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Abstract

Principal components extraction with orthogonal and oblique rotations tested construct validity for the Personal Profile System. MOST-LIKE endorsements of 96 behavioral descriptors were coded with 4, LEAST-LIKE with 1, and unendorsed with 2.5. Descriptor data from 1045 Senior Noncommissioned Air Force Officers were normalized. Four factors accounted for 85% of total variance with 19 descriptors loading significantly on 2 factors and the remaining 77 on just 1 factor. The measure of sampling adequacy for every descriptor exceeded .94. One factor for the varimax-rotated (best) analysis was bi-scalar loading on Steadiness and Compliance descriptors; a second resembled Influencing, a third loaded almost exclusively on Dominance, and a fourth did not contain a non-chance number of loadings for any single theoretical dimension. All descriptors loaded on at least 1 factor at .30 or higher accommodating an acceptable theoretical degree of psychometric and measurement properties and indicating 4-factor relevance. Results do not completely justify previous Personal Profile System publisher claims.

Factor Analysis of the Personal Profile System

Abilities to understand, predict, direct, change, and control human behavior are often difficult to acquire, yet are highly desirable personal attributes helpful for success in a variety of inter-personal environments. In order for people better to understand their own behavioral tendencies and the behavioral tendencies of others with whom they come in contact, many educational methodologies have been applied. Among these are self-scoring psychological instruments. However, from their inception as a technique in educational and organizational settings, psychological instruments have been the target of extensive scrutiny, criticism, and debate (Standards for Education, 1985).

One widely-used self-scoring instrument that seems to have withstood (as measured by its widespread use) rigors of criticism is the Personal Profile System (PPS). According to its author, Geier (1979), the self-scoring PPS instrument measures human behavioral responses along four dimensions: Dominance (D), Influencing (i), Steadiness (S), and Compliance (C). Characteristics of people possessing these dimensions are described in the PPS Manual (1986) approximately as follows: (a) People with Dominance tendencies tend to have their objectives for changing courses of action firmly in mind and generate messages designed to stimulate and prod others. (b) People with Influencing tendencies actively seek to shape and mold events with stimulating and prodding messages considerate of personal needs of others. (c) People with Steadiness tendencies tend to be product oriented sending messages preserving stability and easy transition to new situations. (d) People with Compliance tendencies seek reasons for change and have concern for accuracy (PPS Manual, 1986).

Measurements were made with the 1986 version of the PPS instrument which contains (a) a measurement device generating scores for each dimension, (b) graphs for plotting obtained scores, (c) directions for interpreting scores, and (d) interpretational formats. Both versions require respondents to select from 24 panels made up of two columns, one labeled MOST and the other labeled LEAST. Each column in a panel has four descriptors. Respondents first select the descriptor most like themselves for recording under the MOST column then another least like themselves for the LEAST column.

After all the selections are made, respondents separately count in turn all descriptors for the MOST and LEAST columns from the 24 panels representing D (Dominance), i (Influencing), S (Steadiness) and C (Compliance). The scores are plotted on three different graphs representing three different interpretations. These graphs are named as follows: (a) "Graph I behavior: expected by others"; (b) "Graph II behavior: instructive response to pressure"; and (c) "Graph III behavior: self-perception" (PPS Manual, 1986). Based on these results, a behavioral pattern emerges for each of the three graphs depicting one or more of the four behavioral dimensions of D,i,S, or C. In producing these dimensional scores, PPS has claimed to allow one to obtain a systematic and comprehensive perception of respondent behavioral tendencies, either one's own behavioral tendencies or those of others (Geier, 1979).

The 1990 and 1986 (and previous) versions are sufficiently similar in purpose, administration, item content, and scoring as to be likely to have somewhat parallel factor structures.

