Electronic Supplementary Material

for

“Pride, Personality, and the Evolutionary Foundations of Human Social Status”

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Dominance and Prestige Scale Construction

Data from Studies 1 and 2 were used to develop and validate new scales for assessing dominance and prestige using both self- and peer-reports. Our strategy was to include a broad item pool and subsequently refine the scales, based on reliability and factor analyses across Studies 1 and 2, with particular attention paid to replication across samples and methods (i.e., self- and peer-reports). Thus, as a first step, Study 1 aimed to identify a set of descriptors that are conceptually relevant to each trait, cohere empirically, and show a clean factor structure with high loadings on the primary factor and low loadings on the secondary factor.

We began with the 16 items from the Self-Perceived Social Status Scale (Buttermore, 2006), which was developed as a self-report measure of dominance and prestige. To ensure coverage of the full scope of each theoretical construct, we supplemented these scales with six new items, resulting in an initial item pool of 10 dominance and 12 prestige items (see Table 1, Supplementary Materials).

In Study 1, all 22 items were administered and participants were asked to "indicate the extent to which each statement accurately describes *you*" using a scale ranging from 1 (*Not at all*), to 7 (*Very much*), with 4 anchored as *Somewhat*. We conducted principal axis factor analyses, with oblimin rotation, to verify the presumed two-factor structure of the 22 dominance and prestige items and to determine which items to retain. As predicted, a scree test suggested two factors; eigenvalues for the first six factors were 4.86, 4.23, 1.54, 1.43, .97, and .90. Together, these two components accounted for 41.29% of the total variance (22.07 % for Factor 1, and 19.22% for Factor 2). As shown in Table 1, the 10 presumed dominance items loaded highly and positively on the first factor, and had low loadings on the second factor, whereas the 12 presumed prestige items loaded highly and positively on the second factor, and had low

loadings on the first factor. The factors were correlated .02, indicating that dominance and prestige are independent.

We next identified potentially problematic items (i.e., items that did not cleanly load on only one of the two factors) as those with primary factor loadings below .50 and/or cross loadings greater than .30. Seven items met this criterion, but, because all 7 loaded more highly on their predicted factor, and because reliability analyses suggested good internal consistency for the full scales (αs= .84 and .82 for dominance and prestige, respectively), we retained all 22 items at this stage.

To examine whether the factor structure of dominance and prestige that emerged in Study 1 replicated across peer-ratings, and across samples, in Study 2 we additionally collected self-ratings from all team members. Using the self-ratings, the two-factor structure that emerged in Study 1 was generally replicated. Eigenvalues for the first six factors were 5.40, 3.58, 1.88, 1.52, 1.08, and 1.06, and the first two components accounted for 40.81% of the total variance (23.08% for Factor 1 and 21.54% for Factor 2) and correlated .04, confirming their independence. In contrast to Study 1, the prestige factor emerged as the first factor and dominance as the second factor, suggesting either that both forms of status are equally important components, or that prestige is more important or salient in the context of athletic teams, and dominance is more important or salient in generalized personality. With the exception of a single item (*I have flashes of unpredictable or erratic anger*), which was designed to assess dominance but loaded slightly higher, and *negatively* on prestige (-.45 vs. .44), all items loaded more strongly and positively on their presumed primary factors than their presumed secondary factors.

To provide a quantitative index of the level of correspondence between the factor structures that emerged in Studies 1 and 2, we computed correlations between the two profiles of

factor loadings. These correlations, computed across the 22 items rather than across participants, indicate the extent to which items with a high (vs. low) loading on the dominance or prestige factor in Study 1 also had a high (vs. low) loading on the dominance or prestige factor in Study 2. The two dominance factors correlated .89, and the two prestige factors correlated .94, suggesting a high level of consistency in the factor structure across the two studies.

We then conducted principal axis factor analyses using oblimin rotation on the 22 peer-rated items (This factor analysis was conducted on all available responses: 438 sets of peer-ratings across 91 targets). Based on the scree test, a two factor structure again emerged. Eigenvalues for the first six factors were 6.01, 5.86, 1.40, .97, .84, and .78. The first two components accounted for 53.96% of the total variance (27.31% and 26.65% for Factors 1 and 2, respectively) and correlated -.01. Once again, all items loaded more strongly and positively on their presumed primary factors, and dominance emerged as the first factor and prestige as the second factor.

