The Primacy of Nurturance and Dominance/ Assertiveness: Unidimensional Measures of the Big Two Mask Gender Differences in Subdimensions

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ABSTRACT

Agency and Communion, the Big Two of social perception, appear to have unique subdimensions, but they have differed across studies and not all may be relevant for understanding gender stereotypes. Across two sets of studies (Total N = 1,648), we examined self- and group gender stereotypes using Abele and colleagues' (2021) conceptualization of agency as a vertical dimension that conveys information about social status and communion as a horizontal dimension that conveys information about approaching groups and individuals. Group stereotype analyses suggested that the vertical dimension comprised assertiveness/dominance and ability subdimensions, whereas the horizontal dimension was unidimensional. In contrast, self-stereotype analyses suggested that the vertical dimension comprised assertiveness/dominance and independence subdimensions and the horizontal dimension comprised a single nurturance subdimension—a unique morality subdimension did not emerge. As expected, women were perceived and rated themselves as higher on the horizontal dimension (group stereotypes), more nurturing (self-stereotypes), and less assertive/dominant (both group and self-stereotypes) than men. Gender differences in nurturance and assertiveness/dominance were stronger, as expected, among individuals whose gender was salient. We discuss implications for examining gender stereotypes and the potential consequences of misspecifying the Big Two as unidimensional.

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Research on group, intraindividual, and interindividual processes often examines the Big Two of social perception: agency and communion. Agency generally encompasses power, ability, and volition, whereas communion involves interdependence, likeability, and trustworthiness, although definitions vary across academic traditions (Abele et al., 2021). To integrate work on gender differences with other work on the Big Two, we adopted Abele and colleagues' (2021) conceptualization of agency as a vertical dimension that conveys information about targets' social status and communion as a horizontal dimension that conveys information about approaching others. Although both comprise subdimensions (e.g., Abele et al., 2016), there remains disagreement about the nature and number of subdimensions (Abele et al., 2021), particularly in work examining gender stereotypes (Folberg, Kercher, et al., 2020; Hentschel et al., 2019). More rigorous work that integrates research on gender stereotypes with other work on the Big Two may help resolve these conflicting findings.

Across two sets of studies, we used bifactor confirmatory factor analysis (CFA) to examine self- and group gender stereotypes with respect to the Big Two among crowd-sourced samples in the US. Following our work on goal orientations (Folberg, Kercher, et al., 2020), we show that gender differences in self- and group gender stereotypes are more pronounced for the horizontal dimension, nurturance (a subdimension of the horizontal dimension), and assertiveness/dominance (a subdimension of the vertical dimension). Gender differences in nurturance and assertiveness/dominance were stronger among individuals whose gender is salient. We further show that the Big Two mask gender differences in their subdimensions, making the use of global measures potentially problematic in work examining gender stereotypes.

POTENTIAL SUBDIMENSIONS OF THE BIG TWO

Women and men's representation in social roles informs gender stereotypes (Eagly et al., 2000). Women's overrepresentation in caretaking roles, such as stay-at-home parent or teacher, contributes to perceptions of greater approachability, nurturance, and warmth, whereas men's overrepresentation in leadership and breadwinning roles contributes to perceptions of greater status and power. Women are thus perceived to be higher on the horizontal dimension, whereas men are perceived to be higher on the vertical dimension. Women and men also ascribe stereotype-consistent characteristics to themselves (Hentschel et al., 2019), reflecting social pressures to engage in gender-role congruent behaviors (Prentice & Carranza, 2002).

The Big Two are often treated as unidimensional (e.g., Eagly et al., 2000); however, recent work suggests they are multidimensional (Abele et al., 2016, 2021; Folberg, Kercher, et al., 2020, Hentschel et al., 2019). Research on person and group perception (Abele et al., 2016, 2021) and gender stereotypes (Folberg, Kercher, et al., 2020; Hentschel et al., 2019; Eagly et al., 2020; Rudman & Glick, 2001), suggests that the vertical dimension comprises assertiveness and ability (often labeled competence). Research on gender stereotypes suggests an additional independence subdimension (Folberg, Kercher, et al., 2020; Hentschel et al., 2019), distinguishing power over others (assertiveness/dominance) from independence.

There is less agreement on potential subdimensions of the horizontal dimension. Person perception work suggests that the horizontal dimension comprises nurturance (often labeled warmth) and morality (Abele et al., 2016). Hentschel and colleagues (2019) examined the Big Two with respect to gender stereotypes and found that the horizontal dimension comprised concern for others, sociability, and emotional sensitivity. (Morality was not assessed.) However, the subdimensions were strongly intercorrelated (*rs* = .72–.80) and gender difference analyses yielded little evidence of discriminant validity.

THE PRIMACY OF ASSERTIVENESS/DOMINANCE AND NURTURANCE

We propose that the vertical, and potentially horizontal, dimensions of social perception may obscure the effects of their respective subdimensions and that, consistent with social role theory (Eagly et al., 2000), women and men primarily differ in perceived and self-rated assertiveness/dominance and nurturance. Gender differences in social roles are largest for roles requiring these characteristics—men remain grossly underrepresented in caretaking fields (Croft et al., 2015), and women remain underrepresented in roles that confer power. For example, only 7.4% of Fortune 500 CEOs (Ebrahimji, 2020), 27% of US congressional representatives (Blazina & Desilver, 2021), and 19% of US military officers (Council on Foreign Relations, 2020) are women. In contrast, gender differences in perceived ability and independence may be small. Indeed, Eagly and colleagues (2020) found that women are now perceived as higher in ability (labeled competence) than men, whereas men are perceived as higher on the vertical dimension than women. Although their investigation did not include independence, women and men are perceived, and rate themselves, as similarly independent (Hentschel et al., 2019).

