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# Proprioception and Person Perception: Politicians and Professors

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## Abstract

Social-categorical knowledge is partially grounded in proprioception. In Study 1, participants describing “hard” and “soft” politicians, and “hard” and “soft” scientists used different “hard” and “soft” traits for the two groups, suggesting that the meaning of these traits is context specific. Studies 2 to 4 showed that both meanings were supported by hard and soft proprioception. Consistent with political stereotypes, perceivers viewing faces while handling a hard ball were more likely to categorize them as Republicans rather than as Democrats, compared to perceivers viewing the same faces while handling a soft ball (Study 2). Similarly, consistent with stereotypes of “hard” and “soft” academic disciplines, perceivers were more likely to categorize photographs of professors as physicists than historians when handling a hard versus soft ball (Study 3). Finally, thinking about Republicans and Democrats led participants to perceive a ball as harder or softer, respectively, suggesting that simulating proprioception might aid social-categorical thinking (Study 4).

## Keywords

person perception, social categorization, grounded cognition, embodiment, metaphor

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Models of grounded cognition (Barsalou, 1999, 2008; Lakoff & Johnson, 1980, 1999) assert that concepts are grounded in concrete experience. For instance, seeing a hammer produces a *simulation* of the muscles relevant to using a hammer, as indicated by response compatibility (Tucker & Ellis, 2001) and neural activation (Chao & Martin, 2000). A simulation is a partial reactivation of sensory, motor, or introspective states drawn from previous experiences (Barsalou, 1999). Thus, representations of concepts (such as a hammer) are not amodal but can include specific modal states—usually based on specific sensorimotor experiences. Therefore, the activation of a concept may produce partial reenactments of sensory or introspective experiences based on prior experience.

Although abstract concepts are intangible and have no obvious associated modal states, they can be grounded in concrete experience via metaphors (Barsalou, 2008; Lakoff & Johnson, 1999). For example, the concept “importance” is described by the metaphor “having weight.” This metaphor is not merely linguistic: Participants who hold a heavy versus light clipboard judge a variety of items as more important (Ackerman, Nocera, & Bargh, 2010; Jostmann, Lakens, & Schubert, 2009). Thus, the metaphor of importance as weight is embodied within physical sensations. Similarly, conceptions of time (Miles, Nind, & Macrae, 2010), moral purity (Lee & Schwarz, 2010; Schnall, Benton, & Harvey, 2008; Zhong & Liljenquist, 2006), secrets (Slepian, Masicampo, Toosi, & Ambady, 2012), and interpersonal warmth (Williams

& Bargh, 2008) are grounded in bodily sensations. As many fundamental areas of social behavior appear to be influenced by sensorimotor activity, the perception and categorization of other people may be guided by sensorimotor states as well.

Perceiving and categorizing others’ group memberships is critical to social behavior (Macrae & Bodenhausen, 2000). Recent work has demonstrated that proprioception might contribute to social-categorical knowledge. For instance, men are described as “tough” and women as “tender,” and, indeed, the experience of toughness led sex-ambiguous faces to be more often perceived as male, whereas the experience of tenderness led the same faces to be perceived more often as female (Slepian, Weisbuch, Rule, & Ambady, 2011). Yet it is unclear to what extent proprioception influences social categorization beyond gender and by what mechanism it does so. For instance, two prominent possibilities, described below, suggest that person perception can be embodied via metaphor and/or simulation. Finally, is the embodied effect specific to categories based primarily in evolutionarily

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ancient biology (i.e., sex) or does it extend to socially constructed categories (e.g., political party affiliation)? The aim of the current research was to answer these questions to provide a more comprehensive account of the role that sensorimotor states play in person perception.

Considering the vital role of the sensorimotor system in how people perceive and interact with the social world, we hypothesized that knowledge for a variety of social categories would be influenced by the sensorimotor system. Knowledge of social categories might therefore be partially understood through simulations of sensorimotor states that aid representations of such categories. Thus, sensorimotor states should influence social categorization and, conversely, social categorization could influence the sensorimotor system. We also hypothesized that even categories not based primarily in biology would be susceptible to sensorimotor cues. Here, we investigated this possibility by examining political and occupational social categories, capitalizing on a sensory metaphor common to both. Specifically, the dimension of hard to soft is often used to characterize differences between several social categories, and this understanding may reflect recruitment of sensorimotor experience to represent abstract stereotypes about social groups. For instance, in American politics, Republicans are generally characterized as being “harder” than Democrats (Hayes, 2005). Republicans tend to show greater support for capital punishment and aggressive military action; political stances associated with being hard or tough. Democrats, in contrast, are more likely to support policies regarded as “softer,” such as social and economic security (e.g., universal health care and affirmative action policies; American National Election Studies, 2005).

