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Power Posing: Brief Nonverbal Displays Affect Neuroendocrine Levels and Risk Tolerance

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Abstract

Humans and other animals express power through open, expansive postures, and powerlessness through closed, constrictive postures. But can these postures actually *cause* power? As predicted, results revealed that posing in high-power (vs. low-power) nonverbal displays caused neuroendocrine and behavioral changes for both male and female participants: High-power posers experienced elevations in testosterone, decreases in cortisol, and increased feelings of power and tolerance for risk; low-power posers exhibited the opposite pattern. In short, posing in powerful displays caused advantaged and adaptive psychological, physiological, and behavioral changes -- findings that suggest that embodiment extends beyond mere thinking and feeling, to physiology and subsequent behavioral choices. That a person can, via a simple two-minute pose, embody power and instantly become more powerful has real-world, actionable implications.

The proud peacock fans his tail feathers in pursuit of a mate. By galloping sideways, the cat manipulates an intruder's perception of her size. The chimpanzee, asserting his hierarchical rank, holds his breath until his chest bulges. And the executive in the boardroom crests the table with his feet, fingers interlaced behind his neck, elbows pointing outward. Humans and other animals display power and dominance through expansive nonverbal displays, and these power poses are deeply intertwined with the evolutionary selection of what is "alpha" (Darwin, 1872; de Waal, 1998; Ellyson & Dovidio, 1985).

But is power *embodied*? What happens when these displays are posed? Can posed displays *cause* one to *feel* more powerful? Do one's mental and physiological systems prepare one *to be* more powerful? The goal of this research was to test whether high-power (vs. low-power) poses actually produce power, by looking at their effects on some fundamental features of having power: feeling powerful, elevation of the dominance hormone testosterone, lowering of the stress hormone cortisol, and an increased tolerance for risk.

Power determines access to resources (de Waal, 1998; Keltner, Gruenfeld, & Anderson, 2003), agency and control over one's own body and mind and positive feelings (Keltner et al., 2003), and enhanced cognitive function (Smith, Jostmann, Galinsky, & van Dijk, 2008). Powerful individuals demonstrate greater willingness to engage in action (Galinsky, Gruenfeld, & Magee, 2003; Keltner et al., 2003), and often show increased risk taking behavior (Anderson & Galinsky, 2006; Davis et al., 2009)[1].

The neuroendocrine profiles of the powerful differentiate them from the powerless, on two key hormones -- testosterone and cortisol. In humans and other animals, testosterone levels both reflect and reinforce dispositional and situational status and dominance; internal and external cues cause testosterone to rise, increasing dominant behaviors, which further elevate testosterone (Archer, 2006; Mazur & Booth, 1998). For example, testosterone rises in anticipation of a competition and as a result of a win, but drops following a defeat (Booth et al., 1989; Mazur, Booth, & Dabbs, 1992) -- and these changes predict the desire to compete again (Mehta & Josephs, 2006). In short, testosterone levels are closely linked to adaptive responses to challenges, both reflecting and reinforcing dominance.

Power is also linked to the stress hormone cortisol, such that power-holders show lower basal cortisol and lower cortisol reactivity to stressors, and cortisol drops as power is achieved (Abbott et al., 2003; Coe, Mendoza, & Levine, 1979; Sapolsky, Alberts, & Altmann, 1997). Although short-term and acute cortisol elevation is part of an adaptive response to challenges large and small (e.g., a predator and waking up), chronically elevated cortisol seen in low-power individuals is associated with negative health consequences like impaired immune functioning, hypertension, and memory loss (Sapolsky et al., 1997; Segerstrom & Miller, 2004), and low-power social groups have a higher incidence of stress-related illnesses, partially attributed to chronically elevated cortisol (Cohen et al., 2006). Thus, the power-holder’s typical neuroendocrine profile of high testosterone coupled with low cortisol, linked to such outcomes as disease resistance (Sapolsky, 2005) and leadership abilities (Mehta & Josephs, 2010), appears to be optimally adaptive.

Unequivocally, power is expressed through highly specific, evolved nonverbal displays. Expansive, open postures (widespread limbs, enlargement of occupied space, and spreading out) project high power, whereas constrictive, closed postures (limbs touching the torso, minimizing occupied space, and collapsed inwardly) project low power – patterns which have been identified in research on actual and attributed power and its nonverbal correlates (Carney, Hall, & Smith LeBeau, 2005; Darwin, 1872; de Waal, 1998; Ellyson & Dovidio, 1985; Hall, Coats, & Smith

LeBeau, 2005). Although we know that power generates these displays, no research has asked whether these displays generate power -- will posing these powerful displays actually cause individuals to feel more powerful, focus on reward as opposed to risk, and experience increases in testosterone and decreases in cortisol?

