

# Assessing the Robustness of Power Posing: No Effect on Hormones and Risk Tolerance in a Large Sample of Men and Women



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In a growing body of research, psychologists have studied how physical expression influences psychological processes (see Riskind & Gotay, 1982; Stepper & Strack, 1993, for early contributions to this literature). A recent strand of literature within this field has focused on how physical postures that express power and dominance (*power poses*) influence psychological and physiological processes, as well as decision making (e.g., Carney, Cuddy, & Yap, 2010; Cesario & McDonald, 2013; Yap, Wazlawek, Lucas, Cuddy, & Carney, 2013). Carney et al. found that power posing affected levels of hormones such as testosterone and cortisol, financial risk taking, and self-reported feelings of power in a sample of 42 participants (randomly assigned to hold poses suggesting either high or low power). We conducted a conceptual replication study with a similar methodology as that employed by Carney et al. but using a substantially larger sample ( $N = 200$ ) and a design in which the experimenter was blind to condition. Our statistical power to detect an effect of the magnitude reported by Carney et al. was more than 95% (see the Supplemental Material available online). In addition to the three outcome measures that Carney et al. used, we also studied two more behavioral tasks (risk taking in the loss domain and willingness to compete).

Consistent with the findings of Carney et al., our results showed a significant effect of power posing on self-reported feelings of power. However, we found no significant effect of power posing on hormonal levels or in any of the three behavioral tasks.

## Method

An initial power analysis based on the effect sizes in Carney et al. (power = 0.8,  $\alpha = .05$ ) indicated that a

sample size of 100 participants would be suitable. On the basis of the results of these first 100 observations, we decided to collect data from another 100 participants to further increase the reliability of our results. Of the final sample of 200, 98 were women and 102 men.

Our design closely followed Carney et al.'s (full details of our methodology, including the instructions given to participants in all tasks, can be found in the Supplemental Material). Each session involved a single participant who was randomly assigned to a high-power- or low-power- pose condition. In each condition, participants first provided a saliva sample. They then adopted two body positions, taken from those in Carney et al., while performing a filler task. Next, participants completed a risk task in both the gain domain, as in Carney et al., and the loss domain. In the gain domain, participants had to choose between winning a predetermined amount of money and a gamble that had an equal probability of resulting in a greater win or no win at all. The loss domain worked similarly, except that participants chose between losing a predetermined amount and a gamble that would result in either a greater loss or no loss. Each risk task consisted of six binary choices between the safe and the risky option (Carney et al. used one such choice in the gain domain only). Task order was fixed to keep the results in the risk task in the gain domain comparable with those of Carney et al. Our measure of risk tolerance was the proportion of risky choices made in each domain (using only the single decision directly comparable with the one in Carney et al. did not change our results).

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After the risk task, we measured competitiveness by asking participants to choose whether to solve math exercises under a competitive tournament-style payment scheme or a noncompetitive payment scheme (Niederle & Vesterlund, 2007). Willingness to compete was measured from this binary choice. As in Carney et al., the behavioral tasks were incentivized (see the Supplemental Material). Participants did not receive feedback on the outcomes of the behavioral tasks until they received their payment at the end of the study. After completing the tasks, but before being informed about their payment, participants provided a second saliva sample and filled out a postexperiment questionnaire. The questionnaire measured, among other things, self-reported feelings of power on a 4-point scale, from 1, *not at all powerful*, to 4, *very powerful* (see the Supplemental Material). As in Carney et al., saliva samples were taken before and approximately 17 min after the power-pose manipulation. The samples were collected in privacy, using passive drool procedures, and frozen immediately. Also as in Carney et al., participants were tested in the afternoon (12:00 p.m.–6:00 p.m.) and instructed not to eat, drink, or brush their teeth for the hour preceding the study (see the Supplemental Material).