To index the level of correspondence between the factor structures of the self- and peer-reported items, we computed correlations between the profiles of factor loadings. Again, these correlations were computed across the 22 items, rather than across participants. Peer- and self-rated dominance profiles, within Study 2, correlated .40 ($p = .06$), and peer- and self-rated prestige profiles, within Study 2, correlated .51 ($p < .05$). Across studies (i.e., peer ratings from Study 2 and self-ratings from Study 1), peer- and self-rated dominance profiles correlated .65 ($p < .01$), and peer- and self-rated prestige profiles correlated .60 ($p < .01$). Thus, a similar structure emerged across self- and peer-ratings, and across studies.

To determine which items to retain for the final dominance and prestige scales, we evaluated each item based on results of all three factor analyses (Study 1 self-ratings and Study 2

self- and peer-ratings). We first excluded all items with primary factor loadings below .50 and/or cross-loadings above .30 in at least two of the three sets of ratings. This led to the exclusion of 5 items from the initial 22, and four remaining items that were sub-optimal in one of the three sets (see Table 1, Supplementary Materials). We opted to retain these four items because although they fell short of the established criteria in one set of ratings (two were suboptimal in Study 1, one in Study 2 self-ratings, and one in Study 2 peer-ratings), they had good properties in the other two sets, and their inclusion increased the overall scale alphas. We also conducted a confirmatory factor analysis (CFA) on the final 17 items using EQS 6.1 (Bentler, 2003). Using pooled self-ratings from Studies 1 and 2, we compared the two-factor solution with a forced one-factor solution. The one-factor model had a poor fit, X^2 (119, N = 282) = 800.31, p < .0001, CFI = .47, GFI index = .64, RMSEA = .15 (.90 CI [.14, .16]), and the two-factor model, with the factors constrained to be independent, significantly improved the fit, X^2_{change}(1, N = 282) = 505.17, p < . 0001. Allowing the two factors to correlate did not significantly improve fit, X^2_{change}(1, N = 282) = 5.19, *ns.* Although the two-factor model fit parameters were still below optimal levels, X^2 (119, N = 282) = 295.14, p < .0001, CFI = .86, Joreskog-Sorbom's GFI fit index = .88, RMSEA = .07 (.90 CI [.06, .09]), the fit improved with the removal of 3 additional items that had high cross-loadings on their secondary factor, X^2 (76, N = 282) = 169.99, p < .05, CFI = .92, GFI = .91, RMSEA = .06 (.90 CI [.05, .08]). We nonetheless opted to retain these items because they capture unique components of each construct not assessed by other items on the scale, and while their negative loadings on the secondary factor made the two-factor structure less clean as assessed by CFA, this is also what makes these items keenly represent the distinction between dominance and prestige.

The final scales thus included 8 dominance items with good internal consistency (αs = .83 in Study 1, .77 for self-ratings in Study 2, and .88 for peer-ratings in Study 2) and inter-rater reliability (alpha = .78, Study 2); and 9 prestige items with good internal consistency (αs = .80 in Study 1, .84 for self-ratings in Study 2, and .85 for peer-ratings in Study 2) and inter-rater reliability (alpha = .84, Study 2). These final scales excluded two of the original Buttermore items and added three new items.

Table 1. Initial 22-Item Pool Used to Assess Dominance and Prestige, and Factor Loadings from Study 1 (Self-Rated) and Study 2 (Peer-Rated)

	Items	Study 1 Factor 1	Study 1 Factor 2	Study 2 Factor 1	Study 2 Factor 2
	Dominance				
	I (he/she) enjoy(s) having control over others (other members of the group).	.768		.838	
	I (he/she) often try(ies) to get my (his/her) own way regardless of what others (in the group) may want.	.687		.792	
	I (he/she) am (is) willing to use aggressive tactics to get my (his/her) way.	. 731		.782	
	I (he/she) try(ies) to control others rather than permit them to control me (him/her).	.772		.806	
R	I (he/she) do(es) not have a forceful or dominant personality.	.563		.513	
	Others (Other members of the group) know it is better to let me (him/her) have my (his/her) way.	.596		.775	
R	I (he/she) do(es) not enjoy having authority over other people (members of the group).	.583		.780	.105
	*Some people (members of your group) are afraid of me (him/her).	.603	-.227	.666	-.128
	†I (he/she) have (has) flashes of unpredictable or erratic anger.	.448	-.392	.726	-.165
R	†I (he/she) dislike(s) giving orders.	.472	.238	.479	.183

