Research Reference

PDP

Contents:

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Copyright Notice

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Professional DynaMetric Programs, Inc.® (PDP ®)

PDP is a dynamic system which provides a concise, direct procedure for measuring the major aspects of self-perception. It reveals the individual's basic behavior, reaction to the environment and predictable behavioral patterns.

The ProScan Survey is at the heart of the PDP Integrated Management System. This survey is intended for the normal segment of society. If there is any suspicion of abnormalities or lack of confirmation of traits to behavior, it may be advisable to refer the individual to a professional for guidance. The ProScan Survey is in no way designed to serve as a pathological identifier, nor is it to be used in isolation without considering other factors, such as experience, education, references, observations or other relevant factors.

The original ProScan Survey was developed by Dr. Samuel R. Houston, Ph.D., Dr. Dudley Solomon, Ed.D., and Bruce M. Hubby, President of PDP, Inc.

The ProScan Survey contains 60 adjectives drawn from the works of Thurstone, Cattell, Guilford, Fiske, Daniels, Horst and others. Respondents are requested to react to each adjective on a five-point Likert scale (1932) under two separate perceptions: BASIC/NATURAL SELF and PRIORITY ENVIRONMENT(S).

Validity of the instrument has been researched using four well-known approaches: construct, concurrent, predictive and content validity.

Split-half reliability of all adjectives has been found to exceed .86.

An independent study reveals an error factor of less than 4% when the PDP-recommended procedures are followed. The use of PDP with employees will tend to create enthusiasm and reduce turnover and dissatisfaction. In some cases, employees feel cared about and understood for the first time in their job.

How is behavior developed?

It is apparent that very early in life, infants exhibit certain behavioral traits that appear to be inherited. During an individual's early years, future values are imprinted through behavioral modeling. Permanent values are established, based on such environmental factors as family, friends, religion, education and media. Social and monetary attitudes, coping behaviors, gender roles and prejudices all contribute to the developing values system. Hero worship is a very important value influence during the pre-teen years. The socialization process finally locks in fairly permanent values and creates the specific method used by each individual to achieve life's goals. According to the work of Dr. Morris Massey, only a significant emotional event can modify these perceptions. (Ref. *People Puzzle*, Morris Massey Associates)

Results

PDP identifies the strengths and intensities in people, enabling managers to recognize each employee's success formula and to capitalize on this for their mutual benefit.

- Quick, accurate and objective
- A powerful management tool that has the advantages of minimum cost, no outside consultant and no time delays for results
- Assists employers in validating employment practices for the office of the Equal Employment Opportunity Commission
- Helps determine the types of people needed in particular jobs
- Aids supervisors in achieving maximum potential from their workers
- Helps compare employees to each other and to match them to positions so that they complement one another, resulting in less conflict and better performance
- Identifies who should do which jobs and how they will approach and accomplish the tasks
- Creates enthusiasm and increases morale
- Reduces turnover and dissatisfaction

Conclusion

Today, the costs of training, hiring incorrectly and terminating employment are rising. Skilled replacements are not always readily available and constant replacement is time-consuming and costly. Informed, aware employers must motivate to achieve results, place people effectively and remodel jobs to better fit people. PDP provides the techniques to achieve these goals for today's enlightened employers.

Research Overview

By: Bruce M. Hubby, 1984.

Two major domains of research exist. One is primarily academic, while one occupies the commercial world. PDP's primary purpose is to market a superior instrument that was developed using the skills of academics combined with case studies from the business world. All research was accomplished through private funding. For this reason, PDP trade secrets are jealously guarded and only limited publishing, if any, is considered.

This philosophy has created the difficult challenge of sharing enough research to satisfy those that are research-oriented while still protecting proprietary information that cost hundreds of thousands of dollars to develop.

Bibliographies from Monographs 1–10 are conclusive phase studies. "Monograph No. 10" is included in this reference. PDP's research includes studies from the 1930s through the 1970s, as well as referencing other well-known personality concepts including Hippocrates's traits of behavior (Melancholy, Sanguine, Choleric, Phlegmatic, 400 BCE), King Solomon's "as a man thinketh," and Pavlov's habituated reaction to stimuli. Research material on these subjects is readily available through numerous university texts.

The PDP Integrated Management System is a computer-dependent factor analysis concept that originally targeted descriptors of purest factor loading (or single complexity). PDP first proved its accuracy through the academic criteria of validation (construct, content, concurrent, and predictive), reliability (split-half and test-retest), structural invariance, factor intercorrelations, and intrinsic/extrinsic validity. Once reliability was established, in 1978 PDP launched a major practical field-norming program that now totals over 5 million. Certainly, the true test was customer satisfaction—broad positive responses and continued usage of the system—which have been most gratifying to PDP as the developer.

In contrast to all or nearly all similar personality systems, PDP originated as a statistically-validated (quantitative) instrument as opposed to originating as a theory origin (cognitive) system. Factor analysis, which is advanced statistics in any university curriculum, is very simply defined as a matrix system for independently determining the isolated purity of, in this case, an adjective or descriptor. Once factor analysis was completed, the next step was to find groupings with components of like purity (primary factor loading) and to consult with experts to identify the behavioral factor or trait. Starting with descriptors (185 adjectives in Monographs 1–4, 1977–78) associated with behavioral studies drawn from the those of Thurstone (1934), Cattell (1950), Guilford (1954), Fiske (1949), Daniels (1973), Horst (1978), and PDP (1978), sixty descriptors were identified and all exhibited high factor loadings for each of the primary factors in the instrument.

After the statistical work had been completed, intense field work followed to develop case studies to best describe the behavior of people with like responses to trait clusters. The type and degree of behavior was determined by two dimensions: (1) the comparable amount of trait intensity from a base of zero, and (2) the amplitude variance from the individual's own norm (*Fundamental Research Statistics for the Behavioral Sciences*, J. T. Roscoe). A fixed-norm system was used only in the primary graphing and later as a point of interest. Most instruments do not get beyond the fixed-norming method, thus missing the values of sensitivity, satisfaction, stress analysis, stress management, logic, and other lesser factors.

Biography—Bruce M. Hubby

Founder of PDP, Inc.

From the field of jet aviation industry and real estate to the gold mining industry, Bruce M. Hubby discovered what every manager needs to be more successful. In 1976, he started Professional DynaMetric Programs®, Inc. (PDP®) to provide organizations worldwide with proven, measurable programs on "how to understand people, manage people, hire people, and build successful organizations." This process involved the assistance of thirteen PhD experts to reach the level of accuracy and reliability Bruce demanded of his programs—the high level that he would demand for programs to be used within his own organizations and the professional services to clients.

After attending Indiana Wesleyan University, he took time serving his country in the Air Force (1955-1959), returning to complete a degree at Wayne State College in Nebraska. Bruce received a bachelor of science degree in bio-science and a bachelor of arts in social psychology (1960). He held the positions of national sales manager of the business aircraft avionics division with Collins Rockwell and international sales manager of Golden Cycle Gold Corporation (a multi-million-dollar real estate and gold mining company).

Beginning in 1976, Bruce focused much of his visionary and missionary zeal on establishing PDP, continuing as chairman until his death in 2003. Bruce's son, Brent W. Hubby, a graduate of the University of Tulsa School of Business with a bachelor or science in marketing and finance (1987), was proudly chosen by Bruce to pick up the mantle of leading PDP, and Brent Hubby has continued the successful direction of this outstanding global organization.

An article featuring Bruce in his university's alumni magazine made the statement, "He wrote the definition of entrepreneur." It was true; Bruce spent his extra energy on several family owned businesses: Safari Iowa (a state-licensed game management preserve), The Manor Hunting Lodge, three agribusiness farms, several commercial real estate developments, and an international telephone company. He was an officer and director for five companies.

He loved to snow ski, hunt (everything), give four-wheel drive tours in remote Colorado places, laugh frequently, and spin spectacular humorous anecdotes. His priorities were serving God, family, and clients…and that is why PDP continues to be so successful.

Research and Development Division
Professional DynaMetric Programs, Inc.

MONOGRAPH NO. 10

Independent Studies of the Reliability and Validity of Responses to the Professional DynaMetric Programs® ProScan® Survey

THE PROSCAN® SURVEY: DEVELOPMENT AND STANDARDIZATION

By:
Samuel R. Houston, Ph.D.[1]
Dudley Solomon, Ed.D.[2]
June 1978

Bruce M. Hubby, President
Malcolm L. Williamson, Ph.D.
March 1988

CASE STUDIES
Bonnie D. Bass, Ed.D., PDP, Inc. VP of Research
Jerry L. Terrill, Ph.D.
Linda Marten, Ph.D.

[1]Samuel R. Houston, Ph.D. (Research and Statistical Methodology). Completed Post-doctoral Certificate in Biometry and Statistics at Yale University.

[2]Dudley Solomon, Ed.D. Completed Doctorate at the University of Massachusetts.

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The ProScan® Survey: Development and Standardization

The ProScan® Survey: Development and Standardization

Introduction

This monograph was written to document the reliability and validity of responses of individuals to a survey that has been carefully prepared by Professional DynaMetric Programs® (ProScan®), Inc.

The ProScan® Survey, originally designated as the PDP® Survey, is a simple, objective device designed to measure important behavioral traits that are possessed in different amounts by every human being. The items of the Survey include 60 carefully selected, self-descriptive adjectives presented on two sides of a single card, 30 adjectives on Part 1 and 30 adjectives on Part 2. The selection of each adjective was made by Hubby, Houston and Solomon (1977a, 1977b, 1978a, 1978b), following the analysis of carefully conducted field trials and extensive case study reports.

The response to each adjective is recorded on a five-point Likert (1932) scale with 1 being least and 5 being most.

The ProScan® Survey purports to measure four primary behavioral traits (1-4) and one secondary trait (5), as follows:

Factors of Behavior Measured by the ProScan® Survey

(1) Dominance, the control trait

(2) Extroversion, the social and fluency trait

(3) Pace/Patience, the rate of motion trait (often referred to as Patience)

(4) Conformity/Structure, the structure and detail trait

(5) Logic/Rationale, the type of reasoning trait

The Survey also measures certain "dynamic features" of the personality that are derived from special formulas applied to the available data. Those features are identified in the list that follows:

Dynamic Features of Behavior Measured by the ProScan® Survey

(1) Energy level

(2) Environmental stress

(3) Direction of stress in behavioral changes, e.g., "...feel the need to be less (or more) dominant"

(4) Energy lost due to stress

(5) Morale/satisfaction

(6) Rationale for decisions, fact or feeling

(7) Primary and back-up management styles

(8) Primary and back-up communication styles

(9) Primary and back-up approaches to tasks or goals

(10) Environmental preferences

(11) Motivators, demotivators

(12) Prime needs, those being met and those not being met

The entire Survey typically is completed within 5 minutes when administered to individuals and within 10 minutes when administered to groups. However, the instrument is not timed and must be used without time restrictions; each respondent may use as much time as he/she requires to complete the Survey.

The next several pages provide the theoretical foundation on which the instrument was built and technical information about its development and standardization.

Theoretical Assumptions

The development of the ProScan® Survey was based on the following primary assumptions:

(1) Human behavior is comprised of different factors.

(2) Factors of behavior can be measured by appropriate sets of self-descriptive word lists.

(3) Knowledge of behavioral traits is useful for describing, understanding and predicting individual behavior.

(4) The ability to describe, understand and predict behavior can make important differences in many real-life situations.

Self description is a common means by which human behavior is measured. Indeed, self-

descriptive word lists have been used extensively to identify and measure important behavioral traits by both early and recent investigators: Cattell, (1945 and 1950); Daniels, (1973); Eysenck, (1947); Fiske, (1949); Guilford, (1954); Horst, (1968); Hubby, Houston and Solomon (1977-1983); Jung, (1933); and Thurstone, (1934).

Carl Jung (1933), a Swiss physician and psychologist, was first to observe the behavioral construct referred to in bipolar terms as "Introversion-Extroversion." Later, Cattell (1950) and Eysenck (1947) independently demonstrated that variations among individuals on this trait can be arrayed at various positions on a continuum. When the sample is large, continuous data of this type usually are distributed in a Gaussian (bell-shaped or normal) curve within a definable range that includes the lowest and highest scores. The normal distribution of scores is an important prerequisite for the appropriate application of a sophisticated statistical tool called factor analysis. Cattell used that procedure to identify 16 potential "factor" dimensions.

Factor analysis is effective in the reduction of large amounts of information, such as a long list of self-descriptive words, to one or more scales that are much more manageable than the original information but still retain their power for measuring important constructs. In addition to the normal distribution of raw scores, factor analysis requires scores to be consistent with repeated administrations of the instrument. A third requirement is that scores reveal certain commonalities in the response patterns. The scores from responses to word lists from which the ProScan® Survey was developed met these conditions, and factor analysis was used as the analytical tool for identifying the behavioral traits.

All self-descriptive techniques are subject to the possibility that respondents guess, make selections at random, deliberately distort responses and/or choose responses that contain erroneous perceptions of the facts. In the present situation, individuals in the normative sample had the same opportunity to make those errors as did subsequent respondents and individuals who will take the Survey in the future. If such errors occurred frequently in the normative sample, the norms of the Survey are flawed and those flaws will be reflected in low coefficients of reliability and validity, perhaps to levels that are unacceptable. On the other hand, if reliability and validity coefficients are

high, then errors from the above sources could not have occurred often in the normative sample and, therefore, they also may be assumed to be rare among respondents, generally. (Results reported in Tables 1 through 19 show that coefficients of reliability and validity with few exceptions were substantial to very high in studies conducted to date.)

Despite the potential sources of error from chance, deliberate distortion or poor judgment, there were three reasons for thinking that, in fact, their effect would be negligible. First, observations clearly show that respondents react without hesitation or difficulty to positive stimuli. For this reason the instrument was specifically designed to include non-threatening descriptors, diminishing the need for distortion. Second, each factor measured by the Survey was developed from not more than eight adjectives all of which were randomly distributed in the two lists of 30 words. The ability to correctly associate every adjective with its appropriate factor is highly unlikely, thereby lowering the probability that respondents are able to bias their choices on several adjectives for any one factor. Third, the Survey was designed to utilize differences between actual and perceived behaviors.

Thus, theoretical assumptions provided an important basis for the definition of human behavior in terms of multiple trait-dimensions within which individuals locate themselves at particular points and which together define the behavior space. Factor analysis was relied upon as the statistical tool for translating theoretical constructs into scales of measurement. The use of that statistical procedure assumed that scores on self-descriptive word lists are distributed normally when samples are large, that consistencies occur in repeated measurements, and that commonalities among responses exist. It was with those understandings that the development of the ProScan® Survey proceeded.

Factor Analytic Methodology

Briefly, the steps involved in the factor analysis were as follows (Houston and Solomon, 1977):

1. A matrix of Pearson product moment correlation coefficients was computed. When a datum was missing, the mean value for that variable was inserted. The amount of missing data was less than one percent.

2. Squared multiple correlations were entered as initial commonality estimates. Iteration for commonalities proceeded until the maximum absolute deviation between iterations dropped below .001.
3. Kaiser's criterion was used to determine the number of factors to be rotated.
4. A rotation to the varimax criterion was performed.
5. The orthogonal varimax solution was rotated to oblique simple structure, using the maxplane and promax criteria (hyperplane width is .10).
6. The matrix of regression weights of the variables of the factors V(fe) was computed using V(fe)=(Rv)-1V(fs), where Rv-1 is the matrix of correlations among the variables and V(fs) is the oblique factor structure matrix.

Development of the Item Pool

A five-point Likert scale was chosen as the medium for responses to self-descriptive adjectives in preference to the Q Sort, interview, or picture alternatives. That decision proved to have many benefits. It ensured quick and effective administration and precise scoring of the instrument, even for a group. It helped simplify the reporting of results, and all of these qualities contributed to the important objective of producing an instrument that is both "user" and "management" friendly.

An original pool of 185 adjectives was drawn from the works of Thurstone (1934), Cattell (1950), Guilford (1954), Fiske (1949), Daniels (1973), Horst (1968) and the designers of ProScan®, Hubby, Houston and Solomon (1978). An experimental survey was administered to several hundred individuals whose responses were factor analyzed. That analysis reduced the list of adjectives from 185 to the 60 adjectives that constitute the present instrument

The terms were arranged on the Survey Card so that measurements of behavioral traits could be obtained from three different perspectives, the Basic/Natural Self, Priority Environment(s) and the Predictor/Outward Self.

The Basic/Natural Self refers to how the individual functions when there is freedom to respond in a completely natural way. The first 30 terms listed on the Survey measure the behavior from this perspective and the responses to these terms are made in reference to the statement:

"How you feel you really are."

Priority Environment(s) refer to environments that are important to the respondent and the responses are to people within those environments. It is a fact of life that individuals either feel the need or are forced to make adjustments to their environment in order to reach goals that are perceived to be necessary for success or survival. Case studies reveal that those adjustments nearly always are in reference to one or more of the six environments. Those environments have been observed to include: the work world (employment or lack thereof); the domestic scene including all aspects of the family and mate (or lack thereof); health, both mental and physical; finances or economic considerations; social relationships and perhaps matters that pertain to one's religious beliefs. This perspective, then, represents the self as perceived through the eyes of "others" who are associated with some environment that predominates in the mind or even in the unconscious thinking of the respondent at the moment the item is scored. Information that pertains to Priority Environment(s) is from the directed responses to "How you feel others expect you to be or act."

The Predictor/Outward Self is a synthesis of responses to the Basic/Natural Self and the Priority Environment(s). Normative data were prepared independently and confirmed by feedback from a large number of case studies.

The Survey also includes a Respondent Information Record (RIR), completed partially by the respondent and partially by the Survey administrator. The RIR contains space for recording date, name, occupation, organization, age, and sex, although the only mandatory information on the list is a name or identifier (initials or an alpha-numeric code).

The Norming Procedure

Standardization procedures provided separate norms for each trait within each of the three perspectives. A major step in those procedures was the administration of the final list of self-descriptive adjectives to the normative sample. That sample consisted of 1024 individuals who were carefully selected to represent a cross section of the adult population in the United States. The factor analysis of scores from the normative sample clearly identified the five behavioral traits. Indices for other important dynamic features also were derived by applying certain proprietary formulas to

normative sample scores. Finally, exhaustive case studies were employed to establish the meaning of a score at any given location on the continuum of its normative distribution.

The raw scores for each individual in the normative sample were converted to standard scores to form standard score distributions each of which had a base of seven sigmas. Also, mean standard scores for the four primary factors provided a standard score "variable norm" within each of the three perspectives, Basic/Natural Self, Priority Environment(s) and Predictor/Outward Self. Thus, the extent of the deviation from the individuals own "central tendency norm" on a given trait provided an index of the intensity of that trait. This unique concept made it possible to measure the strength of individual behavioral traits not only with reference to other traits of the individual, but also with reference to the population norms.

