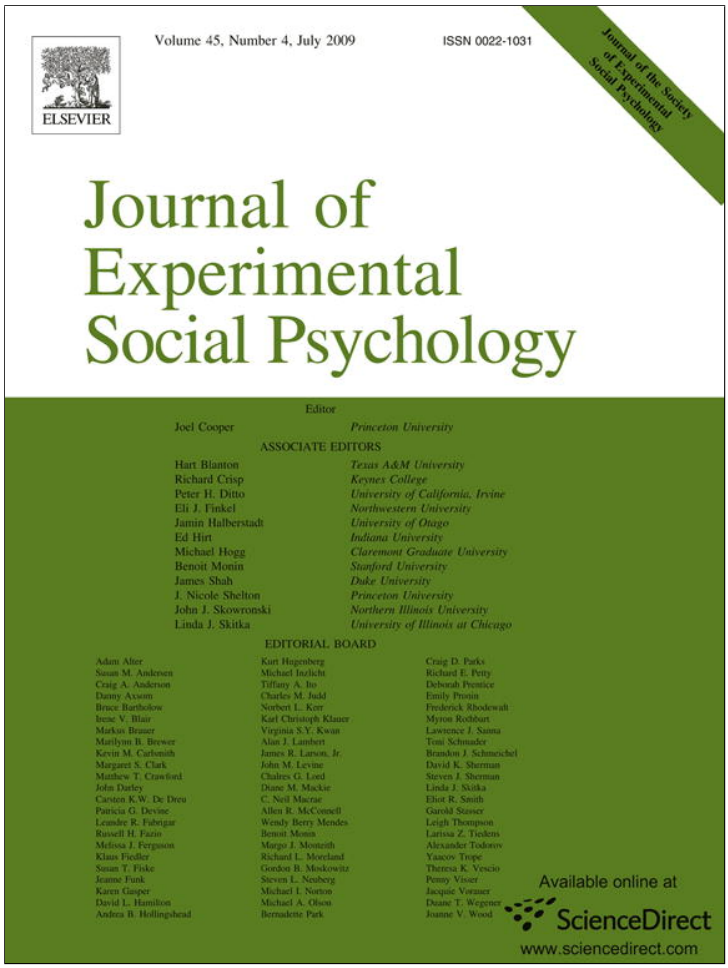

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Reports

The embodied self: Making a fist enhances men's power-related self-conceptions

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ABSTRACT

In line with recent theories of embodied cognition, the authors propose that the self-concept may be embodied in sensory-motor representations. To test this notion, two studies investigated the effects of bodily feedback from a gesture associated with power (making a fist) on the self-concept. As expected, making a fist led male participants to perceive themselves as more assertive and esteemed (Study 1) and to display stronger associations between the self-concept and power (Study 2), while these effects were absent among female participants. The gender difference may reflect that men are more prone to use physical force to gain social influence. The results indicate that people's conceptions of themselves are partly grounded in bodily experiences.

The self-concept consists of people's views of who they are and what they stand for in life. By lending meaning to experiences, the self-concept enables people to understand and react appropriately to situations (Higgins, 1996). Indeed, people's self-concepts predict such important outcomes as academic achievement, depression, work performance, and divorce rates (Swann, Chang-Schneider, & Larsen McClarty, 2007).

Contemporary theories have generally assumed that the self-concept is based in people's abstract, symbolic knowledge about themselves (Kihlstrom, Beer, & Klein, 2003). For instance, Sedikides and Skowronski (1997, p. 83) defined the self-concept as an abstract cognitive representation that is formed through language, and referred to it as the "symbolic self". As such, one could easily get the impression that the self-concept exists primarily as a linguistic construct, independent of people's bodies. However, in the present article, we propose that the self-concept may be more embodied than is traditionally assumed. This proposal draws on recent work showing that social and non-social concepts are processed in close interaction with sensory-motor systems (Barsalou, 2008; Fischer & Zwaan, 2008; Niedenthal, Barsalou, Winkielman, Kraut-Gruber, & Ric, 2005). The present article explores some implications of this so-called embodiment research for our understanding of the self-concept.

