others are responsible for their actions. In Study 7, therefore, we examined the influence of fixed/malleable proprioceptions on moral judgments.

Study 6

In Study 6, we attempted to test the impact of proprioceptive malleability and fixedness in a third domain: group perception. Previous work has demonstrated that those who hold an entity, relative to incremental, theory of personality perceive groups as more homogeneous and, as a result, endorse stereotypes about those groups to a greater extent (Levy et al., 1998; Plaks et al., 2001; Rydell, Hugenberg, Ray, & Mackie, 2007). Thus, we reasoned that it experiencing proprioception consistent with malleability or fixedness while thinking about social groups could impact perceptions of those groups, as indicated by stereotype endorsement. We predicted that fixed proprioception while thinking about social groups would lead to perceptions of greater fixedness in those groups and, as a result, increased stereotype endorsement since endorsing stereotypes implies that groups are relatively homogeneous and, thus, fixed. In contrast, we predicted that experiencing malleable proprioception would lead to more malleable perceptions of groups and therefore decreased stereotype endorsement.

It is also possible that the effects we have described thus far are limited to the materials used: squeezing balls of varied amounts of malleability. In this study we utilized a different

manipulation of proprioceptive fixedness/malleability to ensure that our effects generalize to other materials and are thus a function of the experience of fixedness/malleability more broadly, rather than something unique to fixed versus malleable balls.

Method

Participants. Fifty-eight undergraduates (67% female) from a private university in the northeastern United States participated in partial fulfillment of a course requirement.

Procedure. Participants were asked how dishonest, intelligent, untrustworthy, attractive, shallow, and vain they thought politicians and actors were on a scale from 1 (Not at all) to 7 (Very much) while either continuously stretching a rubber band or clicking a ballpoint pen with their non-dominant hand. The rubber band constituted the malleable proprioception manipulation, as repeatedly stretching out its shape and letting it re-contract led to the experience of its malleability, whereas engaging the similar repetitive motor task of clicking the pen did not, as it was relatively more fixed in nature. For politicians, the sum of ratings for attractive, shallow, and vain (less stereotypical) was subtracted from the sum of ratings for dishonest, intelligent, and untrustworthy (more stereotypical). For actors, it was the reverse: the sum of the ratings for the latter three traits (less stereotypical) was subtracted from the sum of the ratings for the former three traits (more stereotypical). These scores were averaged together to create an index of the how much participants endorsed stereotypical, relative to non-stereotypical, items.

Results and Discussion

Participants who continually stretched the rubber band endorsed stereotypes less ($M = 3.45$, $SD = 1.69$) than participants who continually clicked the pen ($M = 4.42$, $SD = 1.89$), $t(56) = 2.06$, $p = .04$, $r = .27$ (see Figure 6).

Thus, manipulation of proprioceptive malleability and fixedness impacted perceptions of groups. Malleable proprioception led to more malleable perceptions of social groups as indicated by less stereotype endorsement, and fixed proprioception led to more fixed perceptions of social groups as indicated by greater stereotype endorsement. Moreover, Study 6 demonstrated that the effects of proprioception in Studies 1 through 4 were not specific to the materials used (i.e., malleable and fixed balls), as the same effects were achieved here when employing other proprioceptive cues to fixedness and malleability.

The six studies presented thus far demonstrate that proprioception can impact perceptions of the self, other individuals, and groups in predictable ways that vary with held theories of personality. These data support our hypothesis that beliefs about others' malleability might be embodied in proprioception. That is, prior work has shown that when individuals hold an entity theory of personality (whether chronically active or situationally activated via the reading of a scientific article) they have fixed self-, other-, and group-impressions (Plaks, Levy & Dweck, 2009). Incremental theories (again, whether chronic or situational), in contrast, lead individuals to think about the self, others, and groups in more flexible and malleable ways. Experiencing proprioceptive malleability influenced how individuals thought about others in line with entity and incremental theories. Lay theories of personality not only impact perceptions of others, but behavior towards others as a consequence of those perceptions. Thus, proprioceptive fixedness/malleability could even impact behavior towards another individual and, if so, this would provide further evidence for the role of proprioception in theories about others. In Study 7 we sought to test the influence of proprioception in a domain dependent on theories of personality: morality.

