Murray's system of needs and the Big Five Personality Traits: Using Exploratory Structural Equation Modeling to evaluate their relationship

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ABSTRACT. Personality tests are used regularly as a requirement within many sectors in Brazil, including education, human resources, and transportation. The Personality Factor Inventory, based on Murray's system of needs theory, is one of the widely used tools within Brazil. Despite its importance, its results are only partially related to the Big Five theory, which is the predominant framework for understanding personality. This theoretical divergence poses practical challenges for professionals who rely on or are required to work within the Big Five model. Harmonizing these two theories could enhance their practical utility. In this study, we evaluate the possibility of fitting Murray's personality theory within the Big Five framework using Exploratory Structural Equation

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Modeling and invariance tests (i.e., gender) using data from 272 845 participants in Brazil (56.2% men, *M* age 21.74 ± 15.24) who completed the Personality Factor Inventory. We also cross-validated the results with random samples. The results demonstrated an adequate fit, consistent reliability, and scalar/strong invariance. The percentage of Murray's theory factor into the Big Five solution led us to conclude that Murray's system of needs could fit into a five-factor solution reflecting the Big Five personality traits. The paper discusses the implications of these findings for future research and practice.

KEYWORDS: personality / Big Five / scale development / Murray's system of needs

EL SISTEMA DE NECESIDADES DE MURRAY Y LOS 5 GRANDES RASGOS DE PERSONALIDAD: EVALUACIÓN DE SU RELACIÓN MEDIANTE UN MODELO EXPLORATORIO DE ECUACIONES ESTRUCTURALES

RESUMEN. Las pruebas de personalidad se utilizan regularmente como un requisito en muchos sectores en Brasil, incluyendo la educación, los recursos humanos y la gestión del tráfico. El Inventario de Factores de Personalidad, basado en la teoría de las necesidades de Murray, es una herramienta ampliamente utilizada en Brasil. A pesar de su importancia, sus resultados solo están parcialmente relacionados con la teoría de los cinco grandes, el marco aceptado para entender la personalidad. Esta discrepancia teórica podría crear desafíos prácticos para los profesionales que deben ajustarse a los perfiles de los cinco grandes y la armonización de ambas teorías mejoraría su aplicación práctica. En este estudio, evaluamos la posibilidad de ajustar la teoría de personalidad de Murray dentro del marco de los cinco grandes utilizando el modelo exploratorio de ecuaciones estructurales y pruebas de invarianza (por ejemplo, de género), utilizando datos de 272 845 participantes en Brasil (56.2 % hombres, M edad 21.74 ± 15.24) que completaron el Inventario de Factores de Personalidad. También validamos los resultados cruzando muestras aleatorias. Los resultados demostraron un ajuste adecuado, consistencia en la fiabilidad e invarianza escalar/fuerte. El porcentaje de factores de la teoría de Murray en la solución de los cinco grandes nos llevó a concluir que el sistema de necesidades de Murray podría ajustarse en una solución de cinco factores. Los resultados se discuten desde una perspectiva psicométrica y se consideran aspectos históricos de la evaluación de la personalidad.

Palabras clave: personalidad / cinco grandes / desarrollo de escalas / sistema de necesidades de Murray

INTRODUCTION

Personality is a construct with a long history of prominence in the social sciences (Bainbridge et al., 2022; Feher & Vernon, 2021; Vitriol et al., 2020). Personality psychology helps us to understand what makes us who we are, and conceptualizes personality traits as enduring patterns of thoughts, beliefs, and actions. As DeYoung, (2015) proposed, personality traits are probabilistic descriptions of relatively stable patterns of emotion, motivation, cognition, and behavior, in response to classes of stimuli that have been present in human cultures over evolutionary time. Although multiple theories of personality are still in the literature, an agreement has been formed around a dominant theory known as the Big Five. The Big Five model has served as a robust theoretical framework for integrating and defining personality (Mammadov, 2022) and consists of 5 factors: (a) Openness, also known as Mental Openness or Intellect, and Openness to Experience, which includes being imaginative, creative, curious, and unconventional thinking; (b) Conscientiousness, which is connected to traits such as being systematic, focused on goals, and having self-discipline; (c) Extraversion which includes being lively, outgoing, and desiring social interactions; (d) Agreeableness, characterized by traits such as friendliness, warmth, and sensitivity towards others; and (e) Neuroticism which is associated with feelings of worry, nervousness, and emotional instability.

Despite the academic consensus defining personality as a set of relatively consistent or stable patterns of feelings, thoughts, and behaviors of individuals (Roberts & Yoon, 2022), there are a variety of theories regarding personality that are still present in the literature (Arruda et al., 2022; Rollings et al., 2022). The fields of Psychology and Neuroscience have been debating definitions of personality since the development of the first psychological test, the Woodworth Personal Data Sheet, also known as Psychoneurotic Inventory, created in 1917 by Robert Woodworth during World War I to identify soldiers prone to experiencing nervous breakdowns during enemy bombardments (Gibby & Zickar, 2008).