In research on embodied cognition, some evidence suggests bodily movements, such as facial displays, can affect emotional states. For example, unobtrusive contraction of the "smile muscle" (i.e., the zygomaticus major) increases enjoyment (Strack, Martin, Stepper, 1988); the head tilting upwards induces pride (Stepper & Strack, 1993); and hunched (vs. upright) physical postures elicit more depressed feelings (Riskind & Gotay, 1982). Approach-oriented behaviors, such as touching, pulling, or nodding "yes," increase preference for objects, people, and persuasive messages (e.g., Briñol & Petty, 2003; Chen & Bargh, 1999; Wegner, Lane, & Dimitri, 1994); and fist clenching increases men's self-ratings on power-related traits (Schubert & Koole, 2009). However, no research has tested whether expansive versus constrictive power poses cause mental, physiological, and behavioral change in a manner consistent with the effects of power. Specifically, we hypothesized that high- versus low-power poses would cause individuals to experience: (1) elevated testosterone, (2) decreased cortisol, (3) increased feelings of power, and (4) higher risk-tolerance. Such findings would suggest that embodiment goes beyond cognition and emotion and could have immediate and actionable impacts on behavior.

Method

Participants and Overview of Procedure

Forty-two (26 female) participants were randomly assigned to the high- or low-power pose condition. Saliva samples were taken before and approximately 17 minutes after the power pose manipulation. Participants believed the study was about the science of physiological recordings focusing on how placement of Electrocardiography (ECG) electrodes above and below the heart could influence data collection. Participants' bodies were posed by an experimenter into high-power or low-power poses. Each participant held two poses for 1-minute each. Participants' risk taking was measured with a gambling task; powerful feelings were measured with self-report.

Power Poses

Poses were harvested from the nonverbal literature (e.g., Hall et al., 2005; Carney et al., 2005) and varied on the two nonverbal dimensions universally linked to power: expansiveness (i.e., taking up more vs. less space) and openness (i.e., open vs. closed limbs). The two high-power poses into which participants were configured are depicted in Figure 1 and the two low-power poses in Figure 2. To be sure the poses chosen conveyed power appropriately, 95 pre-test participants rated each pose from 1 (*very low power*) to 7 (*very high power*). High-power poses ($M = 5.39$, $SD = .99$) were rated significantly higher on power than low-power poses ($M = 2.41$, $SD = .93$), $t(94) = 21.03$, $p < .001$; $r = 99$.

To be sure changes in neuroendocrine levels, powerful feelings, or behavior could be attributed to high or low power attributes of the poses, 19 participants pre-tested the pose manipulation on comfort, difficulty, and pain. Participants made all four poses (while wearing ECG leads) and completed questionnaires after each. There were no differences between high- and low-power poses on: comfort/discomfort, $t(16) = .24$, $p > .80$, ease/difficulty, $t(16) = .77$, $p > .45$, or painlessness/painfulness, $t(16) = -.82$, $p > .42$.

To configure participants into the poses, the experimenter placed an ECG lead on the back of each calf and the underbelly of the left arm and explained, "To test accuracy of physiological responses as a function of sensor placement relative to your heart, you are being put into a certain physical position" and proceeded to manually configure participants' bodies by lightly touching arms and legs and providing additional verbal descriptions when needed. An examples of an additional verbal description is, "keep your feet above heart level by putting them on the desk in front of you." Participants were videotaped; all correctly made and held all poses. After manually configuring participants' bodies into each of the two (1-min) poses, the experimenter left the room and participants formed impressions of 9 faces.

Measure of Risk Taking and Powerful Feelings

After posing, participants were endowed with $2 and told they could keep it – the safe bet, or roll the die and risk losing the $2 for a payout of $4 (a risky but rational bet; odds of winning were 50/50). Finally, participants indicated how "powerful" and "in charge" they felt on a scale from 1 (*not at all*) to 4 (*a lot*).

Saliva Collection and Analysis

Testing was scheduled in the afternoon (12:00-6:00pm) to control for diurnal rhythms in hormones (e.g., Kudielka, et al., 2004). Saliva samples were taken approximately 10 minutes after arrival and again 17 minutes after the power pose manipulation ($M = 17.28$ minutes; $SD = 4.31$).

