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Psychometric Properties of the Multifaceted Gender-Related Attributes Survey (GERAS)

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Abstract

Since the 1920s, psychologists have sought to assess the sex- and gender-related attributes of men and women, including primarily aspects of personality and focusing on positive characteristics. In this paper, we introduce a new questionnaire for assessing gender-related attributes with a broader approach than provided by previous ones. Therefore, the questionnaire includes (a) not only personality traits but also cognitions and interests and (b) not only positive but also negative and neutral characteristics. Two independent datasets were acquired (Study 1: N = 1,466; Study 2: N = 471) for development and psychometric analyses. Factor analysis confirmed a hierarchical structure with two separate dimensions of masculinity and femininity overarching the multiple first-order domains of personality, cognition, and interests. Analyses of reliability and convergence with other gender identity and personality scales revealed sufficient values. The new instrument discriminated between the biological sexes and was related to the gender quotas in participants' occupations and social environments, thus providing evidence for criterion-related validity. Therefore, we propose the Gender-Related Attributes Survey (GERAS) as a useful tool for objectively assessing gender-related attributes across multiple facets in gender and sex-difference research.

Keywords

gender role identity; gender stereotypes; masculinity; femininity; psychometric properties

Since the 1920s, psychologists have aimed to assess sex-and gender-related psychological attributes of men and women (for a summary, see Beere, 1990). The emerging differentiation between *sex,* reflecting the biological basis, and *gender,* reflecting shared cultural aspects, further led to increasing interest in these constructs (e.g., Dean & Tate, 2017). A number of related constructs have been differentiated such as *gender roles* or *gender role identity.* The former "refer to social and behavioral norms that, within a specific culture, are widely considered to be socially appropriate for individuals of a specific sex" (UN Women Training Centre eLearning Campus, 2018, para. 22). The latter emerges when individuals incorporate these cultural meanings into their self-concept, mostly used synonymously with gender role

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orientation, gender role self-concept, or gender-related self (see Guimond et al., 2007; Stewart & McDermott, 2004). Gender role identity terms a person's identification with cultural definitions of being female and male or typically masculine or feminine attributes - independent of a person's actual biological sex. The construct has been identified as an important characteristic in different fields: For example, higher masculinity in both, adolescent boys and girls was related to fewer depressive symptoms in health and developmental research (Priess, Lindberg, & Hyde, 2009), or higher scores on both masculinity and femininity were related to positive self-concept in Black male adolescents in racial/cultural research (Buckley, 2018).

In the late 1980s, Beere (1990) selected over 200 measures on gender roles, of which 28 were constructed to assess gender identity in both men and women. As we describe below, this number is even higher today. However, as Beere already criticized the authors did usually not sufficiently provide the psychometric properties of these measures, especially regarding coefficients of reliability and validity.

Wood and Eagly (2015) recently distinguished two approaches for assessing gender role identity in psychological research: The first, older tradition was developed on the basis of research on individual differences in personality and interests. Gender-stereotypic personality traits and gender-typed interests (e.g., Lippa, 1991) represented this approach. Early attempts (e.g., Terman & Miles, 1936) suggested a unidimensional, bipolar construct of masculinity and femininity (e.g., Smiler, 2004) in this branch of research. However, newer studies – in which the personality traits communion and agency have commonly represented femininity and masculinity (Abele et al., 2016; Bem, 1974) – have suggested that masculinity and femininity form two separate dimensions. As a consequence, a person does not have to be categorized as either (a) masculine or (b) feminine, but – if classification is the goal – can also be classified as (c) *androgynous*, characterized by high scores on both the Masculinity and Femininity scales, or (d) *undifferentiated*, characterized by low scores on both scales (see Bem, 1977). A second, newer tradition of research and the assessment of gender role identity relates to the social identity perspective. Items have been designed to assess individuals' feeling of belonging to the social category of women or men (Wood & Eagly, 2015). This newer approach has led to further developments that have also included indirect reaction time measures (e.g., van Well, Kolk, & Oei, 2007).

With respect to the first tradition, the most influential and widely applied early questionnaires were the Personal Attributes Questionnaire (PAQ; Spence, Helmreich, & Stapp, 1974) and the Bem Sex Role Inventory (BSRI; Bem, 1974). Both were designed primarily to integrate socially desirable items targeting agency and communion and were criticized for their unclear factor structure (Choi & Fuqua, 2003), low stability in recent decades (Twenge, 1997), and their poor applicability to different cultures (Colley, Mulhern, Maltby, & Wood, 2009; Hill, Fekken, & Bond, 2000). Newer approaches based on the BSRI and PAQ added negatively valued personality traits (PN-SRI; Berger & Krahé, 2013; PAQ-M/PAQ-F; Spence, Helmreich, & Holahan, 1979). A newer brief scale, the Traditional Masculinity-Femininity scale (TMF; Kachel, Steffens, & Niedlich, 2016), assesses the agreement between what an individual thinks the social norm is and his/her own position with respect to that on only six items. The brevity of this measure, albeit including four

aspects of gender role identity beyond personality characteristics, represents advantages. However, scales consisting of so few items, on the one hand, require respondents to be capable of summing up all the necessary information to answer a rather broad item, and on the other hand, run the risk of having low reliability (Raykov, 2008).

To summarize, at present, the existing questionnaires for assessing gender role identity focus on more or less socially desirable aspects of personality (BSRI, PAQ), gender-related interests (gender diagnosticity; Lippa, 1991), or directly address the criteria with single items (TMF; sex role self-concept [SIS]; Pletzer, Petasis, Ortner, & Cahill, 2015). However, a literature search did not identify any instrument that combines these characteristics because they usually focus on one domain. To expand the choices of gender role identity measures, our new questionnaire was designed (a) to comprise a set of contemporary items that empirically reflect the current indications of research, (b) to apply sound methodology for scale construction, and (c) to implement aspects of personality, cognition, and interests into one measure.