Study 7

As experiencing proprioceptive fixedness/malleability influences the perceived stability of others' behavior, as well as self-endorsed person theories, we sought to test the influence of proprioception in the consequential domain of morality, which is influenced by these outcomes (Erdley & Dweck, 1993; Chiu et al, 1997; Gervy et al., 1999). If one holds an entity theory, then a single observed behavior may be representative of that person's disposition due to both the tendency to expect stability in others' behavior and the propensity to ascribe dispositional attributions from observed behavior. Holding an incremental theory of personality, however, leads to less dispositional attributions from a single behavior (Levy et al., 1998; Levy & Dweck, 1999; Plaks et al., 2001). These differing attributions can have a significant consequence when the observed individual has committed a reprehensible act, one potentially punishable by law. For instance, if a doctor makes a costly mistake during an emergency should he or she be punished for it? An entity theorist may believe the doctor should indeed be punished. An incremental theorist may recognize the constraints of the situation, however, and mete out a less severe punishment. We tested this hypothesis in Study 7.

Method

Participants. Fifty-nine undergraduates (57% female) from a private university in the northeastern United States participated in partial fulfillment of a course requirement.

Procedure. During a study ostensibly investigating multi-tasking, participants continuously squeezed either the malleable or fixed ball from Study 1, while reading the summary of a legal trial (modified from Niedermeier, Horowitz, & Kerr, 1999). The summary described that a tornado hit a small town in the Midwestern United States, and that the only hospital within 100 miles was overwhelmed by injured patients. Because of the urgent need for immediate blood transfusions, a medical doctor used blood unscreened for HIV, which he knew

was thus potentially unsafe. Two years later a man found out that he was HIV-positive, and records indicated that this was a result of the unscreened transfusion he received two years prior.

The man died seven years later. Participants also read:

The testimony indicated that the victim was, in fact, in need of the transfusion, that the medical doctor made the decision to administer the blood, and that he knew that his actions were a violation of medical regulations. Furthermore, an expert witness testified that it was unequivocally against 1997 medical regulations to administer unscreened blood and the regulations permitted no exceptions.

The defendant was charged guilty of willful neglect, a crime punishable by imprisonment.

Participants were told that they were to play the role of the judge and decide for how many years the defendant should be imprisoned.

The results of Studies 1 and 3 demonstrated that experiencing proprioception consistent with fixedness, rather than malleability, led to more perceived stability in others' behavior, as well as more self-endorsed entity theories. We hypothesized that this same reasoning about the fixed nature of individuals' traits would extend beyond perception to exert an influence upon the application of behaviors towards others. Thus, we expected participants who were influenced towards believing others' traits as fixed and immutable, by the proprioceptive fixedness (versus malleability), to provide more harsh punishments to criminals because their transgressions would be viewed as characteristic of their personalities, rather than as contextually-dependent.

Results

Three participants assigned sentences that were 3 standard deviations above the mean, and were thus excluded from analysis. Consistent with our hypothesis, we observed that participants who squeezed the fixed ball sentenced the defendant to more years in prison ($M =$

5.81, $SD = 4.25$) than did participants who squeezed the malleable ball ($M = 3.35$, $SD = 4.02$), $t(54) = 2.19$, $p = .03$, $r = .29$ (see Figure 7).

Discussion

Participants who handled a fixed ball assigned a harsher punishment to an individual's transgression, consistent with his criminality being the result of his character instead of the situation—a response typical of an entity theorist. Participants who handled a malleable ball assigned a lesser punishment following a transgression, perhaps because they attributed the crime to situational constraints more than impurity of character—a response typical of an incremental view of personality. Thus, proprioception not only influences individuals' perceptions of others as a function of lay theories of personality, but also influences outcomes related to those worldviews.