Standard salivary hormone collection procedures were used (Dickerson & Kemeny, 2004; Schultheiss & Stanton, 2009). Before providing saliva samples, participants didn't eat, drink, or brush teeth for at least one hour. Participants rinsed their mouths with water and chewed a piece of sugar-free Trident Original Flavor gum for 3 minutes to stimulate salivation (this procedure yields the least bias as compared to passive drool procedures; Dabbs, 1991). Participants provided approximately 1.5 mL of saliva through a straw into a sterile polypropylene microtubule. Samples were immediately frozen to avoid hormone degradation and to precipitate mucins, and within two weeks were packed in dry ice and shipped for analysis to Salimetrics in State College, PA where samples were assayed for salivary cortisol and testosterone in duplicate using a highly-sensitive enzyme immunoassay. For cortisol, the intra-assay coefficient of variation (CV) was 5.40% for time 1 and 4.40% for time 2. The average inter-assay CV across high and low controls for both time-points was 2.74%. Cortisol levels were in the normal range at both time 1 (M = .16 µg/dL; SD = .19) and time 2 (M = .12 µg/dL; SD = .08). For testosterone the intra-assay CV was 4.30% for time 1 and 3.80% for time 2. The average inter-assay CV across high and low controls for both time-points was 3.80%. Testosterone levels were in the normal range at both time 1 (M = 60.30 pg/mL; SD = 49.58) and time 2 (M = 57.40 pg/mL; SD = 43.25). As would be suggested by appropriately taken and assayed samples (Schultheiss & Stanton, 2009), men were higher on testosterone at both time 1 ($F[1, 41] = 17.40$, $p < .001$; $r = .55$) and time 2 ($F[1, 41] = 22.55$, $p < .001$; $r = .60$). To control for sex differences in testosterone, participant sex was used as a covariate in all analyses. All hormone analyses examined changes in hormones observed at time 2 controlling for time 1. Analyses with cortisol controlled for testosterone and vice-versa[2].

Results

To examine changes in testosterone and cortisol, one-way ANOVAs examined the impact of power-pose on post-manipulation hormones (time 2) controlling for baseline hormones (time 1). As hypothesized, Figure 3 shows that high-power poses caused an increase in testosterone as compared to low-power poses, which caused a decrease, $F(1, 39) = 4.29$, $p < .05$; $r = .34$. Also as hypothesized, Figure 4 shows that high-power poses caused a decrease in cortisol as compared to low-power poses, which caused an increase, $F(1, 38) = 7.45$, $p < .02$; $r = .43$.

Also consistent with predictions, high-power posers were more likely to focus on rewards -- 86.36% took the gambling risk (only 13.63% were risk averse). In contrast, only 60% of the low-power posers took the risk (and 40% were risk averse), $\chi^2(1, N = 42) = 3.86$, $p < .05$; $\Phi = .30$. Finally, high-power posers reported feeling significantly more "powerful" and "in charge" ($M = 2.57$, $SD = .81$) than the low-power posers ($M = 1.83$; $SD = .81$), $F(1, 41) = 9.53$, $p < .01$; $r = .44$. Thus, a simple 2-minute power pose manipulation was enough to significantly alter the physiological, mental, and feeling states of our participants. The implications of this result for everyday life are substantial.

Discussion

Results show that *posing* in high-power (versus low-power) displays causes physiological, psychological, and behavioral changes consistent with the literature on the effects of power on power-holders – elevation of the dominance hormone testosterone, reduction of the stress hormone cortisol, and increases in behaviorally demonstrated risk-tolerance and feelings of power.

These findings advance our understanding of embodied cognition in two important ways. First, they suggest that the effects of embodiment extend beyond emotion and cognition, to physiology and subsequent behavioral choice. For example, as described above, nodding one's head "yes" leads to more persuasion, and smiling increases humor responses; we suggest that these simple behaviors, a head-nod or a smile, might also cause physiological changes that activate an entire trajectory of psychological, physiological, and behavioral shifts—essentially altering the course of that person's day. Second, these results suggest that any psychological construct, such as power, with a signature pattern of nonverbal correlates may be embodied.

These results also offer a methodological advance in power research. Many reported effects of power are limited by the methodological necessity of manipulating power in a laboratory setting (e.g., complex role assignments). The simple, elegant power pose manipulation can be taken directly into the field and used to investigate ordinary people in everyday contexts.

