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Diverging associations of dimensions of competitiveness with gender and personality

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ABSTRACT

More attention must be paid to the multidimensional nature of competitiveness to better understand how competitiveness relates to personality and gender. We focus on three dimensions: Desire to Win (DW), Personal Development competitiveness (PD), and Enjoyment of Competition (EC). Our empirical exploratory analysis is based on a large sample of 1520 individuals. We control for interdimensional correlations, correct for multiple testing, and use conservative thresholds to provide robust evidence on dimension-specific associations of competitiveness with personality, operationalized via the HEXACO framework, and gender. Independent of the respectively other competitiveness dimensions, DW relates to less honesty-humility and less agreeableness, PD to more emotionality, and EC to more extraversion and less emotionality. EC is the sole source of gender differences among the correlated competitiveness dimensions.

1. Introduction

Previous research suggests that competitiveness is a multidimensional construct (Houston, Mcintire, et al., 2002; Newby & Klein, 2014; Ryckman et al., 2011). Two dimensions emerge rather robustly as relevant, irrespective of whether correlations between complete scales (Houston, Mcintire, et al., 2002) or correlations between individual items (Newby & Klein, 2014) are analyzed: *Desire to Win* (DW) and *Personal Development competitiveness* (*PD*). Individuals scoring high on DW feel the need to win more than others and may even strive to win for its own sake, independent of associated rewards (Malhotra, 2010). In contrast, individuals scoring high on PD do not focus on winning competitions but rather seek mastery of a given task (Ryckman et al., 1996). While *Enjoyment of Competition* (EC) is already recognized as an element of individual competitiveness (Houston et al., 2012; Houston, Harris, et al., 2002; Newby & Klein, 2014; Spence & Helmreich, 1983), it is rarely conceptually or empirically distinguished from other dimensions. Complementing both DW and PD, we define EC as individuals' affective reactions to the competitive process itself, but not to achievements in competitions like winning or personal development (Houston, Harris, et al., 2002). Individuals can, for instance, strive to win a competition without enjoying it. Likewise, they may enjoy the competition and the related interpersonal dynamics (e.g., rivalry) without an increased incentive to win.

Not acknowledging the multidimensionality of competitiveness leads to incomplete, incorrect, and possibly contradictory observations. Studies following a unidimensional approach use a variety of measurement instruments reflecting and weighing the dimensions of competitiveness differently. Seemingly conflicting observations may arise (Bönte, Lombardo, & Urbig, 2017; Houston, Mcintire, et al., 2002). Furthermore, studies considering multiple dimensions often do not control for interdimensional dependencies, for instance, when building

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on binary zero-order correlations or on multiple regressions that do not control for dependencies between competitiveness dimensions (Fong et al., 2021; Ross et al., 2003; Ryckman et al., 2011). Consequently, observed associations between single competitiveness dimensions and other variables might be spurious due to correlated dimensions' associations with these variables. The benefits of considering *independent* associations of correlated construct dimensions are acknowledged across diverse fields (e.g., Van den Broeck et al., 2016). This study makes a strong case for considering the *uniqueness* of competitiveness dimensions when studying competitiveness' associations with personality and gender.

Specifically, we expect previously shown associations of extraversion, emotionality, and exploitative behaviors with competitiveness (Fletcher & Nusbaum, 2008; Ross et al., 2003; Ryckman et al., 1990) to be dimension-specific. Individuals scoring high in *extraversion* enjoy social gatherings and interactions (Ashton & Lee, 2009) and, hence, may enjoy the social aspect of competition, appreciating it for its own sake independent of winning and personal development. Scoring low in *emotionality* relates to feeling little worry in stressful situations that might threaten one's social and physical well-being (Ashton & Lee, 2009). This, in turn, may allow individuals to enjoy competitions despite its stressful character. In contrast, more emotional individuals might experience a need to demonstrate competence and status towards themselves and others (Ashton & Lee, 2009) and, hence, display stronger incentives to develop their competencies and win in competitions. Furthermore, while the desire to win might be so strong as to leverage unsocial, unethical behaviors, striving for personal development and enjoying social interactions may facilitate more cooperative and agreeable attitudes. One-dimensional approaches may hide these potentially opposing associations of competitiveness dimensions. Furthermore, while women seem to be less competitively inclined than men (Croson & Gneezy, 2009; Niederle & Vesterlund, 2011), there is no evidence of whether gender differences are attributable to all three dimensions of competitiveness or to just one of them that then correlates with the others.

We explore the associations of competitiveness dimensions with personality and gender based on a large sample of 1520 individuals. We address typical pitfalls of exploratory research by correcting for multiple testing (Anglim & O'Connor, 2019) and using conservative thresholds for statistical tests (Benjamin et al., 2018). To quantify *independent* associations between each of the three competitiveness dimensions and personality and gender, we not only control for correlations among personality factors by simultaneously including all personality factors (e.g., Ryckman et al., 2011; Fong et al., 2021) but also for correlations among competitive dimensions by simultaneously controlling for other competitiveness dimensions. Moreover, we build on the HEXACO personality framework, which introduces Honesty-Humility as a sixth factor (Lee & Ashton, 2005) that better than agreeableness in the Big Five captures negative personality aspects, such as the dark triad of personality (Psychopathy, Machiavellism, and Narcissism; Lee & Ashton, 2005). This, in turn, is important as it relates significantly to competitiveness (Houston et al., 2015).

2. Method

2.1. Procedures and sample

We administered an online survey to adult students (18 years or older) enrolled at three Colombian universities between August and September 2018. University ethics committees approved the survey. Enrolled students were contacted via an institutional email from the communication department, respectively the chancellor, providing a link to the online survey and encouraging students to share it with others. To incentivize participation, we promoted eleven randomly distributed cash prizes, ranging from COP 50,000 (approximately USD 15) to COP 300,000 (approximately USD 90). We informed participants that identities were not recorded to ensure anonymity. Of 1522 completed surveys, we excluded two participants who did not report their gender, leading to a sample of 1520 responses. Among those who indicated their study program, a majority are undergraduate students (93%) with the rest (7%) enrolled in graduate studies, mostly in the Business or Economics Faculty (50%), Engineering (20%), or Social Sciences (18%). The average age is 22 years; 54% of participants are female.