General Discussion

Prior work on embodied cognition has demonstrated that many concepts, both concrete and abstract, can be embodied in sensorimotor systems (Barsalou, 2008). Representations of concepts such as time, interpersonal warmth, moral purity, and importance are, at least in part, based in sensorimotor activity (Ackerman et al., 2010; Jostmann et al., 2009; Lee & Schwarz, 2010; Miles et al., 2010; Williams & Bargh, 2008; Zhong & Liljenquist, 2006). Prior work has also established that beliefs about the concrete world are embodied in concrete experience, as well (Kerzel, 2005; Schwartz & Black, 1999; Wexler et al., 1998).

The lay theory that some hold that people's dispositions are mutable is quite abstract. First, personality is an abstract concept itself; the idea that people have stable psychological characteristics that drive their behavior admits that these dispositional invariants are not visible, but only their manifestations are, which do not have a one-to-one correspondence with

dispositions (Heider, 1958). Second, the idea that one's personality is mutable relies on the concepts of time and context, also abstract concepts (Lakoff & Johnson, 1980, 1999). Given the highly abstract nature of people's lay theories about the mutability of personality, and based upon work suggestive that abstract concepts might be understood in part through embodiment, we proposed that beliefs about others' personalities would be embodied too. The words psychologists use to describe these lay theories about personality perfectly capture the metaphoric and embodied understanding we propose. For instance, the primary definition of *malleable* is "capable of being hammered or pressed out of shape" (Oxford English Dictionary, 2000). Personality, something intangible, clearly cannot be physically shaped, but we propose that this metaphorical language is a consequence of embodiment (Barsalou, 2008; Lakoff & Johnson, 1980, 1999). The experience of shaping malleable objects can be drawn upon or simulated to aid representations of so-called malleable personalities; the former might provide a basis for the latter.

Across seven studies, we provide evidence that beliefs about others' personalities are indeed embodied in sensorimotor systems. Proprioceptions of malleability led to greater endorsement of incremental person theories, resulting in more malleable self-descriptions, greater perceived variability in others' behaviors, less punishment for another's crime, and more perceived heterogeneity in social groups. In contrast, experiencing the proprioception of fixedness led to more endorsement of entity person theories, resulting in more fixed self-descriptions, greater perceived stability in others' behaviors, more punishment for another's crime, and more perceived homogeneity in social groups. These data thus suggest that people rely on bodily sensations such as proprioception to provide a grounding for theories about personality: how it does or does not change through time or situations.

The current findings also extend recent work examining an embodied basis of social cognition. For instance, previous work has demonstrated that gender categorization might be, in part, embodied. When experiencing tough or hard proprioception, perceivers were more likely to perceive sex-ambiguous faces as male, whereas when experiencing tender or soft proprioception perceivers were more likely to perceive these faces as female (Slepian, Weisbuch, Rule, & Ambady, 2011). This work has demonstrated that social categorical knowledge and stereotypes—abstract social information—might be understood on a bodily level. The present research extends these findings by demonstrating that knowledge and beliefs about people, in general, might be embodied. Therefore, the way that people perceive and think about the social world around them might rely on bodily sensations.

The current findings leave open a number of questions. One question of particular importance is *how* lay theories of personality are embodied. Although there are a number of possibilities, two theories loom most prominently. Conceptual Metaphor Theory (CMT; Lakoff & Johnson, 1980, 1999; see also Gibbs, 1994) posits that perceptual experience provides a source domain to structure abstract concepts, which cannot be experienced directly. Drawing from concrete experience may reduce the abstractness of a representation (Lakoff & Johnson, 1980). Therefore, relating a changing disposition over time to physical shaping of an object, by means of metaphor, might lend to easier comprehension of personality. Indeed, many examples of metaphoric language exist to describe theories of personality. People can be malleable, rigid, flexible, pliable, or unyielding. CMT suggests that the metaphoric language used to describe people as malleable is an outcome of metaphoric thought: We understand people as malleable by means of the metaphoric mapping between the malleability of physical objects (how objects can change shape in space) to the malleability of people (how people can change through time).