Is it possible that the findings are limited to the specific poses utilized in this experiment? While the power-infusing attribute of expansiveness and the poses which capture it requires further investigation, findings from an additional study ($N = 49$) suggest that the effects reported here are not idiosyncratic to these specific poses. Consistent with the poses used in the current report, three additional high- and three low-power poses produced the same effects on powerful feelings, $F(1, 48) = 4.38$, $p < .05$, $r = .30$; and risk-taking, χ^2 ($df = 1$, $N = 49$) = 4.84, $p < .03$; $\Phi = .31$.

By simply changing one's physical posture, an individual prepares his or her mental and physiological systems to endure difficult and stressful situations, and perhaps to actually improve confidence and performance in such situations – such as interviewing for jobs, public speaking, disagreeing with a boss, or taking potentially profitable risks. These findings suggest that, in some situations requiring power, people have the ability to 'fake it 'til they make it.' Over time and in aggregate, these minimal postural changes and their outcomes potentially could improve a person's general health and wellbeing, which is particularly important when considering people who are or feel chronically powerless due to lack of resources, hierarchical rank in an organization, or membership in a low-power social group.

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Figure 1: High-power Poses (Expansive)

Figure 2: Low-power Poses (Constrictive)

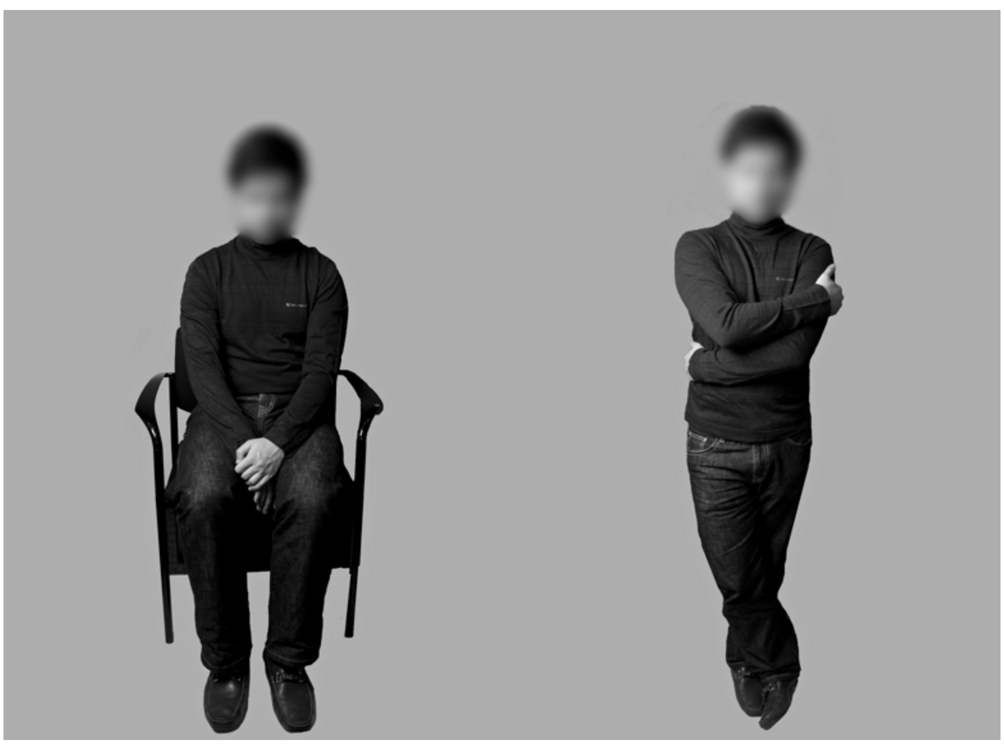


Figure 3: Change in Dominance Hormone Testosterone (depicted as difference scores; statistical analysis examined time 2 controlling for time 1; error bars are *SE*s)

