

## BODIES IN CONTEXT: POWER POSES AS A COMPUTATION OF ACTION POSSIBILITY

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One perspective on embodiment proposes that bodily states exert direct, context-free effects on psychological states, as in the research on “power poses.” We propose instead that bodily states influence psychology by providing information about what actions are possible. If such an assessment is to be effective, however, it must consider the body as it exists *in context*, as context provides essential information in defining action possibility. In Study 1, expansive and constrictive poses influenced power only when held in an interpersonal context, which provides action-relevant meaning to these poses as dominance and submissiveness. In Study 2, poses had no effect on power when roles provided more important information about potential action (e.g., being frisked by police while holding an expansive pose resulted in *less* powerful behavior). If the function of cognition is to prepare the body for effective action, then cognitive processes cannot be insensitive to the current context.

How do the body’s physical states influence psychological processes? This is one of the core questions for the general approach known as *embodiment* (see, e.g., Barsalou, Simmons, Barbey, & Wilson, 2003; Niedenthal, Barsalou, Winkielman, Krauth-Gruber, & Ric, 2005; Pezzulo et al., 2011; Schubert & Semin, 2009). There are several varieties of embodiment (see Chemero, 2009), but all have in common at least the following two positions: (1) that the evolved properties of the body and brain constrain how cognition operates, and (2) that the philosophical understanding of the mind as a processor of amodal symbols should be discarded in favor of one that “grounds” conceptual knowledge in modality-specific experiences (Barsalou, 2008). While there are useful and productive debates to be had about the representational status of the mind, the primary goal of the present work is to

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address one specific theoretical account for the effects of physical pose on power and to offer evidence for an alternative, situated viewpoint.

Researchers have begun to note the overemphasis in embodiment research on demonstrating novel phenomena and the underemphasis on describing and testing underlying mechanisms (Meier, Schnall, Schwarz, & Bargh, 2012). Within the research on physical pose and embodiment, however, one proposed mechanism has stood out: a *direct connection* involving a stored, context-independent association between particular physical positions of the body and corresponding psychological states. In the current manuscript, we offer a contribution that goes beyond such an account. Namely, we propose that bodily positions influence psychological states by defining for a person what actions can and cannot be accomplished. Given that a primary function of the brain is to prepare the body for successful action in the world, it naturally follows that the brain should incorporate information about action possibility from bodily position. Yet if one accepts this function of the brain, then it also becomes clear that such a function must be situated—it must be constructed in the moment with inputs from the current environment (beyond one's physical pose) that define action possibility. This focus on action preparation has been noted previously in the literature as a potentially productive avenue of research (e.g., Meier et al., 2012) and we hope to contribute to this enterprise.

## PHYSICAL POSITION AND POWER

One recent line of research within the embodiment tradition has centered on the relationship between bodily position and the psychology of power. Researchers have argued that the amount of space the body occupies relates to the psychological experience of power, such that holding expansive positions increases power (and conversely, that holding constrictive positions decreases power). Indeed, demonstrations of this basic effect have accrued in recent years. For example, Carney, Cuddy, and Yap (2010) found that participants who held expansive positions (relative to constrictive positions) for one minute showed increased feelings of power, increased likelihood of taking a risky gamble, as well as increased testosterone and decreased cortisol levels. Huang, Galinsky, Gruenfeld, and Guillory (2011) found that having participants sit in expansive positions (relative to constrictive positions) for several minutes led them to feel more powerful, show more abstract thought, and be more likely to take a risky gamble.