Much work demonstrates a metaphoric understanding of time by using space as a source domain. One prevalent metaphor for time maps the future with movement forward in space, and the past with movement backward in space (Boroditsky & Ramscar, 2002; Lakoff & Johnson, 1999; Miles et al., 2010). Relating *movement through time* to *movement through space* lends itself quite easily to understanding *change through time* as *change through space*, and this could be the metaphor for lay theories of personality: people changing through time are like objects changing through space.

Another notable feature of CMT is that it predicts an asymmetry in metaphorical mapping. Concrete domains structure abstract domains because the former can be experienced directly while the latter cannot. Thus, one draws from elements of the concrete source domain to corresponding elements in an abstract target domain in order to better comprehend the abstract domain. There is no need, however, to do the converse: to draw from an abstract domain to comprehend a concrete domain, as a concrete domain can be experienced directly. For instance, space provides a source domain towards understanding time, and indeed priming spatial concepts changes representations of time (Boroditsky & Ramscar, 2002), but priming temporal concepts does not change representations of space (Casasanto & Boroditsky, 2008). This asymmetry is predicted by CMT, and thus the use of space to understand time provides an example of an asymmetric metaphoric mapping (for other notable examples see Meier & Robinson, 2004; Meier, Robinson, & Clore, 2004). Our data meet some of the predictions of CMT. Providing participants with physically malleable experiences changed their representations of the self, others, and groups towards seeming more malleable. Yet, asking participants to generate self-concepts of malleability (without using such language) also changed representations of physical

malleability. This latter finding does not meet the prediction made by CMT of an asymmetry between concrete and abstract domains.

Another explanation for how lay theories are embodied is provided by Perceptual Symbol Systems theory (PSS; Barsalou, 1999; 2008), which posits that modal-specific states that occur during perception are also used to represent those perceptions off-line, rather than amodal symbols that re-describe those perceptions. For instance, proprioceptive states experienced while handling something malleable might be *simulated* when thinking about something malleable. Indeed, as described above, merely seeing or conceiving of an object often leads to a simulation of how one would interact with it. Seeing a hammer leads to a simulation of a power grip, whereas seeing a grape leads to a simulation of a precision grip (Tucker & Ellis, 2001). Abstract concepts can become associated with bodily states that occur during interactions with relevant concrete entities, and abstract concepts can become associated with bodily states in this way (Barsalou, 2008). For instance, thinking about a malleable object might lead to a simulation of proprioceptive malleability, and given the similarities of malleable objects and people—including common language to describe both, one might come to associate proprioceptive malleability with person malleability. Unlike CMT, PSS does not predict an asymmetry, but instead predicts bi-directionality. There exist a few notable examples of such bi-directionality: relations between concrete experiences of warmth and abstract concepts of friendliness are bi-directional (see IJzerman & Semin, 2009, 2010; Williams & Bargh, 2008; Zhong & Leonardelli, 2008), as are concrete experiences of weight and abstract concepts of importance (Ackerman, et al., 2010; Jostmann et al., 2009; Schneider, Rutjens, Jostmann, & Lakens, 2011). The current work meets the predictions of PSS: providing participants with malleable proprioception influenced the perceived malleability of people; and, conversely, asking participants to think

about a malleable self led to perceptions of physical malleability, which was perhaps a proprioceptive simulation. Thus, lay theories of personality may be embodied through mechanisms suggested by PSS (namely, modality-specific simulations), yet the possibility remains that lay theories of personality are embodied by means of metaphor as well (see Williams et al., 2009 for an account that has elements of both metaphor and simulation). One way to supplement such behavioral data on conceptual influences on the sensorimotor system would be more direct measures of sensorimotor activation, such as with fMRI or EEG (e.g., Chao & Martin, 2000; Gutsell & Inzlicht, 2010). Additional work is needed to better understand how lay theories of personality are embodied.