Prescriptive norms also seem strongest for nurturance and assertiveness/dominance. Although women are encouraged to be caring and nice, men who exhibit these

characteristics are often perceived as lower in status (Rudman & Glick, 2001). Similarly, men are encouraged to enact their masculinity through dominance and aggression (Vandello & Bosson, 2013), whereas women who are perceived as powerful or dominant are often sanctioned (Prentice & Carranza, 2002; Rudman & Glick, 2001). Similar patterns of sanctions and rewards are less evident for other subdimensions of the vertical dimension. Women are not necessarily punished for displaying ability (Rudman & Glick, 2001) or self-direction (Schaumberg & Flynn, 2017), nor does ability necessarily contribute to perceptions of masculinity (Todorov et al., 2015). Indeed, threats to men's masculinity often elicit physical or sexual aggression (Vandello & Bosson, 2013), suggesting that masculinity is more closely tied to perceived power than are other subdimensions of the vertical dimension.

The primacy of assertiveness/dominance and nurturance is also consistent with our work on goal orientations. We (Folberg, Kercher, et al., 2020) used bifactor structural equation modeling to examine the factor structure of Diekman and colleagues' (2010) measure of agentic (vertical) and communal (horizontal) goal orientations. Communal goal orientations were unidimensional (although the measure did not include morality goals), whereas agentic goal orientations comprised global agentic goals and assertiveness/dominance and independence subdimensions. Gender differences emerged in communal and assertiveness/dominance goals but not in global agentic or independence goals. Goals related to the vertical dimension of social perception, thus, masked gender differences in assertiveness/dominance goals, making the use of global agentic goals problematic.

Similar issues may arise with respect to the horizontal dimension. Although women are perceived as higher on the horizontal dimension (Eagly et al., 2000; 2020) than are men, whether gender differences may emerge in morality is unclear. Women are perceived as purer and more innocent than men (Glick & Fiske, 1996), suggesting women may also be perceived as more moral. However, person perception research suggests that greater morality is associated with greater respect (Prestwich et al., 2021), which men are accorded more than women (Glick & Fiske, 1996). Thus, men may be perceived as more moral than women.

THE PRESENT STUDY

Following Abele and colleagues (2021), we expected that for group (Studies 1 and 2a) and self-stereotypes (Studies 1 and 2b), the vertical dimension would reflect general perceptions of status/hierarchy, with specific ability, independence, and assertiveness/dominance subdimensions. We also expected that the horizontal dimension would reflect perceived approachability with nurturance and morality subdimensions. We also explored potential subdimensions identified by Hentschel et al. (2019).

MODELING THE BIG TWO

We modeled the Big Two using reflector-indicator models (Abele et al., 2016; Folberg, Kercher, et al., 2020). Visually, reflector-indicator models display arrows emanating from a latent construct (e.g., assertiveness/dominance), represented with a circle, to observed items (e.g., 'assertive') represented by boxes (See Figure 1s). These models imply that global dimensions and their respective subdimensions influence responses to individual items. For example, latent self-perceptions of assertiveness/dominance are assumed to cause individuals to rate themselves as higher on items, such as 'assertive' or 'aggressive.'

Global and subdimensions may be modeled using second-order CFA or bifactor CFA (see Figure 1s). In second-order CFA, global dimensions exert causal effects on subdimensions, which influence responses to individual items (Morin et al., 2016). Global dimensions thus indirectly influence responses to items through subdimensions. In bifactor CFA, both global and subdimensions directly influence individual items. If the subdimensions are poorly defined when the global dimension is also modeled, measures are considered unidimensional (Dueber & Toland, 2021; Rodriguez et al., 2016).

Thus, bifactor and second-order CFA have different theoretical implications even if they often yield similar conclusions (Morin et al., 2016). We view second-order CFA as unnecessarily restrictive, as unlike bifactor models, global factors exhibit no direct effects on individual items in second-order CFA. Items such as 'independent', 'assertive', or 'competent' may reflect both general perceptions of women and men's social standing and specific perceptions of their independence, assertiveness/dominance, and ability, respectively. Further, bifactor modeling allows researchers to model gender differences in global and subdimensions simultaneously (Morin et al.) and thus test whether gender differences in subdimensions emerge *over and above* gender differences in the vertical and horizontal dimensions. Bifactor modeling, thus, provides robust tests of whether the Big Two mask differences in respective subdimensions (Folberg, Kercher, et al., 2020).

EXPECTED GENDER DIFFERENCES

We expected that women would be perceived and rate themselves as higher on the horizontal dimension than men, but that women and men would be perceived and rate themselves similarly on the vertical dimension.

Consistent with our hypothesis about the primacy of nurturance and assertiveness/dominance, we expected that women would be perceived and rate themselves as more nurturing but less assertive/dominant than men, whereas women and men would not differ in ability and independence. We further expected gender differences to be larger among individuals whose gender was salient, which is associated with stronger self-stereotyping (Cadinu & Galdi, 2012). Finally, we explored gender differences in potential subdimensions of the horizontal dimension identified by Hentschel et al. (2019) and gender differences in perceived morality.

STUDY 1

METHOD

Participants

We recruited participants (N = 498) from Prolific Academic for a study about perceptions of people. One participant failed both attention checks (e.g., 'I am checking "somewhat" because I am reading this question carefully.'). The final sample included 497 participants who were from 18 to 79 years old (M = 44.89, SD = 15.86) and identified as men (50.7%), women (47.2%), or transgender/non-binary or used different words to describe their gender (1.6%); one participant did not report their gender. Most participants (70.0%) identified as White, followed by Black/African American (13.1%), Asian/Pacific Islander (5.8%), multiracial (4.0%), Hispanic/Latino/a (3.4%), Native American (1.6%), and East Indian (0.8%). Three participants identified as other; one participant did not report their race.