The mechanism proposed to underlie these effects is a *direct connection* between bodily position and psychological states. A fundamental connection is thought to exist between expansiveness and power, such that assuming expansive positions will make a person feel powerful and induce powerful behaviors, such as increased risk tolerance. Most important, it is argued that the mere positioning of the body will influence psychological experiences of power *independent of any other features of the situation*. Stated most forcefully, Adam and Galinsky (2012) explained that “in embodied cognition, the link between a physical experience and its symbolic meaning is direct, as it is the physical experience itself that carries the symbolic meaning. In other words, the symbolic meaning is *always automatically embodied* because it *directly stems* from the physical experience” (p. 919; italics added). Huang and colleagues (2011) suggested that “the causal link between body expansiveness and power-related behavior may be so close that it is not mediated

by and may precede perception" (p. 96). Carney and colleagues (2010) similarly propose a context-insensitive, direct link by stating, "In some situations requiring power, people have the ability to 'fake it 'til they make it'... This potential benefit is particularly important when considering people who are or who feel chronically powerless because of lack of resources, low hierarchical rank in an organization, or membership in a low-power social group" (p. 1367). In other words, irrespective of the *actual low-power roles* a person may occupy, physical changes in body position can have the same psychological experience as actual power.

#### A SITUATED COMPUTATION OF ACTION POSSIBILITY

Are the links between a person's physical position and their psychological state so strong and direct that a situated approach is unnecessary? Or might there be a benefit to considering this type of embodiment as the output of an in-the-moment construction? There are compelling reasons why one might expect a strong influence of the current situation on how bodily positions influence psychology. In order to appreciate this proposal, it is first necessary to recognize that the reason why one should expect connections between neural systems and bodily systems is because the two are functionally linked. The brain evolved as an organ within the body, and one of its primary functions is to navigate that physical mass successfully through the world—in other words, to prepare the body for adaptive action (e.g., Smith & Semin, 2004). One reason why physical positions might have an influence on psychological states is because bodily positions provide useful information about action possibility. That is, the body informs the computational machinery of the brain with respect to which of many possible actions the person is able to undertake, and the resulting psychological experience reflects the brain's preparation for adaptive action.<sup>1</sup>

One can therefore understand decisions about which courses of action to take (e.g., risky or less risky options, fight or flee behaviors) as the output of a process that assesses which actions are most likely to be effectively enacted. This assessment should incorporate inputs from all relevant sources of information, including what the body is doing, what the situation allows, and what one can accomplish given the presence of one's coalitional partners (see, e.g., Cesario & Jonas, 2013; Cesario & Navarrete, in press). Accordingly, bodily states influence psychological states by informing the brain of what behaviors the body can execute; when one is lying prone, one cannot fight with the same effectiveness as when one is standing tall. However, this informational process can only be functional if bodily information is integrated with relevant information from the broader situation. The body must be only *one* source of information, not the exclusive source, and context should be predominant. This is because, as we show in the current work, con-

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1. We have not addressed here the question of the relationship between subjective assessments and objective assessments of action possibility (see Cesario & Jonas, 2013, for more discussion on this point). One can distinguish the subjective experience of being able to execute a given action from the objective ability to do so. One possibility is that the mind chooses courses of action by following decision rules based on input from objective sources (e.g., what is my physical size compared to the physical size of my opponent?), which then feed into an experience of subjective efficacy. At that point, subjective experiences may or may not play a causal role in the subsequent execution of behavior.

text can change the implications of the body's input and can provide information that overrides that provided by the physical position of the body.<sup>2</sup> If psychological states are to play a functional role in the production of behavior, such processes cannot operate independent of the situation in which a person currently exists.

Therefore, while different positions might afford different actions, there should not be a direct connection between bodily states and psychological states because the psychological level has to incorporate other, situational information. For example, standing tall relative to lying prone might always lead to more effective fighting behavior (it's simply the nature of the mechanics of fighting), but we hypothesize that the translation of this physical position into the psychological feeling of power or the inclination to fight should be a situated process. If you're standing tall but doing so in front of a bear or an aggressor more formidable than yourself, it would be non-adaptive, to say the least, for a direct link between your body and your psychology to automatically execute aggressive behaviors. Claims about the direct effects of bodily position that ignore a person's hierarchical rank or actual resources will suffer from the same logic.