Similar notions also apply to academic disciplines. Scholars in the natural sciences are described as “hard” scientists, whereas scholars in the social sciences and humanities are thought of as “soft” (Hedges, 1987; Storer, 1967). This notion draws from the idea that “hard” disciplines rely more on describing phenomena with precise physical properties, direct observation, and empirical data, whereas “soft” disciplines are more amorphous, abstract, and use less precise measures (Storer, 1967). Like politicians, it therefore seemed possible that conceptualizations about academic scholarship might be embodied in physical sensations of hardness and softness.

Concepts are not processed in isolation, but rather are contextually situated (Barsalou, 2003, 2009). Thus, a hard or soft personality trait should mean different things in different contexts (see Uleman, 2005). For example, a “hard politician” might be unyielding, whereas a “hard scientist” might be rigorous; a “soft politician” might be agreeable, whereas a “soft scientist” might be imprecise. In Study 1, we examine whether people describe hard and soft personality traits differently in different contexts.

Despite different situated conceptualizations for hard and soft interpersonal traits (for political vs. academic domains), in Studies 2 and 3, we examined whether both conceptualizations were nonetheless supported by hard and

soft proprioception. In Study 2, we tested whether hard and soft proprioception would influence the categorization of individuals as Democrat and Republican. In Study 3, we tested whether hard and soft proprioception would influence the categorization of professors as physicist and historian.

Finally, in Study 4, we examined possible mechanisms for embodiment. For instance, when considering political affiliation, “hard” and “soft” might be metaphors for policies supported by individuals. *Conceptual Thought Theory* (Lakoff & Johnson, 1980, 1999) implies that concrete experience is drawn upon to aid the comprehension of abstract concepts and that properties of the concrete domain (e.g., the experience of hardness) are metaphorically mapped onto elements of an abstract domain (the firmness or toughness of social policies). This theory predicts an asymmetrical mapping between concrete and abstract domains. For instance, one draws on a concrete source domain to better comprehend an abstract domain, but the converse is unnecessary; one does not need to draw on an abstract domain to better comprehend a concrete bodily sensation, which can be experienced directly. This asymmetry predicts that a concrete embodied experience can influence conceptual processing, but that exposure to an abstract concept will not influence sensation.

Another possibility is that hard and soft proprioception partially underlie representations of social categories such as Republican and Democrat, respectively. *Perceptual Symbol Systems Theory* (Barsalou, 1999) would suggest that social categories consist of multimodal states and that thinking of a social category consequently leads to a simulation of relevant sensorimotor states. For instance, thinking about a hard object might lead to a simulation of proprioceptive hardness and, given the noted commonalities between hard objects and Republicans, one might come to associate proprioceptive, physical hardness with Republicans. This would support a bidirectional relationship, wherein experiencing a bodily sensation can influence conceptual processing in a manner similar to what is predicted by *Conceptual Thought Theory*, while the reverse influence occurs as well. Because sensations are part of the representation of a concept in *Perceptual Symbol Systems Theory*, thinking about a Republican or a Democrat could lead to simulations of hard and soft proprioception. In Study 4, we examined these two possibilities.

## Study 1

As described above, the different language used to describe “hard” and “soft” individuals across different social groups (e.g., politicians vs. academic disciplines) suggests that conceptualizations of hard and soft personality traits may be situated or domain specific. If so, traits used to describe a hard (soft) politician should differ from those used to describe a hard (soft) scientist. Study 1 tested whether there is indeed context sensitivity in meaning for hard and soft interpersonal traits.