Embodied (social) cognition

Human cognition is often likened to computerized information processing. In this view, the "software" of the mind is assumed to be largely independent of the "hardware" of the body and the brain. High-level cognition, such as inference, categorization, and memory, is believed to rely on abstract, linguistic symbols that bear arbitrary relations to input (sensory) and output (motor) modalities. This perspective has been criticized in recent years (Barsalou, 2008; Niedenthal et al., 2005). Researchers in cognitive science, philosophy, robotics, and linguistics have increasingly recognized that cognitive representations and operations are fundamentally grounded in their physical context, a recognition that has led to the development of theories of embodied cognition. A central claim of such theories is that all human cognition, including high-level conceptual processes, relies on the brain's modality-specific systems. Converging empirical support has been found for this notion in studies of conceptual processing, neuro-imaging studies, and brain lesion studies (Barsalou, 2008).

Embodiment also influences social information processing. For instance, Barsalou, Niedenthal, and associates (Barsalou, Niedenthal, Barbey, & Ruppert, 2003; Niedenthal et al., 2005) have proposed that repeated social situations become "entrenched" in memory as situated concepts. These situated concepts include sensory-motor states experienced in those situations. The activation of a situated concept leads to the activation of its constituent sensory-motor states. Conversely, "embodiments, when experienced, can trigger the situated conceptualization via the inference process of pattern completion. Specifically, the experienced embodiment activates a larger pattern that contains it, with non-perceived aspects of the pattern constituting inferences about the situation" (Niedenthal et al., 2005, p. 198). In short, sensory-motor states become associated with situated conceptualizations, such that priming the one can activate the other.

One important source of evidence for the embodiment of social concepts are studies that manipulate bodily states or movements,

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and thereby induce bodily feedback. For instance, approach and avoidance movements (e.g., pushing versus pulling, nodding or shaking one's head) may influence evaluative processing (Cacioppo, Priester, & Berntson, 1993; Chen & Bargh, 1999; Förster & Strack, 1998; Ito, Chiao, Devine, Lorig, & Cacioppo, 2006; Seibt, Neumann, Nussinson, & Strack, 2008), and perceptions of social justice (van Prooijen, Karremans, & van Beest, 2006). Likewise, the gesture of making a fist has been found to influence attributions of power to ambiguously acting targets (Schubert, 2004). These and other studies point to an important role of bodily feedback in particular and embodied cognition in general in the processing of social concepts.

The aforementioned studies investigated only the perception of other persons or concepts, and thus fell short of demonstrating the role of embodiment in the self-concept. In spite of the advances made by embodiment research, it remains to be seen whether embodied cognition influences the self-concept. The self-concept differs from other knowledge structures in important respects, in that people have the opportunity to observe themselves pretty much all the time, and they experience themselves in more situations than any other target. As a consequence, the self may be more familiar than any other object that people represent in memory. Moreover, the self-concept is among the most complex and multi-faceted concepts that people represent (Rafaeli-Mor & Steinberg, 2002; Symons & Johnson, 1997). In view of these considerations, it is important to establish whether and how the self-concept is influenced by bodily states.

The embodied self-concept

Modern research on the self-concept departs from James' (1890) classic distinction between the self-as-subject, or the *I*, and the self as an object of knowledge and evaluation – the *Me*. Research on the self has mostly focused on the *Me*, by studying the cognitive representations and conceptualizations that people hold of themselves, or their self-concepts (Kihlstrom et al., 2003; Swann et al., 2007).

Prevailing theories have suggested that the self-concept may be understood as part of an associative, propositional network of nodes that resemble words (Bargh & Tota, 1988; Bower & Gilligan, 1979; Greenwald & Banaji, 1989; Greenwald & Pratkanis, 1984; Greenwald et al., 2002; Kihlstrom & Cantor, 1984; Markus, 1977). The self is conceived as a node in the network, with activation spreading to and from it. Associative network models have generated important insights into the self-concept (Kihlstrom et al., 2003), as they have done for other types of memory structures (Anderson, 1993). Alternative models of self-relevant information processing exist, but have been largely neglected in self-concept theorizing (Kihlstrom & Klein, 1994; Kihlstrom et al., 2003).

To date, theorists have paid relatively little attention to the role of sensory-motor states in the self-concept. Nevertheless, the importance of such states to the self was foreshadowed by James' (1890) discussion of the *I*, which he described not only as the self that interprets, but also as the self that experiences and perceives. More recently, the importance of perceptual experiences for the self-concept has been highlighted by theories that contrast between an experiential self-system, which contains constructs of the self that are based in gut feelings and concrete imagery, and a rational self-system, which contains constructs of the self that are generated through logical reasoning (Epstein, 1994; Woike, 2008).