2.2. Variables

We used short scales based on four items to measure each competitiveness dimension. For *Personal Development competitiveness* (PD), we rely on Newby and Klein's (2014) 4-item Personal Enhancement subscale, which among others also predicts individuals' interest in a competitive management career (Bönte, Lombardo, & Urbig, 2017). Since our conceptualization of *Desire to Win* (DW), in contrast to hypercompetitiveness by Ryckman et al. (1990), does not refer to neuroticism or emotionality, we did not use Ryckmann and colleagues' scale. Smither and Houston's (1992) commonly used scale does not distinguish DW from EC, while Newby and Klein's scale system splits DW into two components and displays critical cross-loadings between dimensions. Therefore, we carefully selected four items that display very high face validity in reflecting individuals' fundamental need to win and outperform others and also displayed high internal and discriminant validity (Newby & Klein, 2014; Smither & Houston, 1992; Spence & Helmreich, 1983). We measure *Enjoyment of Competition* (EC) with an experimentally validated 4-item scale by Bönte, Lombardo, and Urbig (2017). Individuals respond to 7-point Likert scales from 1 (fully disagree) to 7 (fully agree). After recoding reverse items, we calculated the average scores for dimension-specific scores (EC, PD, DW) and an overall one-dimensional score (TC).

Online Appendices report all items, sources, and statistics with a confirmatory factor analysis indicating a good fit (CFI = 0.972, SRMR = 0.047, RMSEA = 0.058), dimension-specific internal reliability (α_{EC} = 0.84, α_{PD} = 0.83, α_{DW} = 0.81) exceeding critical thresholds. Consistent with previous research (e.g., Fong et al., 2021), the competitiveness dimensions are moderately correlated ($r_{EC,PD}$ = 0.65, $r_{EC,DW}$ = 0.51, $r_{PD,DW}$ = 0.57). Nevertheless, confirmatory factor analyses show that the three-dimensional model fits better than the one-dimensional model (CFI = 0.785, SRMR = 0.085, RMSEA = 0.155, Likelihood ratio test of the difference between three- and one-dimensional model: $\chi^2(3)$ = 1705.25, $p < 0.001$). Exploratory factor analyses also indicate the presence and clear separation of the expected three factors as well as convergent validities with the subscales "Enjoyment of Competition" from Houston, Harris, et al. (2002) Competitiveness Index and "Competitiveness" from Helmreich and Spence's (1978) Work and Family Orientation Scale.

We measured *personality* using Ashton and Lee's (2009) six-factorial 60-item *HEXACO* inventory. We follow a back-to-back translation procedure based on the original English version and two independent native Colombian-Spanish translators. We compared differences in the resulting Spanish version to an existing Spanish translation (Romero et al., 2015) and discussed them, resulting in an improved Spanish version adapted to Colombian cultural-linguistic particularities (available upon request). Participants responded on 7-point Likert scales ranging from 1 (fully disagree) to 7 (fully agree). After recoding reverse items, average scores were calculated: the factors' coefficient alphas and composite reliabilities are sufficiently high (α_H = 0.71, cr_H = 0.88, α_E = 0.73, cr_E = 0.75, α_X = 0.83, cr_X = 0.89, α_A = 0.74, cr_A = 0.74, α_C = 0.78, cr_C = 0.77, α_O = 0.72, cr_O = 0.69).

Existing studies on the selection into competitive environments statistically control for *confidence* and *risk-taking* to demonstrate that observed gender differences in competitiveness are not spurious of gender differences in confidence and risk-taking (cf. Niederle & Vesterlund, 2011). We measure individuals' general self-efficacy, that is,

beliefs about their ability to perform well, as a general proxy of confidence. Following Urbig and Monsen (2012), we use four items (α = 0.75) from the New General Self-Efficacy scale of Chen et al. (2001). We also include an experimentally validated measure of individuals' general risk preferences (Dohmen et al., 2011). On a scale from "unwilling to take risks" (1) to "very prone to take risks" (7), participants indicated their willingness to take risks.

Despite employing well-established and experimentally validated instruments, using self-reported measures in cross-sectional surveys may result in common method bias (Podsakoff et al., 2003). We run a principal component analysis of competitiveness and personality items. Only 9.6% of all item variance is accounted for by the first factor, which essentially captures the covariation between competitiveness items. Addtionally, despite measured in the same way, openness to experience does not show any substantial association with EC or DW. Hence, common method variance does not seem to be a major complication in our study.

2.3. Analytical approach

We regress personality factors on the different competitiveness dimensions (summary statistics reported in the online appendix). We report standardized regression coefficients for (1) regressions not controlling for other personality factors or competitiveness dimensions (equivalent to zero-order correlations) and (2) regressions controlling for other personality factors, common in previous research (e.g., Fong et al., 2021; Ryckman et al., 2011). We add (3) regressions controlling for other personality factors *and* competitiveness dimensions to quantify competitiveness dimensions' *independent* associations with personality that are not spurious due to correlations between competitiveness dimensions. We employ procedures that ensure conservative tests (cf., Anglim & O'Connor, 2019; Benjamin et al., 2018). Specifically, we use Bonferroni corrections to adjust reported significance levels for multiple testing. We use the letter "c" to indicate that the thresholds of the significance levels are corrected. To further reduce Type I errors, we follow Benjamin et al. (2018) and set higher standards regarding the critical threshold used to judge a correlation as strong statistical evidence. A corrected *p*-value of 0.001 is our threshold for strong statistical evidence, and higher corrected values up to 0.05 reflect *suggestive* evidence.

3. Results

To set the scene, we first employ a *one-dimensional* perspective on competitiveness, we observe that competitiveness is robustly associated with less honesty-humility and less agreeableness, more extraversion, and suggestively associated with more conscientiousness. The following analyses, however, demonstrate that this simple analysis can be misleading, because they obscure the substantially differing independent associations of the three competitiveness dimensions (Table 1).

