Article

Validity and Reliability Evidence for Assessing Holland's Career Types[1]

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Abstract: Professional interests are a synthesis of personal characteristics and function as a guiding factor for one's career choice. This study shows evidence of validity and reliability for the interpretation of the scores of a measure of career types. The responses of 1,265 high school students to 154 items from the Escala de Avaliação dos Tipos Profissionais de Holland (ATPH) [Assessment Scale of Holland's Career Types] were used. Exploratory and confirmatory factor analyses showed that the six-factor structure is appropriate and consistent to represent the RIASEC types. Evidence of convergent-discriminant validity of parcels of items was demonstrated to represent the latent factors of the ATPH Scale. Results of multidimensional analysis and *phi* correlation phi partially confirmed the hypothesis of circularity and congruence among the career types, which are organized in the acronym RASIEC. The implications of these results and study limitations are discussed.

Keywords: professional interests, factor analysis, test validity, psychometrics

Evidências de Validade e Precisão Para Avaliação dos Tipos Profissionais de Holland

Resumo: Interesses profissionais representam uma síntese das características pessoais que atua como fator de orientação para a escolha profissional. O presente estudo apresenta evidências de validade e precisão para a interpretação dos escores de uma medida dos tipos profissionais. Foram analisadas as respostas de 1.265 estudantes do Ensino Médio aos itens da Escala de Avaliação dos Tipos Profissionais de Holland (ATPH). Análises fatoriais exploratórias e confirmatórias demonstraram que a estrutura de seis fatores é adequada e consistente para representar os tipos RIASEC. Foram demonstradas evidências de validade convergente-discriminante de parcelas de itens para representar os fatores latentes da ATPH. Resultados de análises multidimensionais e de correlação *phi* confirmaram parcialmente as hipóteses de circularidade e de congruência entre os tipos profissionais, os quais se organizaram no acrônimo RASIEC. As implicações dos resultados aqui encontrados e as limitações do estudo são discutidas.

Palavras-chave: interesses profissionais, análise fatorial, validade do teste, psicometria

Evidencias de la Validez y Fiabilidad Para Evaluación de los Tipos Profesionales de Holland

Resumen: Intereses profesionales representan una síntesis de las características personales que actúa como guía para la elección de carrera. Este estudio muestra evidencia de la validez y fiabilidad para la interpretación de las puntuaciones de una medida de tipos profesionales. Se analizaron las respuestas de 1.265 estudiantes de secundaria a los artículos de la Escala de Evaluación de los Tipos Profesionales de Holanda (ATPH). Análisis factorial exploratorio y confirmatorio mostraron que la estructura de seis factores es adecuada y consistente para representar los tipos RIASEC. Se demostró evidencias de validez convergente-discriminante de las parcelas de artículos para representar los factores latentes de la ATPH. Análisis multidimensional y correlación *phi* confirmaron parcialmente la hipótesis de la circularidad y la congruencia entre los tipos de profesionales, que se organizan en el acrónimo RASIEC. Se discuten las implicaciones de los resultados actuales y las limitaciones del estudio.

Palabras clave: intereses profesionales, análisis factor, validación de test, psicometría

One of the best known approaches to understanding personality traits related to professional interests is the Career Typology and Environmental Models proposed by Holland (1959, 1997). This approach was developed to meet needs

concerning the professional qualification of individuals in the United States in the mid-20th century. Career interests are expressions of life's objectives, values, identifications, competencies and the abilities of individuals within the professional sphere, representing a synthesis of personal characteristics that orient one's career choice. Six basic types of personality and working environments can represent these characteristics: Realistic (R); Investigative (I); Artistic (A); Social (S); Enterprising (E), and Conventional (C); they are assessed in terms of predominance (Holland, 1996, 1997; Holland, Fritzsche, & Powell, 1994).