Procedure

Participants indicated how much 27 vertical and 19 horizontal attributes (see Table 1) described them on a 1 (*Not at all*) to 7 (*Very much*) scale. Thirteen items assessed assertiveness/dominance, seven items assessed independence, and seven items assessed ability—the three proposed vertical subdimensions. Seven items assessed nurturance, seven items assessed morality, and five items assessed emotional sensitivity—the potential subdimensions of the horizontal dimension. Participants were randomly assigned to rate the extent to which the same attributes (order was randomized) described the average woman or man on a 1 (*Not at all*) to 7 (*Very much*) scale; target gender varied between participants. We assessed self-stereotypes before group stereotypes to avoid priming gender. Counterbalancing the measures would have required us to assess potential order effects, which would add parameters to the model, increasing the likelihood of non-convergence (Bader et al., 2022). However, in Study 2a, we assessed group stereotypes without a self-stereotyping measure and reached similar conclusions, suggesting that order did not affect conclusions in the present study.

Attributes were drawn from Abele and colleagues (2016), who curated the most used vertical and horizontal attributes across 21 studies on person perception. These attributes included one independence item, 10 assertiveness items, six ability items, five nurturance items, and seven morality items. We also included attributes used at least twice in gender stereotype research (i.e., Diekman & Eagly, 2000; Eagly et al., 2020; Hentschel et al., 2019). These attributes included three

VERTICAL DIMENSION				HORIZONTAL DIMENSION	
ASSERTIVENESS/DOMINANCE	ABILITY	INDEPENDENCE	NURTURANCE	MORALITY	EMOTIONAL SENSITIVITY
Ambitious	Capable	Desire responsibility	Affectionate	Considerate	Emotional
Assertive	Clever	Independent	Caring	Fair	Kind
Can make decisions easily	Competent	Self-reliant	Empathetic	Just	Sensitive
Superior	Efficient	Emotionally stable	Friendly	Reliable	Sympathetic
Have leadership abilities	Intelligent	Self-directed	Helpful	Trustworthy	Intuitive
Never give up easily	Persistent	Self-focused	Warm	Honest	
Purposeful	Creative	Individualistic		Compassionate	
Self-confident				Moral	
Stand up under pressure					
Aggressive					
Competitive					
Courageous					
Dominant					

Table 1 Vertical and Horizontal Items Across Studies.

assertiveness items, one ability item, two morality items, and five emotional sensitivity items. Independence attributes (six items) came primarily from Diekman et al. (2010) and Hentschel et al. (2019). We used factor analytic evidence from prior studies (Abele et al., 2016; Eagly et al., 2020; Folberg, Kercher, et al., 2020; Hentschel et al., 2019) to classify attributes with a few exceptions. Abele and colleagues (2016) categorized 'independent' as an indicator of assertiveness; we categorized it as an indicator of independence. We also added one item, 'moral', to reflect morality.

Analyses

Analyses were conducted using full-information maximum likelihood estimation (FIML) with robust standard errors in M*plus* Version 8.6 (Muthèn & Muthèn, 2021). For all studies, all participants' responses were included in measurement model development. Only participants who identified as women or men were included in analyses involving participant gender. We first estimated separate exploratory structural equation models (ESEM) to detect subdimensions of the Big Two. We then conducted CFAs of potential subdimensions of the Big Two and estimated bifactor models. We attempted to estimate full measurement models in each study, but the models did not converge, which is common in bifactor modeling (Bader et al., 2022). We, thus, reduced the number of latent factors by estimating measurement models separately for the vertical and horizontal dimensions. Results of these analyses, including criteria for model fit, are reported in the Online Supplement.

We report here the bifactor models, estimating all item loadings freely and constraining factor variances to 1 for model identification. Covariances among subdimensions and covariances of subdimensions with global factors were constrained to zero. In addition to the comparative fit index (CFI), Tucker Lewis Index (TLI), root mean square error of approximation (RMSEA), and standardized root mean square residual (SRMR), we considered omega hierarchical (ωH) and omega hierarchical for the subscale (ωHS). ωH indicates the amount of item-level variance accounted for by the global factor, partialing out variance accounted for by each subdimension. It varies between zero and one; values that exceed .80 indicate unidimensionality (Rodriguez et al., 2016). ωHS is an index of the amount of item-level variance accounted for by a specific subdimension over and above the global dimension. Higher values are more desirable, although subdimensions may yield reliable findings with values as low as .25 (Dueber & Toland, 2021). Finally, we estimated a full measurement model, including bifactor models of the Big Two followed by a structural model. For group stereotypes, we regressed each latent variable on participant gender, target gender, and their interaction. For self-stereotypes, we regressed all latent variables on participant gender.

RESULTS

Group Stereotypes

The Vertical Dimension

ESEM analyses (see Online Supplement) yielded the expected subdimensions: assertiveness (assertive, self-confident, aggressive, competitive, dominant), ability (capable, clever, competent, efficient, intelligent, creative), and independence (independent, self-reliant, self-directed). The initial bifactor model did not converge. Increasing the number of random starting values to 50 resulted in model convergence, $\chi^2(63) = 160.89$, CFI = .96 TLI = .94, RMSEA = .06, 90%CI[.05, .07], SRMR = .07. However, the independence subdimension was poorly defined (λ = −.10–.39, *M* = .19), indicating no unique variability in independence items that could be attributed only to the independence subdimension.