## Method

Forty participants (61% female;  $M_{\text{age}} = 32$  years,  $SD = 11$ ) were recruited online (from Amazon's Mechanical Turk; see Buhrmester, Kwang, & Gosling, 2011) for a study ostensibly on impression formation. In one condition, participants were asked to list five adjectives for each of five people, describing what a "hard politician," "hard scientist," "hard teacher," "hard parent," and "hard business person" were like. In the other condition, they described what a "soft" politician, scientist, teacher, parent, and business person were like; condition was randomly assigned between subjects. Our predictions focused on comparing hard (soft) politicians with hard (soft) scientists, and thus, we did not analyze adjectives from the other three social groups. We predicted that whereas in the "hard" ("soft") condition, participants would list "hard" ("soft") interpersonal traits for politicians and scientists, they would show domain specificity in the traits ascribed (e.g., describing hard and soft politicians as unyielding and agreeable, respectively, but describing hard and soft scientists as rigorous and imprecise, respectively).

## Results and Discussion

To analyze the data, two independent judges ( $\alpha = .69$ ) first examined each trait and removed those that were descriptive of a politician or a scientist, in general, rather than arising due to different meanings of hard and soft, for instance, "partisan" or "empirical." Because we were interested in comparing the number of overlapping and nonoverlapping hard and soft traits present in the descriptors of the two groups, removing these group-specific traits helped to ensure that any nonoverlap between descriptions was not due to describing politicians or scientists, in general, but was due to different meanings of hard and soft emerging in different contexts. Even if only one judge recommended deleting an item, that item was deleted (i.e., this increased overlap, further providing a conservative estimate of nonoverlap). In total, 10% of adjectives were removed for the "hard" condition and 11% for the "soft" condition.

We then pooled together the hard adjectives used to describe the politicians and scientists and performed a chi-square analysis on the number of overlapping and nonoverlapping adjectives. Identical words used to describe both (e.g., cold, tough, driven) were considered to be overlapping as were any adjectives that were synonyms (e.g., difficult, stubborn, obstinate; *Roget's 21st Century Thesaurus*, 3rd ed., 2012).<sup>1</sup> For the "hard" condition, the adjectives used to describe politicians significantly differed from those used to describe scientists, with adjectives only overlapping 25% of the time,  $\chi^2(1, n = 180) = 42.89, p < .001$ , Cramér's  $\phi = .50$ .

We performed the same analysis for the soft adjectives. For the "soft" condition, the adjectives used to describe politicians significantly differed from those used to describe scientists, with adjectives only overlapping 39% of the time,

$\chi^2(1, n = 178) = 7.28, p < .01$ , Cramér's  $\phi = .21$ . Again, identical words used to describe both groups (e.g., gentle, indecisive, easy going) were considered overlapping as were any adjectives that were synonyms (e.g., appeasing, catering, pandering; *Roget's 21st Century Thesaurus*, 3rd ed., 2012).

Next, we performed a manipulation check to examine whether participants did indeed provide adjectives that described metaphorically hard and soft personality traits for politicians and scientists. Thus, two judges were presented with all of the adjectives in random order. Judges rated each adjective on a scale anchored at 1 (*soft*) and 7 (*hard*). Judges ( $\alpha = .78$ ) rated the adjectives that participants provided for "hard" politicians and scientists as significantly harder ( $M = 4.90, SD = 1.23$ ) than the adjectives participants provided for "soft" politicians and scientists ( $M = 3.20, SD = 1.29$ ),  $t(398) = 13.51, p < .001, r = .56$ . Thus, participants provided traits rated as hard for "hard" politicians and scientists, and traits rated as soft for "soft" politicians and scientists.

Although the adjective used to describe "hard politicians" and "hard scientists" described hard personality traits, they differed across the two domains. Hard politicians were often described as firm, unyielding, and harsh, whereas hard scientists were described as detail oriented, exact, and rigorous. The same was true for adjectives describing "soft politicians" and "soft scientists": The adjectives were both soft but in different ways. Soft politicians were often described as nonassertive, tender, and weak, whereas soft scientists were described as subjective, unsure, and flexible.<sup>2</sup>