3.1. Desire to Win (DW) and personality

DW is robustly associated with lower levels of both *honesty-humility*, with its focus on achieving status and benefit through breaking the rules and exploitative actions, and *agreeableness*, reflecting individuals' reactions to perceiving others' status-enhancing possibly exploitative actions (Ashton & Lee, 2009). Specifically, DW is the dimension uniquely responsible for competitiveness being negatively related to these dimensions because EC and PD's associations with these factors are revealed as spurious once controlling for the other competitiveness dimensions. Moreover, DW positively relates to *conscientiousness*, which is an individual's tendency to strive for accuracy and perfection, making decisions carefully and deliberately, which is consistent with viewing DW as an achievement-oriented component of competitiveness (Hart et al., 2007).

3.2. Personal Development competitiveness (PD) and personality

The most distinctive feature of PD is its positive association with higher *emotionality*, that is, greater dependency on others and greater sensitivity to potential harm, which may incorporate self-doubts about their competencies (Ashton & Lee, 2009). Thus, more emotional individuals might engage in competition not just to improve their competencies but to simultaneously assure themselves that they are neither incompetent nor worthless in the eyes of others. This positive association with emotionality counter-balances other competitiveness dimensions' negative associations, which may render one-dimensional competitiveness measurements being unrelated to emotionality. Moreover, the suggestive positive association of PD with *agreeableness* provides preliminary evidence that developing mastery or seeking reaffirmation through competitions coincides with a tendency to be more collaborative with and be more lenient towards others.

3.3. Enjoyment of Competition (EC) and personality

EC's most distinctive feature is its unique association with both higher levels of *extraversion* and lower *emotionality*. Less emotional individuals are more likely to unconditionally enjoy competitive situations than emotionally unstable, fearful individuals. Because extroverted individuals enjoy social gatherings and interactions (Ashton & Lee, 2009) such as competitions, they are more likely to enjoy it. Zero-order associations indicate that EC negatively relates to *honesty-humility*

Table 1
Competitiveness and personality.

	Honesty-Humility	Emotionality	Extraversion	Agreeableness	Conscientiousness	Opennes to experience
(1a) Overall associations, one-dimensional: No control variables (equivalent to zero-order correlation)						
TC	−0.32 (0.03)^{ccc}	−0.09 (0.03)	0.22 (0.03)^{ccc}	−0.20 (0.03)^{ccc}	0.12 (0.03)^{cc}	0.03 (0.03)
(1b) Overall associations: No control variables (equivalent to zero-order correlation)						
EC	−0.27 (0.04)^{ccc}	−0.23 (0.04)^{ccc}	0.33 (0.03)^{ccc}	−0.14 (0.04)^{cc}	0.06 (0.04)	0.02 (0.04)
PD	−0.22 (0.04)^{ccc}	−0.01 (0.04)	0.20 (0.03)^{ccc}	−0.09 (0.04)	0.17 (0.04)^{ccc}	0.11 (0.04)
DW	−0.47 (0.03)^{ccc}	−0.04 (0.04)	0.13 (0.03)^{cc}	−0.36 (0.04)^{ccc}	0.14 (0.04)^{cc}	−0.02 (0.04)
(2) Controlling only for other personality factors (reflecting frequently applied analyses)						
EC	−0.27 (0.04)^{ccc}	−0.21 (0.04)^{ccc}	0.35 (0.03)^{ccc}	−0.15 (0.04)^{cc}	0.08 (0.04)	0.03 (0.04)
PD	−0.29 (0.04)^{ccc}	0.01 (0.04)	0.18 (0.03)^{ccc}	−0.07 (0.04)	0.18 (0.04)^{ccc}	0.10 (0.04)
DW	−0.48 (0.04)^{ccc}	−0.03 (0.03)	0.16 (0.03)^{ccc}	−0.27 (0.04)^{ccc}	0.26 (0.04)^{ccc}	0.03 (0.04)
(3) Independent/unique associations: Controlling for other personality factors and competitiveness dimensions						
EC	−0.01 (0.03)	−0.20 (0.03)^{ccc}	0.22 (0.03)^{ccc}	−0.06 (0.03)	−0.08 (0.03)	−0.03 (0.03)
PD	−0.01 (0.03)	0.11 (0.03)^{ccc}	−0.03 (0.02)	0.09 (0.03)^{c}	0.06 (0.03)	0.08 (0.03)
DW	−0.32 (0.03)^{ccc}	0.01 (0.03)	0.02 (0.03)	−0.22 (0.03)^{ccc}	0.18 (0.03)^{ccc}	−0.01 (0.03)

Notes: $N = 1520$. Ordinary least squares regression analyses, reporting standardized coefficients with standard errors in parentheses. Significance levels corrected for multiple testing ($3 \times 6 = 18$): $^{ccc}p < 0.001$, $^{cc}p < 0.01$, $^{c}p < 0.05$.

and *agreeableness*, but these associations disappear once controlling for the other two dimensions of competitiveness. Although EC correlates with PD and DW, it is, already based on zero-order correlations, not associated with conscientiousness, which further supports that EC reflects an affective and less achievement-oriented motivation for competing.

3.4. Facet-level analyses

The online appendix reports supplementary facet-level analyses, which offer additional insights, particularly regarding extraversion facets and competitiveness. Indeed sociability, reflecting enjoyment of social interaction, is particularly positively associated with EC, but suggestively negatively associated with DW. Since DW also positively relates to social boldness, reflecting enjoyment of tanding out in groups, DW is not associated with extraversion in general. This finding coincides with studies demonstrating extraversion facets having opposing signs of associations with competitiveness, particularly when operationalized with an emphasis on DW (Fletcher & Nusbaum, 2008).

3.5. Competitiveness dimensions and gender

Table 2 reports regression analyses of competitiveness on gender. Females report, on average, lower levels along all competitiveness dimensions. However, once controlling for correlated competitiveness dimensions, an independent association with gender is observed only for EC.