We, thus, removed the latent independence factor and allowed the three independence items to load only onto the global vertical dimension, $\chi^2(66) = 161.07$, CFI = .96 TLI = .94, RMSEA = .05, 90%CI[.04, .06], SRMR = .07. Items generally loaded on the vertical dimension (λ = .09–.81, *M* = 0.55) and their respective assertiveness/dominance (λ = .37–.64, *M* = .57) and ability (λ = .41–.62, *M* = 0.54) subdimensions. ωH for the vertical dimension (.71) and ωHS for assertiveness/dominance (.55) and competence (.44) subdimensions indicated multidimensionality. Thus, partially consistent with expectations, the vertical dimension comprised assertiveness/dominance and competence subdimensions.

The Horizontal Dimension

ESEM analysis (see Online Supplement) suggested a two-factor structure of nurturance (affectionate, caring, empathetic, warm) and morality (fair, just, reliable, trustworthy, honest, moral). We estimated a bifactor model allowing all items to load onto the horizontal dimension and their respective nurturance and morality subdimensions. We dropped the item Trustworthy, which had a negative residual variance, and re-estimated the model, $\chi^2(18) = 17.40$, CFI = 1.00, TLI = 1.00, RMSEA = .00, 90%CI[.00, .04], SRMR = .01. Despite excellent fit, estimates of ωH (.91) for the horizontal dimensions and ωHS for nurturance (.20) and morality (.01) yielded strong evidence of unidimensionality. We, thus, modeled the horizontal dimension as unidimensional.

Final Measurement and Structural Models

We estimated a full measurement model, specifying 50 random starting values, $\chi^2(216) = 597.22$, CFI = .93 TLI = .92, RMSEA = .06, 90%CI[.05, .07], SRMR = .08; factor loadings were consistent with those from previous

analyses. (See Table 1s.) Higher scores on the horizontal dimension were associated with higher scores on the vertical dimension, $r = .58$, $p < .001$, lower assertiveness/dominance, $r = -.33$, $p < .001$, and higher perceived ability, $r = .64$, $p < .001$.

We regressed all factors on target gender, participant gender, and their interaction, $\chi^2(273) = 695.29$, CFI = .93, TLI = .92, RMSEA = .06, 90%CI[.05, .06], SRMR = .05. As expected, women were perceived as higher on the horizontal dimension than were men, $d = 0.53$, whereas women and men were rated similarly on the vertical dimension, $d = 0.01$, $p = .926$. Also, as expected, women were perceived as less assertive/dominant than were men, $d = -0.59$, $p < .001$. Unexpectedly, women were perceived as higher in ability than were men, $d = 0.63$, $p < .001$. Perceived group differences in assertiveness/dominance depended on participant gender, $d = -0.10$, $p = .031$. The tendency to judge men as more assertive/dominant than women was stronger for women, $d = -0.66$, $p < .001$, than men, $d = -0.53$, $p < .001$. Finally, women provided slightly higher ratings on the vertical dimension than did men, $d = 0.13$, $p = .007$. All other *p*s > .338.

Self-Stereotypes

The Vertical Dimension

As expected, ESEM analyses (see Online Supplement) indicated the vertical dimension comprised assertiveness/dominance, ability, and independence subdimensions. Items differed slightly from the group stereotype task: Assertiveness/dominance included four of the five items from the group stereotype task (assertive, aggressive, competitive, dominant), ability included four of the six items (capable, competent, efficient, intelligent), and independence included one item (independent) and two additional items (self-focused and individualistic). Correlations among subdimensions suggested an overarching dimension.

The bifactor model, using 50 random starting values, did not converge because of a negative residual variance for the item Competence. Constraining that variance to zero resulted in model convergence, $\chi^2(34) = 69.28$, CFI = .98 TLI = .96, RMSEA = .05, 90%CI[.03, .06], SRMR = .03, but yielded an ill-defined ability latent factor ($\lambda = -.12$–$.77$, $M = 0.30$), suggesting that ability was not a subdimension of the vertical dimension.

We, thus, dropped the ability factor, allowing ability items to load only onto the vertical dimension, and released the constraint on Competence, $\chi^2(37) = 82.55$, CFI = .97 TLI = .96, RMSEA = .05, 90%CI[.04, .06], SRMR = .03. All items loaded on the vertical dimension ($\lambda = .14$–$.81$, $M = .55$) and their respective assertiveness/dominance ($\lambda = .42$–$.70$, $M = 0.57$) and independence ($\lambda = .32$–$.62$, $M = 0.45$) subdimensions. ωH for the vertical dimension (.74) and ωHS for assertiveness/dominance (.55) and independence (.31) suggested multidimensionality. In sum, the vertical dimension comprised assertiveness/dominance and independence, partially consistent with expectations.

The Horizontal Dimension

ESEM analyses of self-stereotypes (see Online Supplement) indicated, as for group stereotypes, that emotional sensitivity was indistinguishable from nurturance, and distinct nurturance (affectionate, caring, empathetic, friendly, and warm) and morality (fair, just, reliable, trustworthy, honest, moral) subdimensions emerged.

The bifactor model exhibited excellent fit, $\chi^2(33) = 66.54$, CFI = .98, TLI = .96, RMSEA = .05, 90%CI[.03, .06], SRMR = .03. Items generally loaded onto the horizontal dimension ($\lambda = .33$–$.81$, $M = .54$) and their respective nurturance ($\lambda = .53$–$.71$, $M = .63$) and morality ($\lambda = -.18$–$.45$, $M = .28$) subdimensions. Indices of ωH (.68) for the horizontal dimension and ωHS (.61) for nurturance suggested a distinct nurturance subdimension. However, ωHS (.10) for morality suggested that the horizontal dimension explained nearly all the variance in morality items. We, thus, dropped the morality subdimension and allowed all morality items to load onto the global horizontal dimension, $\chi^2(39) = 112.68$, CFI = .95, TLI = .93, RMSEA = .06, 90%CI[.05, .08], SRMR = .04.