With the present paper, we therefore present the development and psychometric properties of a new self-report questionnaire for assessing gender-related attributes: the Gender-Related Attributes Survey (GERAS). We conducted two studies to investigate the measure's characteristics and to develop the present version of the questionnaire: In Study 1, we employed an online sample for the scale construction, factor analyses and first investigations of reliability and construct validity. In Study 2, we applied the thus resulting shortened version of the questionnaire as paper-pencil instrument in the lab, in order to cross validate the factor structure, and to investigate the new measure's reliability, stability, and validity further. We essentially repeated the procedure from Study 1 but added more criteria for the analyses of criterion validity.

Study 1 – Scale Construction and Prevalidation

Method

Procedure—Participants were invited to take part in an online survey presented in the survey panel Unipark (by Questback GmbH, see https://my.unipark.com/) through Internet panels and mailing lists at German, Austrian, and Swiss universities and colleges. We promoted the questionnaire as an investigation of their self-report on several dimensions and whose relation to several biological and social variables. First, participants provided demographic information. Second, the first version of the GERAS was presented with all items in a randomized order, and the predominant gender in participants' social environments was addressed. Third, participants were instructed to either rate the personality items regarding their relevance (How relevant is this item for describing gender differences?), stereotyping (How stereotypical is this item for a men/women?), social desirability (How socially desirable is this characteristic?). These ratings were conducted on Likert-scales from 1 (= *not at all* […]) to 7 (= *very* […]) for a preselection of the items further used for factor analyses, for results see Electronic Supplementary Material 1 (ESM 1). Alternatively, they filled out construct-related questionnaires such as the BSRI and PAQ, the Freiburg Personality Inventory (FPI-R; Fahrenberg, Hampel, & Selg, 2001), and the 16 Personality Factors Questionnaire (16PF-R; Schneewind & Graf, 1998). The subsample

employed for estimating the measure's test–retest correlations filled out the GERAS a second time after a period of 2–8 weeks. Thus, the number of items presented differed between the resulting subsamples and duration time ranged from 15 to 45 min, depending on the survey version. Table 1 presents the sample size, gender distribution, and age of the subsamples per each research goal.

Sample—A sample of 1,466 participants recruited from Austria (48.5%) and Germany (50.2%; 1.3% were native German speakers with other nationalities) completed the survey consisting of 399 men between 15 and 81 years of age ($M = 27.47$, $SD = 10.19$) and 1,067 women between 15 and 77 years ($M = 23.87$, $SD = 6.65$). As their highest educational level, 2% of the sample had completed primary school, 6% secondary school, 8% professional school, 59% A-levels, and 25% had a University degree. Participants were mostly students (about 70%) who had completed their A-levels (84%). About 30% of the participants were recruited from the general population from posts in online panels (e.g., under the topics sports or cooking).

Material

GERAS: The original version of the GERAS consisted of 100 items representing aspects of personality (formulated as single-word expressions), 24 items representing cognitive abilities, and 40 items representing activities and interests (both formulated as short-term statements). This item pool was based on (a) previous research literature examining (perceived) sex/gender differences in personality, cognitive abilities, or interests, and (b) a previous study exploring and clustering characteristics that participants named as relevant for the classification of their gender role identity (Pletzer et al., 2015).

The resulting first subscale focused on aspects of personality (Personality subscale, PS) that are culturally believed to be more present in women than in men or vice versa. Individuals were asked to rate themselves in relation to a general population of other men and women, in reference to the culture they predominantly associated themselves with. Besides the general positive communal and agentic personality traits (Abele et al., 2016; Bem, 1974), feminine items included aspects such as frequency of emotional expressions (e.g., Feingold, 1994) and intuition (e.g, Fischer, 1993) as well as contents obtained from the Big Five personality traits neuroticism and agreeableness (Schmitt, Realo, Voracek, & Allik, 2008). Masculine items addressed ascribed rationality (Fischer, 1993), risk-taking behavior (Byrnes, Miller, & Schafer, 1999), and competitiveness (Lynn, 1993). The second subscale (Cognition subscale, CS) focused on cognitive abilities that are typically seen as more pronounced in either men or women (for a review, see Andreano & Cahill, 2009; Eccles, Freedman-Doan, Frome, Jacobs, & Yoon, 2000). Participants were asked to rate the anticipated difficulty of performing certain tasks (e.g., "finding the right words" [feminine] or "finding one's way" [masculine]). The masculine dimension of the GERAS further comprised abilities such as visuospatial processing, navigation, or logical/mathematical skills. The feminine dimension of the first version of the GERAS included verbal ability, autobiographical memory, or the ability to memorize faces and names. For the third subscale, the Activities and Interests Subscale (AIS), participants were asked to rate their desire to pursue certain activities. In line with previous studies (e.g., Dietz-Uhler, Harrick,

End, & Jacquemotte, 2000; Evans, Schweingruber, & Stevenson, 2002), activities considered feminine lay within the areas of language and arts, make-up/clothing, and social activities (e.g., “talking on the phone”), as well as sports that are considered to be rather calm in nature (e.g., “dancing”). Masculine items mostly focused on competitive, team-related, or comparatively action-packed sports and activities (e.g., “pursuing ball-sports”, “playing cards”).

Related Measures of Gender Role Identity: We employed the BSRI-F (Femininity; 20 items, e.g., “romantic”; ω = .88) and BSRI-M (Masculinity; 20 items, e. g., “fearless”; ω = .92) scales on a 7-point Likert-scale ranging from 1 (= *does not apply to me)* to 7 (= *mostly applies to me).* Furthermore, we employed the PAQ-M (Masculinity/Instrumentality; eight items, e.g., “active”; ω = .81) and the PAQ-F (Femininity/Expressivity; eight items, e.g., “friendly”; ω = .86) scales on a 5-point Likert-scale ranging from 1 (= *does not apply to me)* to 5 (= *mostly applies to me).*

Personality Questionnaire Subscales: We employed the subscales Dominance, Emotional Stability, Warmth, Sensitivity, and Concern from the 16PF-R (.77 ≤ ω ≥ .84), as well as the FPI-R (.69 ≤ ω ≥ .82) to assess Achievement Orientation, Aggressiveness, Irritability, and Social Orientation.

