# Review and Summary of Research on the Embodied Effects of Expansive (vs. Contractive) Nonverbal Displays

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Abstract

In this review we list the 33 published experiments based on 2,521 participants demonstrating the embodied effects of expansive versus contractive nonverbal postures. We discuss a new addition to this list that found an embodied effect of nonverbal expansiveness on self-reported feelings of power but no effect on risk-taking, cortisol, or testosterone. Taken together, the body of work demonstrates support for the embodied effects of expansive nonverbal postures. However, multiple experiments have found that the postural effects appear to be bounded by social context, culture, and participants' awareness of the hypothesis. Fruitful avenues for future research are suggested.

Carney, Cuddy, and Yap (2010) published a paper with two experiments. Both experiments demonstrated that expansive (vs. contractive) nonverbal displays produced subjective feelings of power and increased risk tolerance and one experiment demonstrated increased testosterone and decreased cortisol. This paper demonstrated the eighth and ninth experiments on the embodied effects of nonverbal expansiveness—7 experiments on this topic were published prior to 2010. Since 2010, 24 additional experiments on the effects of expansive postures have been published (see Figure 1). Embodiment and the discussion of mind-body connection finds its experimental roots in William James's theories of emotion and ideomotor action. Since 1890, many studies have demonstrated the bi-directional link between nonverbal behavior and human thought and feeling (see Laird & Lacasse, 2014). Ranehill, Dreber, Johannesson, Leiberg, Sul, and Weber (2014) reported a conceptual replication of Carney et al finding an effect of expansive posture on subjective feelings of power, and no effect on risk tolerance, cortisol, or testosterone.

We offer four comments that we hope elucidate similarities and differences among the 33 published experiments (harvested from the literature through extensive keyword searches and continued cross-referencing of articles once found) and the newly published Ranhill et al. We also highlight the specific differences between Carney et al (2010) and Ranehill et al (2014). Unpublished findings were excluded. Ranehill et al (2014) paper, with the review presented here, serves as an excellent springboard for identifying several potential moderators of the psychological effects of nonverbally expansive posture.

**Comment #1: 33 Published Results on Expansive Posture**

In Carney et al. (2010) we report the effect of nonverbal expansiveness (vs. contractiveness) on increased subjective feelings of power, risk taking, testosterone, and

decreased cortisol. Using a conceptually similar paradigm to Carney et al. (see differences in Figure 2), Ranehill et al. (2014) reported no effect of nonverbal expansiveness on risk taking, testosterone, or cortisol—only an increase in subjective feelings of power. Prompted by Ranehill et al.'s contribution, we listed in Figure 1 all published tests (to our knowledge) of expansive (vs. contractive) posture on psychological outcomes. Ranehill et al joins a body of research that includes 33 independent experiments published with a total of 2,521 research participants (Figure 1). Together, these results may help determine when nonverbal expansiveness will and will not cause embodied psychological changes. Each experiment is listed with article information, independent and dependent variables, findings, and implications.

***Insert Figure 1***

**Comment #2: Differences Between Ranehill and Carney Papers**

Figure 2 lists the methodological differences between Ranehill et al (2014) and Carney et al (2010). A summary of the literature reported in Figure 1 suggests that all significant results employed paradigms with complex, detailed cover stories in which participants were *unaware of the hypothesis of the experiment*. And many, but not all, significant results employed paradigms situated in a social context, suggesting social context as a moderator. By "social context" we mean there was either a social interaction with another person/experimenter during the posture manipulation or participants were engaging in a real or imagined social task. Cesario and McDonald (2013) found direct evidence that social context (present vs. absent) moderates the effect of expansive posture such that effects were found only when the participant was in a social context. Figures 1 and 2 taken together suggest that the three differences between Ranehill et al. and Carney et al. that may account for the varied results are: (a) Carney's two experiments were careful to conceal experimental purpose with a detailed cover story; Ranehill's experiment told

participants the hypothesis—to investigate posture on hormones. (b) Carney's two experiments involved a social task during the postural manipulation; Ranehill's experiment did not. (c) Carney's experiments used postural manipulations that were comfortable, easy, and short in duration; Ranehill's experiment employed postures that were three times as long as those used in the original experiments.

***Insert Figure 2***

**Comment #3: Contributions of Ranehill et al.**

Some of the variables listed in Figures 1 and 2 suggest future directions. One key moderator may be awareness of the hypothesis of the experiment; virtually all of the published reports demonstrating significant effects of expansive posture used elaborate cover stories to distract participants from the goal of the experiment. As is common in economics research, Ranehill et al did not use any deception in the experiment and participants were told the study examined how physical position affects hormone levels and behavior. This seems like an interesting and useful avenue for future research.