Woodworth, a former student of William James and James McKeen Cattell, introduced two key methodological strategies when developing this test. First, the test was comprised of 116 questions that could be responded to objectively with "yes" or "no" answers, an innovative approach at the time. Second, the test had a score and classification system based on statistics (Thissen, 2001). Examples of the items on the test included "Can you sit still without fidgeting?", "Do you often have the feeling of suffocating?", "Do you like outdoor life?", and "Have you ever been afraid of going insane?" (Thorndike & Lohman, 1990). After this initial conceptualization and system of measurement, the following decades witnessed the introduction of grand theories of personality, including Henry Murray's system of needs, introduced in 1938 (Costa et al., 2019). Following the introduction of Murray's perspective, personality was considered to be one of the most

important sub-areas of psychology and, as a concept, it was applied in various fields, including motivation and psychoanalysis, resulting in several objective tests including the Thematic Apperception Test (Murray, 1938).

According to Henry Murray, behavior was based on a press-need combination. A need is a drive that arises from internal processes (hunger or thirst) or the external environment, which energizes and directs intellectual and perceptual capacity. A press is an environmental object or situation that designates directional tendencies or guides our needs. His list included 27 needs, which he believed to be basic and universal (Murray, 1938). After a period of initial influence, Murray's theory was gradually replaced by the Big Five theory (Feher & Vernon, 2021; Marsh et al., 2010). The Big Five theory has since dominated the field as one of the most popular and widely used personality models (Vitriol et al., 2020; Wilmot & Ones, 2022). However, despite the prominence of the Big Five perspective, many personality scales based on Murray's needs framework (Costa & McCrae, 1988) were developed and used to measure personality. This divergence between commonly used measures of personality based on Murray's needs-based perspective and the broader acceptance of the Big Five personality traits can create difficulties for psychologists when evaluating and interpreting the results of personality assessments. One potential solution to this problem is harmonizing or bridging differences between Murray's system of needs and the Big Five theory through the application of modern statistical techniques.

Historically, almost all personality tests were developed using factor analysis, either exploratory (EFA) or confirmatory (CFA). However, the literature presents mixed evidence, with some researchers concluding an adequate fit for their scales (Booth & Hughes, 2014; Burneo-Garcés et al., 2020), whereas others have failed to demonstrate adequate model fit, especially in CFA framework (Booth & Hughes, 2014). Exploratory Structural Equation Modeling (ESEM) has emerged as a promising tool in personality research and a viable alternative for addressing models that do not achieve adequate fit using EFA and CFA methods (Booth & Hughes, 2014). One objective of the current study was to use ESEM to determine if a commonly used personality assessment based on a relatively old paradigm could be harmonized with more recent conceptualizations of personality (Furnham & Robinson, 2022).

Big Five and Psychometric Findings

Personality research and statistics are closely related (Atherton et al., 2021). One of the empirical roads that researchers took in this field was based on the lexical hypothesis study of Allport and Odbert in 1936. They identified about 18 000 terms from an English dictionary used to describe differences in behavior among people. In 1943, Raymond Cattell started using clustering and factor analysis to group the terms of this personality lexicon.

By 1960, more empirical data was subjected to exploratory factor analysis (EFA) resulting in the first version of the Big Five model. This name was proposed by Lewis Goldberg (1981) and popularized by McCrae and Costa's studies (Desson, 2017). Over the following decades there has been a plethora of statistical advances for analyzing data, including personality constructs (Marsh et al., 2014; Moosbrugger & Fischbach, 2002). These methods include CFA (Lee & Ashton, 2007; Raykov, 1998), Network Analysis (Fonseca-Pedrero, 2018), Item Response Theory (Steinberg & Thissen, 2014), and ESEM (Marsh et al., 2014).

As shown in Figure 1, ESEM is a versatile integration of EFA and CFA models (Marsh et al., 2014) that involves the specification of measurement and structural models, which allows the assessment of both direct and indirect effects among variables (Mindrila, 2024). The measurement model examines the relationship between the latent variables and their measures, whereas the structural model evaluates relationships between the latent variables. The ESEM framework incorporates different sets of EFA factors, CFA factors, and observed variables, which can be measured as either continuous or categorical (Morin et al., 2022). Therefore, within an ESEM framework it is feasible to work with a set corresponding to a series of indicators related to a series of factors with all cross-loadings freely estimated within this set, but not between sets, as well as indicators previously related to a specific factor. The only operational input required to run an ESEM model is the number of factors. All other parameters are freely estimated, and goodness-of-fit is computed. Thus, ESEM has the possibility to replace EFA and CFA, as all factors are allowed to load on all indicators and the goodness-of-fit indices are provided after all parameters are estimated using an optimal rotation (Asparouhov & Muthén, 2009).

Figure 1

Confirmatory Factor Analysis and Exploratory Structural Equation Modeling
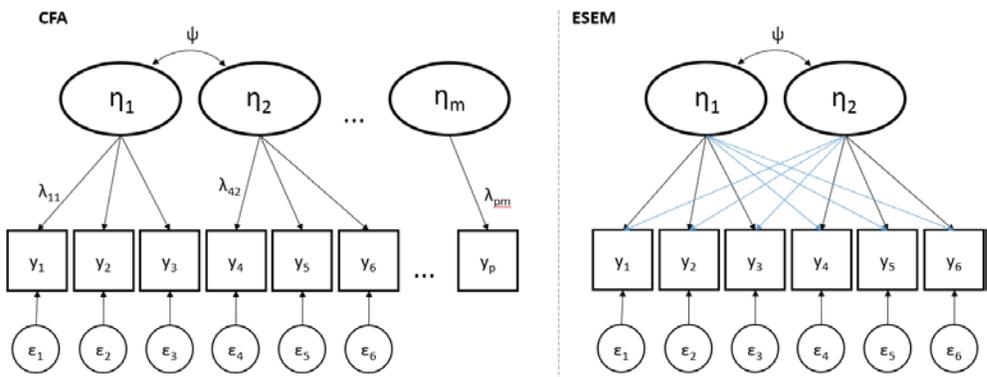
Personality Testing in Brazil