Other Criteria

Social Environment: We assessed participants’ usual social environment with eight items from the newly developed Peer Relations Scale (PRS; male-PRS: ω = .75 and female-PRS: ω = .73). Items addressed the sex of important self-reported attachment figures (“Are there mainly women/men among your closest attachment figures?”), sex of social environment while growing up (Did you grow up with many women/men?), sex of current friends, and self-reported general feelings of how one gets along with women and men. Ratings were given on a 7-point Likert-scale ranging from 1 (= *do not agree at all)* to 7 (= *agree very much).*

Occupational Gender (OCG): Participants indicated their current profession or professional education. Professions were clustered into a scale ranging from 1 (= *very masculine profession)* to 7 (= *very feminine profession)* in accordance with the gender distribution of the profession or branch (Institut für Arbeitsmarkt-und Berufsforschung - IAB, 2010).

Demographic Data: We further assessed participants’ age, nationality, first language, and educational background.

Statistical Analyses: Missing values in both datasets were imputed by applying the Multivariate Imputation by Chained Equation (MICE) Algorithm implemented in SPSS 24. Further analyses were carried out with R (version 3.5.0) using the packages “lavaan” (version 0.6-1; Rosseel, 2018), “nFactors” (version 2.3.3; Raiche & Magis, 2010) and “psych” (version 1.6.4; Revelle, 2016).

To investigate the factor structure in a first step, we split the Study 1 dataset employing Subset 1 for exploratory purposes and Subset 2 to cross-validate these findings (and further

the dataset from Study 2). In the exploratory part, we first used EFA to set the number of factors to find a model separately for the three subscales PS, CS and AIS. We excluded items with (a) loadings < .30 on any factor or (b) loadings > .30 on more than one factor. We then cross-validated this factor solution. Second, we tested measurement invariance across men and women for these factor solutions of the subscales in all datasets. Finally, we investigated the hierarchical factor structure modeling latent variables based on the previous factor analyses (see ESM 2 for a more detailed description of our modeling approach).

We investigated internal consistency of the GERAS sub-scales by calculating omega, and further calculated split-half and retest reliability. Masculinity and femininity scores from related measures as well as the 16PF-R and FPI-R scales served as criteria for analyses on convergent validity. In order to evaluate criterion-related validity, we analyzed sex differences for all GERAS scales, and the relation to the PRS items and occupational classification. Data and R scripts are published in the Open Science Framework (see https://osf.io/42jhr/).

Results

Factor Structure

First-Order Models: For PS, EFA and CFAs revealed a final five-factor model including 10 masculine and 10 feminine items. The feminine items loaded on two factors that we named “expressivity” and “neuroticism”; the masculine items were grouped in three factors “risk-taking,” “assertiveness,” and “rationality” (see Table S1 for item loadings and Table S4 for the model fits from the EFA and CFAs in ESM 3). For CS, the factor analysis revealed a final four-factor model including seven masculine and seven feminine items. Masculine items accumulated into “spatial abilities” and “numerical abilities”; feminine items accumulated into “verbal abilities” and “memory functions” (see Table S2 for item loadings in ESM 3). For AIS, factor analyses revealed a model including eight masculine and eight feminine items, which congregated into masculine and feminine “social interests” and “sports interests” factors (see Table S3 for item loadings in ESM 3). For these first-order models, all datasets revealed measurement invariance across men and women (Tables S1-S3, ESM 4).

Higher-Order Model—Investigations of the higher-order facture structure revealed best model fit indices for a third-order model (χ^2[66, N = 733] = 88.83, CFI = .944, RMSEA = .022, SRMR = .092, χ^2/df = 1.35; for the fit indices of all three tested higher-order models, see Table S5 in ESM 3). Within this final model, the first-order factors loaded on subscale-conform second-order Personality, Cognition, and Activities and Interests factors per each third-order factor Masculinity and Femininity. In order to obtain model fit, we allowed for error covariance between the first-order factors risk-taking and neuroticism, and between the second-order factors of masculine and feminine cognitions. This factor solution was confirmed in Subset 2 in Study 1 (χ^2[66, N = 733] = 98.26, CFI = .924, RMSEA = .026, SRMR = .092, χ^2/df = 1.49, displayed in Figure 1).

Reliability Analyses—Revelle's Omega, Split-half coefficients ($r_{tt\alpha}$), and retest correlation coefficients (r_{tt}) were sufficient for both the GERAS-Masculinity ($\omega = .85$, $r_{tt\alpha} = .87$, $r_{tt} = .88$) and GERAS-Femininity ($\omega = .86$, $r_{tt\alpha} = .85$, $r_{tt} = .80$) scales.

Convergent Validity—For detailed results regarding subscales (Table S1) and calculated separated by sex (Table S2), see ESM 6.

Convergence With Other Gender Role Identity Scales: GERAS-Masculinity was significantly related to the BSRI-M ($r = .44$, $p < .01$) and PAQ-M ($r = .35$, $p < .01$) scales, whereas GERAS-Femininity was significantly related to the BSRI-F ($r = .50$, $p < .01$) and PAQ-F ($r = .58$, $p < .01$) scales. A similar pattern emerged when calculated for men and women separately.

Convergence With Other Personality Scales: GERAS-Masculinity was significantly positively related to the FPI-R score for Achievement Orientation ($r = .41$, $p < .01$) and the 16PF-R scores for Dominance ($r = .27$, $p < .01$) and Emotional Stability ($r = .26$, $p < .01$). GERAS-Femininity was positively related to the FPI-R score for Social Orientation ($r = .22$, $p > .05$ after Holm correction) and the 16PF-R scores for Warmth ($r = .33$, $p < .01$), Sensitivity ($r = .26$, $p < .01$), and Concern ($r = .16$, $p > .05$). A somewhat similar pattern emerged when calculated separated by sex.

Criterion-Related Validity

Biological Sex: Men scored significantly higher on GERAS-Masculinity ($M = 4.49$, $SD = 0.72$) than women ($M = 3.68$, $SD = 0.67$, $F[1, 1464] = 404.23$, $p > .001$), and women scored significantly higher on GERAS-Femininity ($M = 4.80$, $SD = 0.60$) than men ($M = 4.04$, $SD = 0.62$, $F[1, 1464] = 462.23$, $p < .001$).