From the standpoint of an abstract and amodal self-concept separated from the body, it is difficult to imagine a model that could integrate cognitive representations of the self (the *Me*) and the perceiving-experiencing self (the *I*), or model their interaction. However, theories of embodied cognition allow us to take such a perspective. Even though the self-concept is highly familiar, complex and abstract, it may be represented as an embodied concept that includes sensory-motor states of one's own body and its interaction with the environment. By experiencing the self in different situations, people may acquire situated conceptualizations of the self which become entrenched over time. These situated conceptualizations can include bodily states. Experiencing these bodily states can re-activate the respective conceptualization of the self via pattern completion.

A smattering of empirical findings provides preliminary evidence for the embodied self-concept. Men standing upright feel more pride, a self-conscious emotion, than men who are in a slumped position while receiving positive feedback (Stepper & Strack, 1993). Notably, standing upright has the opposite effect among women (Roberts & Yousef, 2007). Overt behavior such as writing with one's dominant versus non-dominant hand can change the confidence with which people hold self-views (Briñol & Petty, 2008). Autobiographical memory becomes facilitated when bodily postures during recall are similar to those during the original events (Dijkstra, Kaschak, & Zwaan, 2005; Schnall & Laird, 2003). Finally, wearing glasses during an intelligence test may lead people to describe themselves as more scholarly and competent, particularly among those responsive to self-produced cues (Kellerman & Laird, 1982). Although wearing glasses does not directly provide bodily feedback in the usual sense, the latter findings do raise the possibility that bodily actions may have conceptually similar effects. Overall, the foregoing findings are highly compatible with the present model of an embodied self-concept, though they fall short of providing a direct test of this model.

Making a fist and the embodiment of the self's power

The embodied self-concept theoretically embraces the influence of all kinds of perceptual, motor, and proprioceptive experiences on people's views of themselves. In the present context, however, we focus on how one particular gesture, that is, *making a fist*, may influence the self-concept. In general, making a fist signals the person's potential and willingness to use physical assertiveness or bodily force in the form of hitting, striking, and pushing in order to gain social influence. Historically, the gesture of making a fist has been used as a symbol of strength and emancipation by many different social movements. Making a fist can express anger and pride, which are both related to the attainment of power (Darwin, 1899; Tracy & Robins, 2007).

For various reasons, the gesture of making a fist lends itself especially well to an investigation of the embodied self-concept. First, participants can be induced to make a fist without realizing that they are making a gesture related to power (Schubert, 2004). This manipulation thus allowed us to investigate whether bodily feedback can influence the self-concept directly, even when this feedback is not consciously perceived as relevant to the self. Second, because making a fist is easy, its effects can be readily studied on both the explicit and the implicit self-concept. Past research suggests that bodily feedback can influence both implicit and explicit responses (Schubert, Waldzus, & Seibt, 2008). We therefore predicted that the bodily feedback from making a fist would have parallel effects across explicit and implicit measures of the self-concept.

Third, the gesture of making a fist allowed for an exploration of possible individual differences in the embodied self-concept. At least in Western cultures, men tend to accept and use bodily force more easily than women (Felson, 2002). Consequently, men are more likely to associate their own use of physical force with gaining influence, whereas women are less likely to do so (Alexander,

Allen, Brooks, Cole, & Campbell, 2004; Campbell, 1999; Driscoll, Zinkivskay, Evans, & Campbell, 2006; Eagly & Steffen, 1986). This makes men more likely to experience making a fist in situations in which they want to achieve or actually achieve power. As a result, men will more often associate making a fist with being powerful and in control. Consistent with this, recent experiments confirmed that when men are unobtrusively induced to make a fist, they perceive situations as affording more control, and judge an ambiguously acting male target as more friendly (Schubert, 2004).

By contrast, it seems possible that women not only do not show such an association, but that they are more likely to associate using bodily force with frustration (Loeb, 1968), fear (Campbell, 1999), and losing control. Consistent with this, a recent experiment found that making a fist leads women to perceive fewer possibilities for control, and to judge an ambiguous male target as less friendly and more hostile. However, negative connotations presumably also make the fist a less frequent gesture among women, effectively weakening the association. It also seems that making a fist is presented in the media much more often as a sign of men's power as compared to women's powerlessness (Schubert, 2008). The latter considerations suggest that overall, women's association of making a fist with losing influence might be weaker than men's with gaining influence.