In Brazil, the use of psychological tests is a cornerstone for several sectors including education, mental health, transportation, and human resources. Psychological tests are used for a wide range of purposes, including school counseling, hiring, replacing, and firing employees, and obtaining a driver's license (Anunciação et al., 2024). According to legal standards, different activities require distinct personality profiles and standards. Psychologists administer personality tests based on approved measures and evaluate the results to determine whether individuals match the required profiles for accessing societal functions (e.g., employment, driving, etc.). Currently, the most frequently used personality test in Brazil is the Personality Factor Inventory, a modified version of the Edwards Personal Preference Schedule (EPPS) based on the Murray's system of needs (Pasquali et al., 1997).

Originally, the EPPS measured 15 dimensions of personality using 155 items, including 135 items related to personality traits and 20 items to check social desirability and the careless responses. These items were formatted on a 7-point Likert type response scale, ranging from 1 = *Not at all characteristic* to 7 = *Totally characteristic*. Pasquali et al. (1997) conducted a CFA of this measure and found that responses accounted for 40 % of the items' variance, and the internal consistency (reliability) of each of the resulting factors was greater than 0.75.

In this revised version of the tool, a hierarchical factor analysis was conducted, and identified three second-order factors, labeled as "Affective Needs," "Need for Organization," and "Need for Control and Opposition." Internal consistency was evaluated using Cronbach's alpha, with the lowest result being.69. The correlation between the scores obtained from this updated version and those from other measures of social ability and personality was also assessed. Results were mixed, though primarily positive and significant. These researchers also developed standardized norms using data from 3889 participants, randomly selected from a database formed by the digital corrections of the Personality Factor Inventory carried out between 2010 and 2012. Of the total, 46.6 % were men and 53.4 % were women. The age ranged between 14 and 86 years (*M* = 31.29 years, SD=10.1).

Despite the comprehensive nature of the revised EPPS, the report it produces is mainly based on the Big Five structure causing confusion during interpretation because the resulting structure does not align with various criteria set forth in governmental testing regulations. Thus, psychologists sometimes stretch their interpretation of results to address these requirements. This issue not only represents a practical concern, it also has legal consequences and has led to ethical, and legal consequences (Anunciação et al., 2021; Erickson et al., 2007). These concerns could be addressed by evaluating whether Murray's system of needs can be modeled as a Big Five structure; that is, harmonizing

measurement and theory to enable better and more accurate interpretation within the Brazilian context, which relies on such evaluations for access to basic societal activities.

Current Study

The current study had two primary goals. First, to evaluate the extent to which a widely used personality test based on Murray's theory of needs could be fitted with a Big Five model. To achieve this, we used ESEM to evaluate the factor structure and reliability of a Big Five solution to the Factorial Inventory of Personality 2nd edition. The application of ESEM allowed us to align results from EFA and CFA into one psychometric model. Our second goal was to test the invariance of the measurement model across genders. This latter analysis was exploratory in nature but was designed to evaluate the extent to which the resulting model could be applied across genders. Both analyses were conducted with a large dataset (N = 272 845) of respondents to the Factorial Inventory of Personality 2nd edition. Cross-validation with subsampling was performed to confirm the robustness of the findings.

METHODS

Participants

Demographic details of the sample are presented in Table 1. The sample consisted of 272 845 participants partially representative of Brazil's 5 macro regions. Males were the most prevalent gender (56.2 %), the mean age of participants was 21.7 (SD = 15.24), and a slight majority of the sample listed undergraduate degree as the most frequent education level (52 %). Since the Southeast region is more densely populated, this was reflected in the proportions of the participants from this region (55.1 %). In turn, as the North region is the least populated in Brazil, this was also reflected in the percentage of participants from this region (4.8 %).

Table 1

Descriptive characteristics of the sample (N = 272,845)

Variable	Count (%) / *M* (*SD*)
Gender	
Female	119 558 (43.8 %)
Male	153 284 (56.2 %)
Age	
Mean (SD)	21.74 (15.24)

(*continued*)

Variable	Count (%) / *M* (*SD*)
Level of Education	
Elementary School	3399 (2 %)
High school	75 515 (45 %)
Undergraduate	87 409 (52 %)
Graduate	1718 (1 %)
Brazilian Region	
Southeast	62424 (55.1 %)
South	25140 (22.2 %)
Northeast	14264 (12.6 %)
Central-West	6100 (5.4 %)
North	5404 (4.8 %)

Procedure

This study was a secondary analysis of extant data gathered through the standardization sample for the second edition of the Personality Factor Inventory. These data were obtained directly from individuals who underwent psychological testing as part of standardization at the original website of the test. . Data were inserted by psychologists from throughout Brazil and included responses from 272 845 adults. Due to federal requirements on privacy, all personal identifiers were omitted from the dataset. We accessed all data from this source and filtered it to have all items fully responded as well as sociodemographic characteristics provided, including the participant's age, gender, region of origin, and level of education. The final dataset for psychometric analyses included 272 826 responses. After applying these filters, three independent samples were used. Each sample consisting of 27 283 randomly selected subjects. The randomness of the samples was tested using inferential statistics, with no significant results found at the 5 % level. This sample size was based on the current recommendation of having at least 10 respondents for each item, ensuring that the sample had sufficient power to minimize the risk of a Type 1 error. The study was approved by the institutional review board (IRB) and the public note number (Certificate of Presentation for Ethical Consideration, CAAE in Portuguese) was 63553522.7.0000.5279 . This study was not preregistered, but all manipulations, measures, and exclusions were reported.