Narrative descriptions of the factors and "variable norm" values are presented for individuals. Each factor is labeled in a positive manner with high scores being most characteristic of the label. For example, references to the two extremes on the continuum of scores on the Dominance scale are "High Dominance" and "Low Dominance," as opposed to common references of "Dominant" and "Submissive," respectively.

The five behavioral traits measured by the ProScan® Survey and for which separate norms are provided within each of the three "perspectives" are described below:

Factor D: Dominance

Individuals with high scores on this factor consider themselves to be concerned about getting things done, very competitive, decisive, calculating and risk takers. Those with low scores consider themselves to be non-confrontive, submissive, cautious, and risk avoiders.

Factor E: Extroversion

Individuals with high scores on this factor consider themselves to be outgoing, friendly, optimistic and persuasive. Those with low scores consider themselves to be bashful, quiet, introspective and awkward or uncomfortable in social situations.

Factor P: Pace/Patience

Individuals with high pace/patience scores consider themselves to be relaxed, stable, likeable,

and at ease or cooperative with their environment. Those with low pace/patience scores consider themselves to be urgent, intense, action-oriented, pressing and receptive to change.

Factor C: Conformity/Structure

Individuals with high scores on this factor consider themselves to be very precise, dedicated, careful and concerned about what is "right." Those with low scores on this factor consider themselves to be very independent, free thinkers, non-traditional, not concerned about the "establishment" and more interested in the "end" as opposed to the "means."

Factor L: Logic/Rationale

Individuals with high scores on logic/rationale consider themselves to be fact-oriented and objective. Those with low scores consider themselves to be feeling-oriented, ruled by the heart, and subjective.

Unique Features

There are eight features of the ProScan® Survey that distinguish it from most other instruments that purport to measure behavioral traits. They are listed below:

(1) The adjectives selected for use by the Survey are unique—no other instrument is composed of the identical word list and, consequently, no other instrument contains exactly the same data on which the specific behavioral traits are based.

(2) Behavioral traits are measured from different perspectives the "Basic/Natural Self" and the "Priority Environment(s)" are measured by direct responses to the Survey; the "Predictor/Outward Self" is an indirect measurement of behavioral traits and is produced from a synthesis between raw scores for the first two perspectives. Separate norms were derived for each trait within each of the three perspectives.

(3) The Survey measures important "dynamic features" of the behavior. Those features are derived from special proprietary formulas applied to the available data.

(4) The Survey was standardized separately on the adult population for the purpose of describing normal behaviors in contrast to instruments designed to identify aberrant or abnormal behaviors.

(5) The four primary factors of behavior produce a "variable norm" that permits measurement of the relative intensity of each individual trait.

(6) The instrument is computerized—scores and results are compiled and reported in both narrative and graphic form entirely by computer.

(7) The software programs, data entry procedures, computer-compiled reports and interpretation of reports were all planned and designed for use by laymen so that mastery could be achieved by thorough but relatively simple training. This means the product accommodates both administrative and managerial issues so the system is both "user friendly" and "management friendly."

(8) The user is able to score, retain, and has complete control over, all information associated with every Survey. No individuals or agencies except those directly involved need to see or have access to the information.

Factor Correlations

Factor analysis attempts to identify factors that are independent and therefore do not correlate significantly with other factors. However, that kind of purity is rare in practice. Correlations among the factors derived from Survey data are presented in Tables 1 and 2. As the results in the two tables indicate, the patterns of intercorrelations among the factors for the Basic/ Natural Self and Priority Environment(s) are quite similar. In general, the correlations among the factors are low to moderate.

Reliability

Estimates of the reliability of responses to the Survey were obtained by test-retest and split-half correlations. Table 3 reports coefficients of reliability for those analyses. The test-retest coefficients are for Surveys administered three months apart.

Test-retest coefficients of reliability for 101 adults ranged in the 0.70's and 0.80's. Split-half coefficients of reliability for a sample of 332 individuals were in the high 0.80's and low 0.90's, except for one factor, Logic/Rationale under Priority Environment(s) that was 0.80. Overall, the

coefficients compare very favorably with the reliability of scores earned on many achievement tests and are somewhat higher than other nationally normed measures in the affective domain.

Intrinsic Validity

Structural integrity is a generic term formulated by Nesselroade and Bates (1970) that incorporates systematic factor analysis procedures for establishing desirable characteristics of a psychological measure. A scale cannot be a valid predictor of outside (extrinsic) criteria unless it predicts itself. The ability to predict itself requires consistency of scores under varying conditions. These qualities include, replicability, invariance, constancy and stability and determine the internal soundness of an instrument, its "intrinsic validity." Each of the four concepts is described briefly below.

Replicability—The extent to which a pattern, regularity, or configuration appears in essentially the same form in random samples or occasions, for example, random replicates of individuals.

Invariance—The similarity of the configuration of the structure across selected groups with varying characteristics, e.g., configurational similarity across race, sex, occupation, age, etc.

Constancy—The degree to which a pattern or configuration appears in essentially the same form in each quartile of the range of a measure or instrument, e.g., do individuals scoring low on Dominance evidence the same configuration of items as do individuals scoring high on that factor?

Table 1. Coefficients of Correlation Among Factors in Basic/Natural Self
(N=1024)

	Dom.	Ext.	Pac.	Con.	Log.
Dominance	1.00	.40	.08	.06	.51
Extroversion	.40	1.00	.21	.20	.41
Pace	.08	.21	1.00	.54	.28
Conformity	.06	.20	.54	1.00	.39
Logic/Rationale	.51	.41	.28	.39	1.00

Table 2. Coefficients of Correlation Among Factors in Priority Environment(s)
(N=1024)

	Dom.	Ext.	Pac.	Con.	Log.
Dominance	1.00	.63	.02	.06	.39
Extroversion	.63	1.00	.12	.13	.33
Pace	.02	.12	1.00	.55	.20
Conformity	.06	.13	.55	1.00	.36
Logic/Rationale	.39	.33	.20	.36	1.00

Table 3. Coefficients of Reliability

	Three-Month Test-Retest (N=101)	Split-Half* (N=332)
Basic/Natural Self:		
Dominance	.83	.91
Extroversion	.81	.90
Pace	.78	.89
Conformity	.85	.92
Logic/Rationale	.76	.86
Priority Environment(s)		
Dominance	.82	.89
Extroversion	.80	.89
Pace	.77	.87
Conformity	.86	.90
Logic/Rationale		

*Internal Consistency

Stability—The similarity of the pattern across two or more administrations of the instrument to the same subjects.

Studies performed by Houston and Solomon (1977) considered two of the four above characteristics, the replicability of the instrument and its invariance across sex, occupation, and race where factor analysis was the statistical procedure employed. Those studies were conducted as part of the initial validation of the instrument and were carried out on the normative sample. The methods they used and the results of their analyses are reported below.

To determine the replicability of the factors, four random subsamples (n=250) were drawn from the total validation samples. The factor analytic procedure previously outlined was applied to

each of the four replicates. Each factor estimation matrix was used to calculate factor scores for each member of the total sample thus yielding four separate estimates of an individual's score on each factor. Correlation coefficients between factor score estimates from each replicate pair were computed, producing six estimates of the coefficient of replicability for each factor. Fisher's r to Z transformation was performed on each of the six coefficients of replicability for each factor. The means and standard deviations of Fisher Z values were obtained and r equivalents of the mean Fisher Z values were computed.

The instruments of the ProScan® system were highly replicable with coefficients of replicability above 0.94 for all factors.

Since replicability across random subsamples was demonstrated, the next concern was to investigate the invariance of the factors across race, sex, and occupation. A procedure identical to the one outlined above was applied to groups selected according to race, sex, and occupation. There were four occupations, nurses, lawyers, ministers, and military, two race categories, white and non-white, and two sex categories, males and females. As a result, 32 coefficients of invariance were calculated.

Each of the factors was highly invariant across race, sex, and occupation with coefficients above 0.87 in all cases.

Validity

Jung's (1933) theory of type provided a model of behavioral traits for the ProScan® Survey. Thus, one appropriate test of the Survey's validity was the strength of coefficients of correlation between Survey scores and scores earned on scales that purport to measure the same or similar constructs when both instruments are administered at the same time and under similar conditions. Such coefficients are examples of concurrent validity.

One practical reason for measuring behavioral traits is that those measurements have a potential for providing information about the future performance or behavior of individuals. Procedures that, in fact, estimate how effective an instrument measures performance in advance deals with its predictive validity.

Whereas, in the previous section the focus was on criteria that were "intrinsic," or internal, the next section assesses the ProScan® Survey with reference to its effectiveness as a measure of "extrinsic" criteria. Both concurrent and predictive validity coefficients are indices of extrinsic validity.

Extrinsic Validity

The validation of the ProScan® Survey with reference to extrinsic criteria was done by studies that correlated scores on the Survey with those obtained concurrently on other comparable instruments (concurrent validity) and by other studies that correlated ProScan® Survey scores with various criteria of performance or success (predictive validity).

In Table 4 are presented concurrent validity estimates in which selected factor scores on the ProScan® Survey are correlated with selected factor scores on the Predictive Index (Daniels, 1973), selected scales (Adjective Rating Scales) from Veldman and Parker (1970), and selected factors from the Self Index (Solomon and Houston, 1982).

Ultimately, the criterion for any method of measuring behavior is its relevance to the goals of the investigators. While it is impossible to assess the extrinsic validity of an instrument for all the potential uses to which it might be applied, a few studies are presented in Table 5 which show that Survey factors can be used to increase understanding of the behavioral differences among predefined groups. A multiple linear regression procedure was employed in which the ten factors of the ProScan® (Basic/Natural Self and Priority Environment(s)) served as the set of independent variables and each of the dependent variables was as specified in Table 5.

In Table 5 a square of the multiple correlation coefficient (R2) is reported for each of the seven empirical studies. That coefficient indicates the percentage of total variance that is common between the independent variables and the criterion (dependent variable). If the coefficient was 1.00, for example, there would be perfect agreement between what was being measured by the set of independent variables and the criterion variable. In that situation, when any set of values for the independent variables was known, the value for the dependent variable also would be known (predicted) without error.

The ProScan® Survey was developed from a sound theoretical base, a carefully selected normative sample and appropriate statistical procedures. Evidence from initial experiments showed high coefficients of reliability and validity. That evidence has been confirmed further by feedback from more than 600,000 individual case study reports.

Table 4. Coefficients of Concurrent Validity

ProScan® Factors	Predictive Index (N=117)	Adjective Rating Scales (N=46)	Self Index (N=87)
Basic/Natural Self:			
Factor D	Factor A (.75)	Factor 2 (.72) (Soc. Abrasiveness)	Factor B (.58) (Personal Style)
Factor E	Factor B (.81)	Factor 4 (.69) (Int. RD/Ext. RD)	Factor A (.45) (Int. Pers. Beh.)
Factor P	Factor C (.63)		Factor C (.61) (Social Attitude)
Factor C	Factor D (.87)	Factor 6 (.64) Individualism	Factor D (.39) (Ego Behavior)
Factor L	Factor E (.86)		
Priority Environment(s)			
Factor D	Factor A (.56)		
Factor E	Factor B (.75)		
Factor P	Factor C (.73)		
Factor C	Factor D (.74)		
Factor L	Factor E (.83)		

Table 5. Coefficients of Predictive Validity

Group	Sample Size (N)	Dependent Variable	Multiple R^2
Ministers	68	Number of Members	.63
Stock Brokers	21	Volume of Sales	.50
Doctoral Students in Administration	31	Graduate GPA	.60
Undergraduate Nursing Students	53	Undergraduate GPA	.61
Attorneys	15	Rank in Law School	.51
Teachers	58	Undergraduate GPA	.54
Military Officers	34	Grade in Graduate Course in Administration	.55

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Biographic Sketch

Samuel R. Houston, Ph.D. **June 1978**

Post Secondary Education

University of California at Los Angeles, B.A.

California State University at Los Angeles, M.A.

University of Oregon, M.S., Mathematics, 1964

University of Northern Colorado, Ph.D., Research and Statistical Methodology, 1967

University of California at Los Angeles, Postdoctoral Scholar, 1967-1968, Biostatistics and Quantitative Psychology

Yale University School of Medicine, Post-doctoral Certificate, Biometry and Statistics, 1974

Research and Administrative Experience

Postdoctoral Fellow (Cancer Research) in Biometry, Department of Epidemiology and Public Health, Yale University School of Medicine (1973-1974)

Chairman, Department of Applied Statistics, UNC (1975-1978, 1981-1982)

Publications

Houston, Samuel R. "Some Educational Applications of the Fixed X Multiple Linear Regression Model." Chapter Three, The 1968 Presession on Multivariate Design and Analysis in Educational Research: An Evaluation, John D. Williams and Edward Krahmer (eds.), (Grand Forks, North Dakota: University of North Dakota Press, 1968), pp. 8-14.

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Research Quotations

1977-1978 Personal Dynamics Profiles
Research and Statistical Methodology Department

by Samuel R. Houston, Ph.D.
Post-Doctoral Certificate in Biometry and Statistics—Yale University

The ProScan® Survey, originally designated as the Personal Dynamics Profiles Survey, is a concise, direct procedure for measuring major aspects of self-perception. It is exceptionally easy to administer, score, and interpret compared to other personality 'inventories' which are available.

Systematic analysis of self-descriptive data from large groups of people will reveal certain commonalities in the response patterns. These commonalities can be abstracted as dimensions, along which individuals implicitly array themselves at various positions. Such a dimension is exemplified by independent researches of R. B. Cattell (1950), H. J. Eysenck (1947) and C. G. Jung (1933). Whether one dichotomizes in a conceptually continuous dimension, or prefers to use bipolar categories, is an essentially arbitrary choice.

Taken together, personality trait-dimensions may be considered to define a personality space, within which individuals implicitly locate themselves at particular points.

Dimensions isolated by analysis of self-descriptive data may be assumed to represent consistencies in the ways that individuals view themselves.

The first PDP study was composed of 185 adjectives drawn from the works of Thurstone, Cattell, Guilford, Fiske, Daniels, Horst, and other sources. Factor analytic techniques (non-orthogonal factor structure, followed by appropriate rotations) were employed.

Experimental norms have been established for N=1024 subjects studied during 1977 and 1978. The subjects represent a wide variety of occupations of both sexes.

Reliability measures the extent of the consistency or stability of the testing instrument. Reliability coefficients are usually expressed as Pearson Product Moment Correlation Coefficients. Several approaches are available to researchers to demonstrate that an instrument is reliable–the authors selected both test-retest and split-half techniques (a measure of internal consistency.)

Validity is an indicator of the extent to which an instrument measures what it purports to test. Construct, concurrent, predictive, and content validity are the usual approaches in establishing how accurately the instrument measures what it has been designed to measure. Usually, in the demonstration of the validity of an instrument, it is sufficient to use only one type of validity measure. In the development of this instrument, all four types of validity have been utilized. In the identification and reduction of an adjective list, both content and construct validity approaches were utilized. The content validity approach was utilized in the selection of the original adjectives for the Likert (1932) five-point scale. Construct validity methods were employed in the extraction of the 19 factors (11 primary and 8 secondary); i.e., factor analytic techniques (non-orthogonal factor structure, etc.). For a further discussion of approaches to validity, see Houston and Schmid (1972).

Ultimately, the criterion for any method of measuring behavior is its relevance to the goals of the investigators. While it is impossible to assess the validity of an instrument for all of the potential uses to which it might be applied, an unreliable instrument cannot be expected to serve any useful purpose.

Source: June 1978. Research Methodology No. 4

Research Vocabulary

Archived Notes for a Presentation of Research and Statistical Concepts for PDP Representatives. Developed by Dr. Samuel Houston, Ph.D. and JoAn Mann, M.A.

Types of Validity

Concurrent: Comparing one instrument to another.
Construct: Using proven principles of proper formation and selection of elements of testing techniques.
Content: Method of selecting sufficient qualities and quantities of descriptors, utilizing both theoretical and empirical criteria.
Predictive: Model applications to substantiate that the instrument is measuring what it is purporting to measure.

Reliability Methods

Split-half: Dividing elements in half and comparing to each other.
Test/Re-test: Correlation of two sets of responses by the same individual to the same form on two occasions separated by a certain time span.
Factor Analysis: Mathematically comparing numerous descriptors together to distinguish the property or properties and the amount of loading thereof.
Factor Loading: The amount of a given property or properties which a descriptor is detecting.

Principle Component Factor Analysis

Orthoginal: (x y matrix) Descriptors at right angles; Non-orthoginal: Not at right angles (vectors).
Single Complexity: Measuring only one thing.
Empirical: Relying upon or derived from observation or experiment … guided by practical experience.
Mean: Weighted average for a group. Example: In a PDP job study to determine the "mean profile," add all the input for each PDP Survey trait and divide each trait by the number of inputs to get a weighted average.
Median: The middle item when all items are arranged either in ascending or descending order.
Dispersion: Variability of scores; how wide a range the scores have for a particular item. Example: Much dispersion—wide variability. Little dispersion—narrow variability.
Standard Deviation: A measure of variance from the mean. The greater the dispersion of values in a group, the larger the standard deviation. If there is no dispersion, the standard deviation is 0, a point instead of a range.
Multiple Regression: Use of two or more variables to predict yet another item. There are two components to a multiple regression: the statistical relationship and the error factor. Example: Using certain traits to try to predict and evaluation score in the Job Success Probability Studies.
Correlations: Degree of relationship and direction between two items. The variability of one item is greatly reduced when considering another. Correlation figures used in PDP studies are set 1 and 1. The closer the correlation to 1 or -1, the stronger the relationship. If the correlation = 0, then there is no relation between the items.

Normal (Probability) Distribution

Bell-shaped, symmetrical curve. Each curve is centered at the mean of the group. The larger the standard deviation (also dispersion), the wider or more spread out is the bell curve.

Standard Normal Distribution Bell Curve Assumes

Mean = 0; Standard Deviation = 1. Note: This is a good model to explain the Trait Intensity Chart and the frequencies of seeing various width-profiles.

University of Colorado at Denver

Department of Psychology

Campus Box 173
P.O. Box 173364
Denver, Colorado 80217-3364
Phone: (303) 556-8565 • Fax: (303) 556-3520

April 16, 1993

Mr. Bruce M. Hubby
President
Professional Dynametric Programs, Inc.
400 West Highway 24, Suite 201
Woodland Park, Colorado 80866

Dear Mr. Hubby:

For the past several years, I have been involved in an external role of directing and verifying research projects related to research projects conducted by your company to determine the soundness of PDP's assessment devices. I have also served as an outside sounding board for the interpretations of such projects.

I am pleased with the high standards of research methodology you set, not only initially, but also in ongoing development. It is heartening to find a business that values accuracy and that takes additional measures to insure validity and reliability with their products.

In my opinion, PDP has taken appropriate steps to ascertain the validity of their tests. They have consistently used sound experimental procedures to make these determinations and are continuing these activities on an ongoing basis.