In developing the PPS instrument, Geier used Marston's (1928) procedure for clustering human behavioral descriptors into the four dimensions. According to Geier (1979), "This is consistent with Cattell's belief that one could

arrive at a short list of . . . . main common traits, then characterize a person according to a trait profile or psycholgraph" (p. xiv). There have been problems, however, with Marston's clustering of descriptors. For example, Cattell (1946), defining Marston's descriptors as traits, stated they should reflect Marston's theoretical correlations empirically. For verification, Marston should have performed a factor analysis for determining which behavioral descriptors clustered within which construct dimensions (Geier, 1979).

Henkel, (1989) and Henkel & Wilmoth (1990) in reviewing 37 PPS reports in the literature, were not able to find supporting objective construct validity assessments of the instrument. Attempts to obtain construct information from the instrument authors also were unsuccessful. However, a number of reports were found indicating widespread use under an assumption of face validity for identifying behavioral tendencies for individuals in measured groups having diverse demographic characteristics. The empirical definition of construct validity for the PPS, therefore, would seem to be an important research goal.

Purpose of Study

The PPS instrument has been used as an essential tool in identifying and understanding human behavioral styles (New Dimensions, 1984). However, without supporting analyses essential construct properties and dimensions are empirically unknown. Moreover, the literature provides no guidance on exactly how one might approach validation on the basis of the usual PPS author-recommended scoring algorithm for the instrument. The purpose of this study, thus, was to test through factor analyses the construct validity claimed (Geier, 1979) for the Personal Profile System by its author and publisher when scored by an amenable scoring algorithm first reported by House (1982).

Restated as a question the purpose became: Do the behavioral descriptors (adjectives on which the Personal Profile System of classifying human behavior is based) in the instrument load on the four defined dimensional factors reported in scoring algorithms by the publisher for the Personal Profile System Instrument (1986)?

The perspective of choice was exploratory rather than confirmatory principal components analysis. This choice was a function of the lack of a firm, pre-existing, theoretical basis for defining the factors. In fact, since the fundamental question of how best to code PPS data for factor analysis is unsetteled, the possibility of confirmatory factor analysis was essentially preempted. Confirmation of the construct validity claimed for the instrument, thereby, reduced to finding empirical factors reflecting those claims in a systematic, replicatable fashion.

The House Coding Algorithm

In A review of the Personal Profile System House (1982) claimed available evidence suggested the Personal Profile System should be "rated near the lower end of any validity scale" (P. 30). House came to this conclusion for several reasons: First, in House's view, the PPS treats the 24 panels of MOST and LEAST descriptive adjectives for behavioral tendencies (selected by respondents in the process of measurement) as though they were obtained from two different interval scales. In actuality, House wrote, "the level of measurement is ordinal" (House, 1982, p. 12). Second, the use of distracters among the PPS instrument's 96 descriptors is subject to criticism because "it is illogical to define a term as a distracter and then count it as evidence for a dimension if it is selected at a given score level" (House, 1982, p. 16).

An approach to overcoming the first dilemma is coding a descriptor selected under a MOST stimulus to have a value of 4, under a LEAST stimulus to have a value of 1, and the others lying between to have a value of 2.5, as in the standard methodology for values recorded for ties on an ordinal variable. Thus, for each respondent there are 96 (24 x 4) adjectives, each having a value lying between 4 and 1 (or a missing value).

Without scoring on an amenable scale it would be meaningless to attempt factor analysis. To do so, in fact, would continue the tradition being criticized as justification for the study. PPS algorithms for scoring, involving as they do subtraction of sums of LEAST from MOST liked adjectives, confounds any theoretically defensive factor analytic approach to defining construct validity. House proposed an approach to the dilemna based on scaling theory having a rather long tradition in correlation analysis studies.

For the purpose of the present study under guidance of House's considerations, each adjective was interpreted as a variable having a value derived from the foregoing considerations. Values were included for each variable from each of the 1045 persons responding with both MOST and LEAST to all 24 panels of the PPS instrument.