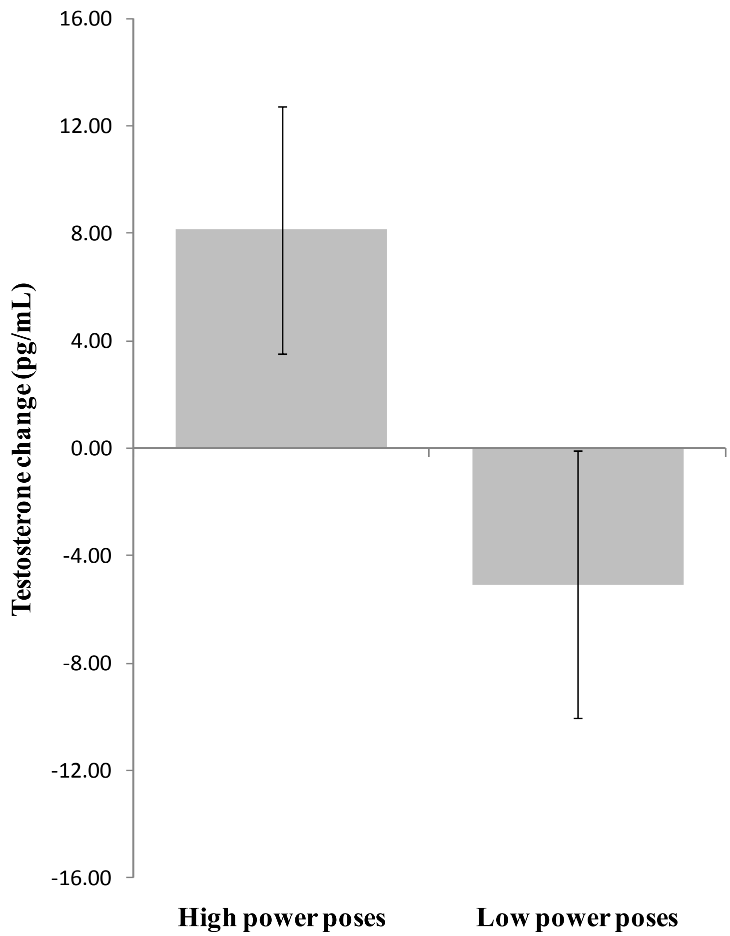
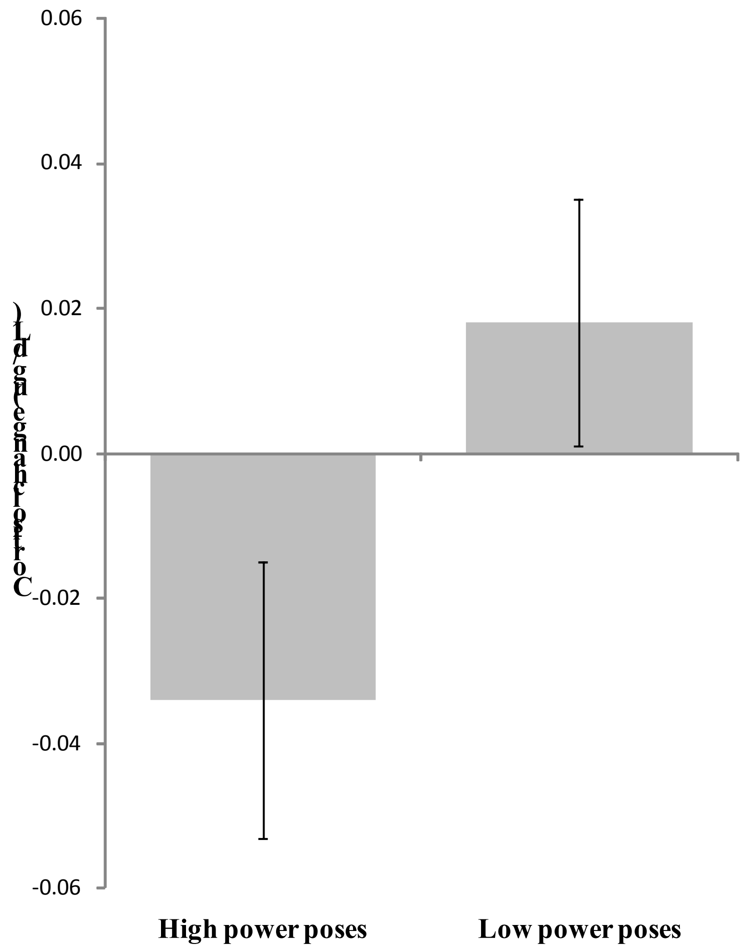


Figure 4: Change in Stress Hormone Cortisol (depicted as difference scores; statistical analysis examined time 2 controlling for time 1; error bars are *SE*s)



Notes

[1] The effect of power on risk-taking is moderated by power motivation (Maner, Gailliot, Butz, & Peruche, 2007) and prenatal exposure to testosterone (Ronay & von Hippel, 2010).

[2] Cortisol scores at both time points were sufficiently normally distributed except for two outliers that were more than 3 *SD*s above the mean and were excluded; testosterone scores at both time points were sufficiently normally distributed except for one outlier that was more than 3 *SD*s above the mean and was excluded.