Instrument

Personality Factor Inventory (Leme et al., 2013) is a psychological assessment that evaluates 13 distinct psychological domains (traits) through 100 items. Participants are asked

to carefully read each item and indicate their level of agreement on a Likert scale ranging from 1 to 7. The factors assessed include Assistance, Intraception, Cuddling, Autonomy, Deference, Affiliation, Dominance, Performance, Display, Aggression, Order, Persistence, and Change. This version is an update from the original measure, which excludes the factor Heterosexuality in compliance with internal regulations from the Brazilian Federal Council of Psychology. The normative data were derived from a sample of 3889 participants. The sample was gender-balanced, with 46.6 % men and 53.4 % women, and ages ranging from 14 to 86 years (M = 31.29, SD = 10.1).

Statistical Analyses

Data was checked through visual and tabular methods. There was no missing data, and no outlier was suppressed from the data frame. The psychometric analyses consisted of several cumulative steps. Random subsets were initially taken from the original data. This procedure provides the source for performing cross-validation tests (Brown, 2015).

Next, an ESEM with delta parametrization, probit link, and geomin (oblique) rotation was carried out for all random subsets. All items were considered categorical, and the Weighted Least Squares Mean (WLSM) was defined as the extraction method (DiStefano & Morgan, 2014; Suh, 2015). Various goodness-of-fit indices were considered when evaluating results. Specifically, Comparative Fit Index (CFI) and Tucker–Lewis Index (TLI) values above .90 were interpreted as indicative of good fit. Additionally, Root Mean Square Error of Approximation (RMSEA) values below .08 were considered indicative of acceptable fit, while values below .05 were interpreted as indicative of good fit (Marsh et al., 2014). A diagram was created to illustrate the results, highlighting factor loadings equal to or greater than .32 (Comrey & Lee, 1992; Tabachnick & Fidell, 2018). Reliability was assessed through internal consistency analysis. The Cronbach's alpha was calculated and to address its tau-equivalence limitation, the Omega coefficient was also calculated (Revelle & Zinbarg, 2009).

Finally, a multigroup analysis was conducted within the ESEM framework to explore potential measurement invariance between male and female participants. Invariance testing assesses the stability of a measure's psychometric properties across different groups. There are four hierarchical levels of measurement invariance: configural invariance (which tests the equality of factor structure and item-factor relationships), metric invariance (which tests the equality of factor loadings), scalar invariance (which tests the equality of item intercepts), and strict invariance (which tests the equality of measurement errors). It is important to note that metric invariance cannot currently be tested for categorical outcomes within an ESEM framework. Goodness-of-fit indices were calculated for the configural (pattern) and scalar (strong) invariance. The models were compared using formal statistical tests, such as the chi-squared difference test, as well

as by evaluating differences in goodness-of-fit indices. Analyses were conducted using R 4.0 software (R Core Team., 2019) and Mplus 8 (Muthén & Muthén, 2017). All data, codes, and the accompanying codebook are freely available at https://osf.io/wkzan/.

RESULTS

Structural Model

As is often suggested, a preliminary analysis was performed before conducting the factor analysis. The Kaiser–Meyer–Olkin index (KMO=.96) and Bartlett's sphericity test χ^2(4950, N=27283)=884510.8, p<.001, indicated that all multivariate procedures were appropriate. Data reliability was assessed using Cronbach's alpha (α), McDonald's omega (ω), and the average inter-item correlation. The results were α=.936, ω=.95, and an average inter-item correlation of.13 (with a median of .14).

The model fit indices were as follows: χ^2(4460)=427 544.759, RMSEA=.059, CFI=.946, TLI=.940, and SRMR=.033. According to the guidelines proposed by Hu and Bentler (1998), the CFI and TLI values indicated adequate fit for the ESEM models, as did the RMSEA values. To ensure robustness, a cross-validation procedure was conducted using two independent datasets of equal size (n=27 283). The results demonstrated stability across datasets: χ^2(4460)=421 282.803, RMSEA=.059, CFI=.947, TLI=.941, SRMR=.033 and χ^2(4460)=420 105.511, RMSEA=.058, CFI=.947, TLI=.940, SRMR=.033.

All items loaded onto all factors in the ESEM solution. However, Figure 2 highlights items with the strongest relationships with their primary factor. A more detailed representation of the model is available in Supplementary Table 1. Certain items, such as "I don't like situations where I'm required to behave in a certain way" (item 4) and "When I am in a group, I gladly accept someone else's leadership to decide what we will do" (item 68), did not strongly load onto any specific factor but were retained in the ESEM model.