People whose predominant characteristics are described by the Realistic (R) type have a tendency to focus more

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frequently on observable and concrete realizations, are not very sociable, have good motor skills, and prefer to deal with concrete problems rather than abstract ones. The Investigative (I) type is represented by individuals predominantly more introverted and focused on intellectual exploration, who enjoy thinking more than acting and are more skilled to deal with abstract ideas and words. The predominant characteristics of the Artistic (A) type are introversion, a tendency to use feelings, emotions, intuition, imagination, and creativity to deal with daily situations (Holland, 1996, 1997).

The Social (S) type corresponds to individuals whose most prominent characteristics are extroversion, sensitivity, solidarity, with good verbal and interpersonal skills and a tendency to social interaction and engagement. More enthusiastic, impulsive, and outgoing individuals who prefer activities in which they dominate, persuade and lead others belong to the Enterprising (E) type. The Conventional (C) type, in turn, gathers characteristics such as conformism and control, prefers more structured activities involving obedience to orders and rules (Holland, 1996, 1997).

In addition to the description of the six types of personality, Holland proposed that these types be clockwise-organized in a multidimensional circular and dynamic hexagonal structure with the acronym RIASEC. This hypothesis predicts that the prototypical distances in the multidimensional area between the adjacent types (R-I; I-A; A-S; S-E; E-C and C-R) is greater than the distance between the alternate types (e.g., R-A; I-S; A-E; S-C; E-R and C-I); which in turn is greater than the distance between the opposite types (e.g., R-S; I-E and C-A (Holland, 1996, 1997; Rounds & Tracey, 1996; Tracey, Watanabe, & Schneider, 1997).

Holland's typology gained international recognition due to its operational simplicity, empirical testability, ease of application, and ease of interpretation of results (Nauta, 2010). Among the instruments proposed to assess RIASEC types, the Self-Direct-Search - SDS (Holland et al., 1994) stands out. It has been translated into 25 different languages and used with more than 22 million people from different cultures around the world (Goldstein & Hersen, 2000). The basic assumptions concerning the existence of six types of vocational personality have broad empirical evidence, with results from numerous cross-cultural and meta-analytical studies showing evidence of its validity (Holland, 1997; Kantamneni & Fouad, 2011; Rounds & Tracey, 1996; Tien, 2011; Yang, Stokes, & Hui, 2005).

Another important aspect of this typology concerns its ability to predict a series of variables related to the world of work. Van Iddekinge, Roth, Putka and Lanivich (2011), showed, based on a meta-analytical study, that RIASEC types are efficient to predict performance at work ($d = .14$), performance in training ($d = .26$), and intentions and volumes of businesses (d ranging from -.15 to -.19). Pässler, Beinicke, and Hell (2015) demonstrated in a meta-analysis study a consistent and significant relationship between professional interests and cognitive abilities, with coefficients ranging from -.29 to .47 for different professional types.

In the Brazilian context, the results of empirical studies using the Questionário de Busca Auto-Dirigida (Primi, Mansão, Muniz, & Nunes, 2010), the name given to the commercial version of the SDS in Brazil, are in agreement with international findings. Mansão and Yoshida (2006), for instance, reports evidence of validity related to the SDS's internal structure. Other studies using SDS found evidence of validity for using the RIASEC model in Brazil, especially as related to external variables, which are important to understanding career types such as: personality (Nunes & Noronha, 2009; Primi et al., 2002; Primi, Moggi, & Casellato, 2004); career choice (Nunes & Noronha, 2009; Sartori, Noronha, Godoy, & Ambiel, 2010); other measures of interest (Primi et al., 2002, 2010); self-efficacy for occupational activities (Nunes & Noronha, 2009); cognitive skills (Nunes & Noronha, 2009; Primi et al., 2002); sex, school year (Sartori, Noronha, & Nunes, 2009), and parents' education (Noronha & Ottati, 2010).