Broad personality factors, like emotionality, display gender differences (Lee & Ashton, 2004) that may lead to gender differences in competitiveness (Müller & Schwieren, 2012). Additionally, gender differences in confidence and risk-taking may spur gender-differences in competitiveness (Niederle & Vesterlund, 2011). To explore whether the gender difference in EC is specific to EC or caused by such spurious correlations, Table 2 additionally reports results from regressions that control for the six HEXACO personality factors, their squared, cubic, all possible between-factor interaction effects, as well as regressions that additionally control for confidence and risk-taking. In contrast to PD and DW, EC still displays a significant association with gender, which provides robust evidence that men enjoy competition more than women.

Verifying the generalizability of the identified pattern that gender relates to competitiveness solely through the EC, we rely on data of Fong et al. (2021) using Newby and Klein's (2014) four-dimensional competitiveness measurement: General Competitiveness relating to EC, Personal Enhancement Competitiveness reflecting PD, and Dominant Competitiveness and Competitive Affectivity reflecting motivational respectively affective parts of DW. Corresponding regression coefficients for female are −0.53, −0.46, −0.48, and −0.38, respectively, all with $p < 0.001$.The coefficients get smaller when controlling for the respectively remaining three dimensions: −0.10, −0.03, −0.02, and 1−0.03, with only the first dimension (EC) achieving a meaningful level of significance ($p = 0.09$). While the low significance of independent associations may result from a smaller sample and the substantial correlation between the four dimensions, the pattern replicates our findings regarding all dimensions being associated with gender, but EC being the cause.

Table 2
Competitiveness and gender and critical confounding variables.

Gender	Included control variables	EC	PD	DW
Female	None	−0.91 (0.08)^{ccc}	−0.48 (0.07)^{ccc}	−0.47 (0.07)^{ccc}
Female	Competitiveness	−0.55 (0.06)^{ccc}	0.09 (0.05)	−0.08 (0.06)
Female	Competitiveness, personality	−0.42 (0.07)^{ccc}	−0.06 (0.06)	−0.07 (0.07)
Female	Competitiveness, personality, confidence, risk-taking	−0.41 (0.07)^{ccc}	−0.08 (0.06)	−0.06 (0.06)

Notes: $N = 1520$. Ordinary least squares regression analyses, reporting standardized coefficients with standard errors in parentheses. We include all factors' linear, squared, cubic, and all possible between-factor interaction effects as personality variables. Significance levels corrected for multiple testing (3): $^{ccc}p < 0.001$, $^{cc}p < 0.01$, $^{c}p < 0.05$.

4. Discussion

Our observation of dimension-specific and even opposing associations of competitiveness with the HEXACO personality factors and gender once controlling for interdimensional correlations (summarized in Table 3) strongly supports the necessity of a multidimensional approach to conceptualize competitiveness (e.g., Houston, Harris, et al., 2002; Houston, Mcintire, et al., 2002; Newby & Klein, 2014; Swab & Johnson, 2019). The findings open up several avenues for future research benefiting from paying more attention to competitiveness' multidimensional nature.

First, future research on behavioral consequences of individual competitiveness needs to focus on competitiveness dimensions. On the one hand, individual competitiveness is often associated with behaviors that lead to positive outcomes, such as higher individual performance in competitive situations (e.g., Lam, 2012). The combination of emotional stability and extraversion facilitates better job performance (Judge & Erez, 2007). Our results suggest that such a personality with positive performance effects is associated particularly with enjoyment of competition. On the other hand, competitiveness is also often associated with exploitative, less cooperative, and ethically ambiguous behaviors in competitive situations (e.g., Helmreich & Spence, 1978; Houston et al., 2015). Our results show that only DW is independently negatively associated with *honesty-humility*. Since honesty-humility captures negative personality aspects more than agreeableness (Lee & Ashton, 2005), the dark side of competition possibly occurs only in individuals who have a strong desire to win, but not in those who enjoy competition for its own sake or see it as an opportunity for personal growth (Mudrack et al., 2012). Suggestive evidence of a positive (rather than negative) association of PD (independent of honesty-humility) and agreeableness may indicate that the separation of honesty-humility and agreeableness as suggested by the HEXACO framework might pave the path to new insights regarding the links between competitiveness and personality.

Second, our study is first to show (and replicate in an independent dataset) that not only do digit ratios as a biological characteristic relate to EC (Bönte et al., 2017), but also gender differences in competitiveness are solely due to gender differences in EC. While experimental (Niederle & Vesterlund, 2011) and self-reported measures of competitiveness (Bönte, 2015) reveal that women are less competitively inclined than men, our results may help better understand the origins of these differences. Rather than pessimism about odds of winning in mixed-gender competitions, we support Niederle and Vesterlund's (2011) suggestion that enjoyment or anxieties that women experience in specific competitive contexts might play an important role.

Third, our study suggests that future research on competitiveness should consider the multidimensionality of competitiveness more

Table 3
Competitiveness dimensions' independent associations with personality (HEXACO) and gender.

	H	E	X	A	C	O	Gender
EC		−	+				−
PD		+		(+)			
DW	−			−	+		

Notes: Only those independent associations are reported for which the significance levels corrected for multiple testing are below 0.001 (suggestive evidence ($p < 0.05$) in parentheses).

thoroughly not only in theory development but also for related measurement instruments. The findings of studies examining the links between *aggregate* measures of competitiveness and other variables are ambiguous since aggregate measures tend to weigh dimensions of competitiveness differently (see complementary analyses of the "competitiveness" subscale from the Work and Family Orientation Scale by Helmreich and Spence,1978, which are reported in the online appendix). A similar problem applies to single-item competitiveness measures, which may reflect or be confounded with different competitiveness dimensions. Fallucchi et al. (2020), for instance, propose measuring individual competitiveness via the survey item "*Competition brings the best out of me*". However, this item very likely overweighs PD compared to EC or DW. Similarly, the single-item measure used by Bönte (2015) might relatively overweigh EC ("*I like situations in which I compete with others*."). To increase clarity and comparability, research using one-dimensional approaches should clarify the implicit weighting of the different competitiveness dimensions in both conceptualization and measurement.