In sum, the present model of embodied self-concept led us to predict that making a fist directly influences the implicitly and explicitly measured self-concept in the power domain. We expected that the direction of this influence would be different for men and women: among men, making a fist was expected to activate a conceptualization of the self as being powerful. Among women, no or the reversed effect was expected. We conducted two studies to empirically test these predictions. In Study 1 we examined the effects of making a fist on men's and women's explicit self-concept, as assessed via self-report. In Study 2, we extended these findings to an implicit measure of the self-concept, as assessed by a response-latency task.

Study 1

Study 1 examined the effects of making a fist on a typical measure of the self-concept, an explicit rating of the self on attributes. Participants rated themselves while they were making either a fist or a neutral gesture. The attributes were both positive and negative, and referred to two self-attributes that are theoretically linked to power: assertiveness and social esteem. The more power one has, the more assertive one can be (Galinsky, Gruenfeld, & Magee, 2003; Keltner, Gruenfeld, & Anderson, 2003), and the more one may expect to be admired and treated positively by others. We therefore predicted that making a fist would lead men to perceive themselves as more assertive and more socially esteemed. We predicted no such effects among women, because they presumably experience the self less often as powerful in situations where they use bodily force (Schubert, 2004).

Method

Participants and design

The study was conducted at a German university. Of the full sample ($N = 76$) participants, five were excluded because they suspected that making a fist had an effect on their responses. Of the remaining 71 participants, 45 were female; mean age was 24. Participants were recruited by flyers on campus and had the chance to win gift certificates in a lottery. Participants were randomly assigned to the two gesture conditions and rated themselves on positive and negative traits related to assertiveness and social esteem. Thus, the experiment conformed to a 2 (gesture: fist vs. neutral) × 2 (gender) × 2 (trait category: assertiveness vs. social esteem) × 2 (trait valence) design, with the first two factors varying between and the last two factors varying within participants.

Materials and procedure

All instructions and measures were administered by a computer program. In order to manipulate the gesture unobtrusively, participants were first reminded of the children's game rock-paper-scissors and shown line drawings of all three gestures. Depending on experimental condition, participants were then asked to form either a rock (implementing the fist condition) or scissors (the neutral gesture) with their non-dominant hand and to hold that gesture throughout the whole experiment.[1] The cover story explained that distraction from another task was being studied and that participants would later be asked how much they felt distracted. The instruction to hold the hand gesture was repeated several times throughout the rating task.

Participants rated themselves on two categories of traits, one by one in randomized order, on a six point scale from "*never applies to me*" to "*always applies to me*". Twelve traits assessed self-views of assertiveness (six positive, e.g., assertive, persistent, and six negative, e.g., hesitating, fearful). Twelve traits described how one is usually treated by others (six positive, e.g., esteemed, respected, and six negative, e.g., being aggrieved, insulted). We also measured mood and arousal in Studies 1 and 2. In line with Schubert (2004), mood and arousal were unaffected by the fist manipulation. (More details can be obtained from the first author.) At the end of the study, participants were questioned about their ideas about the purpose of the study.

Results and discussion

Scores for negative attributes were reversed because we were interested in whether positive and negative traits were affected in the same way. Ratings were averaged separately for the two trait categories and two valences; internal consistencies ranged from .71 to .83. We conducted a 2 (gesture, between) × 2 (gender, between) × 2 (trait category, within) × 2 (valence, within) ANOVA on these averaged ratings. A marginal effect of gender, $F(1,67) = 2.89$, $p = .094$, $\eta_p^2 = .04$ was found, but it was moderated by the predicted gesture × gender interaction, $F(1,67) = 6.34$, $p = .014$, $\eta_p^2 = .09$. This interaction was not qualified by trait category or valence (all Fs < 1), indicating that positive and (reverse-scored) negative attributes of both types were equally influenced. The four-way interaction was not significant, and there were also no other significant effects involving gesture.