I am looking forward to future associations between our department and PDP.

Sincerely,

Rick M. Gardner, Ph.D.
Professor and Chair

Research and Development Division
Professional DynaMetric Programs, Inc.

The ProScan® Survey: Empirical Test of Reliability and Validity

Post Normative Study

By:
Bruce M. Hubby, Founder and President, PDP, Inc.
Malcolm L. Williamson, Ph.D., Director of Research (Statistics) [1]
March 1988

[1]Malcolm L. Williamson, M.S. (Education with specialties in psychometric tests and measurements), Ph.D. (Educational psychology with specialties in experimental design and statistics). Completed Doctorate at the University of Southern California.

Table of Contents

The ProScan® Survey: Empirical Test of Reliability and Validity Post Normative Study

The ProScan® Survey: Empirical Tests of Reliability and Validity Post Normative Study

The information reported in Monograph No. 10 describes work performed on the standardization of the ProScan® Survey. The ProScan® Survey was developed from a sound theoretical base, a carefully selected normative sample and appropriate statistical procedures. Evidence from initial experiments showed high coefficients of reliability and validity. That evidence has been confirmed further by feedback from more than 600,000 individual case study reports.

The Post Normative Study reports evidence of the reliability and validity of Survey scores from an empirical study conducted subsequent to standardization. Selected uses and applications of the instrument also are listed.

Purpose

The Post Normative Study was designed to document certain practical effects of the structural integrity of the ProScan® Survey. The plan called for analyses of responses to the ProScan® Survey obtained on two groups of adults who were thought to differ significantly on one or more behavioral traits. This was a deliberate attempt to "stretch" the instrument, to determine if the set of terms that predict a given behavioral trait is the same when the group means are at opposite ends of the scale. Thus, by design and for the purposes of the study no attempt was made to represent any large population of individuals. The rationale for such a design was that positive findings would provide practical evidence of the instrument's replicability, invariance, constancy and stability and would demonstrate its unbiased utility even in atypical situations.

Sample

Under normal conditions the ProScan® Survey is used to describe, understand or predict the behavior of individual respondents. In the present study, however, the focus was reversed—it was on the instrument rather than on the respondents. Therefore, the two groups that made up the sample were intentionally selected to facilitate an evaluation of the instrument with reference to its reliability and validity. In order to reach the goal, one desirable condition was that the groups

differ in their locations on the continuums for some of the factors being measured. That objective introduced the need to conceal the identities of the groups so that there would be no possibility that inappropriate inferences be made about the respective populations from which each group was drawn. For this reason the groups will be identified by labels rather than by descriptive references.

The sample was formed by two groups of adults labeled Group A and Group B. One group included 162 individuals drawn from the population of ProScan® respondents who took the Survey sometime during 1986. Scores for Group A were obtained at random from computer storage files without regard to the respondents' gender, age, race, occupation, level of education, address, or other condition.

Group B included 49 adults all of whom were members of a single organization located in one area in southern California. The organization provided opportunities for its members to relate to and support each other in common difficult circumstances. The nature of those circumstances introduced the possibility that the group's responses might result in low coefficients of intrinsic validity. Such a finding had the potential for restricting the appropriate uses and applications of the instrument.

Methods

The ProScan® Survey was administered to Group B on two occasions exactly one week apart. This was done so scores earned at the time of the first administration could be correlated with those earned at the time of the second administration, providing coefficients of reliability for each trait. The numbers 1 and 2 were associated with the group label to differentiate between the two occasions of Survey administration.

As described earlier, the procedures by which the Survey was developed ensured that the same factors measured on Part 1 also were measured by different, but highly correlated, terms on Part 2. The minimum inter-term correlation coefficient that was acceptable for a term to be included as a predictor of a primary trait was 0.80. The range of those coefficients was from 0.804 to 0.940. Under ideal initial research conditions each term should contribute to the measurement of one and only one behavioral trait which, in fact, was achieved for the normative sample (Monographs 1,

1977, through Monograph 6-B, 1984).

For purposes of the study it was important that the statistical analysis of the data identify the set of terms that predicted each behavioral factor (1 through 5) within each group/administration (Group A, B1, B2) and each form (Part 1 versus Part 2). Thus, the analysis produced thirty different regression equations. This meant that there were thirty separate opportunities for differences to be found among the various sets of predictors of behavioral traits.

To achieve the above goal, raw scores for the 30 adjectives on Part 1 (Basic/Natural Self) and the total scores for the five behavioral traits were entered into a computer for the entire sample to form one data base. A second data base was formed by entering the raw scores and total scores for the 30 adjectives on Part 2 (Priority Environment(s)) for all respondents. Separate analyses then were performed for each factor, group and form, utilizing a stepwise multiple regression procedure. In each analysis the independent variables (predictors) were the 30 quantitative responses to each adjective, and the dependent variable (criterion or variable that was predicted) was the total score for a given behavioral factor.

The terms entered each regression equation in a stepwise manner until the set of "true" predictor terms for a given factor was complete. Results were tabulated to display coefficients at each step in the identification of "true" predictors, plus one additional step for a term that contributed minimally to the prediction. Whereas, "true" predictors were represented by alpha characters other than "X," the foreign term always was labeled "X."

Results

The first analysis of the data tested the difference in mean values for statistical significance between Groups A and B1 and between Groups A and B2 on each of the behavioral traits. The purpose of that test was to determine if the selection procedures indeed had resulted in groups that were drawn from different populations. Table 6 reports the results of that analysis.

Whereas, it was desirable for differences to be found for comparisons between the independent Groups A and B, that condition was not necessary and was unexpected for comparisons between the correlated mean values for the two Survey administration for Group B

(Groups B1 and B2). Table 7 shows the results of the latter comparisons.

Differences in the mean values between Groups A and B1 and between Group A and B2 were statistically significant on three of the five factors for the Basic/Natural Self and on the same factors for the Priority Environment(s). In contrast to that finding, differences in mean values between the two administrations of the Survey (Groups B1 and B2) were significant on one factor, Basic/Natural Self, Logic/Rationale. Since ten comparisons were made, the probabilities that one was significant was undoubtedly a chance occurrence and did not represent a true difference. These findings provided the conditions that the investigators needed for examining the instrument under empirical circumstances that were more extreme than would be expected in typical applications of the instrument.

The reliability coefficients earned by correlating results for Groups B1 and B2 are reported in Table 8. In general the coefficients were similar to those obtained for the normative sample (See Table 3, Part I), however, the former were based on scores earned from separate administrations of the Survey that were three months apart rather than one week apart.

The results of stepwise multiple regression analyses are reported in a series of tables that follow. Traits that were predicted by terms in the Basic/Natural Self are presented in Tables 9A through 13B2 and for traits predicted by terms in the Priority Environment(s) in Tables 14A through 18B2. The letter assigned to each table identifies the group on which the results were obtained, as follows: Tables with the letter "A" are always associated with results for Group A; tables with the letter "B1" report results for the first Survey of Group B; tables with the letter "B2" report results for the second Survey of Group B.

All of the tables have the same format. The important points to observe are listed below. Since the pattern of results was similar for all of the behavioral traits, one trait, "Dominance," will be discussed in some detail to call attention to the important points to note in each table. Then, the reader should be able to locate the same points in the remaining tables without the need for separate interpretations.

Table 6. z-Scores and Probability Values for Comparisons Between ProScan® Survey Mean Values for Groups A and B1 and Groups A and B2 by Factor

	Group A vs. Group B1			Group A vs. Group B2		
	Mean Values	z	p	Mean Values	z	p
Basic/Natural Self:						
Dominance	59.5 – 45.0	4.92	< 0.01	59.5 – 45.8	4.97	< 0.01
Extroversion	55.8 – 45.9	3.63	< 0.01	55.8 – 46.5	4.03	< 0.01
Pace	59.4 – 60.7	-0.42	> 0.05	59.4 – 61.8	-0.79	< 0.01
Conformity	61.8 – 63.9	-0.84	> 0.05	61.8 – 63.4	-0.62	> 0.05
Logic/Rationale	63.6 – 52.9	43.1	< 0.01	63.6 – 55.4	3.58	< 0.01
Priority Environment(s)						
Dominance	49.2 – 41.7	2.13	< 0.05	49.2 – 41.3	2.18	< 0.05
Extroversion	57.9 – 48.8	3.01	< 0.01	57.9 – 50.7	2.73	< 0.01
Pace	65.6 – 60.6	1.90	> 0.05	65.6 – 60.5	1.95	> 0.05
Conformity	63.1 – 58.8	1.58	> 0.05	63.1 – 60.7	0.83	> 0.05
Logic/Rationale	61.2 – 53.8	2.77	< 0.01	61.2 – 55.0	2.38	< 0.05

Note: Probability values (p) that were < 0.05 were statistically significant.

Table 7. t-tests and Probability Values for Comparisons Between ProScan® Survey Paired Mean Values for Groups B1 and B2 by Factor

	Mean Value Group B1	Mean Value Group B2	Mean Difference	t-value	p
Basic/Natural Self:					
Dominance	45.0	45.8	7.2	-0.78	0.44
Extroversion	45.9	46.5	6.8	-0.66	0.51
Pace	60.7	61.8	8.6	-0.92	0.36
Conformity	63.9	63.4	6.7	0.54	0.59
Logic/Rationale	52.9	55.4	8.6	-2.08	0.04
Priority Environment(s)					
Dominance	41.8	41.3	10.1	0.30	0.77
Extroversion	48.8	50.7	8.7	-1.59	0.12
Pace	60.6	60.5	11.9	0.07	0.95
Conformity	58.8	60.7	11.8	-1.09	0.28
Logic/Rationale	53.8	55.0	9.5	-0.82	0.42

Note: The p-value for Basic/Natural Self, Logic/Rationale was 0.04, indicating statistical significance for the difference between the mean values.

Table 8. Test-Retest Coefficients of Reliability

Factor	Group B (n=49)
Basic/Natural Self:	
Dominance	.86
Extroversion	.81
Pace	.81
Conformity	.87
Logic/Rationale	.67
Priority Environment(s)	
Dominance	.69
Extroversion	.78
Pace	.71
Conformity	.71
Logic/Rationale	.68

The points that should be given special attention in all the tables follow:

1. Note the number of steps and "terms" required to predict a specified behavioral trait. Each term is identified in the tables as an alpha character. The use of both upper and lower case is not important and merely reflects the need for more than 26 identifiers of terms. The alpha characters have been randomly assigned to obscure any association with the actual terms on the Survey card. Each alpha character that represents a term in the Basic/Natural Self (Part 1) is identical to the character that represents a related term in the Priority Environment(s) (Part2).

2. Note the sizes of F-ratios for terms that entered each regression equation in comparison to the F-ratio for each term labeled "X." "X" terms were free to enter the equation at any step, but they typically added very little to the prediction of the trait after the "true" predictors had been entered; they were not considered members of the set of factor predictors.
3. Note the size of R SQ (multiple correlation coefficient, squared), especially the R SQ value on the bottom complete row of values. That value for R SQ is an index of the efficiency of the regression equation to predict the designated behavioral trait.
4. Note the mean value for each factor and the standard error of the mean value.

Tables 9A, 9B1 and 9B2 now can be used as examples for implementing the above instructions. In Table 9A, it took seven steps and seven terms to predict the Dominance factor for the Basic/Natural Self. The strength of the relationship between each term and Dominance is reflected in the large F-ratios, although these F-ratios are based on part-whole relationships and therefore are higher than they would be if the factor being predicted was strictly an extrinsic criterion. Nevertheless, a statistically significant F-ratio, at the standard 5 percent level of significance is approximately 3.9 for 1, 160 degrees of freedom. Term "B" was weakest among the set of "true" predictors with an F-ratio of 146.4. The square of the multiple regression coefficient, R SQ, was 0.980. This means that only 2 percent of the variance in the prediction of Dominance was not explained by the set of seven adjectives that entered the regression equation. Another important point to note is the relatively small F-ratio (4.9) of the "X" term at step 8. Its contribution to the prediction was minimal, suggesting that it was not a member of the set of "true" predictors of the Dominance factor.

Table 9A. Terms that Predicted Dominance in the Basic/Natural Self for 162 Randomly Selected Adults in Group A

Step	Terms	F-Ratio	Multiple R	R SQ	RSQ CHG	Simple r
01	N	231.5	0.721	0.519	0.519	0.721
02	G	146.4	0.848	0.719	0.200	0.684
03	d	230.0	0.914	0.835	0.116	0.718
04	V	252.9	0.943	0.890	0.054	0.611
05	I	320.8	0.961	0.924	0.035	0.691
06	Y	84.9	0.977	0.955	0.031	0.560
07	b	202.0	0.990	0.980	0.026	0.603
08	X	4.9			0.223	

DOMINANCE: Mean = 59.51; Standard Error at Step 7: Mean ± 2.16

Table 9B1. Terms that Predicted Dominance in the Basic/Natural Self for 49 Adults in Group B1

Step	Terms	F-Ratio	Multiple R	R SQ	RSQ CHG	Simple r
01	d	53.9	0.767	0.588	0.588	0.767
02	V	149.2	0.893	0.798	0.210	0.651
03	N	50.1	0.934	0.872	0.073	0.702
04	G	41.5	0.959	0.920	0.048	0.652
05	Y	87.9	0.969	0.938	0.018	0.636
06	I	38.2	0.983	0.967	0.029	0.631
07	b	36.6	0.991	0.983	0.016	0.672
08	X	9.0				-0.161

DOMINANCE: Mean = 45.0; Standard Error at Step 7: Mean ± 2.01

Table 9B2. Terms that Predicted Dominance in the Basic/Natural Self for 49 Adults in Group B2

Step	Terms	F-Ratio	Multiple R	R SQ	RSQ CHG	Simple r
01	d	44.0	0.812	0.659	0.659	0.812
02	N	38.7	0.884	0.781	0.122	0.765
03	V	112.0	0.934	0.872	0.091	0.661
04	G	77.5	0.957	0.917	0.045	0.704
05	Y	94.6	0.970	0.941	0.024	0.606
06	I	70.6	0.982	0.964	0.023	0.694
07	b	53.4	0.992	0.984	0.020	0.568
08	X	5.6				0.437

DOMINANCE: Mean = 45.8; Standard Error at Step 7: Mean ± 1.77

Table 10A. Terms that Predicted Extroversion in the Basic/Natural Self for 162 Randomly Selected Adults in Group A

Step	Terms	F-Ratio	Multiple R	R SQ	RSQ CHG	Simple r
01	e	225.9	0.745	0.555	0.555	0.745
02	W	274.9	0.857	0.735	0.179	0.668
03	T	262.9	0.914	0.836	0.101	0.731
04	E	466.0	0.953	0.909	0.073	0.582
05	A	256.4	0.973	0.947	0.038	0.677
06	b	244.8	0.990	0.979	0.033	0.682
07	X	10.8				0.192

EXTROVERSION: Mean = 55.8; Standard Error at Step 6: Mean ± 1.81

Table 10B1. Terms that Predicted Extroversion in the Basic/Natural Self for 49 Adults in Group B1

Step	Terms	F-Ratio	Multiple R	R SQ	RSQ CHG	Simple r
01	T	25.6	0.752	0.566	0.566	0.752
02	b	28.8	0.869	0.755	0.190	0.660
03	E	126.1	0.928	0.862	0.107	0.563
04	W	80.2	0.955	0.913	0.051	0.463
05	e	66.8	0.976	0.952	0.039	0.663
06	A	26.6	0.985	0.971	0.019	0.728
07	X	7.6				0.472

EXTROVERSION: Mean = 45.9; Standard Error at Step 6: Mean ± 2.04

Table 10B2. Terms that Predicted Extroversion in the Basic/Natural Self for 49 Adults in Group B2

Step	Terms	F-Ratio	Multiple R	R SQ	RSQ CHG	Simple r
01	A	55.6	0.801	0.643	0.643	0.801
02	X	0.2	0.925	0.855	0.213	0.758
03	E	207.7	0.945	0.894	0.038	0.607
04	e	110.7	0.959	0.921	0.027	0.667
05	W	109.3	0.977	0.955	0.034	0.535
06	b	60.0	0.986	0.972	0.017	0.637
07	T	40.4	0.993	0.986	0.014	0.762

EXTROVERSION: Mean = 46.5; Standard Error at Step 7: Mean ± 1.44

Table 11A. Terms that Predicted Pace/Patience in the Basic/Natural Self for 162 Randomly Selected Adults in Group A

Step	Terms	F-Ratio	Multiple R	R SQ	RSQ CHG	Simple r
01	Q	210.2	0.654	0.428	0.428	0.654
02	R	247.1	0.799	0.638	0.210	0.538
03	O	311.6	0.880	0.775	0.136	0.504
04	a	310.2	0.914	0.835	0.060	0.620
05	D	281.9	0.933	0.871	0.037	0.430
06	P	330.3	0.957	0.915	0.044	0.542
07	c	346.9	0.979	0.958	0.043	0.603
08	M	145.8	0.989	0.978	0.021	0.331
09	X	2.7				0.094

PACE: Mean = 59.4; Standard Error at Step 8: Mean ± 2.13

Table 11B1. Terms that Predicted Pace/Patience in the Basic/Natural Self for 49 Adults in Group B1

Step	Terms	F-Ratio	Multiple R	R SQ	RSQ CHG	Simple r
01	c	68.2	0.667	0.445	0.445	0.667
02	O	62.5	0.834	0.695	0.250	0.644
03	P	64.3	0.880	0.775	0.080	0.634
04	a	107.2	0.906	0.820	0.045	0.496
05	D	82.0	0.932	0.869	0.049	0.373
06	R	90.6	0.961	0.924	0.055	0.472
07	Q	57.5	0.974	0.949	0.025	0.569
08	M	56.4	0.989	0.979	0.030	0.426
09	X	4.5				0.266

PACE: Mean = 60.7; Standard Error at Step 6: Mean ± 2.27

Table 11B2. Terms that Predicted Pace/Patience in the Basic/Natural Self for 49 Adults in Group B2

Step	Terms	F-Ratio	Multiple R	R SQ	RSQ CHG	Simple r
01	O	54.2	0.698	0.487	0.487	0.698
02	c	69.8	0.841	0.707	0.220	0.574
03	a	77.7	0.898	0.807	0.099	0.615
04	P	71.8	0.923	0.852	0.045	0.642
05	M	54.1	0.940	0.884	0.033	0.581
06	Q	71.7	0.958	0.919	0.034	0.541
07	D	82.4	0.977	0.955	0.036	0.113
08	R	49.0	0.990	0.980	0.025	0.516
09	X	2.0				0.072

PACE: Mean = 61.8.8; Standard Error at Step 6: Mean ± 2.18

Table 12A. Terms that Predicted Conformity/Structure in the Basic/Natural Self for 162 Randomly Sampled Adults in Group A