## Study 2

Study 1 demonstrated that social categories can be metaphorically related to sensations of hardness and softness. Someone can readily describe what a "hard politician" is like and another can recognize those qualities as "hard." Scientists can also be described as "hard," but the meaning of a hard personality trait that emerges changes across social categories, and likewise for the meaning of soft personality traits. One possible explanation for how these different traits can map onto hard and soft sensations across political and academic discipline domains is that they are metaphorically linked to different elements of hard and soft proprioception. Applying pressure against an object provides sensory feedback about the relative hardness (or softness) of that object. Thus, when handling something relatively hard, that object cannot be shaped as easily as something soft. This might metaphorically relate to the *firmness* or *toughness* of "hard politicians" and the *malleability* or *agreeableness* of "soft politicians" (italicized words are traits provided by participants in Study 1). In addition, when handling something hard and less malleable, that object's boundaries are less amorphous and more rigid relative to a soft object, which has more flexible boundaries. This might metaphorically

relate to the *precise* and *exact* nature of “hard scientists” and the *imprecise* and *flexible* nature of “soft scientists” (italized terms are again responses generated by participants in Study 1).

In the following two studies, we test whether these two relationships between personality traits and proprioception influence person perception by providing participants with the experience of hardness and softness, and examine whether these sensations influence social-cognitive processing. In Study 2, we examined the influence of proprioception on person perception in the domain of politics. Republicans and Democrats are stereotypically regarded as more and less hard, respectively (Hayes, 2005). We therefore expected sensory feedback of hardness/softness to influence the categorization of individuals’ political affiliations.

### Method

Fifty-two undergraduates (83% male) judged the political affiliation of four male and four female faces while continuously squeezing either a hard or soft ball.<sup>3</sup> The faces were gray-scale photos from recent undergraduate yearbooks, cropped to include just the face, presented in random order. The two balls were similar in all respects except their density. The hard ball was latex filled with millet, and the soft ball was a standard polyurethane-foam stress ball.

### Results and Discussion

As expected, an analysis of variance (ANOVA) on the percent of targets categorized as Republican revealed that participants squeezing the hard ball identified more faces as Republican ( $M = 52.60\%$ ,  $SD = 17.28\%$ ) than did participants squeezing the soft ball ( $M = 42.86\%$ ,  $SD = 17.49\%$ ),  $F(1, 50) = 4.06$ ,  $p < .05$ ,  $r = .27$  (there was neither a main effect of participant gender,  $p > .21$ , nor interactions with participant gender,  $p > .56$ , or target gender,  $p > .64$ ).<sup>4</sup> Thus, sensory feedback of hardness versus softness influenced the perception and categorization of political affiliation, consistent with the idea that social-category representations might be partially embodied in proprioception on the dimension of hardness to softness.

### Study 3

In Study 3, we next examined the influence of proprioception on person perception in the domain of academic disciplines. As described earlier, a division is often drawn between the “soft” academic disciplines (e.g., political science, sociology, or history) and the “hard” disciplines (e.g., biology, chemistry, and physics; Storer, 1967). An object that is hard has more rigid boundaries, whereas a soft, malleable object has more flexible and amorphous boundaries; these might relate to the perceived precision or imprecision of scientific measures used by scholars. We therefore expected sensory

feedback of lesser or greater hardness to influence the categorization of professors associated with these disciplines.

### Method

Sixty-five undergraduates (57% female) categorized the academic discipline of eight male professors while continuously squeezing the same balls as in Study 2. The photos consisted of gray-scale images of actual professors downloaded from the Internet, none of whom studied history or physics. Each photo was cropped to include just the face and was presented in random order.

### Results and Discussion

As expected, an ANOVA on the percent of targets categorized as physicists revealed that participants squeezing the hard ball identified more faces as physicists ( $M = 48.31\%$ ,  $SD = 12.90\%$ ) than did participants squeezing the soft ball ( $M = 41.52\%$ ,  $SD = 13.20\%$ ),  $F(1, 63) = 4.33$ ,  $p = .04$ ,  $r = .25$  (there was neither a main effect of participant gender,  $p > .28$ , nor an interaction with participant gender,  $p > .09$ ). Thus, across Studies 2 and 3, the sensory experience of hardness versus softness influenced person perception in two distinct domains.