Aiming to propose an alternative measure to assess RIASEC types, Primi, Muniz, Nunes and Mansão (2008) proposed a version parallel to the SDS, developing the Escala de Avaliação dos Tipos Profissionais de Holland (ATPH) [Holland Assessment Scale for Holland Career Types] as a non-comercial alternative for assessing career types in Brazil. This instrument, in addition to its practical and economic advantages linked to research in the field of vocational and career guidance, is also a shorter alternative (154 items) for the assessment of career types in Brazil, compared to the SDS with 216 items. The initial studies conducted with the ATPH, Mansão and Noronha (2011) reported evidence of reliability (Cronbach's alpha coefficients > .90) and validity based on the scale's internal structure to assess Holland six occupational personality types. Another study reports convergence validity between ATPH and the Photos of Professions Test (BBT-Br), equivalent to BBT - Berufsbilder test, masculine and feminine versions (Mansão, Noronha, & Ottati, 2011). Noronha, Mansão and Nunes (2012), in turn, showed that the Holland types are related to the personality traits of the Big Five model, corroborating results from other international studies (Barrick, Mount, & Gupta, 2003; Holland et al., 1994; Larson, Rottinghaus, & Borgen, 2002; Staggs, Larson, & Borgen, 2007).

Overall, the revised studies reveal that there is an effort to show evidence to compose, in Messick's (1980) terms, evidence for the use and interpretation of scores obtained from instruments such as RIASEC. Particularly in regard to the ATPH, promising evidence has been found in regard to its appropriateness to assess Holland types. The structural hypothesis of circularity, however, which grounds the interpretation of congruence between the types within the hexagonal model, has not yet been assessed. Additionally, the scale's factor structure has not yet been tested based on analyses that consider the polychoric correlation matrix as a source of information, as is recommended by Kline (2011) to analyze categorical items as is the case of ATPH. Additionally, confirmatory analyses have not yet been conducted to assess the factor structure found by Mansão and Noronha (2011), so that new studies addressing larger samples and testing the

scale's internal structure based on different methods of data analysis are relevant and justified.

Considering the previous discussion, this study sought to gather validity and reliability evidence for the ATPH. The study was conducted around distinct, but closely related objectives, namely: to find validity evidence based on the ATPH's internal structure; to assess the internal consistency of career types assessed by the instrument; and to test the hypotheses of circularity and congruence among the career types assessed by the ATPH.

Method

Participants

The sample was composed of 1,265 participants regularly enrolled in public or private high schools in cities of the interior of São Paulo, Brazil. A total of 710 (56.1%) students were females and 555 (43.9%) were males, aged between 13 and 54 years old ($M = 17.19$; $SD = 4.02$; 89.6% with up to 20 years).

Instruments

Escala de Avaliação dos Tipos Profissionais de Holland (ATPH). The ATPH was developed by Primi et al. (2008) based on the SDS - Self-Directed-Search (Holland et al., 1994) with the objective to verify vocational interests and preferences. It is composed of 154 items that represent the six RIASEC types. The participant is asked to assess each item and respond as to the intensity of his/her interest, recording answers on a four-point ordinal scale ranging from 1 = *no interest* to 4 = *a lot of interest*. Reliability coefficients (Cronbach's alpha) for all six factors were above .90 (Mansão & Noronha, 2011; Mansão et al., 2011).

Procedure

Data collection. After initial contact with the schools and gaining the principals' authorizations to collect data, the students were contacted and given clarification about the study's objectives. Free and informed consent forms were distributed to the students' parents/legal guardians. The collection of data, initiated after forms were returned with the parents' signatures, was performed in the classrooms. The respondents self-administered the instrument, a procedure that took 30 minutes on average.

Data analysis. Analysis involved assessing the structure and internal consistency. The database was randomized and divided into two parts, similar in terms of age and sex. Exploratory Factor Analysis (EFA) was conducted with the scale's 154 items, considering the subsample "A" ($n = 616$). Mplus7 with a matrix of polychoric correlations was used, as was estimation by the Ordinary Least Squares method (OLS) and oblique rotation GEOMIN (Asparouhov & Muthén, 2009; Kline, 2011). To establish the initial number of factors to be extracted, parallel analysis was performed using R software (Lorenzo-Seva & Ferrando, 2006). Criteria to keep the items within the factors were: theoretical reasonableness

and saturation $\geq$ .30. The items kept in each factor were assessed in terms of their internal consistency (Cronbach's alpha) and item-total correlation using SPSS 19.