	Items	Study 1 Factor 1	Study 1 Factor 2	Study 2 Factor 1	Study 2 Factor 2
	Prestige				
	Members of my (your) group respect and admire me (him/her).	.112	.702		.791
R	Members of my (your) group do not want to be like me (him/her).	-.136	.609	-.280	.645
	†I (he/she) have (has) gained distinction and social prestige among others in the group.	.334	.596	.244	.807
	*Others (Other members of your group) always expect me (him/her) to be successful.	.177	.382	.150	.715
R	*Others (Other members of your group) do not value my (his/her) opinion.		.443	-.132	.748
	I (he/she) am (is) held in high esteem by those I know (members of the group).	.228	.658	.116	.838
	My (his/her) unique talents and abilities are recognized by others (in the group).	.201	.679	.128	.747
	*I (he/she) am (is) considered an expert on some matters by others (other members of the group).	.149	.681	.302	.680
	†I (he/she) like(s) to help others.	-.340	.455	-.266	.464
	Others (Other members of your group) seek my (his/her) advice on a variety of matters.		.700	.108	.704
R	Others (Other members of your group) do not enjoy hanging out with me (him/her).	-.266	.552	-.289	.570
R	†Others (Other members of your group) do not like to do favors for me (him/her) or help me (him/her).	-.416	.464	-.519	.498

Note. *N*s = 191 (Study 1) and 438 (Study 2). Self-report versions of all items are presented; modifications for peer-report assessment are presented in parentheses. An "R" denotes reverse scored items. Loadings < .10 are not presented. Items with sub-optimal properties in only one of the three sets of factor analyses (in both Studies 1 and 2), which were retained in final scale, are indicated by *. Items eliminated from the final scale due to sub-optimal properties in two of the three sets of analyses are indicated by †.

The final scales and scoring key are available online: http://ubc-emotionlab.ca/research/#dompres.

Interpretation of the Hierarchical Linear Model (Study 2)

Peer-ratings were modeled as random effects that may vary across both perceivers and targets. Variance in the dependent variable was partitioned into within-person and between-person components, allowing predictor terms to be represented at the level of the specific dyad (Level 1) and at the level of the person (Level 2). For clarity of presentation, however, we present a single equation that specifies the multiple sources of variation from both Levels 1 and 2. Separate models were estimated for dominance and prestige. We specified the following model to estimate the effect of hubristic pride on dominance:

(1) $Y_{ij} = \beta_{00} + \beta_{01}Authentic\ Pride_j + \beta_{02}Hubristic\ Pride_j + \beta_{03}T_1 + \beta_{04}T_2 + \beta_{05}T_3 + \alpha_i + \rho_j + \varepsilon_{ij}$

Y_{ij} is perceiver *i*'s rating of target *j* on dominance. Random effects are modeled with terms α_i, and ρ_j—representing person *i*'s target effect, and person *j*'s perceiver effect—and their variances are estimated as parameters of the model. T_1, T_2, and T_3 are dummy codes for the volleyball team, soccer team, and rugby team, respectively, with baseball team as the reference group. The tests of the coefficients for the team dummy codes (β_{03}, β_{04}, and β_{05}) represent tests of each sports team's difference in mean dominance level when compared to the baseball team. Dummy codes correct for differences in the mean dominance of the teams when examining the effect of pride on dominance ratings (i.e., the regression of dominance on hubristic and authentic pride with team membership controlled). The hypothesis of interest was examined by testing β_{02}, which is the effect of hubristic pride on peer-rated dominance, and comparing it to β_{01}, the effect of authentic pride on dominance.

For estimating the effect of authentic pride on prestige, the following model was specified:

(2) $Y_{ij} = \beta_{00} + \beta_{01}Authentic\ Pride_j + \beta_{02}Hubristic\ Pride_j + \beta_{03}T_1 + \beta_{04}T_2 + \beta_{05}T_3 + \alpha_i + \rho_j + \varepsilon_{ij}$

This model is identical to the model predicting peer-rated dominance, except that Y_{ij} is Perceiver *i*'s rating of Target *j* on prestige. Consequently, the terms α_i, and ρ_j—representing person *i*'s target effect, and person *j*'s perceiver effect—are random variables and their variances are estimated as parameters of the model. In this model, the key test of our hypothesis is β_{01}, which is the effect of authentic pride on peer-rated prestige, and examining how it compares to β_{02}, the effect of hubristic pride on prestige. As in the previous model, dummy codes correct for differences in the mean prestige of the teams.