## EXISTING SUPPORT FOR THE APPROACH

There are existing findings in the literature that could be understood as consistent with this situated perspective on the role of bodily position and psychological process. In one recent study (Harmon-Jones & Peterson, 2009), participants were insulted while either lying prone or sitting upright. Left prefrontal cortex activity was assessed using EEG; this neural activity is correlated with anger approach motivation. When participants were seated upright, relative to when reclined, there was a greater left frontal asymmetry in response to the insult. Consistent with the current perspective, this difference in neural activation reflecting anger approach motivation stems from the different actions afforded by being upright vs. lying prone. Yet in going beyond this finding, we would further predict that if the insulter was much more formidable than the participant or if the participant's arms were bound to the chair (both of which should make approach anger ineffective), such anger approach activity would not be observed even in the upright position.

Additional evidence consistent with an action orientation approach to embodiment comes from Jonas, Cesario, Sassenberg, and Heinen (2012). These researchers looked at the role of bodily affordances in the activation of different response behaviors and the way in which the body would define what behaviors should be prepared in response to a social category (in contrast to a direct link between social categories and responses). Participants were primed with pictures of crying babies (or control pictures), and their reaction times in a lexical decision task were assessed. The key target words in the LDT were words related either to comforting a baby with one's mouth (e.g., singing lullabies) or to comforting a baby with one's arms (e.g., cradling). Of importance, participants completed the study either with their arms bound to the table, thereby preventing motor responses with the arms,

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2. Context can also completely redefine the behavior. In the context of a fight, lying prone indicates submissiveness, whereas in the context of the beach, lying prone indicates relaxation. Along these lines, it is likely that expansive poses have been inadvertently defined as powerfulness/dominance given the business school setting of past research. Indeed, over two decades ago, Trope (1986) demonstrated the fundamental role of context in the interpretation of actions.

or while chewing gum, thereby preventing motor responses with the mouth. When a given motor schema was blocked, participants were faster to respond to words related to the non-blocked motor schema. In other words, the cognitive system incorporated information from the bodily system about which actions were currently possible and used such information in flexibly and adaptively preparing responses.

While consistent with the current emphasis on action possibility, neither of the above studies directly tests for the situated character of embodiment by varying context. Still, it is unusual for an embodiment effect such as the effect of physical position on power to be described in a context-independent way, given that embodiment research is often described in the same breath as situated cognition (Semin & Smith, 2013, this issue). Given the above reasoning, there is a precedent for proposing a situated understanding of physical position on power.

## OVERVIEW

The goal of the present studies is to provide evidence that the effects of bodily position on the psychological experience of power can be understood as a situated process. If power-related behaviors are the output of an assessment of what a person can and cannot do in the moment, then this necessarily places the body in the current situation and redefines the role of bodily positions away from a direct, context-free effect. To this end, we provide the first evidence that context provides input into embodiment effects in a way that cannot be understood with a context-free mechanism.

In Study 1, we varied whether participants held expansive or constrictive poses either alone or in an interpersonal context (operationalized as holding the poses while looking at faces; see Carney et al., 2010). If the effect of bodily position on power is direct and insensitive to context, whether a person is alone or in the presence of others should have no influence. If embodied effects are sensitive to context, then whether a person is in an interpersonal context should matter: expansive and constrictive bodily positions are indicators of dominance and submissiveness, and as such, these states only have meaning in the presence of others. One cannot be dominate or submissive in the absence of others.<sup>3</sup>

In Study 2, we varied whether participants held expansive or constrictive poses while imagining being in dominant or submissive roles. One primary function of roles is to provide information about what behaviors a person can and cannot execute (Stryker & Statham, 1985), and as such, the context (role) in which a person currently exists must be considered if action preparation is to be a functional process. If roles provide more important information about action possibility than one's current bodily position does, then varying the role a person occupies should override the information provided by bodily positions. However, if there is a direct connection between bodily position and power, then one would predict either no effect of role or, at most, an additive effect wherein both role and body position are important. The idea that bodily position should be insensitive to current roles

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3. The presence of faces could have any number of effects beyond making dominance and submissiveness relevant. The important point is that a direct connection account and a situated account make clear, opposite predictions about whether this manipulation should matter for the effects of holding different poses.

is consistent with prior claims about the importance of power poses (e.g., Carney et al., 2010, p. 1367).