Future research might also directly extend our study in the following four ways. First, studies may approach populations from different cultures because different associations might be found in different cultures (Houston et al., 2012). Second, while we replicate parts of our new findings for previously published data based on different populations and measurements, future research might use systematic pre-registered large-scale replications with improved multidimensional measurement systems or even behavioral measures that target particular competitive dimensions. Third, while DW and PD and, to some extent, EC are well-established dimensions of competitiveness (Houston et al., 2012; Houston, Mcintire, et al., 2002), future research might explore additional dimensions and, for instance, separate not only cognitive from affective components in DW (Fong et al., 2021; Newby & Klein, 2014) but also in EC and PD. Last, we focused on analyzing broad personality factors and explored facets based on only limited measurements (see appendix). Future research might more thoroughly explore personality facets based on measurement instruments that have higher validities.

CRediT authorship contribution statement

Diemo Urbig: Conceptualization, Methodology, Resources, Formal analysis, Software, Writing – original draft. **Werner Bönte:** Conceptualization, Methodology, Formal analysis, Resources, Writing – original draft. **Jana Schmutzler:** Methodology, Investigation, Resources, Data curation, Writing – original draft, Supervision, Project administration, Funding acquisition. **Andrés Felipe Zambrano Curcio:** Resources, Investigation, Data curation. **Veneta Andonova:** Resources, Investigation, Funding acquisition.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.paid.2021.110775.

References

Anglim, J., & O'Connor, P. (2019). Measurement and research using the Big Five, HEXACO, and narrow traits: A primer for researchers and practitioners. *Australian Journal of Psychology, 71*(1), 16–25.

Ashton, M. C., & Lee, K. (2009). The HEXACO-60: A short measure of the major dimensions of personality. *Journal of Personality Assessment, 91*, 340–345.

Benjamin, D. J., Berger, J. O., Johannesson, M., Nosek, B. A., Wagenmakers, E. J., Berk, R., … Cesarini, D. (2018). Redefine statistical significance. *Nature Human Behaviour, 2*(1), 6.

Bönte, W. (2015). Gender differences in competitive preferences: New cross-country empirical evidence. *Applied Economics Letters, 22*(1), 71–75.

Bönte, W., Lombardo, S., & Urbig, D. (2017). Economics meets psychology: Experimental and self-reported measures of individual competitiveness. *Personality and Individual Differences, 116*, 179–185.

Bönte, W., Procher, V., Urbig, D., & Voracek, M. (2017). Digit ratio (2D:4D) predicts self-reported measures of general competitiveness, but not behavior in economic experiments. *Frontiers in Behavioral Neuroscience, 11*, 238.

Chen, G., Gully, S. M., & Eden, D. (2001). Validation of new general self-efficacy scale. *Organizational Research Methods, 4*, 62–83.

Croson, R., & Gneezy, U. (2009). Gender differences in preferences. *Journal of Economic Literature, 47*(2), 448–474.

Dohmen, T., Falk, A., Huffman, D., Sunde, U., Schupp, S., & Wagner, G. G. (2011). Individual risk attitudes: Measurement, determinants, and behavioral consequences. *Journal of the European Economic Association, 9*(3), 522–550.

Fallucchi, F., Nosenzo, D., & Reuben, E. (2020). Measuring preferences for competition with experimentally-validated survey questions. *Journal of Economic Behavior and Organization, 178*, 402–423.

Fletcher, T. D., & Nusbaum, D. N. (2008). Trait competitiveness as a composite variable: Linkages with facets of the big-five. *Personality and Individual Differences, 45*(4), 312–317.

Fong, M., Zhao, K., & Smillie, L. D. (2021). Personality and competitiveness: Extraversion, agreeableness, and their aspects, predict self-reported competitiveness and competitive bidding in experimental auctions. *Personality and Individual Differences, 169*, 109907.

Hart, J. W., Stasson, M. F., Mahoney, J. M., & Story, P. (2007). The big five and achievement motivation: Exploring the relationship between personality and a two-factor model of motivation. *Individual Differences Research, 5*(4).

Helmreich, R. L., & Spence, J. T. (1978). The Work and Family Orientation Questionnaire: An objective instrument to assess components of achievement motivation and attitudes toward family and career. *JSAS Catalog of Selected Documents in Psychology, 8*, 1–35.

Houston, J., Harris, P., McIntire, S., & Francis, D. (2002). Revising the competitiveness index using factor analysis. *Psychological Reports, 90*(1), 31–34.

Houston, J. M., Edge, H., Anderson, L. E., Lesmana, C. B. J., & Suryani, L. K. (2012). Competitiveness and individualism-collectivism in Bali and the US. *North American Journal of Psychology, 14*(1), 163–174.

Houston, J. M., Mcintire, S. A., Kinnie, J., & Terry, C. (2002). A factorial analysis of scales measuring competitiveness. *Educational and Psychological Measurement, 62*(2), 284–298.

Houston, J. M., Queen, J. S., Cruz, N., Vlahov, R., & Gosnell, M. (2015). Personality traits and winning: Competitiveness, hpercompetitiveness, and Machiavellianism. *North American Journal of Psychology, 17*(1).

Judge, T. A., & Erez, A. (2007). Interaction and intersection: The constellation of emotional stability and extraversion in predicting performance. *Personnel Psychology, 60*(3), 573–596.

Lam, W. L. (2012). Impact of competitiveness on salespeople's commitment and performance. *Journal of Business Research, 65*(9), 1328–1334.

Lee, K., & Ashton, M. C. (2004). Psychometric properties of the HEXACO personality inventory. *Multivariate Behavioral Rresearch, 39*(2), 329–358.

Lee, K., & Ashton, M. C. (2005). Psychopathy, Machiavellianism, and narcissism in the Five-Factor Model and the HEXACO model of personality structure. *Personality and Individual Differences, 38*(7), 1571–1582.