Figure 2

Exploratory Structural Equation Modeling of Personality according to the Big Five theory
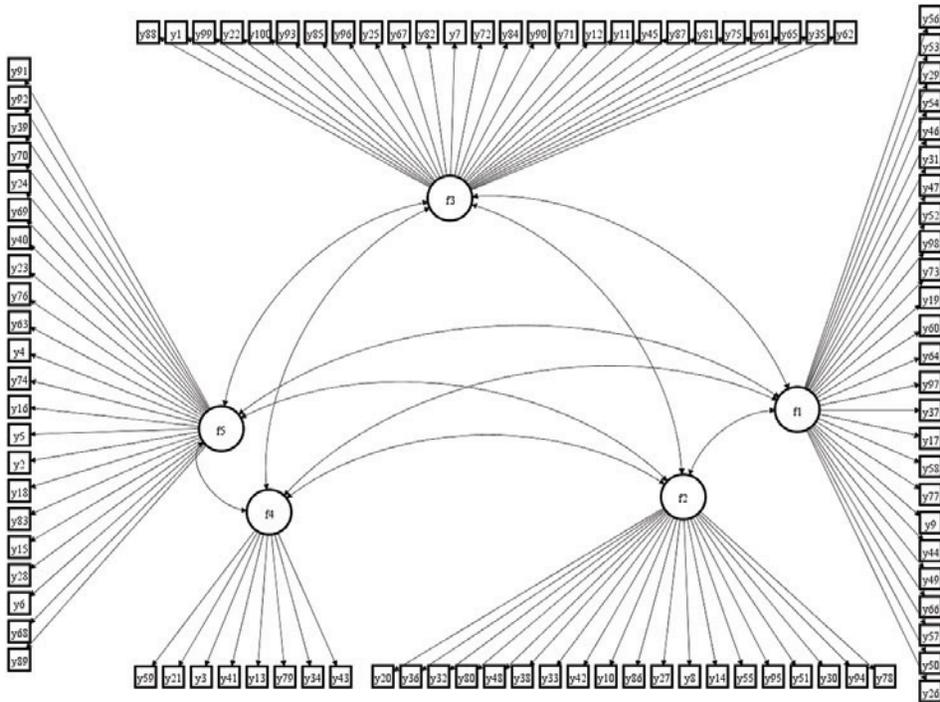
Note. Connections between factors and items with low factor loadings exist in this is ESEM model, but are not displayed.

Items such as "I like my friends to be supportive and understanding when I have problems." (item 56, λ=.783) and "I like to keep in touch with my friends" (item 64, λ=.783) had strong loadings on F1. Items such as "I like to plan and organize, in every detail, any work I do" (item 78, λ=.774) and "Any written work I do, I like it to be accurate, clean, and well-organized" (item 95, λ=.656) loaded more strongly onto F2. For F3, items such as "I enjoy being one of the leaders in the organizations and groups to which I belong" (item 62, λ=.721) and "I like to be considered a leader by others" (item 35, λ=.697) had higher loadings. Items such as "I like to do new and different things" (item 79, λ=.578) and "I like to experiment and try new things" (item 13, λ=.531) loaded more strongly onto F4. Finally, items like "I like to feel free to do whatever I want" (item 91, λ=.712) and "I like to do things my way no matter what others think" (item 40, λ=.421) were more closely related to F5.

The correlations between the latent factors were as follows: F1 with F2=.453; F3 with F1=.154, and F2=.089. F4 correlated with F1=.292, with F2=.337, with F3=.225. F5 showed correlations of-.141 with F1, of -.304 with F2, of .177 with F3, and of -.116 with F4.

Invariance Testing

Given that the measure demonstrated an adequate model fit for a five-factor structure, invariance testing was performed to assess equivalence between male and female participants. The results, presented in Table 2, indicate that both configural and scalar invariance were achieved, supporting scalar equivalence between males and females. Therefore, a five-factor solution appears appropriate.

Table 2

Invariance by gender

Model	Par.	χ2	*df*	*p*	CFI	TLI	RMSEA	SRMR	Δχ2	ΔCFI	ΔTLI
Configural	2180	429 206.37	8920	<.001	.947	.941	.059	.033			
Scalar	1210	385 162.81	9890	<.001	0.952	.952	.053	.035	-44043	.005	.011

Note. Par = Number of free parameters; χ2 = chi-squared test; *df* = degrees of freedom; CFI = Comparative Fit Index; TLI = Tucker-Lewis index; RMSEA = Root Mean Square Error of Approximation; SRMR = Standardized Root Mean Square Residual.

Big Five Personality Traits and Murray's Needs Theory

Table 3 provides an overview of the five-factor Big Five solution mapped onto the 13 Murray types of needs. The occurrence percentage of each factor may indirectly support the integration of the Big Five theory into Murray's system. This table shows how the 13 factors from the second version of the Personality Factor Inventory can be reduced to five factors, based on the following number of items per factor: F1 (25), F2 (19), F3 (26), F4 (8), and F5 (10).

Agreeableness was primarily associated with Affiliation and included items such as "I like showing a lot of affection for my friends." (item 56, λ=.783). Conscientiousness was mostly composed of Persistence and included items like "When I have a task to do, I like to start right away and work on it until it's done" (item 14, λ=.634). Extraversion was mainly formed of items indicative of Exhibition, such as "I like being the center of attention in a group" (item 61, λ=.618). Openness included items that reflected flexibility and willingness to change, such as "I like trying new and different things" (item 79, λ=.578). Lastly, Neuroticism was somewhat dispersed but was largely comprised of items related to assertiveness such as "I want to tell people to be quiet when I disagree with them" (Item 39, λ=.483).