Another avenue for future research is length of time in expanded posture. Time in posture was rarely reported and is not listed in Figure 1. In extensive pilot testing, Carney et al (2010) settled on 1 min for each of 2 postures because longer expressions of the feet-on-the-desk pose were uncomfortable and difficult if held longer than 1 minute. Ranehill et al (2014) tripled the amount of time in all postures—including the uncomfortable ones. Although it may make intuitive sense that longer time in the posture would increase effects, some postures for too long are uncomfortable. Length of time in posture should be directly tested.

Finally, experimenter blindness was impossible to determine from most experiments and was not listed in Figure 1. Ranehill et al used experimenters blind to the hypothesis. This is a

critical variable to explore given the impact of experimenter bias and the pervasiveness of expectancy effects.

**Comment #4: Looking Forward**

Although we hope that Figures 1 and 2 will assist in moving forward the study of nonverbal expansiveness, at present, direct replications are needed of Carney et al (2010) and many of the other reports in Figure 1. Note that in other disciplines, such as human physiology, similar results to Carney et al have shown that holding an expansive yoga-style pose for 2-3 minutes significantly increases blood serum levels of testosterone and decreases blood serum levels of cortisol (Minvaleev, Nozdrachev, Kir'yanova, & Ivanov, 2004). For the purposes of a direct replication of Carney et al., all materials can be obtained from the first author or downloaded from her website.

Figure 1

| # | *Published Article* | *Expt.* | *Sample Size* | *IVs and DVs* | *Cover Story* | *Findings & Paradigm-Informing Implications* |
|---|---|---|---|---|---|---|
| 1 | Allen et al (2013) | Main Expt. | *N* = 97 *female* | Configured posture; DV eating less (context social) | Marketing & physiology | Expansive-posture+body concern→eat more; paradigm→cover story, social context |
| 2 | Arnette & Pettijohn (2012) | Main Expt. | *N* = 42 | Viewed and mimicked photos of postures; DV choice of leader seating (context non-social) | No instruction given | Expansive-posture→selected leader seating; paradigm→no instruction given, non-social context |
| 3 | Bohns & Wiltermuth (2012) | Expt. 1 | *N* = 89 | Configured posture; DV pain (context non-social) | Yoga stretch | Expansive-posture→ increased pain tolerance (measured w/tourniquet); paradigm: cover story, non-social context |
| 4 | Bohns & Wiltermuth (2012) | Expt. 2 | *N* = 30 | Naturally occurring posture in Tiedens & Fragale (2003) complementarity paradigm (context social); DV pain | Social interaction | Expansive-posture→increased pain tolerance; paradigm→cover story, social context |
| 5 | Brinol et al (2009) | Main Expt. | *N* = 71 | Configured posture x thought direction (pos vs. neg); DV positive attitude toward self | Acting and body muscles | Expansive-posture→increased thought confidence; Expansive-posture+positive-thoughts→pos attitude toward self; paradigm→cover story, semi-social context |
| 6 | Carney et al (2010) | Pilot expt. p. 1367 | *N* = 49 | Viewed and mimicked photos of postures; DV risk, power-feelings (context social) | Bodies and impressions | Expansive-posture→increased power-feelings and risk tolerance; paradigm→cover story, social context |
| 7 | Carney et al (2010) | Main Expt. | N = 42 | Configured posture; DVs power-feelings, endocrine responses, and risk tolerance (context social) | Physiological measurements; above and below heart level | Expansive-posture→increased power-feelings, risk tolerance, and testosterone; decreased cortisol; paradigm→cover story, social context |
| 8 | Cesario & McDonald (2013) | Expt. 1 | *N* = 216 | Configured posture x social context (social vs. non-social); DV risk taking | Physical body and memory | Expansive-posture→increased risk taking only when context was social; paradigm→cover story, social context manipulated as moderator |
| 9 | Cesario & McDonald (2013) | Expt. 2 | *N* = 167 | Configured posture x imagined social context (dominant vs. submissive); DV risk taking (context social) | Physical body and memory | Expansive-posture→no effect risk taking; imagined role (dom vs. sub)→increased risk taking; paradigm→cover story, social context, imagined power trumped effect of posture |
| 10 | Cuddy et al (*in press*) | Main Expt. | *N* = 66 | Experimenter explained and configured posture; TSST job interview, DVs power-feelings, job interview performance, nonverbal | Physical motion and performance | Expansive-posture→marginally increased power-feelings, increased performance & nonverbal presence; paradigm→cover story, social context |