Men described themselves as more assertive and socially esteemed when they made a fist ($M = 4.34$, $SE = .12$), than when they made the neutral gesture ($M = 3.94$, $SE = .13$), $F(1,67) = 5.45$, $p = .023$, $\eta_p^2 = .08$. For women, this difference was reversed, but the means did not differ significantly ($M = 3.89$, $SE = .09$, and $M = 4.03$, $SE = .09$, respectively), $F(1,67) = 1.18$, $p = .280$, $\eta^2 = .02$. Looking at the other pair of simple comparisons, it becomes clear that men and women did not differ in their self-ratings in the control condition, $F < 1$, but they differed when they made a fist $F(1,67) = 9.44$, $p = .003$, $\eta^2 = .123$.

Study 1 found that making a fist influenced participants' self-ascribed assertiveness and their social esteem. Men and women were affected differently. Making a fist only empowered the self-concept

[1] Note that the study was conducted in Germany, where the "rock" of rock-paper-scissors is known as "stone," which is less associated with power than "rock" might be. Also note that we chose to manipulate the non-dominant hand to ease working on the task. Requiring participants to work with their non-dominant hand can have unintended side effects, such as creating experiences of difficulty and doubts about themselves (Briñol & Petty, 2003).

of men: they regarded themselves as more assertive, and as more esteemed by others when making a fist.

Study 2

In Study 2, we investigated the effects of making a fist on the implicit self-concept. To this end, we used a modified version of an implicit self-evaluation task developed by Hetts, Sakuma Michiko, and Pelham (1999). The task assesses the degree to which positive versus negative evaluations of traits are facilitated by self-related versus neutral primes. By including traits related to different motives, this measure has recently been adapted to assess implicit self-evaluations in the domains of power, affiliation, and achievement (Koole, 2004). To the extent that the self is associated with traits related to one of these motives (e.g., powerful), priming the self-concept should facilitate positive evaluations and inhibit negative evaluations of the traits (Hetts et al., 1999; Otten & Wentura, 1999; Spalding & Hardin, 1999). Note that even though the traits are explicitly evaluated, the task measures associations between the self-concept and specific traits and thus captures the implicit self-concept.

In Study 2, male and female participants were asked to make a fist or a neutral gesture while they were performing the reaction time task. Our main prediction was that making a fist would empower only men's implicit self-concepts. More specifically, we predicted that only for men, but not for women, making a fist would enhance priming of traits indicating power by a self-concept prime (and diminish interference of traits indicating powerlessness).

In addition, the task also measures associations between the self and affiliation, and the self and achievement. Making a fist does not have any relation to affiliation, but would it influence achievement-related self-conceptions? At first glance, it would seem that people frequently make a fist when they are celebrating an important achievement. However, in such situations, achievement may be conflated with power. The physical force afforded by making a fist is more closely related to the core of the power motive, which consists of attaining social influence, than to the core of the achievement motive, which consists of meeting a certain standard. Furthermore, numerous studies support the independence of power and achievement motives (Kazén & Kuhl, 2005; Koole, 2004; Kuhl & Kazén, 2008; Schultheiss, 2008). We thus did not expect effects of making a fist on the self-concept in the domains of achievement or affiliation.

Method

Participants and design

Participants were recruited at the campus of a German university and received €2 and a chocolate bar for their participation. Of the total sample ($N = 80$), 4 participants were excluded because they had more than 20% wrong or missing answers in the reaction time task. Of the remaining 76 participants, 43 were female; mean age was 21.

In the reaction time task, positive and negative traits relevant to power, achievement, and affiliation were presented, preceded by a self-concept prime or a neutral prime. Thus, the study had a 2 (gender) × 2 (gesture) × 3 (trait domain) × 2 (attribute valence) × 2 (prime) design, with the first two factors being between participants, and the others varied within participants.

Materials and procedure

The study was presented to participants as investigating the effects of hemisphere activation from hand gestures. The gesture manipulation was identical to Study 1. Instructions were computer-administered. The reaction time task was explained, and practice items completed, before the introduction of the gesture manipulation. Participants maintained the gesture with their left hand throughout the task. For each of the categories power, achievement, and affiliation, there were twelve traits, half of them of positive valence indicating the presence of that feature (e.g., for power, *autonomous* and *powerful*), and half of them were negative, indicating absence of that feature (e.g., for power, *powerless* and *submissive*).[2] Each trait was presented twice, once with self-prime (*ich*, German for I), and once with neutral prime (*abc*), resulting in a total of 72 trials. Participants had to indicate whether the trait was positive or negative by pressing one of two response keys. They used the index and middle finger of the right hand. Item order was randomized for each participant with the provision that traits were presented once in each half.