Step	Terms	F-Ratio	Multiple R	R SQ	RSQ CHG	Simple r
01	Q	287.6	0.680	0.462	0.462	0.680
02	H	267.1	0.812	0.659	0.196	0.587
03	L	344.6	0.864	0.746	0.088	0.631
04	C	378.3	0.901	0.812	0.066	0.439
05	J	402.9	0.929	0.863	0.051	0.423
06	K	428.5	0.952	0.907	0.043	0.421
07	c	443.9	0.977	0.955	0.040	80.591
08	M	187.9	0.990	0.980	0.025	0.285
09	X	8.5				0.077

CONFORMITY: Mean = 61.8; Standard Error at Step 8: Mean ± 1.94

Table 12B1. Terms that Predicted Conformity/Structure in the Basic/Natural Self for 49 Adults in Group B1

Step	Terms	F-Ratio	Multiple R	R SQ	RSQ CHG	Simple r
01	c	129.7	0.679	0.461	0.461	0.679
02	L	177.0	0.847	0.717	0.256	0.623
03	H	84.9	0.895	0.802	0.085	0.628
04	K	219.1	0.933	0.870	0.068	0.371
05	M	57.8	0.948	0.899	0.029	0.514
06	Q	117.4	0.966	0.932	0.033	0.598
07	C	140.8	0.978	0.957	0.025	0.496
08	J	104.7	0.994	0.988	0.031	0.422
09	X	2.8				-0.056

CONFORMITY: Mean = 639; Standard Error at Step 8: Mean ± 1.56

Table 12B2. Terms that Predicted Conformity/Structure in the Basic/Natural Self for 49 Adults in Group B2

Step	Terms	F-Ratio	Multiple R	R SQ	RSQ CHG	Simple r
01	c	95.6	0.666	0.444	0.444	0.444
02	L	118.0	0.847	0.717	0.273	0.569
03	H	111.5	0.912	0.832	0.115	0.630
04	C	0.4	0.932	0.869	0.037	0.393
05	J	115.4	0.954	0.911	0.042	0.533
06	Q	101.0	0.968	0.936	0.025	0.545
07	K	89.3	0.982	0.965	0.029	0.469
08	M	64.0	0.993	0.987	0.022	0.617
09	X	3.6				-0.049

CONFORMITY: Mean = 63.4; Standard Error at Step 8: Mean ± 1.71

Table 13A. Terms that Predicted Logic/Rationale in the Basic/Natural Self for 162 Randomly Sampled Adults in Group A

Step	Terms	F-Ratio	Multiple R	R SQ	RSQ CHG	Simple r
01	D	261.3	0.738	0.545	0.545	0.738
02	U	499.9	0.849	0.721	0.177	0.607
03	B	333.3	0.909	0.826	0.104	0.369
04	Z	405.7	0.935	0.874	0.049	0.726
05	S	390.3	0.958	0.917	0.043	0.555
06	F	419.2	0.981	0.963	0.045	0.616
07	M	172.2	0.991	0.982	0.020	0.410
08	X	6.6				0.392

LOGIC/RATIONALE: Mean = 63.6; Standard Error at Step 7: Mean ± 1.78

Table 13B1. Terms that Predicted Logic/Rationale in the Basic/Natural Self for 49 Adults in Group B1

Step	Terms	F-Ratio	Multiple R	R SQ	RSQ CHG	Simple r
01	D	77.4	0.713	0.509	0.509	0.713
02	U	119.5	0.834	0.695	0.187	0.653
03	X	1.7	0.880	0.774	0.078	0.209
04	B	101.9	0.906	0.821	0.047	0.214
05	F	121.6	0.928	0.862	0.041	0.391
06	Z	103.9	0.959	0.920	0.058	0.580
07	S	61.0	0.967	0.936	0.016	0.174
08	M	57.7	0.987	0.974	0.038	0.225

LOGIC/RATIONALE: Mean = 52.9; Standard Error at Step 8: Mean ± 1.72

Table 13B2. Terms that Predicted Logic/Rationale in the Basic/Natural Self for 49 Adults in Group B2

Step	Terms	F-Ratio	Multiple R	R SQ	RSQ CHG	Simple r
01	Z	189.3	0.713	0.509	0.509	0.713
02	B	139.3	0.839	0.704	0.195	0.364
03	U	126.3	0.913	0.834	0.130	0.554
04	F	158.7	0.936	0.876	0.041	0.547
05	M	169.6	0.957	0.915	0.040	0.289
06	S	94.4	0.979	0.959	0.044	0.469
07	D	77.7	0.993	0.986	0.027	0.667
08	X	4.2				0.514

LOGIC/RATIONALE: Mean = 65.4; Standard Error at Step 7: Mean ± 1.44

Table 14A. Terms that Predicted Dominance in the Priority Environment(s) for 162 Randomly Sampled Adults in Group A

Step	Terms	F-Ratio	Multiple R	R SQ	RSQ CHG	Simple r
01	V	130.2	0.762	0.581	0.581	0.762
02	N	266.9	0.852	0.726	0.145	0.664
03	b	162.7	0.901	0.812	0.086	0.592
04	Y	300.8	0.929	0.863	0.051	0.490
05	G	226.5	0.956	0.914	0.033	0.663
06	d	230.3	0.973	0.946	0.028	0.563
07	I	170.3	0.987	0.975	0.001	0.620
08	X	8.7				0.454

DOMINANCE: Mean = 49.2; Standard Error at Step 7: Mean ± 2.56

Table 14B1. Terms that Predicted Dominance in the Priority Environment(s) for 49 Adults in Group B1

Step	Terms	F-Ratio	Multiple R	R SQ	RSQ CHG	Simple r
01	V	76.4	0.672	0.451	0.451	0.672
02	I	66.4	0.819	0.670	0.219	0.482
03	d	74.3	0.889	0.790	0.120	0.489
04	Y	49.6	0.926	0.858	0.068	0.670
05	b	65.6	0.958	0.919	0.061	0.455
06	N	51.3	0.976	0.953	0.034	0.573
07	G	18.4	0.984	0.967	0.015	0.574
08	X	5.6				0.098

DOMINANCE: Mean = 41.7; Standard Error at Step 7: Mean ± 2.42

Table 14B2. Terms that Predicted Dominance in the Priority Environment(s) for 49 Adults in Group B2

Step	Terms	F-Ratio	Multiple R	R SQ	RSQ CHG	Simple r
01	d	24.8	0.794	0.631	0.631	0.794
02	N	66.4	0.862	0.744	0.113	0.643
03	V	19.3	0.907	0.823	0.079	0.667
04	G	52.0	0.935	0.873	0.051	0.561
05	Y	69.7	0.964	0.928	0.055	0.662
06	I	34.0	0.977	0.954	0.026	0.643
07	b	16.3	0.984	0.967	0.013	0.553
08	X	2.3				0.196

DOMINANCE: Mean = 41.3; Standard Error at Step 7: Mean ± 2.57

Table 15A. Terms that Predicted Extroversion in the Priority Environment(s) for 162 Randomly Sampled Adults in Group A

Step	Terms	F-Ratio	Multiple R	R SQ	RSQ CHG	Simple r
01	E	311.5	0.760	0.577	0.577	0.760
02	e	315.6	0.874	0.764	0.187	0.709
03	A	353.1	0.924	0.853	0.089	0.729
04	b	438.6	0.958	0.917	0.064	0.517
05	T	327.8	0.975	0.951	0.033	0.654
06	W	301.4	0.992	0.983	0.033	0.717
07	X	6.4				0.329

EXTROVERSION: Mean = 57.9; Standard Error at Step 6: Mean ± 1.81

Table 15B1. Terms that Predicted Extroversion in the Priority Environment(s) for 49 Adults in Group B1

Step	Terms	F-Ratio	Multiple R	R SQ	RSQ CHG	Simple r
01	W	51.2	0.756	0.571	0.571	0.756
02	T	41.5	0.922	0.850	0.279	0.748
03	b	62.3	0.948	0.898	0.049	0.468
04	e	35.7	0.967	0.935	0.036	0.697
05	E	37.3	0.974	0.949	0.014	0.734
06	A	36.5	0.986	0.973	0.024	0.669
07	X	5.1				0.202

EXTROVERSION: Mean = 48.8; Standard Error at Step 6: Mean ± 2.42

Table 15B2. Terms that Predicted Extroversion in the Priority Environment(s) for 49 Adults in Group B2

Step	Terms	F-Ratio	Multiple R	R SQ	RSQ CHG	Simple r
01	E	42.2	0.747	0.558	0.558	0.747
02	A	58.8	0.887	0.786	0.229	0.686
03	e	94.1	0.932	0.869	0.083	0.594
04	W	102.4	0.953	0.908	0.038	0.711
05	T	90.6	0.974	0.949	0.041	0.684
06	b	62.7	0.990	0.979	0.031	0.520
07	X	9.7				0.320

EXTROVERSION: Mean = 50.7; Standard Error at Step 6: Mean ± 1.92

Table 16A. Terms that Predicted Pace/Patience in the Priority Environment(s) for 162 Randomly Sampled Adults in Group A

Step	Terms	F-Ratio	Multiple R	R SQ	RSQ CHG	Simple r
01	Q	320.7	0.674	0.454	0.454	0.674
02	D	412.8	0.780	0.609	0.155	0.521
03	R	448.9	0.853	0.728	0.119	0.625
04	O	659.8	0.899	0.809	0.081	0.448
05	a	533.0	0.932	0.869	0.060	0.525
06	c	446.3	0.960	0.922	0.052	0.581
07	M	463.5	0.980	0.961	0.039	0.507
08	P	322.2	0.994	0.987	0.027	0.650
09	X	11.8				0.361

PACE: Mean = 65.6; Standard Error at Step 8: Mean ± 1.67

Table 16B1. Terms that Predicted Pace/Patience in the Priority Environment(s) for 49 Adults in Group B1

Step	Terms	F-Ratio	Multiple R	R SQ	RSQ CHG	Simple r
01	X	1.7	0.694	0.482	0.482	0.694
02	a	79.0	0.814	0.662	0.181	0.641
03	P	58.5	0.876	0.767	0.105	0.653
04	R	106.2	0.909	0.826	0.059	0.569
05	O	77.9	0.934	0.873	0.046	0.536
06	c	50.3	0.953	0.907	0.035	0.389
07	D	97.9	0.971	0.944	0.036	0.426
08	Q	70.5	0.977	0.955	0.011	0.532
09	M	67.4	0.992	0.983	0.029	0.561

PACE: Mean = 60.6; Standard Error at Step 9: Mean ± 2.03

Table 16B2. Terms that Predicted Pace/Patience in the Priority Environment(s) for 49 Adults in Group B2

Step	Terms	F-Ratio	Multiple R	R SQ	RSQ CHG	Simple r
01	Q	27.0	0.780	0.608	0.608	0.780
02	O	66.5	0.905	0.820	0.211	0.588
03	D	67.4	0.944	0.890	0.071	0.696
04	R	103.1	0.962	0.925	0.035	0.496
05	c	54.8	0.975	0.950	0.025	0.630
06	a	57.0	0.982	0.965	0.015	0.733
07	P	39.0	0.987	0.974	0.009	0.689
08	M	38.6	0.993	0.987	0.013	0.681
09	X	10.0				0.187

PACE: Mean = 60.5; Standard Error at Step 8: Mean ± 2.09

Table 17A. Terms that Predicted Conformity/Structure in the Priority Environment(s) for 162 Randomly Sampled Adults in Group A

Step	Terms	F-Ratio	Multiple R	R SQ	RSQ CHG	Simple r
01	Q	302.4	0.621	0.386	0.386	0.621
02	J	479.7	0.766	0.588	0.202	0.572
03	H	1001.8	0.845	0.713	0.125	0.525
04	C	406.3	0.900	0.810	0.097	0.541
05	L	541.9	0.931	0.867	0.056	0.557
06	c	438.5	0.960	0.922	0.056	0.537
07	K	593.0	0.982	0.964	0.041	0.546
08	M	287.5	0.994	0.987	0.024	0.514
09	X	4.7				0.354

CONFORMITY: Mean = 63.1; Standard Error at Step 8: Mean ± 1.74

Table 17B1. Terms that Predicted Conformity/Structure in the Priority Environment(s) for 49 Adults in Group B1

Step	Terms	F-Ratio	Multiple R	R SQ	RSQ CHG	Simple r
01	C	56.5	0.792	0.629	0.629	0.792
02	L	34.1	0.876	0.768	0.139	0.525
03	H	75.7	0.912	0.832	0.064	0.490
04	K	72.7	0.936	0.875	0.043	0.737
05	M	86.5	0.953	0.908	0.033	0.639
06	Q	70.9	0.970	0.942	0.033	0.494
07	c	60.0	0.981	0.963	0.022	0.421
08	J	50.2	0.992	0.984	0.021	0.585
09	X	4.7				-0.130

CONFORMITY: Mean = 58.8; Standard Error at Step 8: Mean ± 2.09

Table 17B2. Terms that Predicted Conformity/Structure in the Priority Environment(s) for 49 Adults in Group B2

Step	Terms	F-Ratio	Multiple R	R SQ	RSQ CHG	Simple r
01	M	41.8	0.779	0.607	0.607	0.779
02	X	0.9	0.874	0.765	0.158	0.639
03	C	58.8	0.906	0.822	0.057	0.684
04	H	102.5	0.935	0.874	0.053	0.544
05	c	55.9	0.954	0.909	0.035	0.588
06	J	71.4	0.967	0.936	0.026	0.641
07	K	56.5	0.977	0.955	0.019	0.622
08	L	61.7	0.989	0.977	0.022	0.465
09	Q	14.0	0.992	0.983	0.006	0.721

CONFORMITY: Mean = 60.7; Standard Error at Step 8: Mean ± 2.32

Table 18A. Terms that Predicted Logic/Rationale in the Priority Environment(s) for 162 Randomly Sampled Adults in Group A

Step	Terms	F-Ratio	Multiple R	R SQ	RSQ CHG	Simple r
01	Z	414.9	0.642	0.412	0.412	0.642
02	B	367.6	0.788	0.621	0.209	0.598
03	D	383.1	0.850	0.723	0.102	0.549
04	U	456.4	0.895	0.800	0.077	0.409
05	S	459.7	0.940	0.884	0.083	0.316
06	F	368.7	0.965	0.931	0.047	0.620
07	M	311.0	0.989	0.977	0.046	0.561
08	X	13.3				0.307

LOGIC/RATIONALE: Mean = 61.2; Standard Error at Step 7: Mean ± 1.95

Table 18B1. Terms that Predicted Logic/Rationale in the Priority Environment(s) for 49 Adults in Group B1

Step	Terms	F-Ratio	Multiple R	R SQ	RSQ CHG	Simple r
01	F	201.3	0.618	0.382	0.382	0.618
02	M	107.6	0.805	0.648	0.265	0.550
03	D	165.9	0.892	0.796	0.148	0.598
04	Z	90.1	0.935	0.875	0.079	0.568
05	B	92.1	0.957	0.915	0.041	0.495
06	U	76.6	0.973	0.947	0.032	0.189
07	S	67.9	0.990	0.980	0.033	0.606
08	X	4.6				0.284

LOGIC/RATIONALE: Mean = 53.8; Standard Error at Step 7: Mean ± 1.82

Table 18B2. Terms that Predicted Logic/Rationale in the Priority Environment(s) for 49 Adults in Group B2

Step	Terms	F-Ratio	Multiple R	R SQ	RSQ CHG	Simple r
01	M	90.9	0.704	0.495	0.405	0.704
02	Z	135.6	0.856	0.732	0.237	0.658
03	D	93.4	0.909	0.827	0.095	0.584
04	F	134.8	0.945	0.893	0.060	0.572
05	S	84.0	0.960	0.921	0.028	0.557
06	U	79.8	0.974	0.949	0.028	0.303
07	B	75.2	0.991	0.982	0.033	0.532
08	X	5.8				0.590

LOGIC/RATIONALE: Mean = 55.0; Standard Error at Step 7: Mean ± 1.74

In Tables 9B1 and 9B2 which report results for the two administrations of the Survey for Group B, the Dominance factor also was predicted in seven steps by the identical sets of terms as those that were the predictors of Dominance for Group A. Furthermore, the efficiency of prediction was not lost in either administration; the R SQs were 0.983 and 0.984, respectively. The F-ratios for the next best predictors at step 8 were relatively low, indicating that the "X" terms would have made virtually no change in R SQ had they been allowed to enter the equations.

The information in Tables 9A, 9B1 and 9B2 was virtually repeated in Tables 10A through 18B2. In the analysis of every factor the sets of predictors were identical. None of the "X" terms that entered an equation early contributed significantly to the prediction of the factor after the last "true" term had been entered, and "X" terms that entered after the true terms had entered made only nominal increases in R SQ, at best. These results show that the ProScan® Survey has high intrinsic validity.

The coefficients of reliability and validity obtained for the ProScan® Survey recommend it as a tool for measuring behavior and using that information for its intended purposes, namely, to describe, understand and predict behavior. The many applications of the instrument have been greatly augmented by the recent mass availability of personal computers. In 1984, in anticipation of that eventuality, all the necessary information, scoring procedures and special formulas were computerized. Now, several reports can be generated and made available within minutes at any local cite following the entry of an individual's responses to the Survey.

One additional post-normative study examined the intrinsic validity of Survey scores in two groups of adults. The groups in the sample were selected intentionally because they were thought to be different on certain of the factors measured by the Survey. Group A contained 162 adults who took the Survey in 1986. Individuals in Group B (n=49) were all members of the same organization and lived in the same general area in Southern California.

Differences in mean values between Group A and Group B were statistically significant on three of the five behavioral traits for the Basic/Natural Self and for the same three traits for the Priority Environment(s). These differences confirmed the investigators' suspicions that the two

groups represented unique populations. Nevertheless, that fact made it possible to evaluate the invariance of scores by identifying the terms included in each set of predictors of a given factor and observing the similarities, or differences, in the configuration of terms under atypical circumstances. Group B was given the Survey on two occasions exactly one week apart. Correlation analyses of these scores produced short-term coefficients of test-retest reliability in the range from 0.67 to 0.87. These coefficients were comparable to those found for Surveys taken three months apart by a subgroup of the normative sample.

Comparisons between results for the Basic/Natural Self (Part 1) and the Priority Environment(s) (Part 2) demonstrated the replicability of responses in that there was opportunity for sets of terms that predicted a given factor on Part 1 to match (replicate) the set of corresponding terms that predicted the same factor on Part 2.

The statistical analysis of the data used raw scores of all 30 adjectives in the Basic/Natural Self as potential predictors of the total score for each behavioral trait. For those analyses raw scores for individual terms entered a multiple regression equation in a stepwise manner until the complete set of major predictors of a given trait was identified.

A second analysis was identical to the one above except the potential predictors of each behavioral trait were the 30 adjectives in the Priority Environment(s).