Final Measurement and Structural Models

The bifactor model of vertical and horizontal self-stereotypes, $\chi^2(191) = 418.77$, CFI = .93, TLI = .92, RMSEA = .05, 90%CI[.04, .06], SRMR = .05, yielded expected item loadings (see Online Supplement). Consistent with group stereotype ratings, higher scores on the vertical dimension were associated with higher scores on the horizontal dimension, $r = .79$, $p < .001$, and less dominance/assertiveness, $r = -.19$, $p < .001$; higher scores on the horizontal dimension were also associated with lower independence, $r = -.20$, $p = .002$. Unlike group stereotypes, nurturance was unassociated with the vertical dimension, $p = .688$, and assertiveness/dominance, $p = .810$. However, greater nurturance was associated with less independence, $r = -.20$, $p = .002$.

We then estimated a structural model, regressing all latent variables on participant gender, $\chi^2(208) = 478.95$, CFI = .92, TLI = .91, RMSEA = .05, 90%CI[.05, .06], SRMR = .05. Unexpectedly, women and men rated themselves as similarly high on the horizontal dimension, $p = .800$. Men rated themselves higher on the vertical dimension than did women, $d = -0.11$, $p = .048$ and as expected, women rated themselves as more nurturing, $d = 0.17$, $p = .001$, and less assertive/dominant, $d = -0.26$, $p < .001$, than did men. Also, as expected, women and men rated themselves as similarly independent, $p = .941$.

DISCUSSION

Analyses of self- and group-stereotypes unexpectedly yielded different subdimensions. For group stereotypes, the vertical dimension comprised assertiveness/dominance and ability, consistent with Abele et al. (2016). No distinct independence subdimension emerged, inconsistent with expectations, Folberg, Kercher, et al. (2020), and Hentschel et al. (2019). Unexpectedly, (Abele et al., 2016), horizontal group stereotypes were unidimensional. Self-stereotype analyses revealed that the vertical dimension comprised assertiveness/dominance and independence, partially consistent with expectations. Bifactor analyses suggested the horizontal dimension comprised nurturance, as expected. However, unexpectedly (Abele et al., 2016), morality was again not a unique horizontal subdimension of self-stereotypes.

Our expectations that gender differences would be largest in assertiveness/dominance, nurturance, and the horizontal dimension were largely confirmed. Women were perceived as less assertive/dominant, higher on the horizontal dimension (group stereotypes), and more nurturing (self-stereotypes) than were men; women and men also rated themselves as similarly independent (Folberg, Kercher, et al., 2020; Hentschel et al., 2019).

Two unexpected findings also emerged. Women were perceived as higher in ability than were men, which is inconsistent with work on gender stereotypes (Fiske et al., 2002; Hentschel et al., 2019; but see Eagly et al., 2020). Also inconsistent with gender stereotype research (Diekman et al., 2000; Eagly et al., 2000, 2020, Hentschel et al., 2019), women and men perceived themselves similarly on the horizontal dimension. This finding may reflect the fact that the horizontal dimension accounted for greater variability in morality items than nurturance items. Thus, unidimensional measures of the horizontal dimension that include morality items may assess morality more than nurturance. As expected, the vertical dimension either completely obscured the effects of subdimensions (group stereotypes) or substantially reduced the effect size (self-stereotypes). Thus, unidimensional measures of the vertical and, potentially, horizontal, dimensions of social perception may yield inaccurate findings about gender stereotypes.

In Studies 2a and 2b, we sought to replicate the factor structure of vertical and horizontal group and self-stereotypes. In Study 2a, we conducted a direct replication of group stereotypes, using a percentage estimation task (e.g., Ryan et al., 2010). In Study 2b, we primed participants with a measure of gender salience (Palomares, 2009) to ensure that self-ratings reflected judgments based on gender (vs. another) identity (Cadinu & Galdi, 2012). We expected gender differences in the horizontal dimension, nurturance, and assertiveness/dominance to be larger among individuals higher in gender salience.

STUDY 2A

METHOD

Participants and Procedure

We recruited participants (N = 650) on Prolific Academic who did not participate in Study 1. All participants passed attention checks. Participants were from 19 to 80 years old (M = 34.83, SD = 13.61) and identified as women (46.3%), men (49.5%), and transgender/non-binary (3.8%). Two participants did not report their gender. Participants identified as White (67.0%), multiracial (9.1%), Asian/Pacific Islander (7.5%), Black/African American (5.8%), Hispanic/Latino/a (5.4%), other (1.2%), East Indian (0.5%), Native American (0.5%), and Middle Eastern/Arab (0.3%).

Participants were randomly assigned to estimate the percentage of women or men in the US who had each of the 27 agency and 19 communal attributes used in Study 1. The order of items was randomized; target gender varied between subjects.

RESULTS

The separate bifactor models of the vertical and horizontal dimensions were confirmed (see Online Supplement). Allowing for 50 random starting values, the full measurement model revealed, as in Study 1, the vertical dimension and assertiveness/dominance and ability subdimensions; the horizontal dimension was again unidimensional, $\chi^2(216) = 708.16$, CFI = .94, TLI = .93, RMSEA = .06, 90%CI[.05, .06], SRMR = .07 (see Online Supplement for factor loadings). Consistent with Study 1, the vertical and horizontal dimensions were strongly and positively correlated, $r = .68$, $p < .001$, and the horizontal dimension was associated with greater perceived ability, $r = .58$, $p < .001$, but lower assertiveness/dominance, $r = -.23$, $p < .001$.