### Study 4

In Studies 2 and 3, proprioceptive hardness versus softness led participants to categorize images of men and women as Republicans more often than Democrats, and images of male professors more often as physicists than historians. As discussed above, person perception could be embodied in proprioception by means of metaphor or, alternatively, it might be embodied by means of simulation. Briefly, as reviewed in the introduction, *Conceptual Thought Theory* implies that the mapping of concrete elements (hard proprioception) to metaphorically similar abstract elements (firmness of social policies) serves an epistemic function (i.e., to better comprehend the relatively abstract stereotypical properties of Republicans, for example, in concrete terms; see Keefer, Landau, Sullivan, & Rothschild, 2011; Lakoff & Johnson, 1980). Because this mapping is made to better comprehend the abstract concept, and not concrete sensation, concrete sensations will influence conceptual processing, but the converse is not true. *Perceptual Symbol Systems Theory*, in contrast, suggests that sensorimotor modalities (e.g., proprioception) are part and parcel to representations of relatively abstract concepts (e.g., Republicans), a consequence of interaction with the external world being perceptual and embodied in nature (Barsalou, 1999). *Perceptual Symbol Systems Theory* therefore predicts a bidirectional relationship between proprioception and social categorization, whereas *Conceptual Thought Theory* proposes that the relationship is unidirectional.



To test which of these two theories better describes the present effects, we examined the role of simulation on proprioceptive judgments. Perceivers might simulate hardness or softness to represent social categories such as Republican/physicist and Democrat/historian, respectively. Thus, thinking about an individual who belongs to a “hard” social category, relative to a “soft” social category, might lead to a simulation of hardness. This activation of proprioceptive hardness could then guide the judgment of an ambiguously hard/soft object, making it seem harder. We asked participants to think about a typical meeting that a Republican (or Democrat) might have, and then asked them to judge how hard/soft a ball was. We predicted that thinking about a Republican, rather than a Democrat, would cause participants to perceive the ball as harder.

### Method

Forty-eight undergraduates (65% female) were asked to write a short narrative about a typical meeting that a Republican (or Democrat, based on random assignment) politician would have. Specifically, they were told to “imagine that the Republican (Democrat) politician is discussing a hot-button issue” and to indicate “some of the things that the Republican (Democrat) politician would say or think about during the meeting.” Participants were allotted 3 min to write their narrative. After 3 min had passed, they were asked to pick up a ball (latex filled with gel—neither especially hard nor soft) and to judge how hard or soft the ball was from 1 (*hard*) to 11 (*soft*).

### Results and Discussion

An ANOVA on proprioceptive ratings revealed that participants who wrote about a Republican judged the ball as harder ( $M = 5.41$ ,  $SD = 1.61$ ) than participants who wrote about a Democrat ( $M = 6.58$ ,  $SD = 2.44$ ),  $F(1, 46) = 4.28$ ,  $p = .04$ ,  $r = .29$  (there was neither a main effect of participant gender,  $p > .47$ , nor an interaction with participant gender,  $p > .10$ ). In Study 2, participants who squeezed a hard versus soft ball judged faces more often as Republican than Democrat. Here, we observed the reverse effect of that study: Participants who thought of a Republican, relative to a Democrat, perceived a ball as feeling harder. Thus, thinking about social categories that vary along the “hard/soft” dimension might lead to simulations of proprioceptive hardness/softness, aiding representations of certain social categories.

### General Discussion

Across four studies, we demonstrated that the relationship between proprioception and person perception extends to different social groups. The meaning of hard and soft personality traits, however, was found to be situated and

domain specific. Study 1 demonstrated that academic discipline and political social categories can be ascribed with hard and soft personality traits, yet the meaning that emerges differs across the two groups. Hard politicians were said to be tough and unwavering, whereas hard scientists were said to be rigorous and precise. Soft politicians were said to be agreeable and tender, whereas soft scientists were said to be imprecise and flexible. In Studies 2 through 4, we examined whether hard and soft proprioception could support these disparate personality traits. That is, although the two social categories that we examined rely on two distinct metaphors or properties of hard versus soft proprioception, they both relate to hard and soft proprioception. Experiencing hard (vs. soft) proprioception led male and female faces to be more often categorized as Republicans than Democrats (Study 2), and it also led male professors to be more often categorized as physicists than historians (Study 3).