In addition, 12 items from the original measure were excluded due to loadings below 0.32. Among these, five items were associated with Deference and predominantly loaded onto the first factor of the solution (Agreeableness). Examples include "I try to adapt to the way of being of the people I admire" (item 83), "I like to tell my superiors that they did

a good job when I believe it" (item 28). Additionally, three items in this pool were related to Autonomy, with each item loading onto a different factor, for example, , "I'm not afraid to criticize people in positions of authority" and "I like to say what I think about things").

Table 3

The Big Five related solution of the 13 Murray types of needs.

Big Five related domain	Murray's Theory	Count	%
Agreeableness	Affiliation	8	32 %
	Caress	7	28 %
	Assistance	7	28 %
	Deference	2	8 %
	Intraception	1	4 %
Conscientiousness	Persistence	7	37 %
	Order	6	32 %
	Performance	5	26 %
	Deference	1	5 %
Extraversion	Exhibition	9	35 %
	Dominance	7	27 %
	Intraception	5	19 %
	Performance	3	12 %
	Autonomy	1	4 %
	Deference	1	4 %
Openness	Change	7	88 %
	Affiliation	1	13 %
Neuroticism	Aggression	5	50 %
	Autonomy	5	50 %

DISCUSSION

Brazilian psychologists play a critical role in administering and interpreting personality tests, which can either facilitate or limit citizens' access to various social, academic, and professional opportunities. The results of these assessments are interpreted and evaluated based on specific criteria established by the government. The present study aimed to bridge the gap between two distinct theoretical frameworks to enhance the application of

one of the most widely used personality tests in Brazil: the Personality Factor Inventory. Specifically, we employed an ESEM procedure to evaluate whether an assessment based on Murray's system of needs aligns with the Big Five personality model. ESEM offers a flexible integration of EFA, CFA, and SEM (Marsh et al., 2014). Previous studies have demonstrated that ESEM models offer a better fit than corresponding CFA models and as are less restrictive than the traditional CFA in part because each item is allowed to load on one factor and all non-target loadings are constrained to be zero (Booth & Hughes, 2014).

The five-factor solution of the Personality Factor Inventory demonstrated good-ness-of-fit outcomes that met or exceeded current standards, indicating that items developed under Murray's system of needs also fit well into the Big Five internal structure. This result is not entirely novel. Previous independent studies have reported similar patterns. These findings also contribute to the current understanding of the Big Five model as a unifying theory (Costa et al., 2019; Digman, 1990; Feher & Vernon, 2021). However, unlike prior research, the present study employed ESEM procedures, representing a novel methodological contribution.

Despite differences in theoretical orientation and scale construction strategies, the five-factor solution gave us the enabled us to establish a link between the Big Five personality theory to Murray's types of needs, which aligns with one of the current goals in personality research (Kandler et al., 2011; Rollings et al., 2022). A similar result was suggested by Costa and McCrae (1988), with the NEO Personality Inventory. The labeling process for this solution led us to infer that F1 corresponds to Agreeableness, F2 to Conscientiousness, F3 to Extraversion, F4 to Openness to Experience, and F5 to Neuroticism. Given that these two theories were developed from different frameworks, these labels represent approximations and should therefore be interpreted with caution and subjected to further validation through future research.

The assignment of the items to the factors was based on a comparison between the original factors proposed by Murray and the five-factor solution obtained. Agreeableness, for instance, refers to amiability in social interactions and includes trait adjectives such as *altruistic*, *kind*, *warm*, *cooperative*, *unselfish*, *polite*, *trustful*, *generous*, *flexible*, *considerate*, and *agreeable* (Wilmot & Ones, 2022). The items that loaded most strongly on this factor in the obtained solution were previously part of the Affiliation factor of Murray's theory. Examples include items such as "I like to show a lot of affection for my friends" and "I like to maintain strong bonds of friendship" (items 46 and 52).

Items originally associated with the persistence factor were strongly related to the second factor, which justified labeling this dimension as Conscientiousness. Several studies have concluded that Conscientiousness is the most robust non-cognitive predictor of occupational performance, primarily because it encompasses traits

related to persistence (Wilmot & Ones, 2019). This domain included items such as "I enjoy completing whatever work or task I have started." (item 8) or "When I have a task to do, I like to start early and keep working until I complete the task" (item 14).

The third factor grouped behaviors related to social relationships, leading us to infer that this factor corresponds to the dynamics of Introversion (intraception, deference) and Extraversion (exhibition, dominance) in the Big Five model. Previous research has suggested that extraverted individuals tend to be energetic and outgoing, particularly in social settings (Ellis et al., 2018). Accordingly, items such as "I like to be the center of attention in a group" (item 61) and "I like to ask questions that no one will be able to answer" (item 71) were part of this factor.

Factor 4 was primarily formed by items related to the need for change, leading us to infer its equivalence to Openness to Experience. However, its other component, affiliation, represents the opposite of change —stability within a group or identity. High values on this factor suggest a strong aesthetic sense and a willingness to try new things, even if doing so involves some risk.

The fifth factor encompassed needs for aggression and autonomy in equal proportions. Both needs are associated with Neuroticism within the Big Five model: the persistent need to attack usually involves emotional instability, while the need for autonomy reflects a focus on the self (Ellis et al., 2018).