Each trial started with a blank screen for 1000 ms, followed by a fixation cross for 500 ms, the prime for 200 ms, another blank screen for 100 ms, and then the target word, all in the middle of the screen. Targets disappeared after participants responded, or after 5 s. After the first half of trials, participants had a self-paced break during which they were encouraged to relax their hand before resuming the hand position and continuing with the task.

Results and discussion

As is customary in the analysis of response times, we first discarded wrong answers and response times above the mean plus 2*SD*s (>1400 ms). We computed average response times separately for positive versus negative traits, each domain, and for traits following self-related versus neutral primes. We then computed the degree to which self-primes facilitated evaluations by subtracting response times to self-prime traits from neutral prime traits. This was done separately for positive and negative traits within each of the motive domains. We then reversed the facilitation scores for negative traits, such that a positive facilitation score always indicated an association of the self-concept with the presence of a trait.

We predicted that making a fist would influence facilitation by a self-prime for power-related traits, but not for achievement or affiliation-related traits. As a first test of this hypothesis, we submitted the facilitation scores to a contrast analysis that compared the power domain to the other two domains. More specifically, we ran a GLM with the between subject factors gender and gesture, the within subject factor valence, and a *Helmert* contrast on the trait domain factor that coded power as 2 and both achievement and affiliation as −1. Thus, the GLM had a 2 (gender) × 2 (gesture) × 2 (valence) × 2 (trait domain contrast: power [+2] vs. achievement [−1] vs. affiliation [−1]) design. The three-way interaction of this trait domain contrast with gender and gesture was significant, $F(1,72) = 4.76$, $p = .032$, $\eta_p^2 = .062$, indicating that the power traits were affected differently from achievement and affiliation. This interaction was not further modified by valence. There were also no significant interaction effects when the orthogonal domain contrast comparing achievement and affiliation was tested (0, 1, −1; all Fs < 1).

Follow-up analyses tested effects on power, achievement, and affiliation traits separately. Facilitation scores for power traits were analyzed in a 2 (gender) × 2 (gesture) × 2 (valence) GLMs with

[2] All attributes are listed in Koole (2004); the German items can be obtained from the first author. Because the task is based on classic motivational theories (McClelland, 1985), positive items always indicate the presence of the respective concept, while negative items always indicate its absence. We use the terms positive and negative here because the participants had to make an evaluative decision. It should be pointed out that by confounding valence and presence/absence, we cannot investigate whether negative aspects of a concept's presence, or positive aspects of a concept's absence got activated (e.g., solitude for the absence of affiliation). We thank Jamin Halberstadt for making us aware of this point.

repeated measures on the last factor. The gender main effect was marginal, $F(1,72) = 2.94$, $p = .090$, $\eta_p^2 = .04$. The interaction of gender and gesture was significant, $F(1,72) = 4.56$, $p = .036$, $\eta_p^2 = .06$. This interaction was not further qualified by valence, indicating identical patterns for positive and negative attributes. To illustrate the pattern, we report the averaged facilitation scores on positive and negative traits (recall that facilitation scores for negative traits were reverse-scored). Thus, the higher the score, the more the self is associated with being powerful. For men, self-primes facilitated power targets more strongly when men made a fist ($M = 8.72$, $SE = 16.39$) than when they made a neutral gesture ($M = -30.77$, $SD = 17.96$), but this difference was not significant, $F(1,72) = 2.64$, $p = .109$, $\eta^2 = .04$.[3] For women, self-primes activated power less strongly when women made a fist ($M = 1.95$, $SE = 15.55$) than when they made a neutral gesture ($M = 31.42$, $SD = 14.50$), but this difference was also not significant, $F(1,72) = 1.92$, $p = .170$, $\eta^2 = .03$.

Parallel analyses on achievement traits did not produce any effects. Finally, the same analyses for affiliation traits showed only a main effect of valence, $F(1,72) = 97.31$, $p < .001$, $\eta_p^2 = .58$, showing that in all conditions participants associated the self much less with negative affiliation traits (i.e., lonely) than with positive affiliation traits.