Social Environment: GERAS-Masculinity and GERAS-Femininity were both significantly positively related to self-reports of growing up with men/women (all $rs \geq .23$, all $ps < .01$), having male/female attachment figures during childhood (all $rs \geq .22$, all $ps < .01$), having mostly male/female friends (all $rs \geq .29$, all $ps < .001$), and getting along with men/women (all $rs \geq .17$, all $ps < .01$). When analyzed separately for men and women, a similar pattern emerged (all $rs \geq .14$, all $ps < .01$), except for the relation between GERAS-Femininity and growing up with women, which disappeared in men ($r = .11$, $p > .05$).

OCG: Correlation analysis between OCG and GERAS-Masculinity revealed a negative coefficient ($r = -.32$, $p < .01$), indicating that participants scoring higher on GERAS-Masculinity were employed in professions predominantly chosen by men. GERAS-Femininity was significantly positively related to OCG ($r = .28$, $p < .01$), indicating that participants scoring higher on GERAS-Femininity were employed in professions predominantly chosen by women. Separate analyses for men and women did not reveal significant correlation coefficients.

Study 2 – Validation

Method

Procedure and Material—Participants were recruited from courses and through announcement boards at the University of Salzburg and through bulletin boards in civic centers. Participants first worked on a demographic questionnaire, followed by a shortened paper-pencil version of the GERAS (20 PS items, 14 CS items and 16 AIS items; see ESM 5 for the whole questionnaire) based on results from Study 1. Except for scales of 16PF-R and FPI-R, additional instruments were presented as in Study 1 (BSRI-F: ω = .77; BSRI-M: ω = .90; PAQ-M: ω = .79; PAQ-F: ω = .85; male-PRS: ω = .76; female-PRS: ω = .74). Additionally, participants were asked to indicate how masculine or feminine (ranging from 1 = not at all masculine/feminine to 9 = very masculine/feminine) they considered themselves compared with men, women, and the total population on a six-item-scale (SIS; Pletzer et al., 2015; three items each; SIS-Masculinity: ω = .94; SIS-Femininity: ω = .94). They were further asked to also have a close friend or relative rate them on the SIS (SIS-Masculinity-other: ω = .96; SIS-Femininity-other: ω = .96).

Sample—Participants were 471 native German speakers (230 men, M_{age} = 26.11, SD = 8.86; 241 women, M_{age} = 25.40, SD = 8.98) who completed the questionnaire (primaryx school: 0.4%; secondary school: 3%; professional school: 4.5%; A-levels: 83%; university degree: 9%). Most of them were students (about 70%) who had completed their A-levels (92%). About 30% of the participants were recruited from the general population.

Statistical Analyses—Statistical analyses were similar to Study 1, adding the SIS scales in convergent validity analyses. Furthermore, we investigated incremental validity in multiple regression analysis including the BSRI, PAQ, and GERAS scales as predictors of OCG.

Results

Factor Structure—Data from Study 2 confirmed the results of Study 1 regarding the factor structure of the GERAS by showing good model fit (χ^2[66, N = 471] = 35.59, CFI = 1.00, RMSEA < .001, SRMR = .088, χ^2/df = 0.54) in the cross-validation.

Reliability Analyses—Revelle's Omega, split-half coefficients ($r_{tt\alpha}$), and retest correlation coefficients (r_{tt}) were sufficient for both the GERAS-Masculinity (ω = .86; $r_{tt\alpha}$ = .88; r_{tt} = .90) and GERAS-Femininity (ω = .88; $r_{tt\alpha}$ = .88; r_{tt} = .93) scales. Tables 2 and 3 present additional results of item analyses (reliability coefficients per scale [and facet], item selectivity, and item difficulties).

Convergent Validity

Relation With Other Gender Role Identity Scales: As Table S3 in ESM 6 indicates in detail per GERAS sub-scales, correlation coefficients ranging from .43 to .57 for GERAS-Masculinity and from .59 to .65 for GERAS-Femininity confirmed convergent validity regarding relations with the BSRI, PAQ, and SIS scales. Separate analyses for men and women revealed a slightly different pattern, however: GERAS-Femininity was not

significantly related to SIS-Femininity in men (Table S4). Further, GERAS-Masculinity was not significantly related to BSRI-M and PAQ-M scores, and GERAS-Femininity to PAQ-F score in women (Table S5).

Multiple regression analyses for incremental validity revealed that GERAS-Masculinity was a significant predictor of participants' OCG, explaining 12% more variance ($R^2 = .18$, $p < .001$) than the BSRI-M and PAQ-M did together ($R^2 = .06$, $p < .05$). Similarly, GERAS-Femininity explained 13% more variance when predicting OCG ($R^2 = .22$, $p < .001$) than the BSRI-F and PAQ-F did ($R^2 = .09$, $p < .01$; for details, see Table S6 in ESM 6).

Criterion-Related Validity

Biological Sex: Men scored significantly higher on GERAS-Masculinity ($M = 4.56$, $SD = 0.68$) than women ($M = 3.89$, $SD = 0.65$, $F[1, 469] = 118.18$, $p < .001$), and women scored significantly higher on GERAS-Femininity ($M = 4.94$, $SD = 0.54$) than men ($M = 4.15$, $SD = 0.56$, $F[1, 469] = 238.38$, $p < .001$; see Figure 2).

Gender Role Evaluation by Others: The perception of participants' SIS-Masculinity and SIS-Femininity by others was significantly related to the GERAS-Masculinity and GERAS-Femininity across all participants (Masculinity: $r = .49$, $p < .01$; Femininity: $r = .54$, $p < .01$). However, this relation disappeared when tested separately for men and women (all $rs \leq .18$; all $ps > .05$).