Beyond our general findings, the results demonstrated gender invariance, providing new evidence supporting the validity of test score comparisons between male and female participants. This suggests that the test results can be interpreted as bias-free in terms of gender. These findings are particularly significant because personality assessments are widely used throughout Brazil for various purposes, and psychologists are frequently tasked with interpreting assessments like the Personality Factor Inventory inrelation to the Big Five personality traits. Consequently, gaining a deeper understanding of the potential alignment between measures grounded in distinct theoretical frameworks can help psychologists interpret assessments more effectively, ensuring alignment with the criteria established for evaluations mandated by the Brazilian government.

Limitations & Conclusions

Although the findings of the current study are promising, several important limitations must be noted. First, while the sample was large and diverse, all participants were Brazilian. Despite evidence suggesting that personality traits may share similarities across cultures, the lack of international diversity in the sample could limit the gener-alization of results to other countries. Additionally, the majority of participants were young and well-educated, which may not fully represent the broader population. Future

research should examine this measure and its application to the Big Five traits in other cultural contexts and among populations with greater diversity in age and educational backgrounds.

Another limitation concerns the complexity of reconciling differing theoretical perspectives on personality. Disputes may arise among researchers, particularly regarding labeling of Big Five factors that encompass fewer traits. Despite this, we believe this study provides initial evidence supporting the integration of two substantial personality theories within a Brazilian context. This research offers a foundation for psychologists in Brazil to interpret the Personality Factor Inventory results in light of the Big Five model.

Future studies are necessary to assess the stability of these findings using data from more diverse populations. Additionally, confirmatory analyses should be conducted to determine whether the five-factor solution remains adequate within stricter analytical frameworks. Such research will help deepen the understanding of the relationship between these theoretical perspectives, particularly in countries like Brazil, where personality testing plays a critical role in various contexts.

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Supplementary Table 1

ESEM results (Big Five Solution)

		ESEM				
		F1	F2	F3	F4	F5
Item	Item content	λ	λ	λ	λ	λ
56	I like my friends to be s	0.783	0.034	-0.024	-0.143	0.376
53	I appreciate my friends'	0.764	0.003	-0.059	-0.082	0.321
29	I like my friends to be s	0.687	-0.008	-0.039	-0.14	0.352
54	I like my friends to do s	0.642	0.04	0.047	-0.058	0.337
46	I like showing a lot of a	0.615	-0.026	0.015	0.213	0
31	I like my friends to show	0.581	-0.007	0.111	-0.053	0.312
47	I enjoy doing favors for	0.57	0.06	-0.015	0.149	-0.117
52	I value maintaining stron	0.566	0.006	-0.06	0.357	0.039
98	I enjoy being generous wi	0.549	0.125	-0.051	0.168	-0.026
73	I'm sympathetic to my fri	0.537	0.122	-0.033	0.158	-0.02
19	I like doing small, affec	0.534	0.062	-0.08	0.197	-0.031
60	I try to understand how m	0.525	0.02	0.156	0.085	-0.053
64	I like keeping in touch w	0.499	0.04	-0.036	0.388	0.046
97	I like my friends to trea	0.488	-0.054	0.01	0.047	0.189
37	I enjoy participating in	0.483	0.097	-0.017	0.207	0.027
17	I like my friends to give	0.481	-0.051	0.077	-0.202	0.361
58	I enjoy treating others w	0.474	0.117	-0.001	0.177	-0.052
77	I like helping people who	0.459	0.096	0.114	0.091	-0.034
9	I like helping my friends	0.417	0.176	-0.088	0.22	-0.062
44	I like sharing things wit	0.417	-0.027	0.015	0.215	-0.171
49	I like complimenting peop	0.407	0.151	0.117	0.183	-0.056
66	I enjoy making as many fr	0.4	-0.001	0.057	0.343	-0.069
57	I prefer doing things wit	0.397	-0.076	0.086	0.228	0.036
50	When I plan something, I	0.341	0.253	0.093	0.102	-0.047
26	I'm loyal to my friends.	0.333	0.19	-0.046	0.257	-0.031
78	I enjoy planning and orga	0.047	0.774	0.012	-0.086	0.024
94	I prefer planning before	0.026	0.73	0.041	-0.033	0.053
30	Before starting a task, I	0.043	0.72	-0.001	-0.06	0.023

(*continues*)

(*continued*)