Although the precise mechanism of how lay theories of personality are embodied may remain an open question, the present work provides critical evidence that person theories are, indeed, embodied. The influence of proprioception in the current findings appeared to be specific to the experience of proprioceptive malleability or fixedness, and not simply just semantic activation that followed proprioceptive experience. Specifically, when examining the causal chain, we demonstrated that proprioceptions influenced semantic activation, and that proprioceptions influenced person theories. However, when using a sufficiently-powered sample size and a well-validated priming paradigm and causal-chain-design, we did not find evidence for the influence of semantic activation mediating the effect of proprioception on person theories. In sum, these results suggest that beliefs about the malleability of traits are embodied in proprioception and, therefore, that proprioception influences perceptions of the self, others, and groups, and has consequential implications for outcomes related to these worldviews, including stereotyping and morality.

Conclusion

Because people have a tendency to perceive behavior as driven by dispositions (Heider, 1958; Jones & Harris, 1967; Gilbert & Malone, 1995), people ascribe personality traits to others (Allport, 1937; Eyesenck, 1967; McCrae & Costa, 1987). A fundamental dimension to understanding the world around us is the malleable versus fixed nature of entities (see Pepper, 1942; Whitehead, 1929, 1938), and work on lay theories of personality has uncovered that this applies equally to understanding the malleable versus fixed nature of others. This work has considered lay theories as chronically accessible knowledge structures about personality that can be altered via priming mechanisms, such as by reading news-media articles, which can activate the knowledge structures that underlie lay theories; e.g., Chiu et al., 1997, Hong, Chiu, Dweck, Lin, & Wan, 1999; Levy et al., 1998; Plaks et al., 2001). Rather than such perceptions of social entities being a parallel dimension to perceptions of the fixedness/malleability of objects, the seven studies presented here suggest that the former is embodied in the latter: the feeling of handling malleable objects supports the theory that people are relatively malleable, and the feeling of handling fixed objects supports the theory that people are relatively fixed. This possibility has important implications for how perceivers make sense of their social world. Lay theories of personality have been described as meaning systems which provide individuals with a framework to perceive, understand, judge and interact with others in the social world (Hong et al., 1999; Plaks et al., 2009). Thus, the possibility that these meaning systems derive from sensorimotor experience suggests an unexplored dimension of how we understand and think about others. Not only can abstract concepts be embodied in sensorimotor systems, so can beliefs. Beliefs about the mutability of others have a wide range of consequences and these beliefs might be based upon bodily sensations.

Future work should examine how proprioception can impact domain-specific person theories, such as intelligence. For instance, might experiencing proprioceptive malleability when receiving feedback indicative of failure lead individuals to think of themselves in more malleable terms, leading to the conclusion that failure indicates a lack of effort rather than ability? If so, simply squeezing something malleable could buffer self-esteem from failure and even lead to increased efforts to improve. Lay theories have been described as cornerstones of meaning in social cognition, which provide distinct ways to decode and extract information from the complex and ambiguous stream of behavior observed in our social world (Plaks et al., 2009). These meaning systems might be embodied in the sensorimotor system and, thus, the body may provide the major framework that underlies the understanding of others and the self in the social world.

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Footnote

1. Levene's test revealed unequal variances, $F(1, 38) = 4.32, p < .05$, and thus a correction factor was used changing the degrees of freedom from 38 to 31.46. Statistical significance remains when not using this correction factor, $t(38) = 2.19, p = .04$.