Throughout, we use manipulations and outcome variables from the existing literature. Our measure of power was the exact measure used by Carney and colleagues (2010) and was conceptually identical to the risky gambling task used in Huang and colleagues (2011). Risk taking has been used as an indicator of power in previous research because power is universally defined as asymmetric control of resources. When individuals feel powerful (i.e., when they feel they have control of important resources), they can take greater risks to obtain additional resources. As a result, individuals who feel more powerful should be willing to make riskier gambling decisions.

In addition, we sought to more precisely estimate the effect of pose on risk-taking behavior by collecting per-cell sample sizes nearly twice that of prior research. Past research has had small samples without any direct replications, potentially providing unreliable effect size estimates. This is important given that the degree to which such manipulations have significance in everyday life, as is often claimed, hinges in part on the estimates of effect size.

## STUDY 1

Study 1 manipulated interpersonal context by having participants hold constrictive or expansive poses (or a no-pose control condition) while viewing faces on a computer screen or not viewing faces.<sup>4</sup> If the presence of others is necessary for defining these poses as dominance and submissiveness, no effects of pose should be observed absent the presentation of faces. If there is a direct and context-insensitive link between physical position and the experience of power, then whether or not faces are present should have no influence on the effects of power poses.

## METHOD

*Participants and Design.* Two hundred sixteen undergraduates at a large American university participated in exchange for partial course credit. Participants were assigned to a 2 (Context: no faces present vs. faces present)  $\times$  3 (Pose: constricted vs. control vs. expansive) between-subjects design.<sup>5</sup> Three participants' data were discarded due to experimenter error and four participants did not complete key demographic measures, leaving a final sample of 209.

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4. Importantly, all prior research studying the effects of physical position on power has either had participants in actual interpersonal interactions (e.g., Bohns & Wiltermuth, 2012) or has had participants viewing faces while holding the poses (e.g., Carney et al., 2010).

5. Some participants in this sample were not randomly assigned to an interpersonal context condition; those who were not randomly assigned were at first assigned to the no faces condition and next assigned to the faces condition (participants were always randomly assigned to the pose condition). However, comparing those participants who were randomly assigned to the interpersonal context condition with those who were not randomly assigned revealed no differences in the effects, indicating that a time confound cannot account for the obtained effects. For example, and with respect to the primary finding: for participants who were randomly assigned, absent the interpersonal context there was no difference in gamble decisions between constrictive (57.14%) and expansive (53.85%) poses.

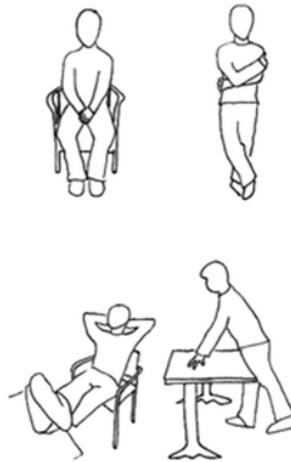


FIGURE 1. Constrictive (top panel) and expansive (bottom panel) poses used in Studies 1 and 2; position A on left, position B on right.

*Procedure and Materials.* Participants completed the study in a laboratory room in the psychology building; all provided informed consent. Participants in the control condition began the gambling task described below without any manipulation of pose. Participants in the constrictive and expansive pose conditions were told the study concerned how “people remember and maintain different physical positions” and, if they were in the *faces present* condition, “how people form impressions of others.” Participants in the two pose conditions were then placed into an expansive or constrictive position, depending on condition (see Figure 1, Position A), and held this position for one minute while the experimenter was out of the room. They were then placed into a second position of the same type (Position B) and held this position for one minute, again with the experimenter absent. Two tables set at different heights were used to ensure that participants of varying heights would be comfortable while holding the poses. In both pose conditions, care was taken to instruct participants only by describing body parts and positions, without any reference to roles. In the *faces present* condition, a series of neutral-expression faces of varying race and sex were presented on a computer screen in front of participants throughout the duration of the poses. All participants then completed the risk-taking measure and demographic items.