A few details differed between our design and that of Carney et al. First, whereas participants in Carney et al.'s study held each position for 1 min, we extended this time to 3 min. Second, Carney et al. manually configured participants' positions before leaving the room, whereas participants in our study received instructions on a computer. As in Carney et al.'s study, participants were recorded while posing; the recordings verified that participants complied with task instructions.<sup>1</sup> Because the instructions were given via computer, the experimenter was blind to experimental condition, which negated potential experimenter effects. Third, the filler task in our study involved constructing words from letters and spaces; in Carney et al.'s study, the task was to form impressions of faces. Finally, we did not use deception, but informed participants briefly in the consent form that the study investigated whether physical position influences hormone levels and behavior (the instructions and consent form are in the Supplemental Material). The instructions gave no hints about specific effects, their direction, or variation in treatments. In the Discussion, we consider whether the above differences are likely to provide a substantive basis for the discrepancy between our and Carney et al.'s results. Notably, however, as did Carney et al., we found a significant effect of power posing on self-reported feelings of power—which indicates that outcomes on at least one measure were not influenced by the different procedures.

## Results

Using two-tailed *t* tests, we replicated Carney et al.'s finding that participants in the high-power condition

self-reported, on average, higher feelings of power than did participants in the low-power condition (mean difference = 0.245, 95% confidence interval, or CI = [0.044, 0.446]),  $t(193) = 2.399$ ,  $p = .017$ , Cohen's  $d = 0.344$ .<sup>2</sup> This suggests that the power-posing manipulation worked.

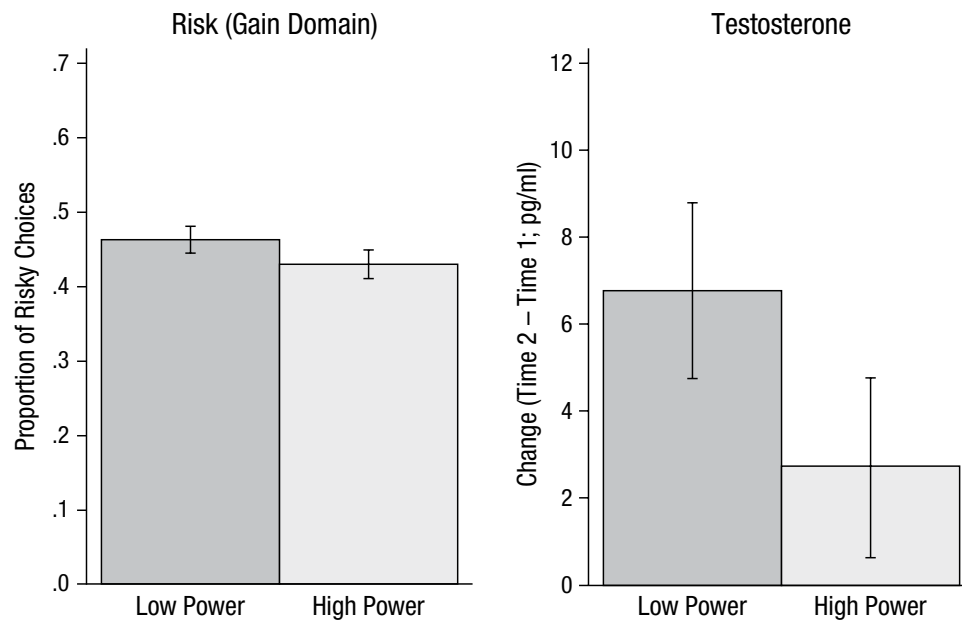
Figure 1 compares mean risk tolerance in the gain domain and mean change in testosterone between the high- and low-power-pose conditions. Two-tailed *t* tests indicated no significant impact of physical position on either risk-taking in the gain domain (mean difference =  $-0.033$ , 95% CI = [ $-0.085$ ,  $0.019$ ]),  $t(198) = -1.245$ ,  $p = .215$ , Cohen's  $d = -0.176$ , or changes in testosterone (mean difference =  $-4.077$ , 95% CI = [ $-9.801$ ,  $1.647$ ]),  $t(196) = -1.405$ ,  $p = .162$ , Cohen's  $d = -0.200$ .<sup>3</sup> We also found no effect for cortisol (mean difference =  $-0.028$ , 95% CI = [ $-0.078$ ,  $0.022$ ]),  $t(196) = -1.101$ ,  $p = .272$ , Cohen's  $d = -0.157$ . Complementary nonparametric and regression analyses yielded similar results for the whole sample, and for women and men separately (see the Supplemental Material). Neither of the other two behavioral tasks yielded significant differences by condition.