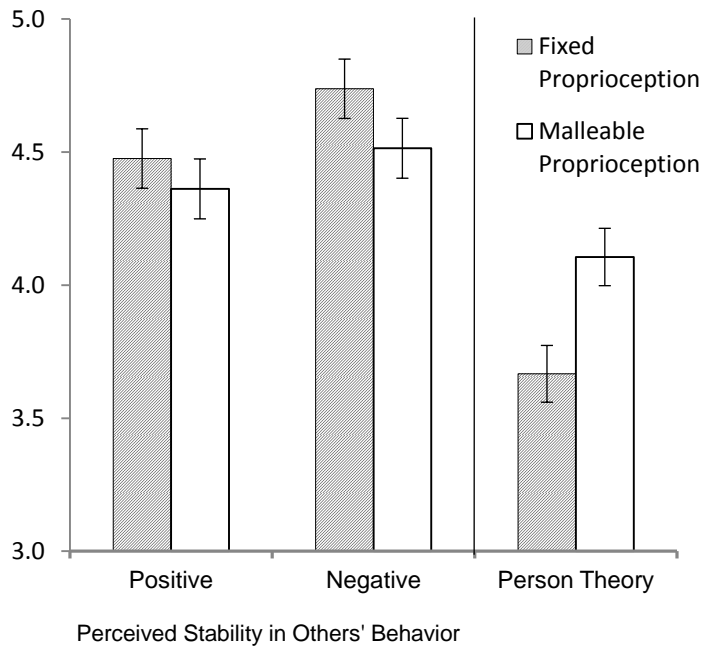


Figure 1. Perceived stability in others' behavior and endorsed person theories in Study 1 as a function of fixed and malleable proprioception. Higher numbers on the left side of the graph indicate greater perceived stability in others' behavior. On the right, higher numbers indicate a more incremental theory of personality, while lower numbers indicate a more entity theory of personality.

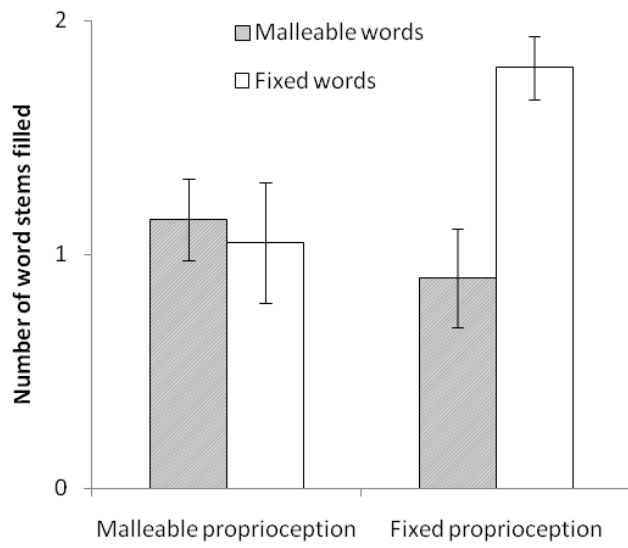


Figure 2. Number of fixed and malleable words completed during fixed and malleable proprioceptions in Study 2.

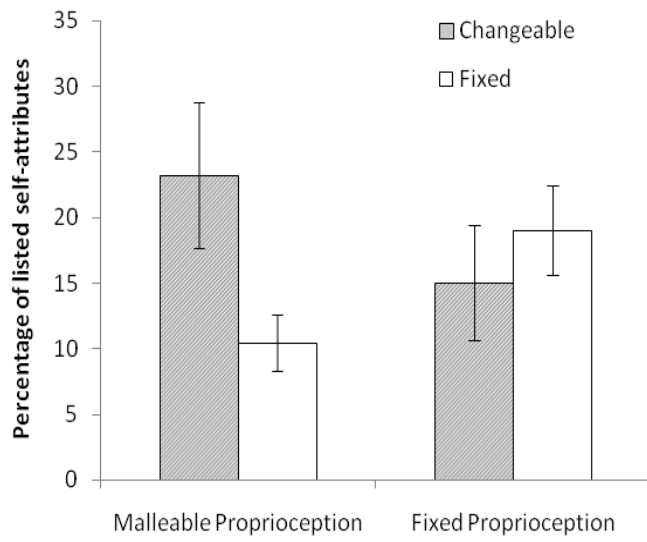


Figure 3. Percent of changeable and fixed traits listed in Study 3 as a function of fixed and malleable proprioception.