In both models, all team dummy variables were non-significant, suggesting that teams did not differ in mean levels of dominance or prestige. However, data from a football team (n=51) were excluded from analyses because football players could not reach consensus on their teammates' levels of dominance (relative target variance=0%, in contrast to M=49% in the other teams examined). Results for the football team are available by request from the first author.

Previous Studies Validating the Self-report Instruments Employed

The predictive validity of the self-report instruments used in the present research, and in the previous research described in the introduction, has been previously established. For example, respondents' scores on the Aggression Questionnaire have been shown to predict actual aggressive acts (e.g., throwing an object at someone or slapping someone; *r*s ranging from .26 to .49; Harris, 1996), and fights (*r*s ranging from .14 to .44; Archer, Holloway, & McLoughlin, 1995). Similarly, scores on the Rosenberg Self-Esteem scale have been shown to predict nurse- and peer-ratings of depression, psychophysiological indicators of anxiety, depressive affect, and the use of psychiatric resources (Kaplan & Pokorny, 1969; Rosenberg, 1965). Individuals who score high on the self-reported measure of narcissism used here and in the previous research mentioned, the Narcissistic Personality Inventory, have been shown to be rated by friends and relatives as high in narcissism, and rated by unacquainted observers as narcissistic ($r = .25$)—these observer ratings were made on the basis of physical appearance and behavior (Vazire, Naumann, Rentfrow, & Gosling, 2008). The Big Five trait measures also have been shown to predict ecological behavior relevant to each trait (Borkenau, Mauer, Riemann, Spinath, & Angleitner, 2004; Funder, Furr, & Colvin, 2000; Mehl, Gosling, & Pennebaker, 2006). In an influential review of the extant empirical evidence on the validity of trait scales in predicting behavior, Kenrick and Funder (1988) concluded that responses on personality trait measures show robust relations to behavior. Together, these findings allow us to conclude that self-reports on the validated trait measures discussed predict observable, real-world behaviors, at least among the subject pools from which we are drawing.

References

Archer, J., Holloway, R., & McLoughlin, K. (1995). Self-reported physical aggression among young men. *Aggressive Behavior, 21,* 325-342.

Bentler, P. M. (2003). *EQS Structural Equations Program for Windows (Version 6.1 Beta Build 70)* [Computer software]. Encino, CA: Multivariate Software.

Buttermore, N. (2006). *Distinguishing Dominance and Prestige: validation of a self-report scale.* Poster presented at the Human Behavior and Evolution Society's 18th Annual Meeting. Philadelphia, Pennsylvania.

Borkenau, P., Mauer, N., Riemann, R., Spinath, F. M., & Angleitner, A. (2004). Thin slices of behavior as cues of personality and intelligence. *Journal of Personality and Social Psychology, 86*, 599-614.

Funder, D. C., Furr, R. M., & Colvin, C. R. (2000). The Riverside Behavioral Q-sort: A tool for the description of social behavior. *Journal of Personality, 68*, 450–489.

Harris, M. B. (1996). Aggressive experiences and aggressiveness: Relationships to ethnicity, gender, and age. *Journal of Applied Social Psychology, 26*, 843-870.

Kaplan, H. B., & Pokorny, A. D. (1969). Self-derogation and psychosocial adjustment. *Journal of Nervous and Mental Disease, 149,* 421-434.

Kenrick, D. T., & Funder, D. C. (1988). Profiting from controversy: Lessons from the person–situation debate. *American Psychologist, 43*, 23–34.

Bryk, A. S., & Raudenbush, S. W. (1992). *Hierarchical linear models: Applications and data analysis methods*. Thousand Oaks, CA: Sage Publications Inc.

Rosenberg, M. (1965). *Society and the adolescent self-image.* Princeton, NJ: Princeton University Press.

Rosenthal, R., & Rubin, D. B. (1982). A simple, general purpose display of magnitude of experimental effect. *Journal of Educational Psychology, 74,* 166-169.

Vazire, S., Naumann, L. P., Rentfrow, P. J., & Gosling, S. D. (2008). Portrait of a narcissist: Manifestations of narcissism in physical appearance. *Journal of Research in Personality.*