*Measure of Risk Taking.* The measure of risk taking was the exact gambling task from Carney and colleagues (2010) and a conceptual analogue of the task used by Huang and colleagues (2011). Participants were given 2 raffle tickets and told the tickets were theirs to be entered into a drawing for a \$50 gift card to a grocery store. They were then told that they could gamble to increase their number of tickets by rolling a die. If they rolled a 4, 5, or 6, they would double their tickets to be entered, but if they rolled a 1, 2, or 3, they would lose all their tickets. Whether participants took the gamble or safe bet was the measure of risk taking.

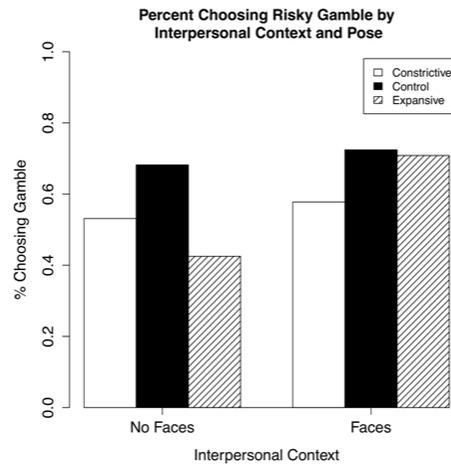


FIGURE 2. Percent of participants choosing the risky gamble, by interpersonal context and physical pose, Study 1.

## RESULTS AND DISCUSSION

Gamble decision (0 = safe bet, 1 = risky gamble) was the predicted variable in a logistic regression with context (0 = no faces present, 1 = faces present) and two dummy-coded variables with the constrictive condition as the comparison condition (dummy 1 = constricted vs. control; dummy 2 = constricted vs. expansive) entered as predictors; as in previous research, participant sex was entered as a covariate. The overall model was significant, likelihood ratio test  $\chi^2(6) = 17.94, p = .006$ .

Several important effects are apparent from Figure 2, which displays rates of choosing the risky gamble by condition. First and most obvious, when no faces were presented, the effects of holding different poses showed no similarity to the effects reported in prior research (e.g., Carney et al., 2010; Huang et al., 2011). Participants in the constrictive condition gambled at (non-significantly) *greater* rates (53.13%) than participants in the expansive condition (42.50%),  $\chi^2 = -0.84, B = -0.41, p = .40$ ; both these were non-significantly less than the control condition (68.18%). Such findings are incompatible with the proposal of a direct link between physical position and power.

Next, the effect of holding different poses on gamble decisions varied by interpersonal context, as reflected in the interaction between context and the dummy variable comparing the constrictive and expansive poses,  $\chi^2 = 1.98, B = 1.34, p = .048$ . Replicating prior research, participants who viewed faces in the expansive position gambled more (70.83%) than those in the constrictive position (57.78%),  $\chi^2 = 1.98, B = 0.93, p = .048$ ; as noted above, this effect was absent when faces were not presented.

As expected, participants in the control condition showed no difference in gambling decision based on whether the faces were absent (68.18%) or present (72.40%). Finally, participant sex also had a main effect on gamble decisions,  $\chi^2 =$

2.24,  $B = 1.11$ ,  $p = .025$ , with males choosing the gamble (81.25%) at higher rates than females (56.67%). No three-way interactions between condition, faces, and sex were observed,  $\chi^2$ s  $< 1$ .

In sum, absent the presence of others there was no effect of pose on risk taking (an established measure of power as used in past research). Dominance and submissiveness cannot be expressed outside the presence of others. Therefore, the interpersonal context was required for the body's physical position to manifest an influence on the psychological processes related to power.

## STUDY 2

Study 2 manipulated context by having participants imagine being in either submissive or dominant roles while holding expansive or constrictive positions. To the extent that bodily positions are directly connected to psychological states, poses should influence risk taking independent of role. To the extent that the situation provides necessary information in a computation of action possibility, risk-taking behavior should be influenced by the imagined role.