Social Environment: GERAS-Masculinity and GERAS-Femininity were both significantly positively related to self-reports of growing up with men/women (both $rs \geq .19$, both $ps < .01$), having male/female attachment figures during childhood (both $rs \geq .27$, both $ps < .01$), having mostly male/female friends (both $rs \geq .29$, both $ps < .01$), and getting along with men/women (both $rs = .14$, both $ps < .01$). When analyzed separately for men and women, a somewhat similar pattern emerged (all $rs \geq .19$, all $ps < .01$), except for the association between GERAS-Femininity and female attachment figures, and growing up with women ($rs \leq .12$, both $ps > .05$), and between GERAS-Masculinity and getting along with men ($r = .13$, $p > .05$) in the women sample.

OCG: Correlation analysis between OCG and GERAS-Masculinity revealed a negative coefficient ($r = -.41$, $p < .01$), indicating that participants with higher GERAS-Masculinity scores were employed in professions predominantly chosen by men. GERAS-Femininity was significantly positively related to OCG ($r = .46$, $p < .01$), indicating that participants with higher GERAS-Femininity scores were employed in professions predominantly chosen by women. Separate analyses for men and women did not reveal significant correlation coefficients, except for the relation to the GERAS-Femininity scale in men, indicating that men with higher GERAS-Femininity scores tended to be employed in professions predominantly chosen by women ($r = .37$, $p < .01$).

Discussion

These studies were conducted to construct a contemporary and multidimensional measure for the self-assessment of gender role identity. In three steps, a large item pool was reduced

to a 50-item instrument in which participants were instructed to rate the extent to which they attributed gender-related traits, activities, and interests to themselves. The instrument stands out against previous approaches by (a) including not only personality traits but also cognitions and interests, (b) including not only agentic and communal but also other gender-typical personality traits, and (c) including not only positive but also negative and neutral traits. The data revealed that all items included in the final instrument differentiated between men and women, and stereotypical views of men and women.

Three independent datasets revealed a similar factor structure. Results confirmed the proposed multifaceted structure of the GERAS with several masculine and feminine first-order factors in PS, CS, and AIS. Interestingly, not only expressivity and assertiveness arose as meaningful first-order factors in PS, but also neuroticism, risk-taking, and rationality, suggesting that gender-related attributes indeed include more than two aspects of personality. Most important, however, analyses revealed an overall two-dimensional model with Masculinity and Femininity as separate third-order factors. We allowed correlations between the first-order factors risk-taking and neuroticism, and between second-order factors feminine and masculine cognition. The former is legitimate as risk-taking is defined as a facet of extraversion, which is expected to be opposite to neuroticism (e.g., Nicholson, Soane, Fenton-O'Creevy, & Willman, 2005). The latter also is explainable, as the feminine cognition factors verbal and memory skills seem to be rather basic cognitive capacities that may explain general cognitive skills to a certain extent and are not specifically feminine compared with spatial and numerical skills on the masculine side. Moreover, as the correlations were not too high across all three datasets, we left them included.

However, because we had constructed the instrument following the two-dimensional approach of gender role identity, one could argue that it is not surprising that the analyses of the data confirmed this structure. Nevertheless, we aimed to assess gender role identity on multiple facets building a base for masculinity and femininity, but we did not focus on only these third-order constructs. Furthermore, in our exploratory factor analyses, we tested a one-dimensional model with one gender role factor overarching all first-order factors in the factor analyses. However, the final two-dimensional outperformed this one-dimensional model, which did not meet the cutoff values set for model fit indices. Our results not only support the assessment of masculinity and femininity as separate dimensions (see Bem, 1974) but also across multiple domains (cf. Choi & Fuqua, 2003; Diekman & Eagly, 2000). As follows, we recommend to calculate the GERAS scores by first averaging the items per masculine and feminine PS, CS, and AIS, and second, by averaging these subscale scores for each a GERAS-Masculinity and -Femininity score.

In contrast to other gender role identity scales, the factor structure revealed measurement invariance across men and women because we excluded the highly stereotypical items referring to body strength or beauty based on the modification indices.

The analyses furthermore suggested good to high internal consistency, split-half, and retest correlation coefficients, indicating the measure's reliability. Medium to high relations between the GERAS scores and other gender role identity scales (BSRI, PAQ, SIS), and significant relations with personality scale scores for assessing constructs such as

dominance, emotional stability, social orientation, and sensitivity provided evidence for convergent and criterion-related validity. GERAS-Masculinity was related to SIS-Masculinity in both men and women and GERAS-Femininity to SIS-Femininity in women, and only slightly in men. A possible explanation for the latter may be the deviation of SIS-Femininity from the less direct femininity assessment via the GERAS that may have resulted from a greater acceptance of and desire for masculine traits in women as opposed to feminine traits in men (cf. Johnson, Murphy, Zewdie, & Reichard, 2008). The fact that male participants showed mean GERAS-Femininity scores above the scale midpoint on PS and CS supported this idea. In other words, when asked directly how feminine they were, men might not have indicated scores that were as high as when asked in a less direct way via the attributes concerning personality or cognition from the GERAS. Given that men's values were rather low on feminine activities and interests scale, this facet seems to be viewed as fairly undesirable by men.

Furthermore, both GERAS scales provided an increased invariance explained in gender quota of participants' occupation above and beyond the amount explained by the BSRI and PAQ scores. These results support our assumption that gender identity bases on more facets than only the ones accounted for by personality characteristics as our measure outperformed previous well-established instruments. Besides the fact that the GERAS-Masculinity and GERAS-Femininity scales discriminated between men and women as predetermined by the item construction, results further revealed evidence for criterion-related validity. Specifically, the GERAS scores were related to the gender quotas for participants' occupations on the one hand and to their social environment on the other hand. However, biological sex may have affected these relations because some of the relations disappeared when calculated separately for men and women. Interestingly, for men, GERAS-Femininity remained significantly related to occupations with a higher quota of women. This may indicate that men tend to choose or prefer professions that match their individual characteristics. Conversely, sex stereotypes may be more relevant for women because women tend to choose professions with higher quotas of women and tend to avoid professions with higher quotas of men (see Eagly & Karau, 2002; Garcia-Retamero & López-Zafra, 2006).

Evaluations of masculinity and femininity by others were related to the GERAS scores only in the total sample but not when analyzed separately for men and women. This suggests that, different from self-ratings, the biological sex of the targets may have strongly biased the others' ratings.