Malhotra, D. (2010). The desire to win: The effects of competitive arousal on motivation and behavior. *Organizational Behavior and Human Decision Processes, 111*(2), 139–146.

Mudrack, P. E., Bloodgood, J. M., & Turnley, W. H. (2012). Some ethical implications of individual competitiveness. *Journal of Business Ethics, 108*(3), 347–359.

Müller, J., & Schwieren, C. (2012). Can personality explain what is underlying women's unwillingness to compete? *Journal of Economic Psychology, 33*(3), 448–460.

Newby, J. L., & Klein, R. G. (2014). Competitiveness reconceptualized: Psychometric development of the competitiveness orientation measure as a unified measure of trait competitiveness. *The Psychological Record, 64*(4), 879–895.

Niederle, M., & Vesterlund, L. (2011). Gender and competition. *Annual Review of Economics, 3*(1), 601–630.

Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology, 88*(5), 879.

Romero, E., Villar, P., & López-Romero, L. (2015). Assessing six factors in Spain: Validation of the HEXACO-100 in relation to the Five Factor Model and other conceptually relevant criteria. *Personality and Individual Differences, 76*, 75–81.

Ross, S. R., Rausch, M. K., & Canada, K. E. (2003). Competition and cooperation in the five-factor model: Individual differences in achievement orientation. *Journal of Psychology, 137*, 323–337.

Ryckman, R. M., Hammer, M., Kaczor, L. M., & Gold, J. A. (1990). Construction of a hypercompetitive attitude scale. *Journal of Personality Assessment, 55*(3–4), 630–639.

Ryckman, R. M., Hammer, M., Kaczor, L. M., & Gold, J. A. (1996). Construction of a personal development competitive attitude scale. *Journal of Personality Assessment, 66*(2), 374–385.

Ryckman, R. M., Thornton, B., Gold, J. A., & Collier, S. (2011). Considering competition avoidant individuals via the big five model. *Current Research in Psychology, 2*(1), 108–114.

Smither, R. D., & Houston, J. M. (1992). The nature of competitiveness: The development and validation of the competitiveness index. *Educational and Psychological Measurement, 52*(2), 407–418.

Spence, J. T., & Helmreich, R. L. (1983). Achievement-related motives and behaviors. In J. T. Spence (Ed.), *Achievement and achievement motives: Psychological and sociological approaches* (pp. 10–74). San Francisco, CA: Freeman.

Swab, R. G., & Johnson, P. D. (2019). Steel sharpens steel: A review of multilevel competition and competitiveness in organizations. *Journal of Organizational Behavior, 40*, 147–165.

Urbig, D., & Monsen, E. (2012). The structure of optimism: Controllability affects the extent to which efficacy beliefs shape outcome expectancies. *Journal of Economic Psychology, 33*(4), 854–867.

Van den Broeck, A., Ferris, D. L., Chang, C. H., & Rosen, C. C. (2016). A review of self-determination theory's basic psychological needs at work. *Journal of Management, 42*(5), 1195–1229.

ONLINE APPENDICES

for

Urbig, Bönte, Schmutzler, Zambrano, Andonova

"Diverging associations of dimensions of competitiveness with gender and personality."

Personality and Individual Differences

Appendix A: Overview of competitiveness items and confirmatory factor analysis

Appendix B: Relationship of the three dimensional to two related measures of competitiveness

Appendix C: Summary statistics

Appendix D: Competitiveness and personality (facet-level analysis)

Appendix E: Multivariate association of dimensions of competitiveness with personality

Appendix A: Overview of competitiveness items and confirmatory factor analysis

Text (English and Colombian Spanish)		Source	Loading
Enjoyment of competition (α=0.84, cr=0.68)			
2-EC1: I enjoy competing against others	Disfruto competir con otros.	Bönte et al. (2017a), Newby & Klein (2014)	0.90
3-EC2: I prefer competing with others when pursuing a goal over pursuing the goal alone.	Prefiero competir con otros al perseguir un objetivo a perseguir el objetivo yo solo.	Bönte et al. (2017a)	0.52
4-EC3: I like situations in which I compete with others	Me gustan las situaciones en las que compito con otros.	Bönte et al. (2017a), Bönte & Piegeler, (2013)	0.92
5-EC4: I find competitive situations unpleasant.	No encuentro placenteras las situaciones de competencia.	Bönte et al. (2017a), Smither & Houston (1992)	-0.70
Personal development motives (α=0.83, cr=0.70)			
6-PD1: Competition allows me to measure my own success	La competencia me permite medir mi propio éxito.	Newby & Klein (2014)	0.79
7-PD2: Competition allows me to judge my level of competence	La competencia me permite juzgar mi nivel de competencias/ habilidades.	Newby & Klein (2014)	0.79
8-PD3: I use competition as a way to prove something to myself.	Uso la competencia como una forma de probarme algo a mí mismo/a.	Newby & Klein (2014)	0.75
9-PD4: I can improve my competence by competing.	Puedo mejorar mis competencias/ habilidades al competir.	Newby & Klein (2014)	0.66
Desire to win (α=0.81, cr=0.69)			
10-DW1: I often try to outperform others	A menudo, trato de ser mejor que los demás.	Smither & Houston (1992)	0.79
18-DW2: I want to win in both work and games.	Quiero ganar tanto en el trabajo como en los juegos.	Adapted from Spence & Helmreich (1983)	0.63
19-DW3: I try to be the best person in the room at almost anything.	Busco ser la mejor persona del lugar en casi todo.	Newby & Klein (2015)	0.71
20-DW4: It is important for me to outperform others.	Para mí es importante desempeñarme mejor que los demás.	Spence & Helmreich (1983)	0.77

Notes. N= 1,520. Table reports coefficient alpha (α) and composite reliability (cr) for the competitiveness dimensions. Factor loadings from the confirmatory factor analysis reported are last column; fit indices for confirmatory factor analysis: $\chi^2(df=51)=309.450$, $p<0.001$, CFI=0.972, SRMR=0.047, RMSEA=0.058 with $CI_{90\%}=[0.052,0.064]$. The one-dimensional model, all items loading on a single latet factor, first significantly worse than the one-dimensional model: $\chi^2(df=54)=2014.69$, $p<0.001$, CFI=0.785, SRMR=0.085, RMSEA=0.155 with $CI_{90\%}=[0.149,0.160]$, Liklihood ratio test for difference to three-dimensional model: $\chi^2(3)=1705.25$, $p<0.001$.