In sum, making a fist had differential effects in two regards: only the association of the self-concept with power traits was influenced, but not achievement or affiliation traits. Furthermore, men and women differed in the direction, with men showing more association of the self-concept with power when making a fist, and women less. In the control condition, women had stronger associations of the self with power attributes than men did. This gender difference disappeared when both genders made a fist. Thus, gender moderated the effects of making a fist on the implicit self-concept, in much the same way as gender moderated the effects of making a fist on the explicit self-concept in Study 1.

Why women showed overall stronger associations between self and power remains unclear. At least superficially, this pattern is consistent with recent work showing that men require more affirmation of their social status than women (Vandello, Bosson, Cohen, Burnaford, & Weaver, 2008). However, the explicit ratings in Study 1 did not show any difference in the control condition. As such, more research is needed to understand the nature of global gender differences in power-related self-concept. In any case, the unexpected gender difference in the control condition of Study 2 confirms that the differential effects of making a fist on men and women are not due to women feeling powerless in general.

General discussion

The present two experiments demonstrate that bodily feedback of making a fist can exert a direct influence on the self-concept. This influence was found both with explicit and implicit measures, was specific to power rather than achievement or affiliation, and affected men and women differently. Making a fist led men, but not women, to adopt more powerful self-concepts. As far as we know, these findings provide the first experimental evidence that people's conceptions of themselves are at least partly grounded in their bodily experiences.

[3] In a further study with 22 male students that followed identical procedures, this difference was significant, and the pattern was replicated with very similar results. The implicit self concept of these men in the power domain was more positive when they made a fist ($M = 12.87$, $SE = 16.90$) than when they made the neutral gesture ($M = -44.02$, $SE = 18.51$), $t(20) = 2.27$, $p = .034$, $\eta^2 = .21$. Making a fist had no effects on the implicit self concept of achievement or affiliation, $ts < 1.2$, $ps > .25$.

Were the effects of making a fist due to embodiment?

Before turning to the implications of the present findings, it is useful to consider some potential alternative explanations. First, one could suspect that the effects of making a fist were driven by semantic priming (Strack, Martin, & Stepper, 1988). A semantic priming process could have taken the form of an activation of the concepts of bodily force or power by some element of the procedure. The present use of an unobtrusive manipulation of bodily feedback makes this unlikely. Furthermore, the present studies were conducted in German, where the rock-gesture is labeled "stone", which is rather associated with inactivity and passivity. Finally, a semantic priming effect could hardly account for the observed gender difference, because one would expect the semantic networks of men and women to be similar if the prime is not connected with the own body and thus to the self-concept.

Second, one might wonder whether the effects of making a fist were mediated by conscious inferences. A conscious inferential process could have taken the form of a conscious categorization of the hand movement and a resulting change in the conscious self-concept based on propositional reasoning about what a fist means for the self, in a kind of self-perception process (Bem, 1967). This change in the propositional representation of the self would have to be transferred into the associative network tapped by the implicit measure. Again, it should be pointed out that the present manipulation of making a fist was unobtrusive, by hiding the meaning of the gesture in the context of the task. As such, a conscious categorization was unlikely. In addition, participants who completed the implicit measure had very little time to engage in complex reasoning because they were busy with a reaction time task while making the fist; this makes an influence of conscious elaboration on implicit measures unlikely (Gawronski & Bodenhausen, 2006).

Some self-perception theorists have suggested that the inferences drawn from the perception of one's own expressions or postures can be automatic, rapid, and inaccessible to conscious inspection (Laird, 1974, 1984, 2007), akin to processes involved in depth perception. These automatic inferences are then thought to result in feelings and emotions. This notion of automatic inferences as the basis of feelings is compatible with models of the emergence of non-affective feelings, such as the feeling of knowing (Koriat, 2007), but it is at odds with many dual process models that describe inferences as slow, effortful, and conscious (Gawronski & Bodenhausen, 2006; Strack & Deutsch, 2004). When we compare this version of the self-perception process to the embodiment account put forward here, it becomes clear that both predict the current results. Indeed, the evidence collected from the automatic self-perception standpoint is frequently cited as evidence for embodiment theories (Niedenthal et al., 2005).