However, our research was not free from limitations. First, samples of both studies were not representative, nor the total samples nor the hypothesis-specific subsamples. Therefore, our findings might not be generalizable. Second and relatedly, our results do not provide indications for a broader cultural context because our samples consisted of only German-speaking participants in Central Europe. Thus, future research should investigate the validity of the GERAS across cultures because gender role identity is a concept formed by cultural and social norms. For example, gender differences have been shown to be larger in Western nations (Guimond et al., 2007); therefore, the GERAS scales might not differentiate between the biological sexes in other cultures. Third, indications of our results might not hold for the long-term because the socially dependent dimensions of gender role identity might differ

over time (Twenge, 1997) and might be influenced by social changes. Fourth, although the questionnaire instructions did not reveal the construct of interest and therefore may reduce biases with regard to a person's gender role identity, social desirability might still be a limitation as is true for all self-report instruments (Morgado, Meireles, Neves, Amaral, & Ferreira, 2017). Fifth, as Morgado et al. (2017) pointed out, web-based surveys present a further limitation regarding the scale development process and therefore affect the methodology of Study 1. However, we accepted this aspect because we were able to obtain a larger sample size and to confirm the validity of the online data by employing a paper-pencil approach in Study 2.

In sum, these results provide comprehensive evidence for the reliability and validity of the GERAS. Thus, we propose that the GERAS is a useful tool for assessing gender role identity across multiple aspects in gender and sex-difference research. Future studies should investigate the stability of our measure in relation to a participant's hormonal state and should evaluate additional aspects of criterion validity, such as correlations between the CS and structural/functional brain imaging, actual achievement in verbal and visuospatial performance tests, or the psychometric properties and validity of the English version of the GERAS for international usefulness.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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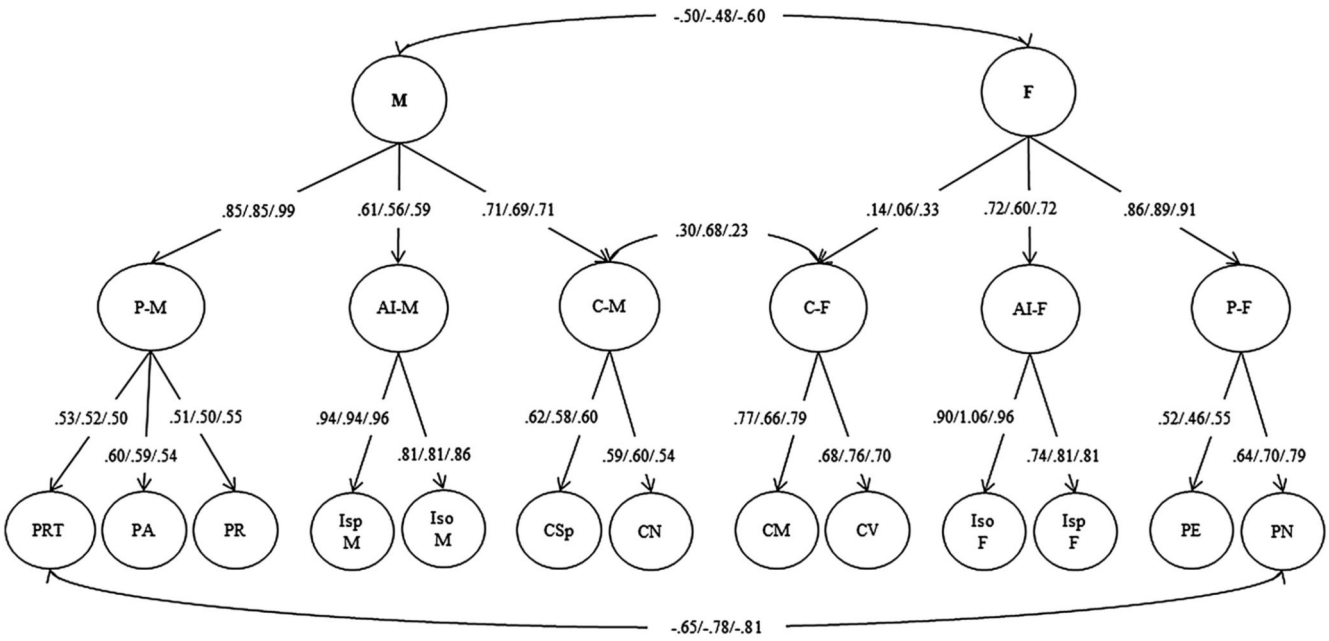

Figure 1.

Factor loadings and allowed covariances in Model 3 for testing the third-order model of the GERAS. Indices are presented for three subsets Study 1 Subset 1/Study 1 Subset 2/Study 2. The third-order factors Masculinity (M) and Femininity (F) each overarched the three second-order factors Personality (P-M/P-F), Activities and Interests (AI-M/-F), and Cognitions (C-M/-F). P-M consisted of first-order factors Risk-Taking (PRT), Assertiveness (PA), and Rationality (PR), P-F consisted of Expressivity (PE) and Neuroticism (PN). AI-M and AI-F consisted in Interests Sports (IspM/IspF) and Interests Social (IsoM/IsoF), respectively. C-M comprised spatial (CSp) and numerical (CN) cognition factors, C-F comprised memory (CM) and verbal (CV) cognition factors.