		ESEM				
		F1	F2	F3	F4	F5
Item	Item content	λ	λ	λ	λ	λ
51	I prefer keeping my works	0.048	0.694	-0.12	-0.036	-0.017
95	Any written work I do, I	0.076	0.656	-0.015	0.033	0.043
55	I enjoy keeping my letter	0.039	0.644	-0.008	-0.066	-0.021
14	When I have a task to do,	0.061	0.634	-0.071	0.002	-0.009
8	I enjoy completing any ta	0.01	0.624	-0.073	0.095	-0.054
27	I like finishing one task	0.092	0.586	-0.136	0.011	0.069
86	I enjoy giving my best ef	0.092	0.55	0.064	0.166	-0.056
10	I usually don't abandon a	-0.01	0.503	0.04	0.09	-0.138
42	I like sticking to a task	0.017	0.477	0.217	0.08	-0.133
33	I like succeeding in the	0.064	0.475	0.222	0.187	0.056
38	I feel satisfied when I c	0.192	0.436	0.12	0.206	0.043
48	I like following instruct	0.271	0.399	-0.02	-0.027	-0.107
80	I would like to accomplis	0.068	0.393	0.298	0.18	0.03
32	I enjoy performing tasks	0.082	0.358	0.347	0.031	-0.007
36	I prefer working hard wit	-0.012	0.345	0.242	-0.012	-0.053
20	I prefer staying up late	0.035	0.323	0.154	-0.012	-0.08
62	I enjoy taking leadership	-0.122	0.186	0.721	0.023	-0.121
35	I like being seen as a le	-0.088	0.17	0.697	0.025	-0.095
65	When I'm part of a commit	-0.086	0.131	0.672	-0.029	-0.074
61	I like being the center o	0.01	-0.088	0.618	0.014	0.132
75	I like supervising and di	-0.093	0.024	0.611	-0.104	0.061
81	When I'm with a group, I	-0.037	0.152	0.558	0.007	0.032
87	I like studying and analy	0.259	-0.01	0.551	-0.108	-0.036
45	I feel satisfied when I c	0.082	0.008	0.529	0.062	0.077
11	I like telling others how	-0.06	0.059	0.518	-0.08	0.016
12	I would like to be consid	-0.056	0.206	0.506	0.013	0.062
71	I enjoy asking questions	-0.046	-0.073	0.475	0.007	0.258
90	I enjoy predicting how my	0.299	0.035	0.451	-0.088	-0.002
84	I enjoy solving puzzles a	-0.004	0.358	0.438	0.05	-0.062
72	Sometimes I like doing th	0.014	-0.117	0.435	-0.043	0.233

(*continues*)

(*continued*)

		ESEM				
		F1	F2	F3	F4	F5
Item	Item content	λ	λ	λ	λ	λ
7	I like being able to do t	-0.091	0.284	0.434	0.005	0.108
82	I'm interested in learnin	0.142	0.068	0.434	-0.006	-0.116
67	I like observing how othe	0.341	0.024	0.432	-0.016	-0.068
25	I like thinking about my	0.303	-0.053	0.42	-0.106	0.01
96	I enjoy when people notic	0.114	0.008	0.418	0.008	0.187
85	I like talking about my s	0.153	0.075	0.417	0.017	0.138
93	I like using words that o	-0.025	-0.072	0.416	-0.011	0.22
100	I enjoy saying things tha	0.235	-0.108	0.413	0.204	0.1
22	I like analyzing other pe	0.311	-0.009	0.389	-0.027	-0.029
99	I like telling funny stor	0.166	-0.212	0.382	0.188	0.041
1	I like doing things that	-0.063	-0.084	0.371	0.195	0.031
88	I enjoy telling others ab	0.23	-0.143	0.324	0.215	0.192
43	I enjoy meeting new peopl	0.349	-0.014	0.028	0.514	-0.104
34	I enjoy making new friend	0.341	0.075	-0.016	0.451	-0.149
79	I like trying new and dif	0.1	0.026	0.173	0.578	-0.019
13	I enjoy trying out new th	0.06	-0.027	0.163	0.531	-0.043
41	I enjoy traveling and exp	0.082	-0.071	0.221	0.457	0.034
3	I enjoy experiencing new	0.013	0.036	0.147	0.442	-0.136
21	I enjoy walking through t	-0.011	-0.101	0.277	0.36	0.014
59	I like trying new and exo	0.089	-0.086	0.309	0.316	-0.006
91	I like feeling free to do	-0.046	0.182	-0.021	0.585	0.712
92	I enjoy coming and going	-0.052	0.194	-0.044	0.545	0.681
39	I want to tell people to	0.012	-0.12	0.254	-0.011	0.483
70	Sometimes I get so angry	0.039	-0.193	0.18	0.083	0.482
24	I want to take revenge wh	-0.017	-0.15	0.262	-0.007	0.479
69	I dislike feeling pressur	0.107	-0.108	-0.035	0.094	0.429
40	I like doing things my ow	-0.092	-0.06	0.155	0.117	0.421
23	I enjoy making fun of peo	0.002	-0.221	0.295	0.023	0.391
76	I tend to blame others wh	0.05	-0.248	0.25	-0.123	0.389

(*continues*)

(*continued*)

		ESEM				
		F1	F2	F3	F4	F5
Item	Item content	λ	λ	λ	λ	λ
63	I value independence when	-0.076	0.153	0.143	0.286	0.348
4	I dislike situations wher	0.009	-0.052	0.033	0.093	0.277
74	I'm not afraid to critici	-0.043	0.035	0.297	0.22	0.158
16	I enjoy working for long	-0.019	0.309	0.209	-0.028	0.125
5	I like expressing my opin	0.072	0.143	0.149	0.215	0.115
2	I would like to accomplis	0.032	0.288	0.209	0.136	0.007
18	I usually analyze my inte	0.309	0.2	0.085	0.032	-0.032
83	I try to adapt to the way	0.281	0.115	0.248	-0.056	-0.043
15	I gladly accept the leade	0.243	0.264	0.078	0.091	-0.084
28	I enjoy telling my superi	0.246	0.212	0.223	0.079	-0.097
6	I enjoy learning what pro	0.116	0.152	0.308	-0.004	-0.101
68	In groups, I happily acce	0.243	0.226	0.002	0.061	-0.136
89	I forgive people who hurt	0.283	0.169	-0.028	0.102	-0.186

Note. x^2 (4460)=427 544.759, *p* <.001, CFI=.946, RMSEA=.059. Items' content was trimmed to 25 characters.