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| | | | | presence | | |
| 11 | Fischer et al (2011) | Expt. 2 | *N* = 36 | Configured posture with chairs; DV power-feelings, confirmatory processing (semi-social) | No instruction given | Expansive –posture→increased power-feelings, confirmatory processing; paradigm→no instructions, semi-social |
| 12 | Huang et al (2011) | Expt. 1 | *N* = 77 | Configured posture x assigned power role (high vs. low); DV word-fragments completed with power words, power-feelings (context social) | Marketing test for ergonomic chairs | Expansive-posture→increased cognitive accessibility of power-related words, power-feelings; role assignment→increased powerful feelings; paradigm→cover story, social context |
| 13 | Huang et al (2011) | Expt. 2 | *N* = 77 | Configured posture x assigned power role (high vs. low); DV action orientation, abstract thinking, power-feelings (context social) | Marketing test for ergonomic chairs | Expansive-posture and role→increased action orientation, abstract thinking; paradigm→cover story, social context |
| 14 | Huang et al (2011) | Expt. 3 | *N* = 57 | Configured posture x assigned power role (high vs. low); DV action orientation (context social) | Marketing test for ergonomic chairs | Expansive-posture and role→increased action orientation; paradigm→cover story, social context |
| 15 | Lee & Schnall (2014) | Expt. 2 | *N* = 41 | Configured posture with chairs; DV weight estimation of boxes (context semi-social) | Ergonomics of work environs | Expansive-posture→decreased estimation of box-weight; paradigm→cover story, social context |
| 16 | Michalak et al (2014) | Main expt. | *N* = 30 *psychiatric inpatients* | Configured posture w/ chairs & instructions; DV memory bias (semi-social) | Effects of relaxation positions on stress | Expansive-posture→equal recall or pos-n-neg words; contractive-posture→increased recall neg words; paradigm→no instruct; semi-social |
| 17 | Nair et al (2014) | Main expt. | *N* = 74 | Configured posture; DV self-esteem, arousal, mood, fear, use of negative words, use of pronouns (context semi-social) during speech task | Physiological measurements | Expansive-posture→higher self-esteem; more arousal; better mood; less fear; fewer negative words; paradigm→cover story; semi-social |
| 18 | Park et al (2013) | Expt. 2a | *N* = 213 | Configured posture of US and Asian-born participants; DV power-feelings (context social) | Body postures being pre-tested for a pilot | Expansive-posture (expansive-hands-spread-on-desk pose)→ increased power-feelings for both US and Asian participants; paradigm→cover story, social task |
| 19 | Park et al (2013) | Expt. 2b | *N* = 119 | Configured posture of US and Asian-born participants; DV power-feelings (context social) | Testing for ergonomic quality of chairs | Expansive-posture (expansive-upright-sitting-pose)→increased power-feelings for both US and Asian participants ;; paradigm→cover story, social task |
| 20 | Park et al (2013) | Expt. 3 | *N* = 106 | Configured posture of US and Asian-born participants; DV priming of power words, power-feelings (context social) | Testing for ergonomic quality of chairs | Expansive-posture (feet-on- desk pose)→increased cognitive accessibility of power-related words, power-feelings only for US participants ; paradigm→cover story, social task |
| 21 | Park et al (2013) | Expt. 4 | *N* = 83 | Configured posture of US and Asian-born participants; DV action-orientation (context social) | Testing for ergonomic quality of chairs | Expansive-posture (expansive-feet-on-desk pose)→increased action-orientation only for US participants; paradigm→cover story, social task |
| 22 | Riskind (1984) | Expt. 1 | *N* = 76 | Configured posture x false feedback; DV locus of control (context non-social) | Bio-feedback | Expansive-posture→helped buffer the negative impact of negative feedback on locus of control; paradigm→cover story, non-social context |
| 23 | Riskind (1984) | Expt. 2 | *N* = 51 | Configured posture x false feedback; DV depression, puzzle-solving persistence (context non-social) | Bio-feedback | Both expansive-posture and pos-feedback→decreased depression; increased persistence; paradigm→cover story, non-social context |
| 24 | Riskind (1984) | Expt. 3 | *N* = 20 | Configured posture; all in negative feedback; DV depression, locus of control (context non-social) | Bio-feedback | Expansive-posture+negative feedback→more depression, higher locus of control; paradigm→cover story, non-social context |
| 25 | Riskind & Gotay (1982) | Expt. 1 | *N* = 20 | Configured posture x false feedback; DV persistence at solving puzzles (context semi-social) | Physiological measurements | Expansive-posture→increased persistence; paradigm→cover story, semi-social |
| 26 | Riskind & Gotay (1982) | Expt. 2 | *N* = 20 | Configured posture x false feedback; DV persistence at solving puzzles (context semi-social) | Physiological measurements | Expansive-posture→increased persistence; paradigm→cover story, semi-social |
| 27 | Strelan et al (2013) | Expt. 3 | *N* = 85 | Configured posture x chronic power feelings; DV retaliation to multiple transgressions (context social) | Ostensibly unrelated experiment with bodies and a box | Expansive-posture→ chronically powerless more vengeful than chronically powerful; paradigm→cover story, social context |
| 28 | Stepper & Strack (1993) | Expt. 1 | *N* = 99 | Configured posture x onset of success feedback; DV feelings of pride (context non-social) | Ergonomic working positions & task performance | Expansive-posture+success feedback→pride feelings; paradigm→cover story, non-social context |
| 29 | Welker et al (2013) | Expt. 1 | *N* = 91 | Configured by experimenter & shown line drawings; posture X social exclusion (in/ex); DV threats to basic needs & mood | No cover story; posture mentioned | Expansive-posture and inclusion→decreased threat (posture effect marginal) & increased mood; paradigm→no cover story, social context |
| 30 | Welker et al (2013) | Expt. 2 | *N* = 84 | Configured by experimenter & shown line drawings; posture X social exclusion (in/ex); DV threats to basic needs | No cover story; posture mentioned | No main effect of expansive-posture→decreased threat or mood; posture x exclusion interaction: expansive+excluded →decreased threat and increased mood; paradigm→no cover story, social context |
| 31 | Yap et al (2013) | Expt. 1 | *N* = 88 | Configured posture; DV stealing (context social) | Stretching & impressions | Expansive-posture→increased cheating; paradigm→cover story, social task |