We regressed all latent factors on participant gender, target group gender, and their interaction, $\chi^2(273) = 851.30$, CFI = .94, TLI = .93, RMSEA = .06, 90%CI[.05, .06], SRMR = .04. Consistent with Study 1, and with expectations, women were perceived as higher on the horizontal dimension than were men, $d = 0.63$, $p < .001$. However, women were also perceived as slightly higher on the vertical dimension, $d = 0.09$, $p = .050$. Importantly, the vertical dimension again obscured mean differences in its subdimensions. Women were again perceived as less assertive/dominant, $d = -0.66$, $p < .001$, and as higher in ability than men, $d = 0.79$, $p < .01$.

Gender differences in the horizontal dimension, $d = 0.17$, $p < .001$, the vertical dimension, $d = 0.13$, $p = .002$, and assertiveness/dominance, $d = -0.16$, $p = .003$, depended on participant gender. Gender differences favoring women on the horizontal dimension were larger for women, $d = 0.63$, $p < .001$, than men, $d = 0.42$. Perceptions that women were slightly higher on the vertical dimension than men only emerged for women, $d = 0.21$, $p < .001$ (for men, $d = -0.05$, $p = .396$).

Gender differences in assertiveness/dominance favoring men were similarly stronger for women, d = –0.63, p < .001, than men, d = –0.46, p < .001. Finally, women provided higher ratings of assertiveness/dominance than did men, d = 0.09, p = .024. All other ps > .194.

STUDY 2B

METHOD

Participants

We recruited participants from Prolific Academic (N = 500) who did not participate in Studies 1 or 2a for a study about women's and men's self-perceptions. All participants passed attention checks. They were from 19 to 80 years old (M = 36.00, SD = 13.5) and identified as women (47.2%), men (49.0%), or transgender/non-binary (3.2%). (One participant used other words; two did not report their gender.) Participants identified as White (70.2%), Asian/Pacific Islander (8.8%), Hispanic/Latino/a (6.8%), Black/African American (5.6%), multiracial/multi-ethnic (6.6%), Middle Eastern/Arab (0.8%), East Indian (0.4%), and Native American (0.2%).

Procedure

Participants completed an eight-item measure of gender salience (e.g., 'Other people often focus on my gender') adapted from Palomares (2009) on a 1 (*Strongly Disagree*) to 7 (*Strongly Agree*) scale (α = .80). They then completed the same self-stereotyping task used in Study 1.

RESULTS

We again estimated separate ESEM models of the vertical and horizontal dimensions (see Online Supplement). Again, the vertical dimension comprised subdimensions of assertiveness/dominance (assertive, superior, aggressive, competitive, dominant), ability (clever, intelligent, creative), and independence (independent, self-reliant, self-directed). Four of the five assertiveness/dominance items (assertive, aggressive, competitive, and dominant), also assessed assertiveness/dominance in the group stereotype task, as did all three independence items. The ability subdimension included only three of six assessing ability in the group stereotype task from Studies 1 and 2a. Analyses of the horizontal dimension yielded evidence of nurturance and morality subdimensions. All items except Friendly were used in Studies 1 and 2a.

We estimated a bifactor model of the vertical dimension, $\chi^2(33)$ = 56.64, CFI = .99, TLI = .97, RMSEA = .04, 90%CI[.02, .05], SRMR = .03. All items loaded on the vertical dimension (λ = .16–.66, M = .50) and their respective assertiveness/dominance (λ = .39–.72, M = .55), independence (λ = .34–.68, M = .53), and ability (λ = .33–.44, M = .40) subdimensions. ωH for the vertical dimension (.65) and ωHS for assertiveness/dominance (.54), ability (.24), and independence (.38) suggested multidimensionality.

The bifactor model of the horizontal dimension fit the data, $\chi^2(33)$ = 55.64, CFI = .99, TLI = .98, RMSEA = .04, 90%CI[.02, .05], SRMR = .02, but the morality subdimension was, again, poorly defined (λ = –.16–.34, M = 0.18). Thus, we removed the morality subdimension and allowed morality items to load only onto the horizontal dimension, $\chi^2(39)$ = 81.37, CFI = .98, TLI = .97, RMSEA = .05, 90%CI[.03, .06], SRMR = .03. All items loaded on the horizontal dimension (λ = .37–.78, M = .61), and nurturance items loaded on the nurturance subdimension (λ = .52–.68, M = .62). ωH for the horizontal dimension (.76) and ωHS for nurturance (.55) suggested multidimensionality.

Final Measurement and Structural Models

The full bifactor model did not converge because of a negative residual variance for Intelligent. As removing the item would require the factor to be defined by two items, we instead dropped the ability factor, consistent with Study 1. The resulting model exhibited good fit, $\chi^2(190)$ = 421.22, CFI = .94, TLI = .93, RMSEA = .05, 90%CI[.04, .06], SRMR = .05. Factor loadings were as expected (see Table 2s).

We regressed all latent variables on participant gender, $\chi^2(207)$ = 486.27, CFI = .93, TLI = .91, RMSEA = .05, 90%CI[.05, .06], SRMR = .05. As expected, women rated themselves as more nurturing than did men, d = 0.15, p = .007. However, no other gender differences emerged, ps > .206. Unexpectedly, then, women and men did not differ in self-ratings of assertiveness/dominance.