The scale's internal structure was replicated with the database's subsample "B" ($n = 649$), using confirmatory testing with item parceling (Bandalos, 2002; Hall, Snell, & Foust, 1999) in structural equation modeling (Kline, 2011). The use of this procedure has been noted in the literature as a useful methodological strategy to increase the stability of estimated parameters and can be employed when there is prior evidence concerning the dimensionality of the set of items that will be combined into parcels. According to Cupani, Vaiman, Font, Pizzichini and Saretti (2012), parceling items of the same factor can be done using different criteria. The most commonly used include: random parceling; based on theoretical content; based on statistical criteria, such as factor load, asymmetry, difficulty, or discrimination, among others.

The specificity of items was maintained in the respective factors according to the structure indicated by EFA when parceling items in this study. Two parceling strategies were tested: with statistical criteria, in order to ensure variability of asymmetry in each parcel; and random-items parceling. Five parcels, with at least four items each, were created to represent each latent factor. No important violations concerning extreme multivariate cases or collinearity among parcels were observed. In regard to normality, the Kolmogorov-Smirnov normality test indicated non-normal distribution of parcels. To deal with this lack of normality among variables, we opted to use bootstrap replications (Hair, Black, Babin, & Anderson, 2010; Kline, 2011) of the coefficients estimated by the Maximum Likelihood estimation (MLE) method, with a 95% confidence interval.

The measurement model was specified assuming the items parceling to be endogenous variables to represent six latent oblique factors. Assessment of the model's goodness of fit was based on recommendations provided by Garson (2012), Hair et al. (2010) and Kline (2011), namely: *CFI* (> .90 indicate goodness of fit); *RMR, SRMR, RMSEA* (close to zero indicate goodness of fit, while values up to .08 are considered acceptable). Indicators such as normed chi-squared (χ^2/gl), *AIC* and *CAIC* were used to assess the best fit among the models tested – values below these indexes indicate the most parsimonious model with the most satisfactory goodness of fit. Indicators that show reliability and convergent-discriminant validity of the scale factor structure were also calculated: Composed Reliability - *CR* (valor $\geq$ .70 indicates satisfactory internal consistency) and Average Variance Extracted - *AVE* > .50 indicates convergent validity of parcels to represent the latent factor; the squared root of AVE ($\sqrt{AVE}$) greater than the association of phi among factors indicates discriminant validity (Farrell, 2010).

Finally, a multidimensional scaling (MDS) analysis (Proxscal algorithm) was performed to assess the hypothesis of circularity of career types with ordinal transformations of proximities, Euclidean distances

and data regarding standardized career types (Z scores). The following fit criteria were established for these analyses: *normalized row stress* (values less than .20 were considered acceptable) and *Tucker's congruence coefficient* (values greater than .90 indicate goodness of fit)

Ethical Considerations

This study was approved by the Institutional Review Board regulating research involving human subjects at the Universidade São Francisco, Bragança Paulista Campus (CAAE no. 0171.0.142.0000-07).

Results

Parallel analyses indicated the possibility of extracting up to 22 factors, among which at least eight factors stood out. Assessment of these potential factor solutions indicated that the six-factor configuration was the best fit and most coherent with the theoretical model grounding the ATPH, corresponding to the career types proposed by Holland (1996, 1997). Table 1 presents a synthesis of results found in this exploratory analysis, as well as coefficients of internal consistency (Cronbach's alpha) for each of the factors extracted.