## METHOD

*Participants and Design.* One hundred sixty-seven participants completed the study in exchange for partial course credit. Data from ten participants were unusable due to inability to hold the positions as requested (participants reported being uncomfortable or unable to hold the pose properly), and two participants did not complete demographic information, leaving 155 participants for the analyses. Participants were randomly assigned to a 2 (Role: submissive vs. dominant)  $\times$  2 (Pose: constricted vs. expansive) between-subjects design.

*Procedure and Materials.* Participants arrived at a laboratory room in the psychology building and provided informed consent. Participants were placed into a constricted or expansive position, depending on condition (see Figure 1, Position A) and were told to imagine being in a specific context (either the submissive role or dominant role) while holding that position. After one minute, participants were placed in a second position (Position B) of the same type and given a new context that depicted the same role, submissive or dominant, as the first imagined context; they held this position for one minute.

As an example, expansive position B could have been described either as submissive (imagine you are being frisked by the police with your hands on the hood of a police car) or dominant (imagine you are at work standing at your executive desk, looking out over a worksite). Similarly, constrictive position B could have been described either as submissive (imagine you are a freshman in high school, leaning against a set of lockers, being made fun of by seniors) or dominant (imagine you are a senior in high school, leaning against a set of lockers, watching all the freshman scrambling to find their classes). (Complete text of all role  $\times$  pose combinations can be found in Appendix A.) After participants held both positions, they completed the same measure of risk taking described in Study 1.

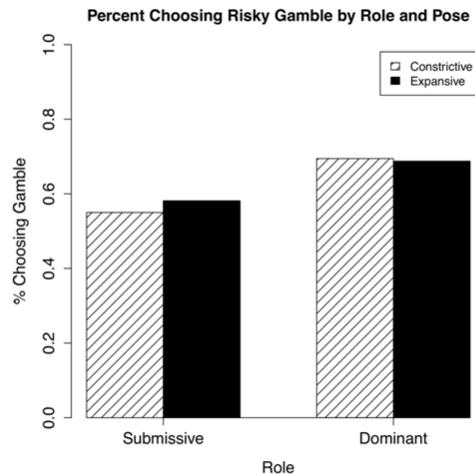


FIGURE 3. Percent of participants choosing the risky gamble, by role and physical pose, Study 2.

## RESULTS AND DISCUSSION

Gamble decision (0 = safe bet, 1 = risky gamble) was the predicted variable in a logistic regression with role (0 = submissive, 1 = dominant) and pose (0 = constrictive, 1 = expansive) entered as predictors; sex was again entered as a covariate. There were no interactions between the predictor variables, so the final model tested had only main effects. The overall model was significant, likelihood ratio test  $\chi^2(3) = 8.25, p = .041$ .

Results indicated a clear, singular effect of role and no effect of pose, as displayed in Figure 3. Participants who imagined being in the submissive role were less likely to take the gamble (56.63%) than those who imagined being in the dominant role (69.05%),  $\chi^2 = 1.91, B = 0.66, p = .056$ , regardless of pose. Conversely, participants did not differ in their gamble choice depending on whether they were holding a constrictive (61.84%) or an expansive (63.74%) pose,  $\chi^2 = 0.22, B = 0.08, p = .824$ . Participant sex again influenced results, with males (82.76%) being more likely to gamble than females (58.52%),  $\chi^2 = 1.90, B = 1.017, p = .057$ .

## GENERAL DISCUSSION

Across two studies, we found evidence more consistent with a situated account than a context-independent mechanism for the effects of the physical body on psychological states. In Study 1, there was no effect of physical position on power-related behavior (risk-taking) absent an interpersonal context (which makes expansiveness/constrictiveness relevant to action by defining them as dominance/submissiveness). In Study 2, imagining being in dominant or submissive roles completely overrode the effects of bodily information, as roles provided the more

meaningful input into a calculation of action possibility. These findings cannot be readily incorporated into a direct connection mechanism.<sup>6</sup>

## EVOLUTION AND COMPUTATIONAL PROCESSES

The current findings are consistent with evolutionary approaches to decision making and philosophy of mind. One dominant understanding is that the brain evolved as a computational organ that follows decision-making rules based on informational input from relevant sources. Although bodily states provide one source of information into the computation of what actions a person can execute (e.g., comparative size influences fight/flight decisions in response to imminent threats), it is only one of many sources. Other sources may be weighed more heavily if they are of greater relevance.