### Implications for Embodied Cognition

The finding that a sensation can be metaphorically mapped onto different social categories, but in contextually specific ways, adds to the extant work on embodied cognition, which to date has focused primarily on demonstrating whether a particular metaphor for an abstract concept is embodied (for a discussion, see Meier, Schnall, Schwarz, & Bargh, 2012). In contrast, here we demonstrated that the same sensation can ground knowledge regarding different social groups by mapping different properties of those sensations onto distinct traits. For instance, experiencing resistance when handling a hard object could provide the foundation for thinking about a stereotypically resistant, firm, unyielding Republican, and experiencing the rigid boundaries of a hard object could provide the foundation for thinking about a stereotypically precise and exact “hard” scientist. Likewise, different properties of handling soft objects could ground knowledge for political affiliations (Democrats) and academic disciplines (“soft” scientists). While a social category such as sex is based in a biological difference, the present two social categories are not rooted in biology to nearly the same degree, if at all. Thus, using these unequivocally socially constructed categories in the present work reveals the richness of just one sensory domain in grounding social-categorical thought quite broadly.

The current work also tested whether proprioception might be simulated to represent social categories. We demonstrated that thinking about a Republican, relative to a Democrat, led participants to perceive a ball as harder in Study 4, suggesting that social-categorical thought might lead to proprioceptive simulation. Thus, it appears that social categorization is embodied by means of perceptual symbols, rather than strictly through metaphor. Yet, although the data do suggest bidirectionality, rather than the unidirectionality predicted by *Conceptual Thought Theory*, it remains a possibility that

metaphor does still play a role in these effects, as we describe below.

One possibility is that early sensorimotor experiences provide the foundation for later social categorization, with sensorimotor states being metaphorically mapped onto abstract social categories (Williams, Huang, & Bargh, 2009). For example, beyond learning in early development what males and females look and sound like (i.e., general differences in facial and vocal qualities; Martin, Ruble, & Szkrybalo, 2002; Quinn, Yahr, Kuhn, Slater, & Pascalis, 2002), during toddler and preschool years, children also learn gender-related characteristics and stereotypes (Martin & Ruble, 2004). Prior to forming semantic propositions about such social stereotypes, sensorimotor experience might provide a foundation for such categorical thinking. That is, through interactions with the physical environment, infants learn when an object is soft and yields to touch or when an object is hard and unyielding. These experiences could create a foundation for understanding people who are “soft” and yielding or “hard” and unyielding; bodily-based information might therefore scaffold the development of social-categorical thinking (see Mandler, 1992; Williams et al., 2009). If so, this early learning and associative mapping process could be long-lasting, with proprioceptive activation being part of the representation of “hard” and “soft” social categories (see Bargh, Williams, Huang, Song, & Ackerman, 2010; Barsalou, 1999). Perhaps, then, these early sensorimotor to social-category associations (e.g., males are stereotypically “hard”) can be extended to novel categories (with similar metaphorical characteristics) learned later during development (e.g., Republicans are stereotypically “hard”). This possibility suggests complex interrelationships between knowledge about social categories, including multiple sensory modalities that contribute to forming an impression about another person (see also Slepian, Young, Rule, Weisbuch, & Ambady, 2012).

### Implications for Personality and Social Psychology

Although cues from visual and auditory channels are known to contribute to the perception of social groups (e.g., race, as in Gaertner & Bickman, 1971; Maddox, 2004), it is less expected based on traditional social-cognitive models that proprioception would exert an influence as well. Indeed, prior work on social-categorical knowledge has considered its semantic nature and has tended to only consider *targets'* perceptual cues as information that can be decoded to judge category membership (e.g., facial, vocal, and body cues that convey group membership). Notwithstanding the fact that perceptual cues often provide the basis for extracting person knowledge from a target (see Macrae, & Quadflieg, 2010), the current work suggests that person knowledge is itself based in the sensorimotor system, even for novel socially constructed categories. These findings therefore hint that the

processes of impression formation and social categorization are perhaps richer and more intricate than previously recognized and, speculatively, that proprioceptive sensorimotor experience is a fundamental dimension of social cognition that influences cognitive processes ranging from social categorization, to impression formation, to stereotyping.

### The Role of Culture

Future work would benefit from examining the embodiment of person perception in a cultural context. For instance, do other cultures conceptualize certain social categories on the dimension of hard and soft? Hard and soft are used to describe people across several languages, including English, Japanese, Thai, and Portuguese. For instance, in these languages, the phrase *hard head* is used to describe a stubborn and inflexible person, and *soft head* is used to describe a flexible, tender, or weak person (Berendt & Tanta, 2011; Farias & Lima, 2010; Vongvipanond, 1994). Context sensitivity of the meaning of hard and soft seems to exist across languages as well. For instance in Thai, “hua on,” literally “soft head,” means obedient, whereas “jai on,” literally “soft heart,” means sensitive.