Nevertheless, we still believe that the embodiment account is the more useful explanation of our findings. First, an automatized inference would require a tremendous amount of repetition and overlearning. While such overlearning might occur for the feeling of knowing and even affect inference from facial expressions, it seems unlikely for a less frequent gesture like making a fist. Second, the embodiment account can integrate other findings better because it also predicts the reverse effect, namely that the activation of concepts prepares motor actions. Although, as far as we know, this has not been shown for the self-concept, this prediction has been confirmed for knowledge about concrete objects and abstract (evaluatively neutral) concepts (Glenberg & Kaschak, 2002). The processing of evaluative information has also direct effects on motor states. Smiling and frowning muscles can be contracted faster after the processing of positive and negative words, respectively (Neumann, Hess, Schulz, & Alpers, 2005). Approach and avoidance movements can be performed faster after the processing

of positive and negative words (Chen & Bargh, 1999). Such reverse effects would not be predicted by a self-perception automatic inference account, which is essentially a one-way street. Future work may test the novel prediction of the embodiment perspective that situated conceptualizations of the self can also prime associated motor schemas, and thereby influence behaviors directly.

Implications for theorizing on self and embodiment

The present work represents an important extension of theories of embodied cognition. In particular, the present findings demonstrate that bodily feedback can influence even knowledge structures that are as complex and familiar as the self-concept. This attests to the strength and explanatory power of embodiment theories. Furthermore, the systematic individual differences in the effects of making a fist point to considerable flexibility in the effects of bodily feedback and embodiment effects (see also Meier, Sellbom, & Wygant, 2008; Moeller, Robinson, & Zabelina, 2008; Roberts & Yousef, 2007).

Notably, the present studies found only effects on men, but not on women, while previous studies found women's perception of the social environment was actually more negative when they made a fist (Schubert, 2004). This seems to indicate that women do associate their use of bodily force with less benign environments, but that this does not necessarily involve a less powerful self-concept.

What are the causes of the observed gender differences? Although it is tempting to attribute these differences to biological differences between men and women, a voluminous literature on gender differences suggests a more nuanced picture. The proximal causes of the differential impact of making a fist may lie in different cultural expectations, gender roles and socialization experiences. Girls' and boys' use of physical force is evaluated and reacted to very differently, and this influences their future use of such behavior, which displays large gender differences (Fagot & Hagan, 1985; Fagot, Hagan, Leinbach, & Kronsberg, 1985; Fagot, Leinbach, & Hagan, 1986). The distal antecedents of these proximal causes may lie in the bodily specialization of each gender (men's greater bodily strength, women's reproductive activities, hormonal differences), its interaction with the economic, social and ecological environment that makes these specializations more or less important for a society (Wood & Eagly, 2002), and its propagation by culture (Campbell, 1999). In view of these considerations, it would be intriguing to investigate the effects of making a fist on female populations who more frequently use physical force, such as female boxers or soldiers. Conceivably, making a fist may affect the self-concepts of the latter women in the same way as this gesture affected the self-concepts of men in the present studies.

The present work resonates with arguments from Kihlstrom and colleagues, who speculated that the visual perceptions of the own body, for instance of its contours, the shape of the face, and qualities of the skin directly constitute a part of the self-concept that is not abstract and based on language (Kihlstrom & Klein, 1994; Kihlstrom et al., 2003). We believe that proprioceptive information from the own body might be equally important. In addition to manual feedback, posture, facial expressions, gait, clenching of certain muscles (e.g., the jaw) or the overall tenseness of the muscles are all readily interpreted when people are perceiving others (Hall, Coats, & Smith LeBeau, 2005), and may also play an important role when people are experiencing the self.

Modern society devotes substantial resources to self-concept change (Swann et al., 2007). At least in Western cultures, traditional methods of self-concept change have pursued an informational route by letting people consider alternative views of themselves. The present work highlights a different route of self-concept change that relies on changing self-relevant embodiments. In fact, it is possible that successful interventions that are traditionally considered "cognitive" are partly effective in changing people's self-conceptions because they change embodied components. For instance, recent training programs that aim to increase mindful awareness of the self typically include procedures that change people's bodily postures and breathing patterns (Brown, Ryan, & Creswell, 2007). As such, these training programs tacitly recognize the importance of embodiment in achieving self-concept change. As the present research attests, altering people's postures and movements can be a potent way of changing their self-views.

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