Method

The methods antecedent to earlier, published PPS validity statements are not clearly delineated in the literature. Therefore, any study purporting to verify validity of the PPS of necessity must approach the analysis according to reasonable contemporary standards. The coding algorithm was developed from consideration of the House criticisms outlined in the foregoing. With coded data it was possible to apply the tools of factor analysis to establish clustering of the behavioral descriptors into validating constructs. To the

degree these constructs parallel claims of Geier, the validity of the instrument as popularly used is supported.

Subjects

One-thousand-forty-five students attending the United States Air Force Senior Noncommissioned Officer Academy (USAF SNCOA) enrolled in five different instructional classes between August, 1987 and August, 1988 participated in this study. The typical class comprised 231 males and 10 females representing 202 Caucasians, 36 Blacks, and 3 others. The average student had 17.8 years of service in the military and was 38.5 years of age.

The subjects represented 11 occupational fields including maintenance, supply, administration, operations, personnel, police, and medical. They represented 10 functional regions including Air Force Reserve, Air Force National Guard, Navy, and Army. All could be regarded as having comparable, successful middle-class life experience as reflected in their senior enlisted status.

Procedure

SNCOA instructors administered the PPS. Participants were informed, during introductory remarks, that confidentially of results would be maintained. Scoring was done individually by the participants as recommended in the PPS Manual (1886). Any assistance with interpretation of the instructions provided by the SNCOA instructors was in accordance with PPS procedures outlined by Geier (1979).

Specified Analytical Methods

Factor Analyses of the House-coded data matrix were approached with the following decision rules; (a) the initial principal components factor matrix was defined without estimating intercepts, (b) the initial factor matrix was

rotated under varimax criteria, (c) the orthogonal criterion in varimax rotation was relaxed to produce an oblique structure. To provide a wide range of opportunities for recovering the dimensional structure of Geier, results for 5 variations on the House coded data Matrix were produced for evaluation:

1. The first of the five analyses used unadjusted House-coded data vectors to generate raw data cross products for the symmetric matrix input to the SAS factor analysis routine.

2. The second used item data from which the item means were subtracted. All vectors were adjusted to the same length (normalization) before producing cross products for the symmetric matrix that was factor analyzed.

Sequentially, subsequent analyses were based on increasing degrees of standardization in the House-coded data producing, in each case, a symmetric matrix of cosines for factor analysis:

3. The third analysis used cosines between raw data vectors.

4. The fourth analysis used cosines between vectors corrected for their item mean values.

5. The fifth analysis used cosines between vectors corrected for both their item mean values and their standard deviations (that is, used Pearson Correlations).

It should be emphasized that the data were factor analyzed as described under different degrees of standardization to provide an adequate opportunity for the historical PPS factors to manifest themselves. Since there was no historical clarity on the issue and since our analyses produced varying degrees of conformity to the historical PPS factors, we felt it desirable to provide a full accounting of the approaches used (if not details for their results).

Results

After completing all analyses as described earlier, the results were evaluated in search of the best fit to the PPS scoring algorithm. Results from only the best fitting analysis are reported here. The best fit was obtained from unconstrained principal components analysis applied to House-coded then normalized data scaled to a common length of one (1.0) as described in Rummel (1970). Thus, the symmetric matrix analyzed consisted of inner products for every pair of vectors (every pair of variables) in which each inner product was computed from House-coded elements divided by the product of the length of the corresponding House-coded vectors (variables).

Factor loadings and communalities are reported in Table 1. Nineteen variables loaded on two factors. The remaining variables loaded on just one factor. The measures of sampling adequacy for every variable exceeded .94, averaging .955.

Insert Table 1 about here

Eighty-five percent of the total variance in the original 96 variables was accounted for with the first 4 factors. The fourth factor in the initial extraction accounted for less than 1% of original total variance. Moreover, the communalities indicated a large proportion of variance for each variable was accounted for with the four factors with Decise (under F2) being the lowest at .59 and HighSP (under F3) being second lowest at .83.