Table 19 is a composite of information reported in Tables 9A through 18B2. Alpha characters in the table represent terms on the ProScan® Survey card. The five behavioral traits were measured by five different sets of terms on each side of the Survey card. Identical alpha characters were assigned to terms in the two sets of predictors of each factor. Responses to multiple terms by individuals in independent groups were correlated in a stepwise manner with total factor scores. By this procedure it was possible to observe several practical effects of the Survey's intrinsic validity.

Table 19. Composite of Tables 9A through 18B2: Terms and Sets of Terms that Predicted Behavioral Traits on the ProScan® Survey by Group/Administration for the Basic/Natural Self and Priority Environment(s)

	Group A	First Survey	Second Survey
Basic/Natural Self: (Part 1)			
Dominance	b,d,G,I,N,V,Y	b,d,G,I,N,V,Y	b,d,G,I,N,V,Y
Extroversion	A,b,e,E,T,W	A,b,e,E,T,W	A,b,e,E,T,W
Pace	a,c,D,M,O,P,Q,R	a,c,D,M,O,P,Q,R	a,c,D,M,O,P,Q,R
Conformity	c,C,H,J,K,L,M,Q	c,C,H,J,K,L,M,Q	c,C,H,J,K,L,M,Q
Logic/Rationale	B,D,F,M,S,U,Z	B,D,F,M,S,U,Z	B,D,F,M,S,U,Z
Priority Environment(s) (Part 2)			
Dominance	b,d,G,I,N,V,Y	b,d,G,I,N,V,Y	b,d,G,I,N,V,Y
Extroversion	A,b,e,E,T,W	A,b,e,E,T,W	A,b,e,E,T,W
Pace	a,c,D,M,O,P,Q,R	a,c,D,M,O,P,Q,R	a,c,D,M,O,P,Q,R
Conformity	c,C,H,J,K,L,M,Q	c,C,H,J,K,L,M,Q	c,C,H,J,K,L,M,Q
Logic/Rationale	B,D,F,M,S,U,Z	B,D,F,M,S,U,Z	B,D,F,M,S,U,Z

Note: Lower and upper case letters in the table have no special meaning other than the fact that more than 26 identifiers were needed to cover the 30 descriptors on each side of the Survey card.

The terms have been arranged in alphabetical order by alpha character rather than in the true order of their entry into their respective regression equations. The actual steps at which terms entered and their order of entry are reported in Tables 9A through 18B2 in Part II of the monograph. Also, terms that made minimal contribution to the predictions—those labeled "X" in Tables 9A through 18B2—were eliminated in the present table. These steps were taken to dramatize the consistency of sets of predictors across factors, groups and forms and to make it easy for the reader to observe important results.

The most important finding of the study was that sets of predictors for a given factor

were identical across groups, Survey administrations, and forms, despite the fact that there were 30 different regression equations formulated any one of which could have introduced a foreign term. These results can be observed in Table 19 by simply comparing the three sets of predictors for each trait under Basic/Natural Self, then comparing those three sets with the three sets for the same trait under Priority Environment(s).

Duplication of terms across sets of predictors was quite low, providing evidence of relatively clean factors. However, the term represented by "b" appeared in the equations that predicted Dominance and Extroversion. Terms represented by "Q," and "c" entered the equations for Pace/Patience and Conformity/Structure, "M" was common to Pace/Patience, Conformity/ Structure and Logic/Rationale, and "D" was common to Pace/Patience and Logic/Rationale. No term in the equations for Dominance or Extroversion appeared in the equations for Pace/Patience, Conformity/Structure or Logic/Rationale. All of the 30 adjectives on Part 1 entered at least one equation; the same was true for Part 2.

Information in Table 19 provides practical evidence of the intrinsic validity of the ProScan® Survey by demonstrating high replicability, invariance, constancy and stability of responses.

Reports

The information generated by responses to the ProScan® Survey is made available through several narrative reports and a graph. The titles and the number of pages of each report are listed below: Each Report has a special purpose and the format of the narrative reports provide a description of behavior from three perspectives, the Basic/Natural Self, the Priority Environment(s) and the Predictor/Outward Self. The graphs also provide visual displays of other "dynamic features" of the behavior as well. All the ProScan® graphs and narrative reports can be displayed on the computer screen and/or printed for initial interpretation and subsequently reinforced in detail through a feedback discussion with ProScan® trained persons.

Applications

The rationale for developing any scale presumes that its application will provide users with information that has practical value. That objective requires the instrument to be constructed

on sound principles of measurement. The authors of the ProScan® Survey were guided by that understanding and have developed an instrument that is objective, quick to administer, has computer-compiled scoring and reporting, is capable of providing immediate feedback from either visual or printed reports, is relatively inexpensive, and produces results that can be understood easily.

But, even more important than those considerations were the standardization and validation procedures and their results. The studies that tested responses to the Survey for their intrinsic and extrinsic validity produced evidence that the instrument measures what it purports to measure under a variety of conditions and does so with substantial to high levels of consistency.

The positive results of research studies make the information supplied by the Survey applicable in a wide range of situations. Its uses are both descriptive and predictive. Descriptively, the reports that can be generated are themselves important criteria of validity. Primarily, they confirm what is already known about oneself and close friends or well known employees. Such reports can be the user's personal source of confidence in the instrument. Thus, when the instrument measures what it purports to measure in situations about which the user has first-hand knowledge, there is a practical basis for assuming that it also can produce information that is true about individuals who are unknown or are known less well.

Predictive applications of the Survey refer to situations where future behaviors can be anticipated with confidence based upon the unique configurations of the individual's behavioral traits.

The ability to know such a large volume of important information about an individual even on first contact has considerable value in numerous situations. Some of the many applications of the ProScan® Survey are listed below:

(1) Employers use the Survey to:

a. Standardize hiring procedures
b. Decrease employee turnover
c. Recognize strengths in others
d. Build team harmony

e. Increase productivity

f. Increase profits

(2) Personnel Managers use the Survey to:

a. Provide and control a management tool as a service to all management and supervisory personnel

b. Improve the interview with job applicants allowing the interviewee to be an integral part of the confirmation and conclusions

c. Improve the selection of new employees

d. Identify sources of employee stress and possible solutions

e. Improve communications among employees and between employees and management

f. Reduce employee interpersonal conflicts

g. Increase morale and job satisfaction

h. Identify individuals' prime needs

i. Discover "on buttons" of employee self motivation

j. Develop management/leadership skills of employees

k. Match people to tasks and tailor jobs to talents

l. Assist in making vertical and horizontal promotions

m. Increase camaraderie

n. Assist in organizational development

(3) Professional consultants/counselors use the Survey to:

a. Gain a quick understanding of the client's behavior

b. Identify the client's prime needs

c. Determine the client's keys to self-motivation

d. Gain insight into relationships between the subject and his/her mate, friends, employer, or other individuals

e. Relate the subjects strengths of behavior to career opportunities or vocational goals

f. Reduce interpersonal conflicts
g. Assist the subject in resolving problems related to current employment, career, marriage, education, religion, emotions, finances, abuses and similar issues pertaining to self-control, and many others
h. Recognize sources of stress and possible solutions

(4) Individuals use the Survey to:

a. Know themselves—to gain insight into their own behaviors
b. Discover their own prime needs and unique set of motivators
c. Become aware of their behavioral strengths
d. Supplement their resume with information about strengths in their behavior
e. Make practical applications of Survey information in their personal Priority Environment(s): economic, health, social/personal, family/mate, religion, work/employer

"Know thyself" is an age-old dictum that remains relevant in the information society. The information supplied by the ProScan® Survey can be an important source by which that fundamental prerequisite is met by individual users either directly, or indirectly through employers or professional counselors. Actually, the potential applications exceed the space available here to report it. The sample list above merely is an attempt to stimulate the reader's imagination.

Conclusions

The data compiled on the ProScan® Survey to date warrant the following conclusions:

(1) The ProScan® Survey is a tool that measures behavioral traits that have been labeled Dominance, Extroversion, Pace/Patience, Conformity/Structure and Logic/Rationale.
(2) Responses on the Survey are sufficiently stable to permit predictions of behavior under a variety of conditions with substantial to high efficiency.
(3) The Survey provides information that is not available through other sources—information that is potentially valuable for describing, understanding and predicting behavior of individuals.

(4) The information supplied by the Survey is useful to employers, counselors, spouses, and to individuals who simply want to increase their knowledge about their own behavioral traits and behavior.

Since its introduction as an instrument for measuring behavioral traits in 1978, positive feedback has been received from a very high percentage of more than 600,000 individual respondents who have taken the Survey, by more than 1,500 trained analysts, 6 professional case study experts and 45 other specialists in the measurement of behavioral traits.

The most representative statement that succinctly summarizes current comments about the Survey is: "It works!"

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Curriculum Vitae

Malcolm L. Williamson, M.S., Ph.D. **1987**

Education

University of Southern California, Los Angeles, 1959-1970 (part time). Ph.D. degree in educational psychology, January 1970, with specialties in experimental design and statistics, child growth and development and special education.

Pasadena College, 1955-1959. B.A. degree with major in psychology and minors in sociology and education. M.S. in Education, June 1965, with specialties in psychometric tests and measurements.

Professional Experience

Associate Clinical Professor, University of Southern California, School of medicine, Department of Pediatrics, Division of Medical Genetics (1970-Present)

Executive Vice President, The Williamson-Termohlen Group (October 1987-present)

President, Infometrics, Inc. (August 1986-1987)

Director of Research, PDP, Inc. (April 1986-present)

Co-founder, Computrition, Inc., Chatsworth, CA
- Vice President and Director of Research (1981-1984)
- Director, on Board of Directors (1981-present)

Collaborative Study of Children Treated for Phenylketon-uria, Children's Hospital of Los Angeles (1965-1983)
- Chief Designer (1965-1967)
- Chief Biostatistician (1967-1983)
- Co-Investigator (1974-1983)
- Member of numerous writing committees (1967-1983)

Professional Staff, Children's Hospital, Division of Medical Genetics and Amino Acid Metabolism, Los Angeles (1970-1983)

Co-investigator, Interaction Between Genetics and Diet in PKU Heterozygote Mothers to Produce Diminuation of IQ in Fetuses: A Test of the Justification Hypothesis (1974-1976)

Co-investigator, Aspartame in Phenylketonuric Heterozygotes (1973-1974)

Project Director, Phenylketonuria in School Age Retarded Children (1962-1965)

Consultantships

Focus on the Family, two national research projects (1984, 1986 & 1987)

National Maternal PKU Collaborative Study, with headquarters at the Children's Hospital of Los Angeles (1983 to 1986)

Children's Hospital of Los Angeles, Professional Staff-provided consultation on statistics, measurement, and computer analysis on medical research projects in pathology, enzymology, neurology, biochemistry, orthopedics, endocrinology, cardiology, surgery, psychiatry, and the Regional Center (1962-1983)

University of Southern California, Department of Psychiatry, Family Counseling in the Treatment of Schizophrenia (1981-1983)

Collaborative Study of Differential Diagnosis of Hyperphenylalanenia, Heidelberg, Federal Republic of Germany (1977)

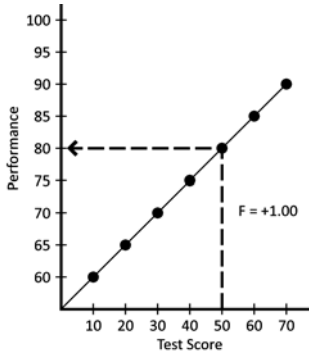
What are Statistical Validation Studies?

First, a bit of history. During the First World War, it was found that traditional tests were not adequate to place groups of new recruits into jobs that were suited for their particular aptitudes and intelligence. This of course, paved the way for an immense research effort to develop the necessary instruments. After the war, testing settled into the industrial setting and continued to grow until the 1960s Like many of the social norms at that time, testing was questioned from both moral and practical standpoints. The accusation was made that testing, in general, had no correlation with job success—that is, the typical tests used to select job candidates could not predict actual performance on the job. Hence, it made no sense to use those tests.

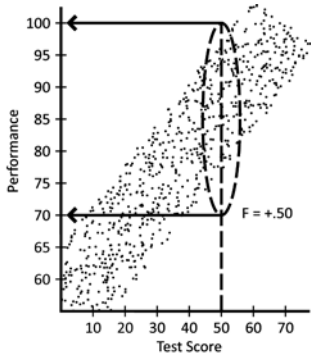
Included in the Civil Rights Act of 1964 was Title VII, which prohibited the use of tests that would discriminate. Further, a set of guidelines were written to aid in the interpretation of the law. Over the years, the guidelines have been refined and rewritten. At the present time, however, it is necessary to have a background in psychological measurement and industrial psychology to effectively interpret their meaning.

Each dot equals a test score.

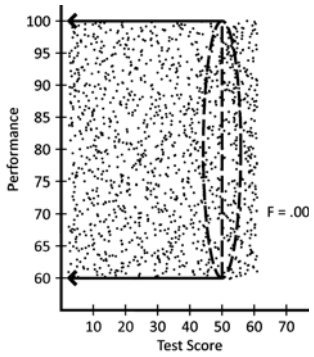
A.



B.



C.



Validity has been outlined by very specific mathematical formulas. Conceptually it relates to the meaning or predictor ability of a test (i.e., Is the test really measuring what it claims to be measuring?). If the score on a test could perfectly predict a person's job performance rating, we would have a high or a perfect validity correlation. Let's look at what that means.

If one knows the test score one can find the performance rating score. Therefore, if an individual scores high on the test, one knows he/she will have high performance. Mathematically, there would be maximum efficiency, a validity coefficient of 1.00. (Example A)

But now, look what happens if the correlation coefficient (between the test scores and the performance rating scores) moves down to the average range, say .50.

If one looks at a test score of 50, one will find that those people will vary on their performance ratings between the scores of 70 and 100. This means that all one knows about an individual based on their test score is that they will probably fall somewhere in a particular range. The ability to make a concrete prediction is now limited. (Example B)

By now, you can guess that an instrument with a .00 validity coefficient is no better than a wild guess in making a prediction. The graph looks as such. (Example C)

From these rather simple examples, you can see that the practical efficiency of a test is directly tied to its validity coefficient. Unfortunately, the mathematics are complicated. The issues also become more complex when we consider where our cut-off scores need to be, and what in fact a good performance rating is and how it is obtained.

University of Colorado at Denver

Department of Psychology

Campus Box 173
P.O. Box 173364
Denver, Colorado 80217-3364
Phone: (303) 556-8565 • Fax: (303) 556-3520

December 20, 1992

Bruce M. Hubby, President
Professional Dynametric Programs, Inc. (PDP, Inc.)
400 West Highway 24, Suite 201
Woodland Park, CO 80866

Dear Bruce:

Enclosed is the report on the validation study project between PDP and the Center for Applied Psychology that has been completed under my direction.

The procedures and analyses conducted as part of the validation project strictly follow guidelines and standards of the American Psychological Association, as well as the principles for the validation of personnel selection procedures authored by the Society for Industrial and Organizational Psychology.

As you can see in the report, the analyses investigated the predictive validity and disparate impact of PDP. The results indicated that the behavioral traits as measured by the PDP system were valid predictors of job success. Moreover, there was little evident of disparate impact with respect to age.

I have enjoyed working with you and look forward to a long-term relationship between PDP and the Center for Applied Psychology.

Sincerely,

Kurt Kraiger, Ph.D.
Associate Professor of Psychology
Director, Center for Applied Psychology

Research and Development Division

Professional DynaMetric Programs, Inc.

VALIDATION

of the Professional DynaMetric Programs®, Inc. (PDP)
ProScan® and JobScan® for Predicting Driver Success

SUBMITTED BY:
Kurt Kraiger, Ph.D.[1]
Director, Center for Applied Psychology
University of Colorado at Denver
Denver, CO 80217-3364
December 1992

[1]Kurt Kraiger, Ph.D. Completed Doctorate at The Ohio State University, 1983.

Table of Contents

Validation of the Professional DynaMetric Programs®, Inc. (PDP®) ProScan® and JobScan® for Predicting Driver Success

Executive Summary

A series of analyses were performed to investigate the predictive validity and disparate impact of the PDP ProScan® and JobScan®. Predictive validity is evident when scores on a test are significantly related to one or more indices of job success. Disparate impact is absent when the relationship of test scores to performance indices is not a function of a demographic variable (e.g., age).

Behavioral trait data and job success criteria were examined for 218 drivers of Fleetline, Inc.

In the present investigation, the predictive validity of the PDP® behavioral traits was investigated by simulating PDP's method for recommending applicants—establishing an envelope for success (based on profiles of high job performers) and identifying candidates who fall within those envelopes on all variables. These recommendations were compared to multiple indices of job success. The Model Profile with the Job Dynamics Analysis report can be found in Appendix A.

The results indicated that the behavioral traits were valid predictors of three criteria: average miles driven per day, tenure with Fleetline, and organizational turnover. These results apply whether all primary behavioral traits are used for prediction, only the core traits, or only the energy traits. Thus, the ProScan® and JobScan® measures are valid predictors of job success in this context.

Disparate impact analyses revealed little or no evidence of disparate impact due to age.

Sufficient data were not available to test for disparate impact for other demographic variables. Thus, the ProScan® and JobScan® modules are fair for applicants regardless of age.

In sum, the analyses provided in this report support the use of the PDP ProScan® and JobScan® as predictors of job success.

Overview

The purpose of this investigation was to provide an independent evaluation of the validity of the PDP ProScan® and JobScan® for predicting job success. There are a variety of uses for the ProScan® and JobScan® measures; one is their potential for reviewing job candidate qualifications and making hiring recommendations based on their score profiles. In order for both PDP® and its franchisees to have complete confidence in the quality of these recommendations, it is valuable to have a third party conduct an empirically-based evaluation of the predictive validity of the testing procedure.

In the fall of 1992, PDP® arranged for the Center for Applied Psychology at the University of Colorado at Denver to direct and conduct a validation study of the PDP® testing system. Subsequently, a PDP® client (Fleetline, Inc.) was identified which could provide indices of job success which could be compared to incumbents' scores on the behavioral traits assessed by the ProScan® and JobScan® modules. A validation design was created by the Center which included the following characteristics:

Criterion-related validity—Behavioral trait scores could be directly compared to performance indices, and a criterion-related validity coefficient could be calculated.

Multiple, relevant criteria—Multiple archival criteria were available, allowing the calculation of separate correlation coefficients. This enabled the investigation of whether the behavioral traits were valid for one aspect of job success but not others. The archival criteria (described below) assessed both production (e.g., miles driven per day) and organizational commitment (e.g., tenure). These "hard criteria" (available from personnel files) are generally more reliable than subjective ratings, (Rothe, 1978) and were judged to be relevant to job success by the client.