## Discussion

Replication is an important tool for identifying the robustness of results, particularly when small sample sizes increase the likelihood of false positives (Ioannidis, 2005; Simmons, Nelson, & Simonsohn, 2011). Using a much larger sample size but similar procedures as Carney et al. did, we failed to confirm an effect of power posing on testosterone, cortisol, and financial risk taking. We did find that power posing affected self-reported feelings of power; however, this did not yield behavioral effects.

It is possible that subtle differences between the experimental protocols in Carney et al. and those in our study, originally designed as an extension of Carney et al., led to the omission of factors crucial for power poses to influence hormonal levels and behavior. Indeed, a reviewer suggested a few possibilities worth considering. First, prolonged posing time in our study may have caused participants to become uncomfortable, which could have counteracted the effect of power posing. To test this interpretation, we reanalyzed our data using first only those participants who reported the postures to be at least "somewhat comfortable" and then only those who reported the postures to be at least "quite comfortable." This did not substantively change our results (see the Supplemental Material). Moreover, at least one previous study found power-posing effects using similar positions and time intervals as those in our study (Cuddy, Wilmoth, & Carney, 2012; see also Fischer, Fischer, Englich, Aydin, & Frey, 2011; Schubert & Koole, 2009).

Second, certain conditions may need to be present during the power-manipulation phase in order for effects to arise. For example, the reviewer suggested that a social



**Fig. 1.** Mean proportion of risky choices in the gain domain (left) and mean change in testosterone from before the power-pose manipulation (Time 1) to 17 min after the power-pose manipulation (Time 2; right). For each graph, results are shown separately for the high- and low-power-pose conditions. Error bars represent standard errors of the mean.

filler task may facilitate power-posing effects, as suggested by Cesario and McDonald's (2013) Study 1. However, other studies have found effects using tasks without social components (e.g., Fischer et al., 2011, Studies 1 and 3; Yap et al., 2013, Studies 2 and 3). A third possibility involves what subjects were told about the purpose of the study. Most studies that have found effects have employed statements that explicitly obscured the study's purpose with a cover story (Carney et al.; Huang, Galinsky, Gruenfeld, & Guillory, 2011). However, power-posing effects have also been reported in at least one case in which subjects were told that the study was about physical motion and performance (Cuddy et al., 2012), which is similar to the degree of information subjects received in our design.

Hence, while it is certainly plausible that power-posing effects generally arise only under some specific conditions—and our study failed to include one or two of these—it is far from clear from the literature what these conditions are. We conclude that more research is needed to identify the precise conditions necessary for such effects.

### Author Contributions

The study was designed by A. Dreber, M. Johannesson, S. Leiberg, E. Ranehill, S. Sul, and R. A. Weber. S. Leiberg and E. Ranehill conducted the study, and E. Ranehill analyzed the data. A. Dreber, M. Johannesson, E. Ranehill, and R. A. Weber wrote the manuscript.

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### Declaration of Conflicting Interests

The authors declared that they had no conflicts of interest with respect to their authorship or the publication of this article.

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### Supplemental Material

Additional supporting information can be found at <http://pss.sagepub.com/content/by/supplemental-data>

### Open Practices



All data and materials have been made publicly available via Open Science Framework and can be accessed at <https://osf.io/6akvt/files/>. The complete Open Practices Disclosure for

this article can be found at <http://pss.sagepub.com/content/by/supplemental-data>. This article has received badges for Open Data and Open Materials. More information about the Open Practices badges can be found at <https://osf.io/tyyxz/wiki/view/> and <http://pss.sagepub.com/content/25/1/3.full>.

## Notes

1. One participant did not fully comply with the posing instructions. Excluding this participant yielded similar results.
2. We did not have information on feelings of power for 5 participants. Three of these cases were the result of questionnaires not being saved correctly after laboratory maintenance.
3. Hormonal levels were not detectable in one saliva sample. An additional sample was lost during the storage and transportation process.

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