Conclusions

In the PPS algorithm for scaled scores (either D, i, S, C) there are linear combinations of the MOST LIKE scores and LEAST LIKE scores. Each of the 96 adjectives on the instrument is endorsed by each respondent as MOST LIKE or LEAST LIKE, or is not endorsed. The MOST LIKE endorsements (using the House algorithm) were coded with 4, the LEAST LIKE with 1, and the unendorsed items with 2.5. Therefore, if a factor is similar to a PPS scale, the factor should load positively and significantly on as many of the same adjectives (behavioral descriptors, vectors, or variables) as the MOST LIKE endorsements accumulated into the PPS scale algorithm.

The question is on how many of the same adjectives should an empirical factor load in order to be designated as similar to one of the PPS scales. A possible answer relies on properties of the binomial distribution function when applied to the expected distribution of chance endorsements. The probability of selecting an item randomly under equal probability assumptions (Burington & May, 1970) from a set of 4 items is 1/4; thus the Binomial mean for selections of the 24 items composing any one PPS scale is 6. The variance for the Binomial Distribution based on 24 selections is 24*(1/4)*(3/4) or (9/2), yielding a standard deviation of about 2. With 95 percent confidence, therefore, one would expect no more than about 10 endorsements by chance alone on any one of the PPS scales.

Under the foregoing reasoning, an empirical factor loading positively and significantly on 10 or more items should reflect properties of that PPS scale. For labeling purposes, however, a factor should be named with a PPS scale name only if its dominant loadings are associated with the same PPS scale items. If more than one PPS scale is represented (by the criterion of having at least

10 or more of its items dominantly loaded on the factor), the factor could be labeled with an arbitrary label such as bi-scalar, tri-scalar, etc. When no PPS scale is represented, the factor could be labeled with an arbitrary label such as F1, F2, ...

Table 1 presents (in the PPS Dim columns) PPS assignments of D, i, S. or C dimensions for each variable on each factor. One can count the variables having the property of high positive loadings from factor analyses and the property of being claimed by PPS to load on a PPS scale (either D, i, S. C.).

The first factor in Table 1 for the normalized varimax analysis was bi-scalar with respect to the PPS scales by incorporating 15 high loadings of behavioral descriptors for the Steadiness and 14 for the Compliance dimensions. The second factor resembled the PPS dimension of Influencing by incorporating 11 of its loadings. The third factor had almost exclusive Dominance PPS dimensional factor loadings with 18 descriptors carrying D attributes. The fourth factor did not contain a non-chance number of PPS behavioral descriptors from either the D, i, S, or C dimensions; thus one could not designate a PPS scale label for the amorphous fourth factor.

Summary

In summary, all claims pertaining to the factor analytic findings are based on a precise set of decision criteria: (a) that a four factor solution be undertaken for comparability with PPS if not in violation of scree and eigenvalue constraints of factor analysis; (b) that loading on a factor meant an item was flagged by SAS as highly loaded; (c) that the symmetric matrix analyzed was normalized. If one alters any of these decision criteria, one should expect a consequent alteration in the findings and, consequently, in the conclusions drawn from them.

However, all PPS behavioral descriptors loaded at .30 or higher in the final solutions. Therefore, the descriptors seem to contribute in a meaningful way to measure whatever the PPS measures. This indicates the behavioral descriptors of the PPS may be relevant but should be renamed and scaled according to a different algorithm for better psychometric and measurement properties. Of course, this in itself does not justify previous claims for construct validity of the PPS. The fact remains that the factor analyses used in this study did not fully confirm the four dimensions of human behavior theorized by the PPS authors and publishers.

Caution should be applied in interpretations of scores developed from the Geier algorithm particularly for the Steadiness and Compliance Dimensions. There is nothing in the findings of the present study to suggest the instrument not be used in measuring adults in educational situations. Rather, prudence in light of these findings suggests that results obtained from applying the Geier algorithm be used under informed interpretive restraint as motivations or starting points for more in-depth, scientific study of adult human behavior.