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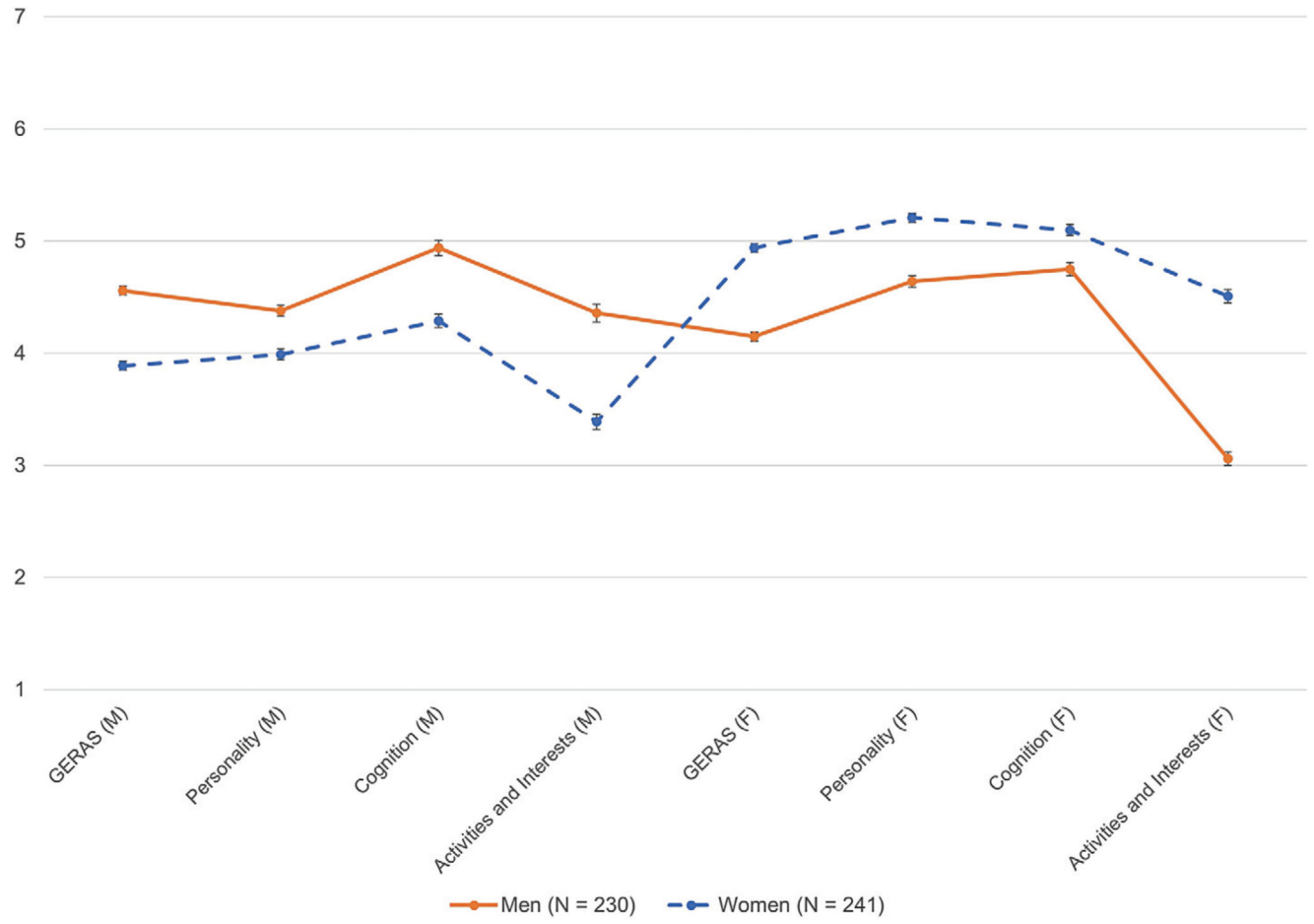

Figure 2.

Sex differences for GERAS-Scales from Study 2 showing men scoring significantly higher on GERAS-Masculinity scales and women scoring sgnificantly higher on GERAS-Femininity scales (all *p*s < .001). Error bars indicate standard errors. M/F indicates masculinity/femiminity scales.

Table 1

Sizes of subsamples, gender distributions, and M_{age} in Studies 1 and 2

Measure	Study 1		Study 2	
	N of subsample	Age *M (SD)*	*N* of subsample	Age *M (SD)*
Whole sample (ws)	1,466		471	
Men	399	27.47 (10.19)	230	26.11 (8.86)
Women	1,067	23.78 (6.65)	241	25.40 (8.98)
Factor analyses	ws[a]		ws	
Reliability	ws		ws	
Test-retest	207		103	
Men	31	23.81 (5.64)	44	23.23 (3.99)
Women	176	25.06 (6.95)	59	22.49 (3.12)
BSRI/GEPAQ	171		143	
Men	58	27.02 (8.09)	66	31.41 (13.39)
Women	113	24.56 (5.69)	77	30.22 (13.53)
SIS self	–		429	
Men	–		197	26.04 (8.63)
Women	–		232	25.17 (8.89)
16PF-R/FPI-R scales	255		–	
Men	41	26.41 (9.00)	–	
Women	213	25.81 (9.47)	–	
Sex differences	ws		ws	
SIS other	–		137	
Men	–		63	30.65 (12.77)
Women	–		74	30.30 (13.75)
Social environment	ws		412	
Men			199	26.59 (9.36)
Women			213	25.81 (9.47)
Occupational gender	340		142	
Men	98	27.27 (8.57)	65	31.51 (13.47)
Women	242	24.94 (7.20)	77	29.78 (13.23)

Note. H = Hypothesis; *M* = Mean; *SD* = Standard Deviation; ws = Whole Sample.

[a]The total sample in Study 1 was divided in two subsamples of *N* = 733 matched by age, sex, and educational background.

Table 2

Psychometric properties (Revelle's Omega, corrected item-total correlations, and item difficulties) for the GERAS-masculinity scales and items from Study 2