Analyses simulate decision-making process—The behavioral traits can be scored and used in a number of ways. When used to recommend hires, the most frequent process used by PDP® is to test first a group of high performers and to establish a model profile on that sample. For each trait, an "envelope" is established by setting comfort intervals about the median score for

the trait. Applicants who score outside the envelope on any trait are not recommended for hire. The analyses performed in this study model this procedure.

Cross-Validation—An important quality of any good validation study is an attempt to cross-validate, i.e., to apply recommendations drawn from one sample to a new sample. In this instance, there was only one available sample. Accordingly, two separate random sub-samples were drawn (each of sufficient sample size) from this single sample. The first was used to identify the envelopes for behavioral traits, while the second was used to apply the envelopes for decision-making. This use of a "hold-out" sample is a commonly-used alternative to true cross-validation.

Details of the design and results are given below.

Method

Sample

Data were available for 218 drivers engaged by Fleetline, Inc. 207 drivers were male, 11 were female. 120 were owner/operators, while 98 were fleet drivers.

Criterion Variables

All criterion variables were collected or recorded by Fleetline during the fall of 1992. Data were available on the following criterion variables:

- Days worked in 1992 (for drivers still with Fleetline)
- Average Miles per day in 1992 (for drivers still with Fleetline)
- Turnover (scored 1 if driver left, 0 if still with Fleetline)
- Tenure (time with Fleetline in years)
- Number of Incidents (complaints, personnel incidents during tenure with Fleetline)
- Whether or not drivers were fleet drivers (scored 1 if they were Fleetline drivers, 0 if owner/operators).

Data were also recorded for the number of accidents by each driver. However, the distribution for this variable was heavily skewed and non-normal. As a result, the accidents variable was not included in the analyses since any obtained results would have been highly distorted due to the properties of the distribution.

Table 1 shows the correlations among all criterion variables. Means and standard deviations for criteria are also displayed in the lower two lines of the table.

Correlations among criterion variables are generally low, which is advantageous since the lower correlations suggest that the various criteria tap different aspects of the job performance construct domain (Campbell, 1990). The means and standard deviations for the criterion variables are appropriate for archival data, though the low means with larger standard deviations for the Tenure and Incidents variables suggest that these variables may have some range restriction problems.

Table 1. Correlations among Criterion Variables

	Days.	Mileage	Turnover	Tenure	Incidents	Fleet/Own
Days	1.00					
Mileage	.09	1.00				
Turnover	-.65	-.03	1.00			
Tenure	.58	-.14	-.38	1.00		
Incidents	.26	.04	-.10	.30	1.00	
Fleet/Own	-.32	-.11	.41	-.31	-.18	1.00
Mean	197.6	223.5	0.42	1.58	3.90	0.45
Standard Deviation	89.3	100.3	0.49	1.71	6.21	0.50

Note: Correlations greater than ± .14 are significant at the .05 level
Correlations greater than ± .18 are significant at the .01 level

Predictor Variables

All predictor variables were measures normally measured before applicants are engaged by Fleetline.

Incumbent scores (in inches) were available for all behavioral traits. The following were used in the present study: Dominance, Extroversion, Pace, Conformity, Logic, Thrust, Allegiance, Ste-nacity, and Kinetic Energy.

Means and inter-correlations for predictor variables are shown in Table 2. Table 2 shows that all behavioral trait scores are highly correlated with each other. Thus, any predictions made on a composite or combination of trait scores would have a very reliable basis. At the same time, the high inter-correlations make it difficult to suggest that any one trait is more critical than another in predicting job success. The means and standard deviations for the behavioral traits are appropriate for use as predictor variables.

Table 2. Correlations among Major Predictor Variables

	Dom.	Ext.	Pac.	Con.	Log.	Thr.	All.	Stn.	Kin.
Dominance	1.00								
Extroversion	.57	1.00							
Pace	.60	.86	1.00						
Conformity	.85	.80	.82	1.00					
Logic	.83	.81	.83	.96	1.00				
Thrust	.62	.92	.94	.85	.91	1.00			
Allegiance	.73	.79	.75	.92	.97	.88	1.00		
Ste-nacity	.76	.88	.90	.91	.95	.94	.90	1.00	
Kinetic Energy	.54	.46	.47	.63	.65	.52	.64	.57	1.00
Mean	388.2	436.0	456.3	404.6	411.6	443.3	391.4	468.3	357.4
Standard Deviation	142.0	127.2	120.9	106.7	134.3	138.4	129.0	110.0	132.9

Note: Correlations greater than ± .18 are significant at the .01 level

Procedure

In order to investigate the predictive validity of the PDP® behavioral traits, a procedure was established to model the method by which scores are actually used in the selection process. The procedure was repeated for each criterion variable.

First, the mean and standard deviation was computed for the criterion variable. For example, it was determined that for all drivers, the mean miles driven per day in 1992 was 223.5, and the standard deviation across drivers was 100.3.

Second, a cutoff score defining high performance on the job was set at one standard deviation above the mean. Thus, the cutoff score for high performance in miles driven was 223.5 + 100.3 = 323.8. By definition, any drivers whose actual scores exceed this cutoff have criterion values above at least 85% of the sample.

Third, a random sample of 70% of drivers were selected, and divided into two groups, those falling above and below the cutoff score. A sample was used so that a holdout group could be used for cross-validation purposes. Minimum and maximum values on each of the behavioral traits were determined for all randomly-selected drivers falling into the group above the cutoff score.

Fourth, a second random sample of 50% of the drivers were selected. Each driver's scores on all predictor variables were compared to the minimum and maximum values determined in the third step. Drivers were classified as "Recommended," unless one of their behavioral values fell outside the high performance range, in which case they were classified as "Not Recommended."

Fifth, the Hire variable (recommended vs. not recommended) values were regressed on each of the criterion variables. Separate analyses were done for decisions based on all nine predictor variables (i.e., a driver could be classified as "Not Recommended" if their scores fell outside the high performance range on any trait), the five core traits, and the four energy traits.

Note that in an effort to employ a cross-validation design, there was some overlap between the two samples. However, most drivers were not in both samples. The degree of overlap could have been eliminated by drawing smaller samples, but the decision was made to draw larger (and overlapping) samples in order to obtain more stable estimates of population parameters.

Finally, the possibility of disparate impact due to age was investigated by a moderated regression analysis using Age, Hire, and the interaction of Hire and Age. The interaction term was calculated as the simple product of Hire and Age. In order to determine whether disparate impact occurred, the interaction term was entered into the regression analysis with the other two variables (Age and Hire) already present in the equation. No other variables could be analyzed for adverse impact due to either incomplete records (e.g., race) or lack of variability in the sample (e.g., gender).

Results

Fleet vs. Owner/Operator Drivers

Since drivers were either fleet-based or owner/operators, an analysis was performed to determine whether criterion scores differed as a result of this distinction. T-tests were performed on each variable to determine whether criterion scores differed as a function of driver group. The results are shown in Table 3. As can be seen in the table, there were significant differences between groups on four variables. Owner operators had significantly greater tenure ($M = 2.06$ vs. $M = .98$, $t = 5.10$, $p < .001$), less turnover ($M = .23$ vs. $M = .64$, $t = 6.58$, $p < .001$), more incidents ($M = 4.92$ vs. $M = 2.65$, $t = 2.72$, $p < .01$), and more worked more days ($M = 223.72$ vs. $M = 165.63$, $t = 5.04$, $p < .001$) than did fleet drivers. There were no significant differences between groups on accidents or mileage).

Because of these significant differences, validity analyses were conducted both with the Hire variable by itself as a predictor and with Fleet vs. Owner/Operator as a covariate. Both analyses showed similar patterns of results (with respect to the validity of the behavioral traits). For ease of presentation, the covariate analyses are not presented.

Table 3. Comparison of Fleet Drivers vs. Owners/Operators

	Owner/Operator		Fleet			
Criterion	M	Std.	M	Std.	t	Sig. (t)
Tenure	2.06	1.91	.98	1.11	5.10	$p < .001$
Turnover	.23	.43	.64	.48	6.58	$p < .001$
Mileage	233.83	98.44	210.80	101.69	1.69	n.s.
Days	223.72	78.02	165.63	92.26	5.04	$p < .001$
Incidents	4.92	7.05	2.65	4.73	2.72	$p < .001$
Accidents	1.98	4.65	1.35	4.12	1.06	n.s.

Validity for Recommendations—All Variables

The primary predictive validity results are shown in Table 4. The first column shows the criterion variable, the second shows the correlation between Hire (using all nine behavioral variables) and the criterion, while the third and fourth show the significance test on the correlation.

The results reveal that the Hire variable is a valid predictor of Mileage, Turnover, and Tenure. In other words, use of PDP® recommendations would have resulted in drivers who are less likely to quit, and who drive more miles per day than drivers who would not be recommended based on their PDP® behavioral scores. Of these criterion variables, Mileage had the strongest correlation with Hire.

Table 4. Validity of Simulated Hire Score for All Criteria

Dependent Variable	R	F	Sig. (F)
Days	.13	1.93	n.s.
Mileage	.29	10.38	$p < .002$
Turnover	.23	6.27	$p < .01$
Tenure	.21	4.87	$p < .03$
Incidents	.11	1.34	n.s.

Similar results were found using recommendations based on the core traits alone and the energy traits alone. (See Tables 5 and 6.) As shown in Table 5, using the core traits (Dominance, Extroversion, Pace, Conformity, and Logic), Hire was significantly correlated with Mileage, Turnover, and Tenure. As shown in Table 6, using the energy traits (Thrust, Allegiance, Ste-Nacity, and Kinetic energy), Hire was significantly correlated with Mileage and Turnover. In no analyses was the Hire variable correlated with days driven or number of incidents in 1992. As noted above, there were range restriction problems with the incident variable, and this could have attenuated the relationship between Hire and Incidents.

Table 5. Validity of Simulated DEPCL Scores for All Criteria

Dependent Variable	R	F	Sig. (F)
Days	.14	2.36	n.s.
Mileage	.24	6.51	$p < .02$
Turnover	.23	6.27	$p < .02$
Tenure	.34	4.52	$p < .04$
Incidents	.14	.39	n.s.

Table 6. Validity of Simulated TASK Scores for All Criteria

Dependent Variable	R	F	Sig. (F)
Days	.09	0.97	n.s.
Mileage	.22	5.73	$p < .02$
Turnover	.23	6.27	$p < .01$
Tenure	.12	1.66	n.s.
Incidents	.13	1.81	n.s.

Disparate Impact Analyses

The possibility of disparate impact due to age was investigated using moderated hierarchical regression. For each criterion variable, the interaction of Age and Hire was entered into an equation already containing main effects for Age and Hire. A nonsignificant increase in R^2 due to the interaction term would indicate the absence of disparate impact, while a significant increase would indicate the possibility of disparate impact.

The results of the disparate impact analyses are shown in Table 7. As can be shown in the table, there is no evidence of disparate impact by the behavioral traits for four of the five criterion variables—Days, Mileage, Turnover, and Incidents. This is evident from the non-significant increases in R^2 when the interaction terms (e.g., Days*Hire) are added to the regression equation.

For the fifth variable, Tenure, the possibility of disparate impact is suggested by the significant increase in R^2 when the interaction term is added to the equation. A significant interaction term generally means that the relationship between two variables (e.g., Tenure and Hire) depends on, or is contingent upon, the level of the third variable (e.g., age). That is, the behavioral traits might be more valid for applicants of one age than another.

However, in this particular study, the interaction term is actually a suppressor variable. Suppressor variables can be identified when: a) their presence in a regression equation increases the amount of variance accounted for in the criterion; b) other variables in the equation are positively

correlated with the criterion; but c) have negative regression weights when the suppressor variable is in the equation (Cohen & Cohen, 1983). In this case, both Age and Hire were positively correlated with Tenure but received negative weights in a regression equation containing the interaction.

Suppressor variables are likely whenever multi-colinearity (high intercorrelations among variables) exists. In this case, the correlation between Hire and the interaction term was .94. Suppressor variables increase the variance accounted for in the dependent variable not because they are highly correlated with it, but because they account for—or suppress—irrelevant variance in the independent variable.

Suppressor variables make the interpretation of regression results very difficult to interpret, more so when the suppressor is an interaction term. In this instance, while the significant increase for the interaction term regressed on Tenure suggests that disparate impact is possible, the fact that the interaction term is a suppressor makes this conclusion more problematic.

Accordingly, the possibility of disparate impact on Tenure was also investigated by splitting the sample into incumbents above and below the age of 40, and determining whether scores on the Hire variable differed by group. No differences were found. This, coupled with no evidence of disparate impact on other dependent variables suggests that the significant interaction for Tenure represents a statistical artifact (due to multi-colinearity and the suppressor variable) than due to disparate impact.

Table 7. Analysis of Disparate Impact with Simulated Hire Scores

Dependent Variable	Overall R	R^2	DR^2	Sig. (DR^2)
Days				
Age	.09	.01	.01	n.s.
Hire	.16	.03	.02	n.s.
Age × Hire	.18	.03	.00	n.s.
Mileage				
Age	.01	.00	.00	n.s.
Hire	.29	.09	.09	$p < .001$
Age × Hire	.33	.11	.02	n.s.
Turnover				
Age	.07	.01	.01	n.s.
Hire	.24	.06	.05	$p < .02$
Age × Hire	.24	.06	.00	n.s.
Tenure				
Age	.20	.04	.04	$p < .02$
Hire	.28	.08	.04	$p < .03$
Age × Hire	.35	.12	.04	$p < .02$
Incidents				
Age	.18	.03	.03	n.s.
Hire	.22	.05	.02	n.s.
Age × Hire	.25	.06	.01	n.s.

Discussion

Summary

A series of analyses were performed to investigate the validity and disparate impact of the PDP ProScan® and JobScan®. A variable called Hire was created to simulate PDP® hiring recommendations. This variable was regressed onto five different variables to investigate its validity for predicting job success. A moderated hierarchical regression was also conducted to investigate the potential for disparate impact.

As a result of these analyses, it is to be concluded that:

The PDP ProScan® and JobScan® are valid predictors of job success at Fleetline, Inc.

When PDP's testing procedure is used to establish an envelope on each behavioral trait, and candidates are recommended on the basis of those envelopes, the recommendations bear a substantive and significant relationship to average miles driven per day, tenure with Fleetline, and organizational turnover. These results apply whether all primary behavioral traits are used for prediction, only the core traits, or only the energy traits.

Notably, the size of the validity coefficients are well within the range normally found for other behavioral assessment instruments (Schmitt, Gooding, Noe, & Kirsch, 1984). **There is little or no evidence of disparate impact due to age.**

For four criterion variables, analyses showed no evidence at all of disparate impact due to age. Thus, the ProScan® and JobScan® are fair for applicants regardless of age. For Tenure, the results indicate the possibility of disparate impact, but these results may be just as likely to be due to a statistical artifact. More research would be necessary to confirm that disparate impact actually occurred.

Recommendations

Given the results of this investigation, the following recommendations are offered:

1. *The PDP ProScan® and JobScan® may be used as predictors of job performance.* However,
2. *The predictive validity analyses should be repeated for different types of jobs and in additional organizations.* As additional studies are conducted, results can be aggregated, allowing

PDP® to determine an overall validity coefficient. This aggregated value would contain less sampling error than the validity coefficient, would be a more accurate estimate of the population parameter, and would be the best estimate of the validity of the behavioral traits in new locations.

3. *Additional criterion measures should be examined.* The criteria in this study were strongly oriented towards personnel indices—attendance, turnover, etc. Mileage was the only pure **performance** indicator. In future studies, other performance-based measures, such as performance evaluations should be used.

   When measures of infrequent events (such as accidents) are desired, care should be taken to collect data over a sufficient time period (i.e., several years) so that the measured variable is normally distributed. Alternatively, other types of measures may be collected. For example, performance ratings by peers or supervisors may be a legitimate measure of the accident construct.

4. *Additional studies of disparate impact should be conducted to confirm.* These studies would be useful for confirming that the significant interaction for age and test scores on tenure was a statistical artifact. Additional studies may also reveal that the test is fair across additional subgroups as well.

References

Campbell, J.P. (1990). Modeling the performance prediction problem in industrial and organizational psychology. In M.D. Dunnette & L.M. Hough (Eds.), Handbook of Industrial & Organizational Psychology (2nd ed., Vol. 1). Palo Alto, CA: Consulting Psychologists Press.

Cohen, J., & Cohen, P. (1983). Applied multiple regression/correlation for the behavioral sciences (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum.

Rothe, H.F. (1978). Output rates among industrial employees. Journal of Applied Psychology, 63, 40 – 46.

Schmitt, N., Gooding, R.Z., Noe, R.A., & Kirsch, M. (1984). Meta-analysis of validity studies published between 1964 and 1982 and the investigation of study characteristics. Personnel Psychology, 37, 407 – 422.

Appendix A

JobScan

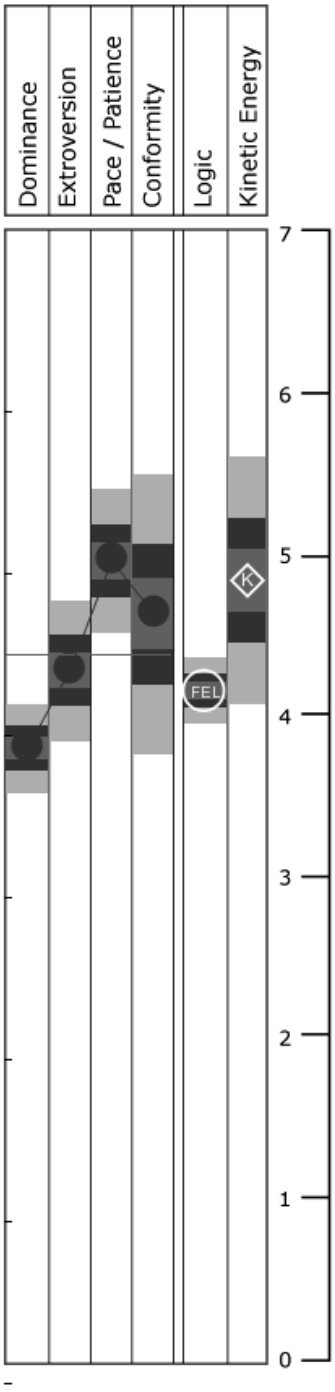
This JobScan Report Is Specially Prepared for:

Miles, Turnover, Tenure

(Survey date: 01/19/11 | Generated on 01/19/11)

By the Offices of:
PDP Training
13710 Struthers Road, Suite 215
Colorado Springs, CO 80921
719-785-7300
(Fax: 1234567890)
kristina.minton@pdpglobal.com
0001-001.20

Job Model Basic



Based upon the job analysis input(s), the **BASIC/NATURAL PROFILE** describes a person who is:

Dependable, steady and efficient. Dedicated to respected programs and people. Sincerely cautious and conscientious, wanting things done well.

Able to do repetitive tasks, usually likes a consistent routine. Makes every move count. Can be uncomfortable if placed under too much unjustified pressure or confrontational environments.