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Table 1

PPS Behavioral Descriptors, PPS Dimension (PPS Dim), Factor Loadings (Ld X 100), and Communities (Cm X 100) after Varimax Rotation of Normalized Data

F1				F2				F3				F4			
Item Name	PPS Dim	Ld	Cm	Item Name	PPS Dim	Ld	Cm	Item Name	PPS Dim	Ld	Cm	Item Name	PPS Dim	Ld	Cm
Gentle	S	59	91	Persuv	i	67	94	Origin	D	58	90				
Humble	C	72	86	Attrac	i	60	90	Stubbr	D	66	87				
Godfer	C	55	86	Loyal	S	70	94	Bold	D	67	91				
Sweet	S	62	88	Opnmnd	i	71	93	Wlpwr	D	64	88				
Easled	C	68	87	Chrful	S	53	91	Compet	D	70	88				
Charm	i	60	89	Jovial	i	52	90	Fussy	C	57	85				
Oblig	C	67	87	Precise	C	60	91	Unconq	D	58	87				
Nervy	D	62	87	Evtem	S	67	89	Brave	D	58	92				
Joyful	i	62	90	Consid	S	67	92	Socibl	i	54	88				
Harmon	C	58	90	Obednt	S	68	92	Selfrel	D	61	93				
Playful	i	51	88	Inspir	i	69	94	Advent	D	70	87				
Submis	S	60	87	Patient	S	59	87	Talk	i	60	87				
Timid	C	71	86	Recpt	C	67	92	Daring	D	70	89				
Sftspk	C	70	88	Conven	C	61	92	LfParty	i	52	89				
Cordal	i	56	90	Cordal	i	56	90	Highsp	i	65	83				
Moderate	S	66	86	Decise	D	59	59	Assert	D	68	87				
Contrl	S	64	88	Diplom	C	70	91	Persist	D	59	91	Persist	D	63	91
Polished	i	56	87	Agrees	D	67	95	Forcar	D	71	89				
Satsf	S	56	89	Willn	S	61	90					Willn	S	63	90
Esmark	S	66	89	Eager	D	58	91					Eager	D	62	91
Fretful	C	65	90	Confid	i	67	93	Pioneer	D	67	88				
Cautus	C	78	91	Weldis	C	68	92					Weldis	C	71	92
Determ	D	71	89	Admirb	i	64	92					Admirb	i	65	92
Convinc	i	73	90	Kind	S	64	92					Kind	S	67	92
Gdnatr	S	75	88	Respect	C	68	93					Respect	C	70	93
Agrebl	C	61	88									Agrebl	C	62	88
Sympah	S	64	89	Optims	i	56	87	Argumt	D	72	89				
Tolert	C	63	87									Tolert	C	60	87
Genros	S	57	92									Genros	S	56	92
Animtd	i	64	88	Adapt	C	73	95					Adapt	C	77	95
Resign	C	73	87	Trust	i	58	87					Trust	i	58	87
Accomd	S	65	87	Positive	D	64	93					Positive	D	67	93
Nonchnt	S	66	88					Gdmix	i	51	86				
Lethrt	i	55	92									Lethrt	i	55	92
Contnt	S	64	84					Vigors	D	63	92	Vigors	D	62	92
Peaceful	C	61	90	Compan	i	55	91					Compan	i	57	91

(table continues)

F1				F2				F3				F4			
Item Name	PPS Dim	Ld	Cm	Item Name	PPS Dim	Ld	Cm	Item Name	PPS Dim	Ld	Cm	Item Name	PPS Dim	Ld	Cm
Cultrd	C	54	88									Cultrd	C	55	88
Lenint	S	67	87	Accurt	C	64	94					Accurt	C	68	94
Rstain	S	71	88					Outspk	D	75	89				
								Restless	D	62	86				
				Neighbor	S	60	95					Neighbor	S	62	95
				Popular	i	57	89					Popular	i	58	89
Devout	C	56	86									Devout	C	54	86

Note: Each behavioral dimensions loading significantly on more than one dimension is connected on the same line between factors .