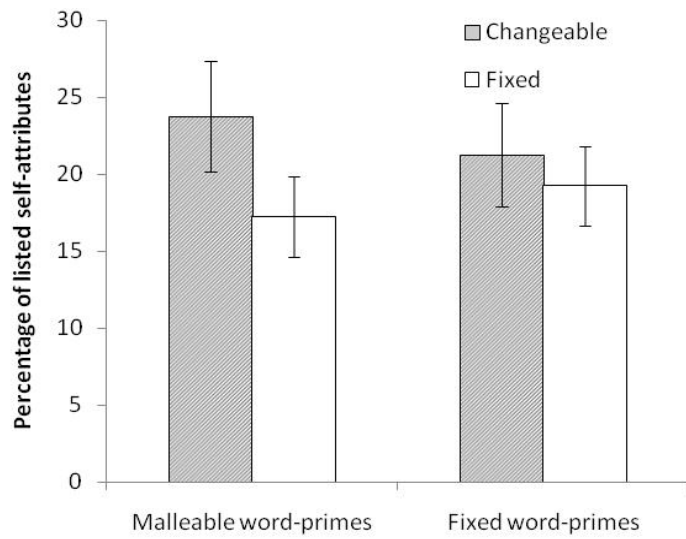


Figure 4. Percent of changeable and fixed traits listed in Study 4 as a function of fixed and malleable semantic priming.

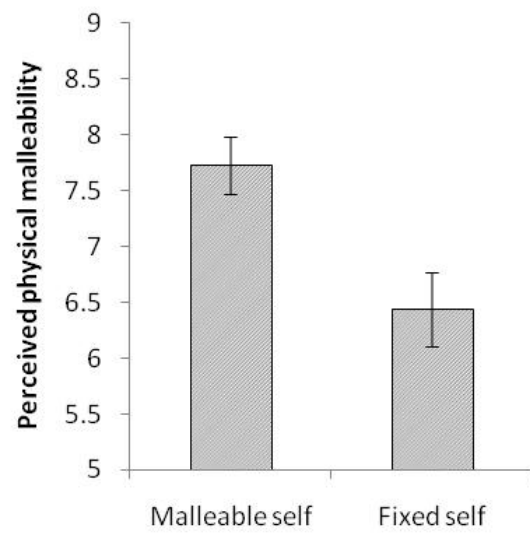


Figure 5. Perceived malleability of a ball in Study 5 as a function of thinking about the self as malleable or fixed.

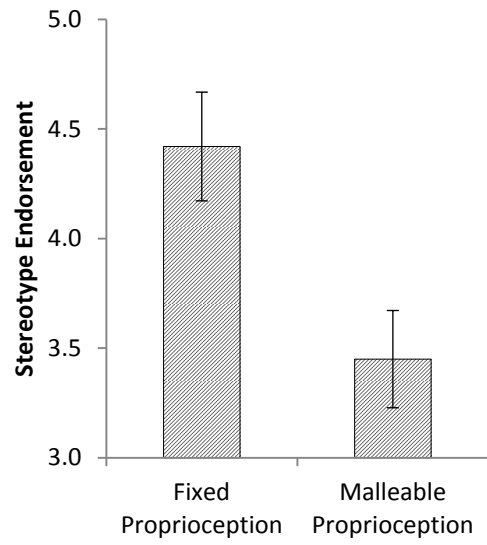


Figure 6. Stereotype endorsement of politicians and actors in Study 6 as a function of fixed and malleable proprioception.

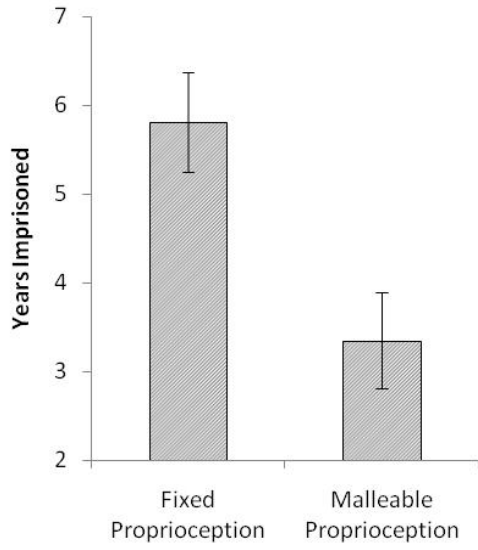


Figure 7. The number of years that participants sentenced to the defendant in Study 7 as a function of fixed and malleable proprioception.