Table 1
Synthesis of the Results of the Exploratory Factor Analysis and Consistency for the ATPH

Factors / Types	Estimated loads (range)	Item-total correlation (range)	Number of items	Eigenvalues	Cronbach's alpha
1. Conventional	.45 to .91	.47 to .82	27	44.4	.96
2. Artistic	.40 to .85	.42 to .71	32	20.54	.94
3. Realist	.51 to .97	.42 to .85	25	12.86	.96
4. Social	.32 to .90	.37 to .83	24	8.53	.96
5. Investigative	.34 to .89	.43 to .80	22	6.38	.95
6. Enterprising	.36 to .75	.45 to .76	24	4.9	.95

The factors extracted with the exploratory factor analysis (Table 1) reproduced a six-factor structure as foreseen by the RIASEC model. Afterwards, a model for the confirmatory analysis of the factor structure found in EFA (Table 1) was specified. The model that specifies covariance among latent factors and assumes the 30 parcels of items as endogenous variables (five parcels to represent each latent factor of RIASEC types) was tested twice, considering the items parceling strategies previously mentioned. The results of these analyses are presented as follows.

The following goodness of fit indexes were obtained for model 1, in which items parceling used statistical criteria: $CFI = .94$; $RMR = .03$; $RMSEA = .08$ [CI: .07 - .08; $PCLOSE = .001$]; $SRMR = .06$; $\chi^2/gl = 4.77$; $AIC = 2.009.249$; $CAIC = 2.419.906$. For model 2, in which parcels were created based on random criteria, the following indexes were found: $CFI = .95$; $RMR = .03$; $RMSEA = .07$ [CI: .06 - .07; $PCLOSE = .001$]; $SRMR = .05$; $\chi^2/gl = 3.96$; $AIC = 1.695.581$; $CAIC = 2.106.238$. Comparison between the two models shows satisfactory goodness of fit for both with a slight improvement of goodness of fit when the strategy used was the random grouping of items (Garson, 2012; Hair et al., 2010; Kline, 2011). The estimated factor loads for the item parcels were significant and ranged from .81 to .96 in model 1 and from .82 to .95 in model 2, and were stable in the bootstrap analysis with a confidence interval of 95% (Table 2).

Correlations among the latent factors are presented in Table 3.

A multidimensional scaling (MDS) analysis was performed to assess the circular hypothesis of the distribution of career types. The fitness measures presented satisfactory values: *normalized row stress* = .07; *S-Stress* = .16; *Tucker's congruence coefficient* = .97. The distribution of career types in the two-dimension space is presented in Figure 1.
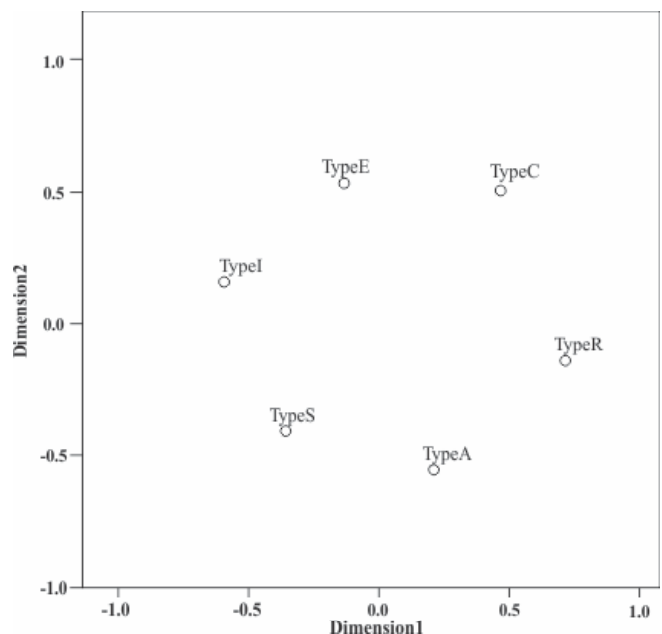

Figure 1. Two-dimension MDS Projection of factors measured by ATPH.