Friendly and well accepted by others. A cooperative and peaceful approach is preferred. Does not want to be taken advantage of.

Job Model profile is based on high performers for the three criteria:

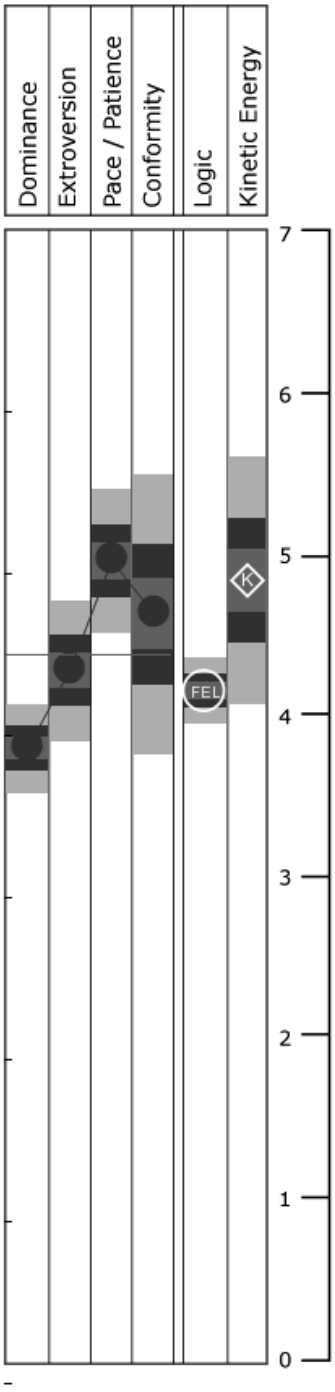
- Miles driven
- Turnover
- Tenure

This Job Model profile is specific only to the Fleetline Driver Position as determined through the Validation Study.

Availability of this Job Model is made for information only.

Usage of this Job Model is not advised for other positions with Fleetline as well as for other organizations, since model profiles will vary from position to position and from organization to organization.

Job Model Basic



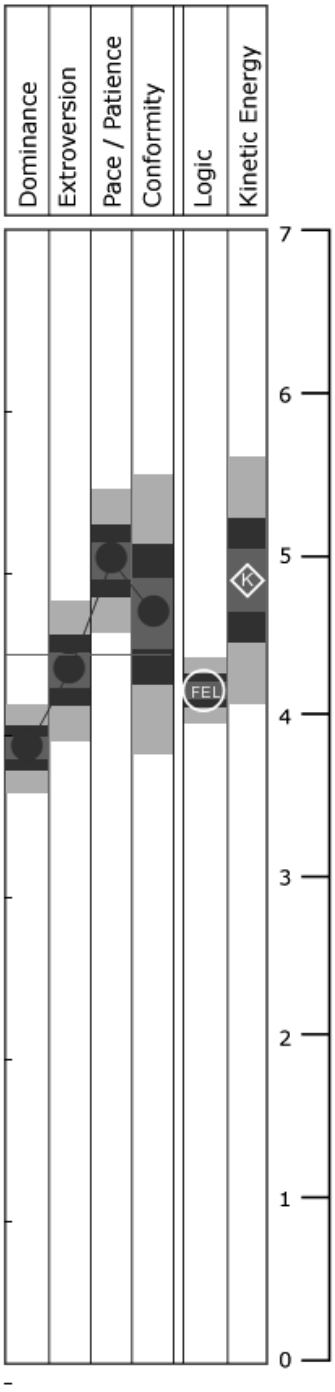
The **PACE** trait, which is predominant, can be described as being in harmony with your environment, patient, steady, warm and cooperative.

The **EXTROVERSION** trait describes a participative, poised, friendly, sincere, congenial and genuine person who can enjoy communicating with others when necessary, but also enjoys private time.

The **CONFORMITY** trait describes a careful, orderly and open-minded person, with a respect for structure. Can either delegate the details or go ahead and complete the project with accuracy and care.

The **DOMINANCE** trait suggests a supportive, collaborative, modest and gentle disposition. Often places a good deal of importance on security and prefer to work with leadership that has a strong sense of direction and purpose.

Job Model Basic



THE POSITION NEEDS THESE UNIQUE TRAIT PAIRS:

PERSUASIVE/SELLER

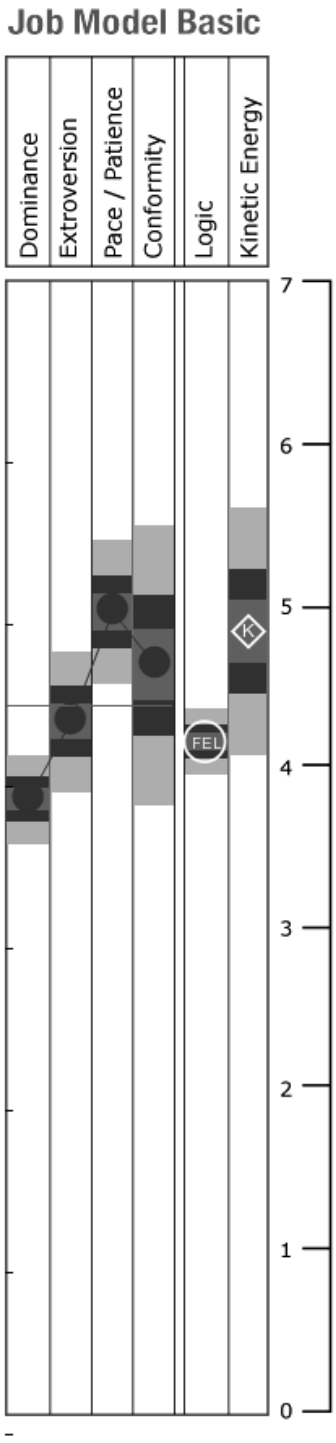
Sells ideas and uses persuasion when accomplishing things through people (Extroversion over Dominance).

DEPENDABLE/PRODUCTIVE

A cooperative disposition. Moves with justifiable pace. Emphasis on steady production flow (High Pace over High Conformity).

CAUTIOUS/REQUIRES PROOF

A cautious show me attitude. Takes role of devil's advocate to avoid wrong actions (High Conformity over Low Extroversion).



LOGIC

This person will most NATURALLY base decisions on:

FEELING

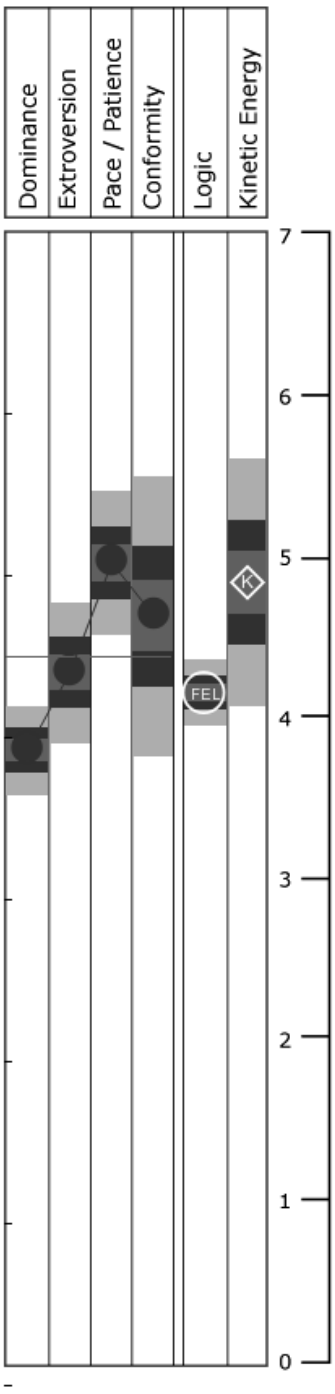
An initial, automatic conclusion based on an inner sense.

Able to make accurate decisions based on innate intuition and trust in a sense of recognized patterns to follow.

Have a sense of what decision to make when in situations involving decisions about new projects and people issues where few hard facts are available.

Feeling style makes valid decisions based on the continual mental recording of information through observations, experiences, reading and listening.

Job Model Basic



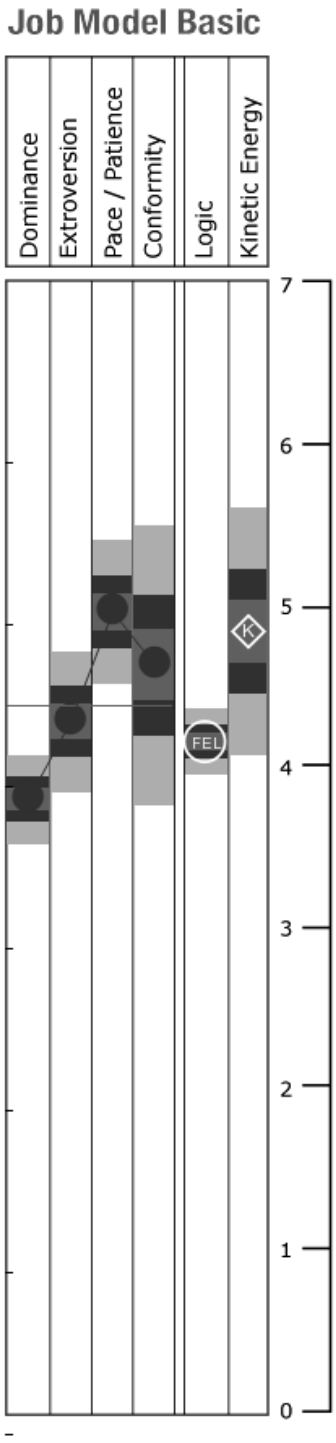
ENERGY STYLES

How individuals approach tasks or accomplish goals. There are three energy styles that people use.

This person's NATURAL or primary style for accomplishing goals is through:

ALLEGIANCE

A follow through, supportive style. Dedicated to completing a predetermined project. Sense of connection to a common purpose.



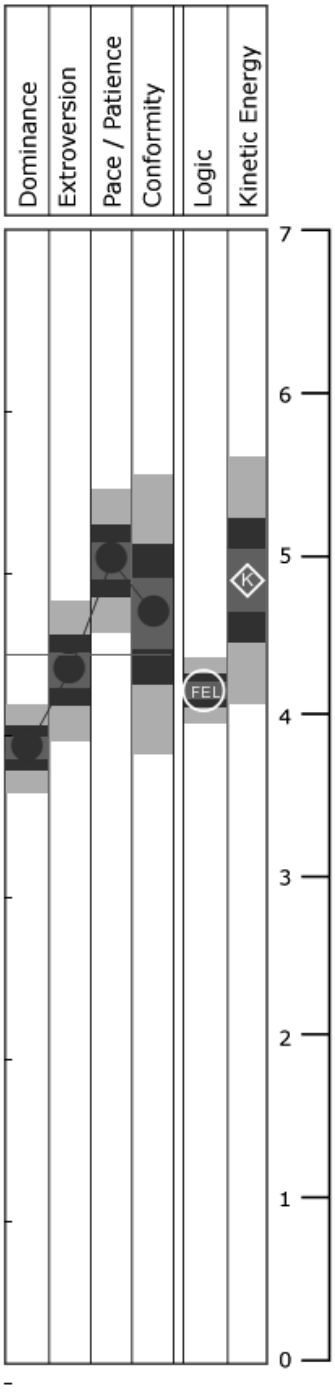
KINETIC ENERGY LEVEL

The KINETIC ENERGY LEVEL for the job needs to be in the:

ACHIEVER ZONE (5)

Significant energy is available to successfully accomplish all tasks and goals. May perceive that there is not enough time in the day, or that priorities of life (job, mate peers, etc.) are unable to utilize the energy that may be available.

Job Model Basic



MANAGEMENT/LEADERSHIP STYLE

CARETAKER/PERSISTENT

Tend to accept pace and tasks set by others, adjust as needed, then push ahead. Provide stabilizing effect through constant observation and consistent behavior. Prefer to obtain positions by earning them.

COMMUNICATION STYLE

CASUAL/CAREFUL

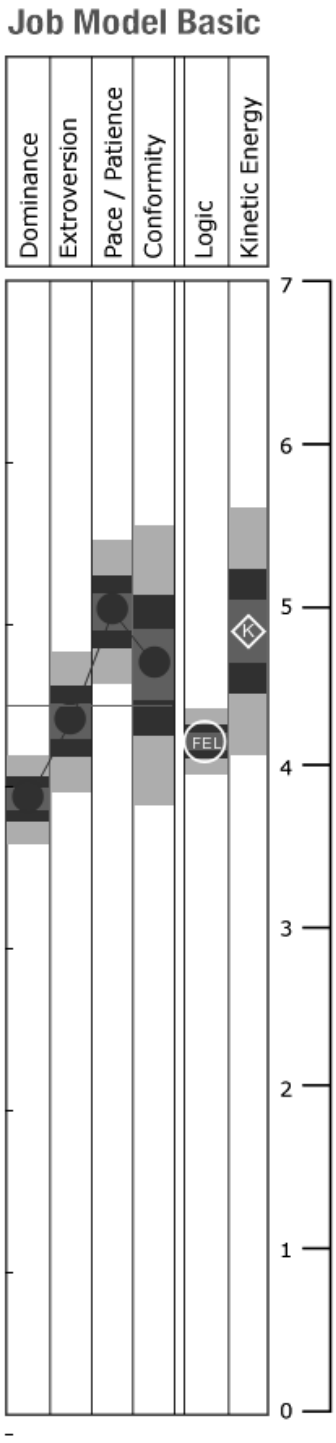
Tend to be warm, friendly and willing to listen. When in charge of people, will use a mild persuasive style. Prefer to have harmonious and non-chaotic surroundings with time to get comfortable in a new environment.

BACK-UP STYLE

The immediate supervisor should be aware of the possibility of this behavior occurring.

AVOID CONFLICT

When all else fails, may avoid conflict and give in so as to not make a scene, but have a get you later attitude. May not actually do this, but will at least feel like it.



NEGATIVE ENVIRONMENTS

Unjustified or erratic pressure, confrontation can be detrimental to this individual.

HOW TO ADVERTISE

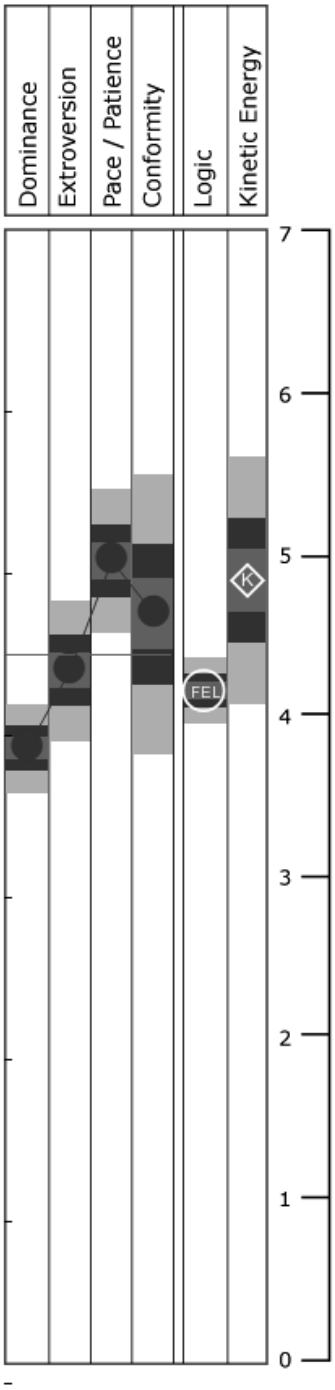
When seeking a person with this profile, use the terms and phrases below to attract the largest percentage of job-matching applicants.

_____

___ Cooperation
___ Stability
___ Harmony
___ Security
___ Praise
___ Structure
___ Predictable Environment
___ Time to Adjust to Change
___ Appropriate Benefits
___ Forewarning of Changes
___ Happiness
___ Limited Emotional Exposure
___ Respect
___ Time to Think
___ Freedom to Think Creatively
___ Protection
___ Direction
___ Strong Leadership
___ Peace
___ Standard Operating Systems
___ Justifiable Changes
___ Conservative/Sound Actions
___ Accuracy/Exact Instructions
___ Privacy

_____

Job Model Basic



MANAGEMENT INSIGHT

The ProScan report descriptions have emphasized the basic, natural characteristics, strengths, and positive qualities of the individual. It is important that a manager recognize these strengths and use them to develop the individual to their fullest potential.

The highest trait has a significant influence on a person's actions and ways of doing things. However, there is a possibility that this high trait can also become negative when MISUSED.

Be prepared to recognize these unproductive behaviors:
Extreme behaviors in stressful environments/situations. (See BACK-UP STYLE)
Negative use of strength. (Aspects of a trait used in damaging ways)
Actions based on a faulty value system. (Dishonest, unethical, irresponsible ways)

It is helpful for managers to learn how to minimize unacceptable responses and actions through effective communication. **Unless the person with a high trait of PACE has learned to avoid reacting to situation in unproductive ways, the following responses might be observed at times of pressure:**

Defer to authority for direction and protection.

Find strength and comfort in numbers and organized groups.

Wait for external pressures to climb organizationally or socially.

Desire a strong person to provide consistency, stability and frequent assurance.

Cautious starters with minimum outward emotion.

Insist on knowing expectations before a project is begun.

Expect routine and predictable environments; therefore, exhibit reluctance to change.

Count on being treated fairly by everyone.

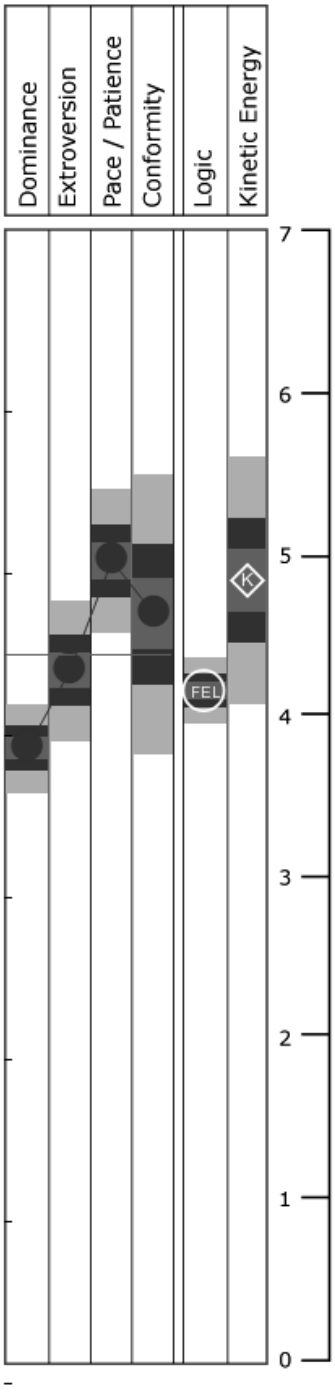
Strong need for a casual, informal environment and resist what they consider to be pretentious surroundings.