Interestingly, in the cases described above, rather than describing an entire person, “hard” and “soft” can be applied to different aspects of a person, such as how hard or soft one’s intellect or reason is (i.e., one’s “head”), or how hard or soft one’s emotions are (i.e., one’s “heart”). Given that there are variations that exist across cultures on how sharp a line is drawn between the “rational” mind and emotions or passions (i.e., ranging from monism to dualism; see Berendt & Tanta, 2011), these metaphors should be applied to perceiving people differently across different cultures. For instance “hard head” and “hard heart” can mean stubborn in Thai (Berendt & Tanta, 2011; Vongvipanond, 1994), expressing monism, whereas in English, stubbornness is usually only described by “hard head,” and “hard heart,” rather, would express being cold or insensitive, suggesting dualism. Future work should examine whether these differences in language reflect differences in thought. Different conceptualizations of the self and others might lead to different metaphorical mappings between hard and soft proprioception and personality traits.

### Conclusion

The current work sought to comprehensively evaluate the hypothesis that person perception is embodied in sensorimotor states. By examining socially constructed categories not rooted in biology, and by examining the situated meaning of traits as well as the mechanism by which proprioception influences social categorization, we provide support for the hypothesis that person perception may be grounded in the sensorimotor system. This therefore suggests that social-categorical knowledge across contexts is, in part, embodied.

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## Notes

1. To determine whether adjectives were synonyms, we looked up each adjective in a thesaurus (*Roget's 21st Century Thesaurus*, 3rd ed., 2012) and located all entries that described the adjective in an interpersonal context. For instance, the word *difficult* is included in multiple entries. If the definition for that entry referred to behavior directed toward others, it was considered interpersonal, whereas if it did not, that specific entry was not considered. For instance, the word *difficult* was located in entries such as *complicated* (definition: complex) and *deep* (definition: complicated in meaning); as these do not refer to interpersonal traits, they were not examined. Other entries, whose definitions did describe interpersonal traits, were included: For instance, there was an entry for *difficult* (definition: hard on someone). Another entry for *difficult* (definition: unmanageable socially) was also included, as was the entry for *crotchety* (definition: irritable). For each unique adjective, we examined the first 10 entries in which it appeared. Other adjectives provided by participants that appeared in the relevant (i.e., interpersonal) entries were considered synonyms and therefore overlapping.
2. Study 1 measured adjectives for politicians and professors within subjects, which could have artificially caused participants to create nonoverlap when greater overlap would normally exist. To examine this possibility, we repeated the design of Study 1 but asked 20 participants to describe (using 5 adjectives) a “hard politician,” “hard scientist,” “soft politician,” or “soft scientist,” but across four between-subjects conditions (100 adjectives in total). Following the same analysis plan, the results of Study 1 replicated with a between-subjects design: Hard adjectives overlapped only 20% of the time,  $\chi^2(1, n = 46) = 14.72, p < .001$ , Cramér's  $\phi = .61$ ; soft adjectives overlapped only 32% of the time,  $\chi^2(1, n = 47) = 4.77, p = .03$ , Cramér's  $\phi = .36$ ; and “hard” adjectives were rated as harder ( $M = 4.78, SD = 1.25$ ) than “soft” adjectives ( $M = 2.77, SD = 1.23$ ),  $t(98) = 8.10, p < .001, r = .63$ .
3. As with Studies 3 and 4, Study 2 recruited a convenience sample of participants from the university subject pool, and this study was run during the final weeks of a semester, reflected by the larger proportion of males in the sample; females sign up earlier than males in psychology studies (Aviv, Zelenski, Rallo, & Larsen, 2002; Cooper, Baumgardner, & Strathman, 1991;

Richter, Wilson, Milner, & Senter, 1981). There were no gender effects in any of the present studies.

4. Although outside the scope of the current article, we note that male targets were marginally categorized as Republican ( $M = 2.04; SD = 0.97$ ) more often than female targets ( $M = 1.75; SD = 0.86$ ),  $t(51) = 1.82, p = .08, r = .25$ , consistent with overlapping stereotypes between males and Republicans as hard, and females and Democrats as soft (see Slepian, Weisbuch, Rule, & Ambady, 2011).

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