Appendix B: Relationship of the three dimensions to two related competitiveness measures

To compare our multi-dimensional measure of competitiveness with related scales, we included the 9-item subscale on 'Enjoyment of Competition' (α=0.90) from Houston and colleagues' (2002a) Competitiveness Index. From Helmreich and Spence's (1978) Work and Family Orientation Scale, we also included the subscale 'Competitiveness' (α=0.72), which should be related to all three of our dimensions (Houston et al., 2002b, Bönte et al., 2017b). Since one item from the WOFO subscale refers to world beliefs as beliefs and feelings regarding issues generalized beyond the own person, i.e., "I feel that winning is important in both work and games", we adapted the item to reflect self-evaluations only: "I want to win in both work and games." An exploratory factor analysis with oblique rotation (PROMAX, reported in the following table) indicates that the three dimensions separate relatively well. As expected, the items from Houston and colleagues' (2002a) enjoyment of competition generally load on the enjoyment of competition dimension. Only one item refers to and correspondingly load on the dimension desire to win, which suggests that this item should be removed from Houston and colleagues' scale.

Survey id	**Variable**	**Factor loadings**		
		1	2	3
2) I enjoy competing against others.	EC1	0.83		
3) I prefer competing with others when pursuing a goal over pursuing the goal alone.	EC2	0.34		
4) I like situations in which I compete with others.	EC3	0.83		
5) I find competitive situations unpleasant.	EC4, CI1	-0.82		
6) Competition allows me to measure my own success.	PD1		0.72	
7) Competition allows me to judge my level of competence.	PD2		0.76	
8) I use competition as a way to prove something to myself.	PD3		0.61	
9) I can improve my competence by competing.	PD4		0.51	
10) I often try to outperform others.	DW1, CI2			0.70
18) I want to win in both work and games.	DW2			0.49
19) I try to be the best person in the room at almost anything.	DW3			0.69
20) It is important for me to outperform others.	DW4, WOFO-1			0.68
11) I like competition.	CI3	0.78		
12) I don't like competing against other people.	CI4	-0.81		
13) I enjoy competing against an opponent.	CI5	0.77		
14) I try to avoid competing with others.	CI6	-0.78		
15) I get satisfaction from competing with others.	CI7	0.79		
16) I dread competing against other people.	CI8	-0.62		
17) I am a competitive individual.	CI9	0.61		
1) I enjoy working in situations involving competition with others.	WOFO-2	0.80		
21) I feel that winning is important in both work and games.	WOFO-3			0.46
22) I try harder when I'm in competition with other people.	WOFO-4		0.38	
23) It annoys me when other people perform better than I do.	WOFO-5			0.67

Notes: EC=Enjoyment of competition, PD=Personal development competitiveness, DW=Desire to win, CI=Competitiveness Index, WOFO-C = Work Family Orientation Subscale competitiveness. Factor loadings below 0.3 are omitted.

Both with respect to zero-order correlation (r) and partial correlation (p), that is, free of the corresponding other dimensions of competitiveness, the Competitive Index (CI) correlates most strongly with enjoyment of competition ($r_{CI,EC}$=0.89, $r_{CI,PD}$=0.67, $r_{CI,DW}$ =0.59, $p_{CI,EC}$=0.80, $p_{CI,PD}$=0.14, $p_{CI,DW}$ =0.29). Regarding the Competitiveness subscale from Helmreich and Spence (1978), we support earlier research reporting that this scale relates to all three dimensions. Due to the majority of items relating to Desire-to-win, however, the overall scale is most strongly related to Desire-to-win rather than to Enjoyment of Competition or Personal Development Competitiveness ($r_{WOFO\text{-}C,EC}$=0.67, $r_{WOFO\text{-}C,PD}$=0.67, $r_{WOFO\text{-}C,DW}$ =0.81, $p_{WOFO\text{-}C,EC}$=0.36, $p_{WOFO\text{-}C,PDr}$=0.24, $p_{WOFO\text{-}C,DWr}$ =0.69).

Appendix C: Summary statistics

Variable	Means	Standard deviation
Competitiveness		
Enjoyment of competition	4.35	1.53
Personal development competitiveness	5.09	1.42
Desire to win	4.57	1.44
Personality		
Honesty-Humility	4.86	1.00
Emotionality	4.42	1.02
Extraversion	4.64	1.11
Agreeableness	4.40	0.98
Conscientiousness	4.93	0.96
Openness to experience	5.08	0.97
Gender		
Female	0.54	0.50
Confounding variables		
General self-efficacy (GSE)	5.28	1.05
General risk-taking (GRT)	7.49	1.95

N=1,520.

Appendix D: Competitiveness and personality (facet-level analysis)