Table 2
Results of the Confirmatory Analysis and Consistency for the ATPH, Considering Different Strategies of Items Parceling

Items[a]	Items parceling	Factors and saturation of parcels into two types of items parceling[b]											
		C		A		R		S		I		E	
		SP	RP	SP	RP	SP	RP	SP	RP	SP	RP	SP	RP
12, 22, 76, 77, 99, 118	TCP1	.93	.93										
20, 21, 74, 116, 120	TCP2	.91	.91										
13, 75, 100, 117, 119	TCP3	.90	.92										
16, 17, 19,73, 154	TCP5	.90	.91										
14, 18, 97, 114, 115	TCP4	.89	.92										
5, 57, 66, 110, 111, 112, 132	TAP4			.92	.94								
6, 7, 9, 11, 68, 71, 108	TAP3			.90	.86								
8, 10, 69, 104, 105, 107	TAP5			.90	.85								
1, 3, 4, 72, 113, 131	TAP1			.81	.91								
2, 15, 67, 70, 106, 109	TAP2			.87	.83								
33, 41, 85, 129, 133	TRP1					.96	.95						
35, 38, 40, 130, 134	TRP2					.95	.90						
36, 84, 87, 88, 128	TRP4					.92	.93						
34, 42, 43, 89, 136	TRP3					.91	.93						
39, 83, 86, 90, 135	TRP5					.86	.87						
49, 52, 92, 93, 138	TSP1							.95	.93				
51, 91, 137, 141, 144	TSP2							.93	.94				
28, 48, 54, 96, 142	TSP5							.92	.87				
45, 47, 50, 53, 95	TSP4							.92	.95				
44, 46, 94, 139, 143	TSP3							.90	.82				
23, 26, 32, 80, 124	TIP1									.91	.85		
30, 31, 122, 125	TIP3									.91	.87		
24, 27, 81, 82	TIP4									.87	.84		
25, 79, 123, 127	TIP2									.86	.89		
29, 37, 78, 121, 126	TIP5									.81	.88		
56, 58, 101, 146, 152	TEP5											.92	.89
61, 64, 98, 145, 150	TEP3											.92	.80
59, 60, 102, 147, 153	TEP4											.91	.88
62, 63, 65, 148, 149	TEP2											.88	.91
55, 103, 140, 151	TEP1											.79	.89
Composed Reliability – CC		.96	.96	.95	.94	.97	.96	.97	.92	.94	.93	.95	.93
Average Variance Extracted - AVE		.82	.84	.78	.79	.85	.84	.85	.82	.76	.75	.78	.77
$\sqrt{AVE}$		.91	.92	.88	.89	.92	.92	.92	.91	.87	.87	.88	.88

Note. [a]The list of items described in Table 2 corresponds to model 2, which presented the most parsimonious goodness of fit. [b]Strategy of items parceling: SP = Statistical Parceling; RP = Random Parceling.

Table 3
Results of Phi Correlation Among ATPH Latent Factors Considering Different Items Parceling Strategies

	C	A	R	S	I
A	.21 (.21)				
R	.39 (.40)	.25 (.26)			
S	.27 (.27)	.48 (.47)	-.01 (.00)		
I	.35 (.36)	.42 (.42)	.41 (.43)	.46 (.46)	
E	.67 (.68)	.44 (.43)	.39 (.40)	.37 (.38)	.43 (.45)

Note. Values outside the parentheses correspond to model 1, with statistical parceling, while the values within parentheses correspond to model 2, with random parceling. All the coefficients were significantly different from zero at $p < .001$, except between the R and S types for both the items parceling strategies adopted.

Discussion

The grouping of items found with exploratory factor analyses (Table 1) almost entirely reproduces the results presented in the single prior study that assessed ATPH's internal structure (Mansão & Noronha, 2011). The items that describe the following characteristics were grouped in factor 1: greater conformism, control and efficiency in structured tasks, identification with power, valorization of material possessions and social position, inflexibility, rigidity and limited creativity (e.g., item 18. Review accounting of a company), which represents the Conventional (C) type. Items 92 "Working with insurance, social security and health insurance" and 100 "Working with sales" were originally developed to represent S and E types, respectively, were grouped into the C type, types that are adjacent on the hexagonal prototypical structure proposed by Holland (1997).