Finally, we regressed all latent variables on participant gender, gender salience (an observed variable), and their interaction, $\chi^2(241)$ = 510.55, CFI = .93, TLI = .92, RMSEA = .05, 90%CI[.04, .05], SRMR = .05. Interactions did not emerge for the vertical, p = .202, or horizontal dimensions, p = .418. However, the expected Participant Gender X Gender Salience interactions emerged for nurturance, d = 0.12, p = .013, assertiveness/dominance, d = –0.14, p = .008, and, surprisingly, independence, d = –0.15, p = .009. Among men, gender salience was associated with greater assertiveness/dominance, β = .23, p = .001, and independence, β = .17, p = .034, but not nurturance, p = .102. Among women, gender salience was associated with marginally greater nurturance, β = .14, p = .082, but was unassociated with assertiveness/dominance, β = –.09, p = .296, and independence, β = –.13, p = .127.

DISCUSSION

Findings were largely consistent with Study 1. For group stereotypes, the vertical dimension comprised ability and assertiveness/dominance subdimensions consistent with Abele et al. (2016); the horizontal dimension was

again unidimensional. For self-stereotypes, the vertical dimension comprised assertiveness/dominance and independence subdimensions consistent with Folberg, Kercher, et al. (2020), whereas the horizontal dimension comprised a single nurturance subdimension. The horizontal dimension, again, accounted for most of the variation in morality items; no unique morality subdimension emerged.

We expected gender differences in the horizontal dimension and assertiveness/dominance subdimension. Results for group stereotypes were largely as expected; women were perceived as higher on the horizontal dimension and as less dominant/assertive than men. Women were also again perceived as higher in ability than men. Gender differences in self-stereotypes were less consistent with expectations. Although, women rated themselves as more nurturing than did men, gender differences did not emerge in assertiveness/dominance or the horizontal dimension. However, among individuals whose gender was salient, men were more likely to ascribe themselves assertiveness/dominance, whereas women were marginally more likely to ascribe themselves nurturance. Men whose gender was salient were also more likely to ascribe themselves independence. Comparisons of gender differences across global and subdimensions suggested again that global dimensions may obscure gender differences in subdimensions (Folberg, Kercher, et al., 2020).

GENERAL DISCUSSION

Across self- and group stereotypes, the Big Two comprised different subdimensions. For group stereotypes, the vertical dimension comprised ability and assertiveness/dominance subdimensions, consistent with Abele et al. (2016). Inconsistent with gender stereotype research and our expectations (Folberg, Kercher, et al., 2020; Hentschel et al., 2019), independence was not a subdimension of the vertical dimension. Inconsistent with expectations, but consistent with prior work on goal orientations, which did not include items assessing morality (Folberg, Kercher, et al., 2020), horizontal group stereotypes were unidimensional. For self-stereotypes, the vertical dimension comprised assertiveness/dominance and independence subdimensions, consistent with Folberg, Kercher, et al., whereas the horizontal dimension included a nurturance subdimension. Interestingly, in both Studies 1 and 2b, no unique morality subdimension emerged; the horizontal dimension accounted for nearly all of the variability in morality items.

The latter finding is somewhat consistent with work suggesting that individuals rely more on judgments of morality than nurturance when evaluating targets (Brambilla & Leach, 2014). Differences in horizontal subdimension across self- and group stereotypes tasks may reflect dynamics specific to gender. All nurturance and morality items were positive in valence. Perhaps the horizontal dimension captured the 'women-are-wonderful' effect, that is, the tendency for individuals to view women more positively than men (Eagly & Mladinic, 1994). It may also reflect benevolent sexism—seemingly positive but limiting beliefs about women (Glick & Fiske, 1996)—as self-stereotypes may be influenced by different identities (Cadinu & Galdi, 2012), whereas group stereotypes were specific to gender.

Despite differences in subdimensions across tasks, we expected and found that men were perceived as more assertive/dominant and as lower on the horizontal dimension than were women. Self-stereotype analyses similarly revealed that men perceived themselves as more assertive/dominant (Study 1 only) and less nurturing (Studies 1 and 2b) than did women. Further, as expected, gender differences in assertiveness/dominance and nurturance were more pronounced among individuals whose gender was salient (Study 2b). Finally, women were perceived as higher in ability than were men (Eagly et al., 2020).

Interestingly, the magnitude of gender differences in the horizontal dimension (group stereotypes), nurturance (self-stereotypes) and assertiveness/dominance (both group and self-stereotypes) differed across tasks. The effect sizes of target group ratings were larger than those of self-ratings; self-ratings effects were generally small or very small. Our work is, thus, consistent with Hyde's (2005) gender similarities hypothesis. Women and men are often more similar than different.

Of course, the present findings of stronger gender differences in group stereotypes than in self-ratings may not be generalizable. They might reflect a general tendency for perceived group differences to be larger than self-rating differences, particularly on attributes that are perceived to be stereotypic (Eyal & Epley, 2017) rather than stereotype inaccuracy specifically (Ryan, 2002). Thus, we urge caution in concluding that the present findings indicate the inaccuracy of gender stereotypes.

THE MEANING OF GLOBAL AND SUBDIMENSIONS

Bifactor models partition item-level variation into variability due to the global factor, subdimensions, and error. Subdimensions are, thus, residualized; that is, subdimensions explain item-level variation left over after the vertical dimension (the global factor) explains all the variation it can across the full set of vertical dimension items (Rodriguez et al., 2016). Researchers may, thus, wonder how to interpret such constructs. We provide a framework for practically interpreting these constructs by considering ωH, which assesses the percentage of

variance *across all items* accounted for by the global dimension, and ωHS, which assesses the percentage of variance across domain-specific *items by a specific subdimension* (Rodriguez et al., 2016).