	M	SD	No control variables			Controlling for remaining personality facets and competitiveness dimensions		
			EC	PD	DW	EC	PD	DW
Honesty-Humility (H)								
Sincerity	5.00	1.37	-0.08(0.03)	-0.06(0.03)	-0.12(0.03)^{ccc}	0.01(0.02)	-0.00(0.02)	-0.01(0.02)
Fairness	5.34	1.51	-0.11(0.03)^{ccc}	-0.08(0.02)^{c}	-0.14(0.02)^{ccc}	-0.04(0.02)	-0.02(0.02)	0.01(0.02)
Greed avoidance	3.44	1.47	-0.15(0.03)^{ccc}	-0.18(0.02)^{ccc}	-0.33(0.02)^{ccc}	0.04(0.02)	-0.03(0.02)	-0.15(0.02)^{ccc}
Modesty	5.38	1.47	-0.20(0.03)^{ccc}	-0.13(0.02)^{ccc}	-0.37(0.02)^{ccc}	-0.02(0.02)	0.06(0.02)	-0.21(0.02)^{ccc}
Emotionality (E)								
Fearfulness	4.33	1.46	-0.16(0.03)^{ccc}	-0.01(0.03)	-0.03(0.03)	-0.11(0.02)^{ccc}	0.06(0.02)	0.01(0.02)
Anxiety	4.99	1.50	-0.12(0.03)^{ccc}	0.02(0.02)	0.06(0.02)	-0.06(0.02)	0.02(0.02)	0.05(0.02)
Dependence	3.80	1.53	-0.11(0.03)^{ccc}	-0.03(0.02)	-0.04(0.02)	-0.04(0.02)	0.01(0.02)	-0.02(0.02)
Sentimentality	4.55	1.39	-0.06(0.03)	0.01(0.03)	-0.05(0.03)	0.01(0.02)	0.01(0.02)	-0.00(0.02)
Extraversion (X)								
Social self-esteem	5.04	1.37	0.22(0.03)^{ccc}	0.13(0.03)^{ccc}	0.05(0.03)	0.09(0.03)	-0.01(0.03)	-0.02(0.03)
Social boldness	4.34	1.42	0.20(0.03)^{ccc}	0.12(0.03)^{ccc}	0.18(0.03)^{ccc}	0.01(0.03)	-0.07(0.02)	0.11(0.02)^{ccc}
Sociability	4.37	1.50	0.19(0.03)^{ccc}	0.11(0.02)^{ccc}	0.02(0.02)	0.10(0.02)^{cc}	0.03(0.02)	-0.08(0.02)^{c}
Liveliness	4.78	1.43	0.19(0.03)^{ccc}	0.12(0.03)^{ccc}	0.04(0.03)	0.00(0.03)	0.02(0.03)	-0.00(0.03)
Agreeableness (A)								
Forgivingness	4.60	1.59	-0.05(0.02)	-0.03(0.02)	-0.14(0.02)^{ccc}	-0.03(0.02)	0.02(0.02)	-0.01(0.02)
Gentleness	4.17	1.29	-0.15(0.03)^{ccc}	-0.07(0.03)	-0.22(0.03)^{ccc}	-0.06(0.03)	0.04(0.02)	-0.02(0.02)
Flexibility	4.32	1.19	-0.15(0.03)^{ccc}	-0.15(0.03)^{ccc}	-0.30(0.03)^{ccc}	-0.00(0.03)	-0.05(0.03)	-0.06(0.03)
Patience	4.68	1.60	0.07(0.02)	0.06(0.02)	-0.07(0.02)^{c}	0.01(0.02)	0.06(0.02)	-0.03(0.02)
Conscientiousness (C)								
Organization	4.79	1.53	0.03(0.03)	0.07(0.02)	0.03(0.02)	-0.02(0.02)	0.03(0.02)	-0.01(0.02)
Diligence	4.99	1.25	0.08(0.03)	0.14(0.03)^{ccc}	0.13(0.03)^{ccc}	0.01(0.03)	0.01(0.02)	0.05(0.03)
Perfectionism	5.01	1.27	0.04(0.03)	0.13(0.03)^{ccc}	0.18(0.03)^{ccc}	-0.03(0.03)	0.02(0.03)	0.10(0.03)^{c}
Prudence	4.90	1.21	-0.00(0.03)	0.03(0.03)	-0.03(0.03)	0.00(0.03)	0.01(0.03)	-0.02(0.03)
Openness to experience (O)								
Aesthetic appreciation	5.27	1.56	-0.05(0.03)	-0.02(0.02)	-0.04(0.02)	-0.01(0.02)	-0.02(0.02)	-0.01(0.02)
Inquisitiveness	5.11	1.39	0.02(0.03)	0.06(0.03)	0.01(0.03)	-0.04(0.02)	0.04(0.02)	0.01(0.02)
Creativity	4.96	1.44	0.04(0.03)	0.08(0.03)^{c}	0.03(0.03)	0.00(0.02)	0.03(0.02)	0.01(0.02)
Unconventionality	5.07	1.17	0.03(0.03)	0.08(0.03)	-0.05(0.03)	0.02(0.03)	0.07(0.02)	-0.07(0.03)

Notes: N = 1,520. Ordinary least squares regression analyses, reporting standardized coefficients with standard errors in parentheses. Since all remaining 23 facets are controlled for at the facet-level, facet-level partial correlations reveal associations that are on top of associations of competitiveness with the common variance of broad personality factors. Abbreviations: M=Mean, SD=Standard deviation.

Significance levels corrected for multiple testing (row-specific degrees of freedom: 3x6x4 = 72): ^{ccc} p<0.001, ^{cc} p<0.01, ^{c} p<0.05

Appendix E: Multivariate association of dimensions of competitiveness with personality

To complement our analyses reported in the manuscript, we also estimate the extent to which each of the three competitiveness dimensions is conjointly explained by differences in multiple personality factors. We first estimate models that include only the six broad personality factors. As a next step, we add squared and cubic effects and all possible interactions of the six factors. Finally, we add the facet-level information for all personality factors. We test the increments in explanatory power via likelihood ratio tests.

For *enjoyment of competition*, the explained variance increases from 13 to 16 percent when including squared, cubic, and all possible interactive effects and to 22 percent when adding the facet-level information.

For *personal development competitiveness*, the explained variance increases from 7 to 12 percent and to 20 percent.

For *desire to win*, the explained variances increases from 18 to 28 percent and to 34 percent.

Overall, the six personality factors, their interactions, and their facets do not explain large parts of variance in each of the competitiveness dimensions, with enjoyment of competition and personal development competitiveness being least strongly associated wwith personality. Hence, while competitiveness dimensions display characteristic relationships with personality and, additionally, competitiveness is sometimes considered just reflecting a broader personality factor such as extraversion, competitiveness is not simply a reflection of a particular constellation of broad personality factors or their facets.