Factor 2 grouped items that describe interests using feelings, emotions, intuition, imagination and creativity to deal with daily situations, solving problems by expressing tastes, thoughts, imagination and feelings through artistic conceptions and realizations (e.g., item 5. Working with artists [musicians, writers or painters]), which corresponds to the Artistic (A) type. Items provided to other types, but which are related to type A characteristics, were also grouped in this set, for instance: item 57(E). Managing leisure and tourism activities; item 131(R) Repairing clothing; and item 132(R) Taking care of gardens. Even though these items were theoretically developed to cover types E, R and R, respectively, for this study's sample, they were seen in the context of careers that enable the expression of feelings and emotions, such as designer, costume designer, and decorator, corroborating the configuration and interpretations for type A as presented by Mansão and Noronha (2011).

Factor 3 grouped items that deal with preferences for activities focused on observable, concrete and manual realizations, which require more prominent motor skills and a greater preference for dealing with concrete problems rather than abstract problems (e.g., item 42. Working in an auto repair shop), corresponding to the Realist type (R). Factor 4, in turn, grouped items that represent the Social (S) type, describing interests in careers that enable social interaction and engagement and the expression of characteristics, such as extroversion, sensitivity, solidarity, verbal and interpersonal skills (e.g., item 47. Working with the rehabilitation of children, adults, and elderly individuals with physical or emotional problems). Item 28 "Know the functions of foods and develop menus", originally provided for type I, was added to factor 4. Considering the cultural meaning of food in Brazil, it may be interpreted in type S as an activity related to concern with health, to the preparation and delivery of food to people, activities normally performed by nutritionists and professionals involved in gastronomy, for instance.

Factor 5 grouped items that correspond to the Investigative (I) type, the interests of which are directed to intellectual exploration, introversion, analytical skills, the ability to critique and perfectionism (e.g., item 82. Seeking solutions to scientific problems). This factor describes people who like to think more than act and have a greater ability to deal with abstract ideas and words, with organizational capacity, independence and originality. Item 37 (Understanding the biological mechanisms of cosmetic products), originally developed to represent the R type, was grouped in factor 5 accompanying the remaining items that describe intellectual curiosity, typical of the I type. Finally, factor 6 grouped items related to enthusiastic, impulsive and extroverted people, who prefer activities in which they can dominate, persuade, and lead others (e.g., item 61. Leading a team to success at work), corresponding to the Enterprising type.

Few variations were found in this study regarding the grouping of items in comparison to the factor configuration reported by the only study that assessed the internal structure of the ATPH (Mansão & Noronha, 2011). The aforementioned study did not report complex items and retained 142 "pure" items in the instrument. In this study, a total of 154 items were retained, 28 of which presented considerable cross-loads (≥ .30) in at least two factors. Complex items were retained in the factors with stronger loadings, a methodological decision based on the results from Mansão and Noronha (2011); in 15 of these, items were grouped in the same factors that were retained in this study.

Other variations involved the migration of a few items (eight in total) among factors adjacent to the hexagonal model of Holland (1996, 1997), which were relatively

well-accommodated by the theoretical hypotheses, since congruence and correlations of greater magnitude among close types are expected (Holland, 1996, 1997; Tracey et al., 1997). Another potential explanation for these variations may be the different ways data were treated: (1) loading saturation was the criterion used to keep items in the factors (≥ .30 in this study, while ≥ .40 was considered in the other study); and (2) type of correlation matrix used for EFA (in this study, polychoric correlation was used, while Pearson's correlation was used in the other study). These small differences, though, are not enough to produce theoretical-semantic violations that harm the valid representation of RIASEC types in both studies.