A common misunderstanding of evolutionary processes is that they select for “unmediated,” context-free effects. Nonhuman animal models are often referenced in an attempt to garner support for theories that propose direct effects (as in the literature on automatic social behavior; see, e.g., Dijksterhuis, Bargh, & Miedema, 2000). In point of fact, evolution has resulted in computational processes that incorporate multiple sources of information in selection of adaptive behavior. This includes the assessment of one’s physical and physiological information, but also relevant environmental factors. Thus, evolutionary theory would predict that situational context should strongly influence behavior, as such context provides necessary information about action possibility (see, e.g., Pezzulo et al., 2011).

The direct connection account found in the power pose literature is not unlike the context-independent, direct expression accounts found in other areas of social psychology. In the domain of priming and automatic social behavior, for example, one dominant account has been the perception-behavior link (Bargh, Chen, & Burrows, 1996), which proposes that activated social category information automatically translates to behavior without input from the situation. As just one example, priming young black males leads to increased aggression because, according to this account, the stored trait *aggressive* is activated via its association with young black men and directly expressed behaviorally, regardless of any contingencies in the situation. As demonstrated elsewhere (Cesario, Plaks, Hagiwara, Navarrete, & Higgins, 2010; Katzko, 2006), one might conceptualize automatic behavior and cognition not as being direct outputs of a stored, inflexible connection but instead as situated processes, ones that are dependent in a fundamental way on the current situation. Specifically, such processes may be dependent on those aspects of the situation that determine what a person can and cannot do in response to a target. For example, Cesario and colleagues showed that priming young black males when participants were in an enclosed cubicle led to increased accessibility

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6. Across both studies, we also had participants provide subjective ratings of how powerful they currently felt. In no case did we obtain the same effects on this measure (all *t*s < 1). A discussion of the relation between measures of power is beyond the scope of the current manuscript. (The first author can be contacted for more details on this topic.) However, it is worth noting that past research (e.g., Carney et al., 2010; Huang et al., 2011) has found little evidence of correlations among multiple indicators of power, including subjective ratings. Therefore, understanding the relation between indices of power is an important future direction.

of fight-related words (reflecting a preparation to act in an aggressive manner), but this same priming led to an increased accessibility of flight-related words when participants were in an open field (reflecting a preparation to escape or flee the aggressive target). That is, the operation of automatic cognitive processes in response to social targets is tied to the contingencies of the situation that define what actions are possible in response to the target. Different situations afford different actions. If cognition is to be functional and is to prepare the body for effective action, it cannot operate independent of the situation in which a person currently exists. It must incorporate situational information into a computation of action possibility. Rather than being the execution of a stored, stable trait or behavior, automatic social behavior has now been shown to be situated. It is constructed in the moment given relevant contingencies important for effective action (see also Cesario and Jonas, 2013).

#### PRIOR INVESTIGATIONS OF ROLE AND POWER

There has been at least one prior attempt to explore the influence of roles within the power pose literature. Huang and colleagues (2011) crossed physical pose and imagined role and found no effects of role on certain indicators of power. Specifically, participants' pose was manipulated by having them sit in an expansive or constrictive position. While holding this position, they read a description of their role for an upcoming task. Participants were assigned to either a *manager* role in which they would direct and evaluate another participant or a *subordinate* role in which they would be directed and evaluated by another individual. These researchers found no effects of role on power-related behaviors, including risk-taking behavior of the type tested by Carney and colleagues (2010) and in the current research. Why did role not have an effect if context is as important as we suggest?