Interpreting global dimensions

The vertical (ωH = .65–.73) and horizontal (ωH = .68–.92) global dimensions accounted for a sizable amount of shared variance across items, suggesting they may adequately capture vertical and horizontal stereotypes as well as their respective subdimensions. However, two issues emerge with this interpretation. First, shared variability is not necessarily construct-relevant variability. Some work has used bifactor models to test for and partial out the effects of common method bias (Podsakoff et al., 2003). The horizontal and vertical dimensions may thus comprise both methodological artifacts and shared-construct relevant variation.

Second, accounting for substantial shared variance *across items* does not mean that global dimensions account for variability in *each item* or *set of items* equally well; global dimensions may assess some subdimensions better than others. As such, ωH should be considered in conjunction with ωHS. Estimates of ωHS for assertiveness/dominance (.54–.58) and nurturance (.56–.61) suggest they account for more than half of the variability in their respective items, and, thus, the global dimensions account for less than half. In contrast, ability (ωHS = .41–.44) and independence (ωHS = .31–.38) account for comparatively less variability across their set of items, and the vertical dimension accounts for comparatively more. In other words, the vertical dimension taps independence (self-stereotypes) and ability (group stereotypes) better than assertiveness/dominance, and the horizontal dimension taps morality more than nurturance (self-stereotypes only). Composite measures that weight all items and subdimensions equally may, thus, yield inaccurate conclusions.

Interpreting subdimensions

ωHS also provides some guidance for interpreting subdimensions, as it indicates the percentage of 'pure' or 'uncontaminated' item-level variation accounted for only by the subdimension (Morin et al., 2016; Rodriguez et al., 2016). As assertiveness/dominance and nurturance explained more variance in these items than did the global dimensions, their interpretation seems straightforward. Independence and ability accounted for comparatively less variation in their respective items and may, thus, seem more difficult to interpret. However, subscales with similar estimates of ωHS are routinely used in educational (Dueber & Toland, 2021) and clinical psychological (Morin et al., 2016) research and explain variation above and beyond the global construct (Dueber & Toland, 2021).

Differences in ability may represent a specific domain of ability (Hentschel et al., 2019) but could also reflect item valence. Unlike some assertiveness/dominance items, such as aggressive, which are negatively valenced, ability items (e.g., creative) were positively valenced. As women are perceived more positively than men (Eagly & Mladinic, 1994), perhaps women received a small 'lift' from the ability items, in addition to small gender differences in ability favoring women (Eagly et al., 2020).

LIMITATIONS AND FUTURE DIRECTIONS

The present research focused on binary gender stereotypes; how gender stereotypes apply to individuals who identify as transgender or non-binary remains unclear. Further, differences between self- and group stereotypes may reflect the influence of other identities, as gender stereotypes vary across race/ethnicity (Rosette et al., 2016). Gender stereotypes as measured in the present studies may, therefore, align less with self-stereotypes among people of color. Future work might examine this hypothesis with a larger sample so that analysis by participant gender, participant race/ethnicity, and their interaction is possible. Further, our findings may be specific to the US (Folberg, 2020). Whether and how findings vary across cultural contexts is an important avenue for future research.

We suggested that differences in the factor structure of the horizontal dimensions across tasks might be due to item valence. Investigations of gender stereotypes often investigate perceived stereotypicality (e.g., Hentschel et al., 2019) and valence (e.g., Glick & Fiske, 1996) separately. Whether the factor structure of the horizontal dimension depends both on stereotypicality and valence remains unclear.

Our work on gender stereotypes (Folberg, Brauer, et al., 2020) suggests that between-attribute differences account for substantial variability in gender stereotypes. Differences between studies may, thus, be due to the particular attributes used rather than true differences in latent perceptions of the Big Two and their subdimensions. Researchers often select different items to assess agency and communion. Indeed, examinations of articles specifically examining gender stereotypes yielded more unique than shared attributes. We, thus, view the selection of items that commonly appear in research on person and gender perception as a strength of the present research. Further, gender differences, which are of utmost interest in research on gender stereotyping, were consistent with our work on goal orientations (Folberg, Kercher, et al., 2020), which used almost entirely different items. Nevertheless, it remains for future work to replicate and extend these findings by examining perceptions of the Big Two across groups and situations. This work may be further enhanced by bifactor modeling with larger sample sizes, increasing the likelihood of model convergence (Bader et al., 2022).

Finally, ambiguity in the meaning of both global and subdimensions suggests that researchers who examine

the Big Two should think carefully about when it is theoretically advantageous to use subdimensions versus global factors and provide both theoretical rational and factor analytic evidence for their choices. In gender stereotyping research, this issue seems particularly important for the vertical dimension, as researchers use items that assess morality less often (Hentschel et al., 2019). Perceptions that women are increasingly 'agentic' (Diekman et al., 2000; Eagly et al., 2020) may capture independence and ability more than assertiveness/dominance. Research that focuses on ways to close perceived and actual differences in assertiveness/dominance, specifically, which speaks directly to women's lack of social power (Eagly et al., 2000; Glick & Fiske, 1996), is needed.

CONCLUSION

The vertical and potentially, horizontal, dimensions of social perception may mask the effects of their respective subdimensions. Researchers examining gender stereotypes, particularly group (vs. self-) stereotypes, should consider focusing on nurturance and dominance/assertiveness rather than composite measures of the Big Two. However, items appear to behave differently across group and self-stereotyping tasks. Researchers, thus, need to think carefully about both the research question and method to determine which facets of the Big Two they wish to assess (or manipulate), and whether those facets can be detected using their desired stereotyping task.

ADDITIONAL FILE

The additional file for this article can be found as follows:

- **Supplemental Materials.** Supplemental materials for all studies. DOI: https://doi.org/10.5334/irsp.690.s1

COMPETING INTERESTS

The authors have no competing interests to declare.

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