The factor structure found when performing EFA (Table 1) was appropriately replicated in the confirmatory analysis (Table 2). The random parceling of items of the same factor in the confirmatory test of this factor structure generated more satisfactory and parsimonious goodness of fit indexes compared to the statistical parceling of items. In regard to the results obtained concerning the internal consistency for the ATPH factors, Cronbach's alphas ranged from .94 to .96, providing evidence of reliability for the measurement. Additionally, the indicators of Composed Reliability (*CR*) and Average Variance Extracted (AVE) for the ATPH latent factors (Table 2) were also above the values recommended by the literature (Hair et al., 2010), indicating that the items parcels presented satisfactory internal consistency (CR ≥ .92) and appropriate converge to represent their respective latent factors (AVE ≥ .75). Taken together, these results show evidence of the reliability and validity based on the ATPH internal structure.

Another important piece of evidence of validity, established based on the results, refers to the specificity of each career type modeled in the confirmatory factor analysis. When comparing the roots of average variance extracted for each factor (Table 2) to the phi (Φ) correlations among factors (Table 3), the √VME indicators were superior to the (Φ) correlations for all the factors. This means that, even though some types present strong correlations among them, the specific variance, explained by each latent factor, is higher than the variance of this factor that is shared with the remaining factors. That is, there is evidence of discriminant validity for each of the six career types, ratifying its specificity and theoretical and practice relevance that justifies keeping the six factors in the structure model (Farrell, 2010).

In regard to the results that enable assessing the hypotheses of circularity and congruence among career types obtained through linear association analysis (*phi* correlations) and non-linear analysis (MDS), we can say that these hypotheses were reasonably ratified. The results summarized in Table 3 indicate that the hypotheses of association among pairs of career types were partially confirmed, since results theoretically expected for most pairs of empirically observed associations were obtained. Higher magnitudes of association (≥ .40) were found for adjacent pairs E-C; A-S; R-I; I-A and C-R compared to the magnitude of relationships observed for the pairs of alternate types S-C; C-I; R-A; E-R, which ranged from .30 to .40. In turn, the smallest correlations were obtained for the pairs of opposite types C-A and R-S, while

for the last pair this relationship was practically null and without statistical significance. For other pairs of career types, however, (S-E, I-A, I-S, A-E, I-E and C-A), the magnitude of relationships obtained contradict the theoretical expectations (Holland, 1997; Rounds & Tracey, 1996; Tracey et al., 1997).

From the point of view of non-linear relationships among career types, assessed using MDS projection (Figure 1), a hexagonal clockwise conformation is observed, characterizing the acronym RASIEC. Even though the exact same ordering of RIASEC types was not observed as postulated by Holland (1996, 1997), we can say that the hypothesis of circular configuration was partially confirmed, as the position of the I type in the two-dimension space diverges from the expected prototypical position.

It is wise to conclude that the ATPH is an instrument in the phase of studies seeking evidence of different types of validity to enable a valid and accurate interpretation of its scores. This paper is the second empirical study in which reliability and validity evidence is reported, based on ATPH's internal structure, to represent career types measured by the ATPH. This study, is however, the first to consider evidence of validity of the hypotheses of circularity and congruence among career types; evidence that partially confirms these hypotheses was found.

Considering that the validation process of a measuring instrument involves a number of studies reporting varied types of evidence of validity, aligned with specific contexts and purposes, caution should be used when interpreting congruence among the career types based on the findings presented here. Future studies should verify whether the results reported here, which conflict with theoretical expectations, are in fact characteristics of the Brazilian people or can be attributed to factors and biases such as acquiescence, specificities of the sample used or limitations of the measuring instrument. Further research assessing the impact of acquiescence, as well as whether there is an impact of differential item functioning (DIF) between men and women and respondents from different Brazilian regions, can be useful to clarify the issue of congruence among types proposed by Holland, enriching the debate over the assessment of careers types by using the ATPH.

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