To answer this, it is important to recognize that the manipulation did not take into account how people *actually experience* physical poses and roles. In crossing the role and pose manipulations without regard for whether the various combinations made sense in the real world, Huang and colleagues essentially created highly inconsistent experiences for participants. In a business context, subordinate workers simply *do not* sit in expansive positions, arms slung across multiple chairs as they await their manager. Thus, the manipulation of role is a highly artificial one and its relevance can be questioned. A more general way of stating this is that the manipulation divorced role from pose such that the two were incidental to one another. Yet this is not how action and position actually operate in the world outside the laboratory.

There are, however, instances in which subordinates do take expansive positions and dominant individuals take constrictive positions. A more reasonable test of the effects of role and posture would therefore be to manipulate each independently (as in Huang et al., 2011), but to do so in ways that capture meaningful experiences for participants. This was the approach taken in our Study 2, in which we found that role information eliminated the effects of physical pose.

## CONCLUSION

In this manuscript, we advanced a situated, action-oriented understanding of the role of bodily states in influencing psychological states. One possibility for future embodiment research is to consider the ways in which the body provides information important for computing action possibility. Because the body always exists in a particular context that provides important information, the computational machinery responsible for assessing potential action must be sensitive to the current context. Thus, caution must be exercised in claims about the mere or direct effects of holding particular physical positions on psychological states.

## APPENDIX

### ROLE DESCRIPTIONS, STUDY 2

#### **Constricted Position, Submissive Role [Position A]:**

"While you're holding this position, I'd like you to imagine that you're at work and you're sitting in front of your boss. Imagine your boss is standing across from you, on the other side of his desk, facing you with his hands on the desk. He's making it clear to you that he isn't satisfied with your latest job performance. Try to really visualize this scene and put yourself in that role as much as possible, and really experience what it would feel like to be that person."

#### **Constricted Position, Submissive Role [Position B]:**

"While you're holding this position, I'd like you to imagine that you're a freshman in high school and you're leaning up against a set of lockers. A group of older students are around you, making fun of you. Again, really try to put yourself in this role as much as possible, and really experience what it would feel like to be that person."

#### **Constricted Position, Dominant Role [Position A]:**

"While you're holding this position, I'd like you to imagine that you're at work and you're sitting in a meeting. You're the head of one of the divisions at the company and your subordinate is presenting the latest performance data from the last quarter. You're watching and evaluating this person's performance as they talk. Try to really visualize this scene and put yourself in that role as much as possible, and really experience what it would feel like to be that person."

#### **Constricted Position, Dominant Role [Position B]:**

"While you're holding this position, I'd like you to imagine that you're a senior in high school and you're leaning up against a set of lockers. It's the first day of your senior year, you're on top of the world, and you're watching all the newer students, including the freshman, scrambling around trying to find their classes. Again, really try to put yourself in this role as much as possible, and really experience what it would feel like to be that person."

#### **Expansive Position, Submissive Role [Position A]:**

"While you're holding this position, I'd like you to imagine that you're at the dentist's office. You're leaning back in the chair and the dentist is working on your mouth. You're not going anywhere and he is pretty much in control. Try to really visualize this scene and put yourself in that role as much as possible, and really experience what it would feel like to be that person."

**Expansive Position, Submissive Role [Position B]:**

“While you’re holding this position, I’d like you to imagine that you’ve just been detained by the police against your will. They have your hands on the hood of the police car and you’re being frisked, after which they’re going to cuff you and take you down to the police station. Again, really try to put yourself in this role as much as possible, and really experience what it would feel like to be that person.”

**Expansive Position, Dominant Role [Position A]:**

“While you’re holding this position, I’d like you to imagine that you’re at work and you’re sitting at your desk. You’re the head of one of the divisions at the company and you have several teams of subordinates working for you. You’ve just gone over the latest performance data from the last quarter that one of your workers has given to you. You’re evaluating this person’s performance on the report. Try to really visualize this scene and put yourself in that role as much as possible, and really experience what it would feel like to be that person.”

**Expansive Position, Dominant Role [Position B]:**

“While you’re holding this position, I’d like you to imagine that you’re at work and you’re standing at your executive desk. You’re looking out over the worksite and overseeing the progress that’s being made on the job you’re in charge of. Again, really try to put yourself in this role as much as possible, and really experience what it would feel like to be that person.”

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