							p (SD)		
Scale	**Facet**	**Item**	**ω**	r_{tta}	r_{tt}	r_{it}	**Men**	**Women**	**Total**
Personality			.79	.83	.81				
	Risk-taking		.52						
		Reckless				.70	3.6 (1.3)	3.5 (1.4)	3.5 (1.4)
		Willing to take risks				.77	4.4 (1.3)	4.0 (1.4)	4.2 (1.5)
		Courageous				.55	4.9 (1.1)	4.5 (1.2)	4.7 (1.2)
		Adventurous				.67	5.1 (1.2)	4.9 (1.4)	5.0 (1.3)
	Assertiveness		.60						
		Dominant				.60	4.3 (1.4)	3.9 (1.4)	4.1 (1.4)
		Controlling				.60	4.0 (1.5)	3.5 (1.5)	3.8 (1.5)
		Boastful				.36	3.3 (1.5)	2.9 (1.4)	3.1 (1.5)
	Rationality		.67						
		Rational				.64	4.9 (1.5)	4.3 (1.5)	4.6 (1.5)
		Analytical				.61	5.2 (1.3)	4.5 (1.6)	4.8 (1.5)
		Pragmatic				.49	4.6 (1.3)	4.3 (1.2)	4.4 (1.3)
Cognition			.88	.90	.86				
	Spatial		.86						
		To find an address for the first time				.60	5.6 (1.4)	5.0 (1.5)	5.3 (1.5)
		To find a way again				.70	5.7 (1.5)	5.3 (1.6)	5.5 (1.6)
		To follow directions				.82	5.5 (1.5)	5.0 (1.6)	5.2 (1.6)
	Numerical		.82						
		To solve equations				.88	4.8 (1.6)	4.1 (1.6)	4.5 (1.7)
		To understand formulas				.73	4.6 (1.5)	4.1 (1.6)	4.4 (1.6)
		Day-to-day calculations				.73	5.1 (1.5)	4.5 (1.6)	5.8 (1.6)
		To write a computer program				.34	3.3 (2.0)	2.0 (1.5)	2.6 (1.9)
Activities and Interests			.82	.88	.93				
	Interests Social Masculine		.76						
		Paintball				.77	4.0 (2.2)	3.4 (1.9)	3.7 (2.2)
		Driving go-carts				.78	4.3 (2.1)	3.4 (2.1)	3.9 (2.1)
		Drinking beer				.78	4.7 (1.8)	3.8 (2.0)	4.2 (2.0)
		Watching action movies				.45	5.0 (1.6)	3.7 (1.9)	4.3 (1.9)
		Playing cards (poker)				.46	4.3 (1.9)	3.4 (1.9)	3.9.(1.9)
	Interests Sports Masculine		.63						
		Watching sports on TV (boxing, Formula 1, ball games…)				.59	3.9 (2.2)	2.4 (1.7)	3.1 (2.1)
		Doing certain sports (soccer, basketball, handball, etc.)				.61	4.9 (1.8)	3.9 (2.0)	4.4 (2.0)
		Gym (weightlifting)				.43	3.8 (1.9)	3.0 (1.9)	3.4 (2.1)

Note. ω = Revelle's Omega; r_{tta} = Split-half Spearman Brown coefficient; r_{tt} = Test-Retest Correlation Coefficient; r_{it} = Corrected Item Total Correlation (selectivity); *p* = Item Difficulty; *SD* = Standard deviation.

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Table 3

Psychometric properties (Revelle's Omega, corrected item-total correlations, and item difficulties) for the GERAS-Femininity scales and items from Study 2

							p (SD)		
Scale	**Facet**	**Item**	**ω**	r_{tta}	r_{tt}	r_{it}	**Men**	**Women**	**Total**
Personality			.86	.90	.90				
	Expressivity		.89						
		Warm-hearted				.77	5.2 (1.1)	5.8 (0.9)	5.5 (1.1)
		Loving				.77	5.2 (1.1)	5.7 (1.0)	5.5 (1.0)
		Caring				.72	5.2 (1.0)	5.7 (0.9)	5.4 (1.0)
		Compassionate				.65	5.2 (1.1)	5.8 (0.8)	5.5 (1.0)
		Delicate				.69	4.8 (1.3)	5.6 (1.1)	5.2 (1.3)
		Tender				.63	4.6 (1.2)	5.0 (1.0)	4.8 (1.1)
		Family-oriented				.46	4.8 (1.5)	5.4 (1.4)	5.1 (1.5)
	Neuroticism		.62						
		Anxious				.64	3.1 (1.2)	3.8 (1.3)	3.4 (1.3)
		Thin-skinned				.49	4.1 (1.2)	4.7 (1.2)	4.4 (1.3)
		Careful				.42	4.3 (1.3)	4.5 (1.3)	4.4 (1.3)
Cognition			.82	.82	.81				
	Verbal		.85						
		To explain foreign words				.48	4.8 (1.4)	4.8 (1.4)	4.8 (1.4)
		To find the right words to express certain content				.48	4.8 (1.4)	5.0 (1.4)	4.9 (1.4)
		To find synonyms for a word in order to avoid repetitions				.85	4.8 (1.4)	5.2 (1.3)	5.0 (1.4)
		To phrase a text				.76	4.8 (1.5)	5.3 (1.4)	5.0 (1.5)
	Memory		.54						
		Remembering events from your own life				.48	5.0 (1.5)	5.5 (1.4)	5.2 (1.5)
		To notice small changes				.50	4.9 (1.4)	5.1 (1.4)	5.0 (1.4)
		To remember names and faces				.44	4.2 (1.7)	4.9 (1.5)	4.5 (1.6)
Activities and Interests			.85	.89	.91				
	Interests Social Feminine		.77						
		Shopping				.61	3.4 (1.6)	4.8 (1.7)	4.1 (1.8)
		To gossip				.71	3.3 (1.6)	4.6 (1.7)	4.0 (1.8)
		Watching a romantic movie				.54	2.8 (1.5)	4.4 (1.7)	3.7 (1.8)
		Talking on the phone with a friend				.68	3.2 (1.7)	4.8 (1.7)	4.0 (1.9)
	Interests Sports Feminine		.71						
		Yoga				.59	2.5 (1.7)	3.9 (2.0)	3.2 (2.0)
		Rhythmic gymnastics				.63	1.7 (1.2)	3.2 (1.8)	2.5 (1.7)
		Going for a walk				.40	4.7 (1.5)	5.5 (1.4)	5.1 (1.5)
		Dancing (classic standard dances, ballet, Latin, free dance, etc.)				.62	2.9 (1.9)	4.8 (1.7)	3.8 (2.2)

Note. ω = Revelle's Omega; r_{tta} = Split-half Spearman Brown coefficient; r_{tt} = Test-Retest Correlation Coefficient; r_{it} = Corrected Item Total Correlation (selectivity); p = Item Difficulty; *SD* = Standard Deviation.