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| 32 | Yap et al (2013) | Expt. 2 | *N* = 34 | Incidentally-caused posture; DV cheating (context social) | Feng Shui & creativity | Expansive-posture→increased cheating; paradigm→cover story, social task |
| 33 | Yap et al (2013) | Expt. 3 | *N* = 71 | Incidentally-caused posture; DV traffic violations (context semi-social) | Physiology & video games | Expansive-posture→increased traffic violations; paradigm→cover story, semi-social task |
| | ***Note: All results reported were significant unless specified otherwise; comparisons between nonverbal expansiveness versus contractiveness (or control). Reports demonstrating causal effects of other power and pride related nonverbal behaviors were excluded (e.g., making fists, pride-postures, arm-crossing, head-tilt up, angry-face, lowered-voice, etc.). Also excluded were the hundreds of published experiments on effects of expanded body posture as an expression of power or dominance and on non-embodied effects such as perceptions, attributions, social interaction.*** | | | | | |

Figure 2

| ***Study Characteristics*** | ***Ranehill et al (2014)*** | ***Carney et al (2010)*** | ***Implication*** |
|---|---|---|---|
| ***Timing of Collection*** | Expt. conducted recently | Expt. Conducted in 2008-2009 | Paper topic in media and courses—exposure to content medium risk |
| ***Participant population*** | Students from University of Zurich and the Swiss Federal Institute of Technology in Zurich | Students from Columbia University | Generalizability to other cultures |
| ***Sample Size*** | 200 | 42 | Stability of effect; statistical power |
| ***Gender ratio (F:M)*** | 98:102 | 26:16 | Gender could moderate |
| ***Cover story*** | No deception (Participants were told that the study examined how physical position affect hormone levels and behavior) | Employed an elaborate cover story about physiological signals above and below hear-level | Results from past experiments favor either a use of a cover story and not telling explicitly presenting the hypothesis of the study to participants before the experiment begins. This is a possible moderator of the effect and could suggest that for these effects to emerge, one must not be immediately aware of the hypotheses. |
| ***Instruction method*** | Received computerized instructions (specific instructions not clear) | Experimenter manually configured participants' poses | Viewing pictures in some experiments produces no effect; this variable could be a moderator |
| ***Time in poses*** | Six minutes | Two minutes | Time in postures varies across experiments—this variable should be directly tested |
| ***Filler task during pose*** | Construct words from letters and spaces | Social filler task: View and form impressions of nine faces | Sociality of task has been shown to be a moderator; cognitive taxation likely produced by constructing words from letters may be a moderator variable |
| ***Risk measure*** | Computer mediated coin flips. Participants made six binary choices between a safe and a risky option in a gain frame and six more choices in a loss frame. | Participants were endowed with $2 and told they could keep the money—the safe bet—or roll a die and risk losing the $2 for a payoff of $4 (a risky but rational bet; odds of winning were 50/50). Participants roll an actual die and see the money they could win | Different experiments have used different risk tasks – this may be a moderator |
| ***Self-report moderators*** | Included competitiveness measure | Not included | Different experiments have used different self-report measures—many possible moderators |
| ***Computation method of hormone change score*** | Difference score (Time 2 minus Time 1) | Regression controlling for Time 1 | This is an analytical difference that can change results |
| ***Saliva collection at Time 1*** | Immediately upon arrival | 10 min after arrival | This is a methodological issue that impact integrity of hormone results |

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