Avoid confrontation and might 'go along to get along.'

Find it difficult to assert rights.

Remember the particulars of injustices and often bring them up later.

Job Model Basic



A separate consideration for this individual is a probable willingness to let others take the lead, letting them make the majority, if not all, of the decisions. Desires a non-confrontational, peaceful coexistence.

IN CONCLUSION: If you need assistance with this Job Model, please contact your PDP Representative. Refer to the last page of this report for contact information.

Curriculum Vitae

Kurt Kraiger, Ph.D. **December, 1992**

Education

Institution	Date	Degree	Major
University of Cincinnati	1975-1979	B.A.	Psychology
The Ohio State University	1979-1982	M.A.	Psychology
The Ohio State University	1982-1983	Ph.D.	Psychology

Professional Experience

1992 – Present	Director, Center for Applied Psychology, University of Colorado at Denver
1992 – Present	Senior Research Associate, International Learning Systems, Golden, CO
1991 – Present	Associate Professor of Psychology, University of Colorado at Denver
1983 – 1991	Assistant Professor of Psychology, University of Colorado at Denver
1989 – 1990	Visiting Assistant Professor of Organizational Behavior, University of California – Berkeley
1989 – 1990	Senior Consultant, Human Resources Solutions, Orinda CA
1981 – 1983	Teaching Assistant, Department of Psychology, The Ohio State University
1980 – 1983	Personnel Analyst, City of Columbus, OH

Professional Service

Editor, The Industrial-Organizational Psychologist (1992)

Editor, Training Research Journal (1992)

Associate Editor, The Industrial-Organizational Psychologist (1990 – 1992)

Associate Editor, Careers Division Newsletter, Academy of Management (1989 – 1990)

Reviewer (1985 – 1992):

Journal of Applied Psychology

Personnel Psychology

Organizational Behavior & Human Decision Processes

Motivation and Emotion

Basic and Applied Social Psychology

International Journal of Applied Psychology

Division 14 Program Committee, American Psychological Association (1988 – 1989)

Division 14 Program Committee, Society for I/O Psychology (1987 – 1991)

Division 14 Program Committee, Planning Sub-Committee, Society for I/O Psychology (1988, 1991)

Division 14 Training and Education Committee, Society for I/O Psychology (1991 – 1992)

Professional Organizations

Academy of Management

American Psychological Society

Society for Industrial and Organizational Psychology

Disparate Impact, The ProScan® and other Hiring Practices

Discrimination in the workplace can be costly to business owners. Disparate Impact (adverse impact) occurs when companies use tests whose outcomes discriminate against certain populations such as women or racial or religious minorities.

The ProScan was found not to favor one population over another when applied in a group setting. Indeed, the ProScan was found by the independent research facility to be nondiscriminatory as a valid and reliable employment testing tool. Clients can rely on the ProScan as an objective measure as part of their hiring practices, and its use does not contribute to disparate impact in their organization. Testing applicants prior to offering them a job is one way for employers to incorporate objectivity into their hiring process.

Pre-employment testing can provide valuable information to aid in the hiring process, but will prove risky if employers do not take into account certain other legal requirements.

Hiring managers must be aware of their overall hiring policies and practices to assist them in remaining compliant with applicable federal and state employment regulations. For example, a company could use the ProScan as an objective tool and yet, through the use of illegal interview questions, create disparate impact within their organizations.

Employer policies and practices that have a disproportionate disparate impact on the employment opportunities of any race, sex or ethnic group can diminish the positive effects of the ProScan's application to a company's cost-savings or bottom line!

All hiring decisions must be based on managers hiring the most qualified applicant for the job regardless of their race, sex, disability or age. Pre-employment information managers typically rely upon when making a hiring decision tend to be:

- Applicant's work history
- Job interviews
- Work sample exercise
- Objective tests
- Reference checking

Case law has shown the use of valid and reliable pre-employment tests, such as the ProScan, and conducting work sample exercises to substantiate an applicant's job fit can increase a company's success hiring the right person for the job!

Testing applicants with the ProScan can provide valuable, objective, nondiscriminatory hiring information to managers. When integrated into a manager's hiring practices and policies that also meet federal and state guidelines for nondiscrimination, the ProScan can prove to be a powerful tool towards increasing an organization's hiring success rate without contributing to disparate impact.

Employing objective, nondiscriminatory hiring methods and tests, such as the ProScan, can significantly improve a company's hiring effectiveness which then positively impacts their bottom line!

By: Dr. Linda Rosene, Ph.D.

University of Colorado at Denver

Center for Applied Psychology

Campus Box 173
P.O. Box 173364
Denver, Colorado 80217-3364
Location: 1200 Larimer Street,
Phone: (303) 556-2965 • Fax: (303) 556-3520

February 8, 1994

Bruce M. Hubby, President
Professional Dynametric Programs, Inc. (PDP, Inc.)
400 West Highway 24, Suite 201
Woodland Park, CO 80866

Dear Bruce:

Enclosed you will the report on the disparate impact study conducted under my direction for PDP by the Center for Applied Psychology.

The procedure and analysis of the study was completed following the guidelines and standards of the American Psychological Association, as well as the principles for validation and personnel selection as endorsed by the Society for Industrial and Organizational Psychology.

The sample used for this study was one that closely resembles the pool of applicants who might be tested using the PDP system. The sample allowed analyses of several protected groups (females and non-white minorities) as defined by current statutory law.

The results indicated that members of either protected group did not score significantly lower on the PRO SCAN instrument than other individuals. Thus, the PRO SCAN does not "adversely impact" members of these groups; that is, there is no evidence of disparate impact against members of these groups. Based on the available evidence, the PDP PRO SCAN appears to be a fair personnel selection instrument.

I hope that you are pleased with the results, since they speak well for the measure. As always, I have enjoyed working with you and the PDP staff.

Sincerely,

Kurt Kraiger, Ph.D.
Director, Center for Applied Psychology

Research and Development Division

Professional DynaMetric Programs, Inc.

DISPARATE IMPACT STUDY

of the Professional DynaMetric Programs® (PDP®)
ProScan® Instrument

SUBMITTED BY:
Kurt Kraiger, Ph.D.[1]
Director, Center for Applied Psychology

Ed Rogan
Research Consultant, Center for Applied Psychology

Tom Valaski
Research Consultant, Center for Applied Psychology

University of Colorado at Denver
Denver, CO 80217-3364

February 1994

[1]Kurt Kraiger, Ph.D. Completed Doctorate at The Ohio State University, 1983.

Table of Contents

Disparate Impact Study of the Professional DynaMetric Programs®, Inc. (PDP®) ProScan® Instrument

Executive Summary

In the Fall of 1993, 92 students from the University of Colorado at Denver participated in a study to assess the potential disparate impact of Professional DynaMetric Programs® ProScan® behavioral assessment device used for employment selection. Disparate impact occurs when members of one applicant group have a greater opportunity for employment than members of another applicant group.

The sample included 55 White students and 37 Non-White students with 34 Males and 58 Females. Their responses were then analyzed to determine if there were significant differences in the way Whites versus Non-Whites and Males versus Females scored on the various dimensions of the ProScan® device. Results showed no overall pattern of disparate impact against women or minorities on either side of the PDP® ProScan® form. Females showed significantly lower dominance scores than Males, and Non-Whites showed significantly higher Extroversion scores in the way that they tend to view their environment than Whites. However these effects, in conjunction with the overall pattern of scores, would not be enough to result in disparate impact if the ProScan® instrument was used for selection.

Since the test has indicated no basic difference between genders and ethnic groups, there is no reason to believe that these instruments would discriminate between groups in a hiring situation.

Overview

One of the legal pressures that an organization faces when developing an employee selection system is to avoid "disparate impact." The purpose of this study was to investigate the possibility of disparate impact of the ProScan® behavioral assessment device development by Professional DynaMetric Programs®, Inc. Disparate impact occurs when members of one applicant group have a greater opportunity for employment than a member of another applicant group.

By law, organizations and test publishers are responsible for conducting studies on disparate impact against members of protected applicant groups including:

- Ethnic minorities
- People over 40 years of age
- Physically challenged people
- Religiously affiliated people

Specifically, PDP®, Inc. wanted to know if people from a protected group generally scored differently on the ProScan® instrument than non-protected groups.

The Instrument: ProScan®

ProScan® is a behavioral assessment device developed by PDP®, Inc. and marketed as an employment selection and management development tool to large and small, profit and non-profit organizations. Years of research indicate that people generally tend to fail on the job because of the environment into which they are placed, not due to a lack of skills or competence. ProScan® is a statistical word response stimuli instrument that is valid, accurate, objective and unbiased, and is used to "put the right person in the right job." By doing so, organizations:

- Increase the probability of success of new-hires
- Reduce turnover
- Reduce absenteeism
- Reduce job dissatisfaction.

Center for Applied Psychology

In the fall of 1993, PDP®, Inc. requested the Center for Applied Psychology at the University of Colorado at Denver to direct and conduct a disparate impact study of the PDP® testing system.

The Center for Applied Psychology (CAP) was established in 1985 by the Department of Psychology at the University of Colorado at Denver (UCD) as a vehicle to study, market, and

perform services in the areas of Clinical and Industrial/Organizational Psychology. The Center is currently engaged in a number of activities to promote the goals and assets of the psychology department at UCD as a valuable resource to area businesses.

Method

Sample

Subjects in the study were 92 students from the University of Colorado at Denver (UCD). Subjects were recruited from University classes and completed the ProScan® form.

A deliberate effort was made to build a representative sample of subjects, by locating as many of the protected groups as possible. Given the age and work experience of UCD students, this sample closely resembles the type of applicants who might be hired using PDP's ProScan®. The representativeness of the sample is shown in Table 1.

Table 1. Sample Demographics

Gender	
Male	37%
Female	63%
Race	
African-Americans	5%
Hispanics	21%
Asians	7%
Native Americans	5%
Whites	60%
Other	2%
Age	
Under 40	93%
Over 40	7%

Collection of Data

The ProScan® forms and the demographics information (See Appendix A for a sample of demographics form), were collected in one of two ways:

- Students in three Ethnic Studies classes and one advanced Psychology class were given the ProScan® and demographics forms during class
- Students in introductory Psychology classes were given the ProScan® and demographics form during an arranged experiment session

Procedure

Originally, two methods were outlined to answer the question set forth in this study. The method involved looking at participants' ProScan® scores and comparing them to scores for a particular job "profile." The PDP® system creates job profiles based on ProScan® data and sets "cutoff" scores for applicants. The job profile that the PDP® system creates is a window between high and low "cutoff" scores. A "cutoff" score is a tally on an instrument that is determined to be the highest or lowest acceptable limit for, in this case, job applicants. Candidates who score within this window have been shown to have a higher probability of performing well on the job than those who do not score within the window.

For this study, it was decided that this method would be both a time consuming and costly way to examine potential disparate impact in the ProScan® system. For this method to be effective, the same procedure would have to be performed on every job profile that PDP® has in their possession. In other words, it was concluded that since the potential for disparate impact inherent in the ProScan® instrument should not be situation or job specific, an analysis of the difference between the means, or averages, of protected and non-protected applicant groups' scores could provide the same information. Thus, the second method involved studying the basic response patterns of the groups. If no difference is found at this level, it is assumed that no difference will exist in the job profiles.

Results

Analyses

The statistic used in this analysis was the standard t-test using pooled variance techniques, which looks at the difference between the means of two groups. More sophisticated multi-variate techniques were initially considered, but due to the straight-forward nature of the results these analyses were considered unnecessary and potentially confusing.

For the t-test analysis, a "statistically" significant difference between two groups on a ProScan® dimension would indicate disparate impact within the ProScan® process. The results of this analysis are shown as follows, three comparisons were made: Female vs. Male, White vs. Non-white, and Basic vs. Priority Environments. Basic environment is what PDP® has found to be the most natural behavior of the individual. Priority environment measures the effort to adjust from the Basic style of behavior to an unnatural behavior.

Part 1 of the ProScan® Instrument (Tables 2 – 5)

The first set of analyses involved Part 1 of the ProScan® form, that is, the scores of Dominance, Extroversion, Pace, Conformity and Logic. Results for gender are shown in Table 2 (including Asians in the analysis) and Table 3 (excluding Asians) in Appendix B.

Means for Males and Females on the ProScan® were not significantly different from each other on four of the five assessed dimensions. The same result was obtained for analyses run with and without Asians in the sample. Females did score significantly lower on Dominance than did males ($t=2.01$, $p<.05$ for the full sample, $t=2.11$, $p<.05$ excluding Asians). Of the other four dimensions with Asians, Males scored higher on Extroversion, while Females scored higher on Pace, Conformity and Logic. Without Asians, Males scored higher on Extroversion and Conformity, while Females scored higher on Pace and Logic.

However, these latter differences were not large; this pattern indicates that there is not a trend towards one gender scoring systematically differently than the other on the ProScan®. Given this result, it is unlikely that Females would suffer disparate impact when being tested on the ProScan® in employment settings.

Results for race are shown in Tables 4 (including Asians) and 5 (excluding Asians) in Appendix B. Means for Whites and Non-Whites on the ProScan® were not significantly different from each other on any of the assessed dimensions. The same result was obtained for analyses run with and without Asians in the sample. On all five dimensions, the means for Non-Whites was actually higher than the means for Whites, though these differences were not large. Given these results, it is unlikely that Non-Whites would suffer disparate impact when being tested on the ProScan® in employment settings.

Part 2 of the ProScan® Instrument (Tables 6 – 9)

The second set of analyses involved the data collected on Part 2 of the ProScan® form. These scores are the Dominance, Extroversion, Pace, Conformity and Logic adjustments that an individual is making from their Basic style of behavior to that which is unnatural. Results are shown on Tables 6 through 9 in Appendix B.

No significant differences were detected when comparing on gender on any of the scales. However, comparisons between the White and Non-White sub-samples did reveal one significant mean difference. Non-Whites tended to score higher on the Extroversion scale than Whites ($t=2.72$, $p<.01$ with Asians, $t=3.37$, $p<.01$ without Asians) indicating that Non-Whites view their environment as demanding more Extroversion than they are likely to exhibit. Although a significant difference between Whites and Non-Whites does exist on this scale, no pattern of differences was detected indicating that it is unlikely that disparate impact would result from the usage of this instrument.

Discussion

The purpose of the current study was to investigate the potential presence of statistically significant differences between average responses to the ProScan® form by Non-White versus White and Male versus Female respondents. By utilizing the t-test statistic and comparing average scores for each dimension represented by the ProScan® instrument, there was no overall pattern of results favoring Males or Whites. Of all dimensions tested, only two significant differences were found: Females tended to score lower than their Male counterparts on the Part 1 Dominance dimension

while Non-Whites tended to score higher than their White counterparts on the Part 2 Extroversion dimension of the ProScan® instrument.

The first significant difference indicates that Females tend to see themselves as less Dominant. The second indicates that Non-Whites tend to view their environment as demanding more Extroversion than they are likely to exhibit.

Other than these two dimensions, there was no pattern of results favoring one particular subgroup. Based on these findings, no consistent pattern of disparate impact emerged in this study, indicating that the instrument is generally sound, and disparate impact in the employment setting is unlikely.

Next Steps

While the study results are encouraging, PDP® and other organizations using the ProScan® should continue to investigate the potential for disparate impact of the instrument. It is important to replicate these findings with additional and larger samples (at least 80 per applicant group). Further, the test should be investigated for a broader range of protected groups including specific minority groups such as African Americans, Hispanics, Native Americans, etc. In addition, PDP® could examine the potential disparate impact in a specific employment context. This would involve comparing actual applicant's scores for a particular job with the PDP® profile for that job, and determining whether significant differences exist.

Appendix A

Demographics Questionnaire 1.1

Geographic Locations:

Current State of Residence: _____

Home State of Residence: _____

Education Level: Please check the highest level of education that you have achieved.

Ph.D., MD., Ed.D., LL.D., etc. _____

M.A., M.S.W., etc. _____

BS., BA., etc. _____

Associates Degree _____

Some College _____

High School Diploma _____

G.E.D. _____

No High School Diploma _____

Gender: Please check one.

Male _____

Female _____

Age: _____ years

Ethnic Identification: Please check one.

African-American _____

Hispanic _____

Asian _____

Native American _____

Inter-Racial _____

White _____

Other: _____

Appendix B

Table 2. Part 1 Comparison of Gender with Asians: Males vs. Females

	Male (n=34)		Female (n=58)			
	M	Std.	M	Std.	t	Sig. (t)
Dominance	403.35	124.08	344.66	141.65	2.01	$p < .05$
Extroversion	383.94	146.64	366.57	162.83	0.51	n.s.
Pace	348.65	127.24	393.17	124.51	-1.64	n.s.
Conformity	349.32	127.57	351.71	115.82	-0.09	n.s.
Logic	264.53	99.67	275.31	118.33	-0.45	n.s.

Table 3. Part 1 Comparison of Gender without Asians: Males vs. Females

	Male (n=32)		Female (n=54)			
	M	Std.	M	Std.	t	Sig. (t)
Dominance	415.56	117.35	352.76	142.22	2.11	$p < .05$
Extroversion	388.03	147.68	372.52	166.15	0.44	n.s.
Pace	354.84	124.99	391.22	126.83	-1.29	n.s.
Conformity	353.22	126.69	347.41	117.36	0.21	n.s.
Logic	268.53	97.99	276.83	121.04	-0.33	n.s.

Table 4. Part 1 Comparison of Ethnic with Asians: Whites vs. Non-Whites

	Male (n=37)		Female (n=55)			
	M	Std.	M	Std.	t	Sig. (t)
Dominance	378.16	136.66	358.40	139.08	0.67	n.s.
Extroversion	396.46	144.45	357.20	163.42	1.18	n.s.
Pace	398.54	142.76	362.04	113.63	1.36	n.s.
Conformity	373.27	126.76	335.73	113.21	1.49	n.s.
Logic	280.92	110.61	264.87	112.41	0.68	n.s.

Table 5. Part 1 Comparison of Ethnic without Asians: Whites vs. Non-Whites

	Male (n=31)		Female (n=55)			
	M	Std.	M	Std.	t	Sig. (t)
Dominance	407.58	127.23	358.40	139.08	1.62	n.s.
Extroversion	415.71	145.37	357.20	163.42	1.66	n.s.
Pace	405.45	144.78	362.04	113.63	1.54	n.s.
Conformity	374.13	129.98	335.73	113.21	1.43	n.s.
Logic	289.48	112.71	264.87	112.41	0.97	n.s.

Table 6. Part 2 Comparison of Gender with Asians: Males vs. Females

	Male (n=34)		Female (n=58)			
	M	Std.	M	Std.	t	Sig. (t)
Dominance	390.71	133.22	341.79	134.30	1.69	n.s.
Extroversion	342.03	146.93	337.00	140.22	0.16	n.s.
Pace	347.88	151.48	402.02	113.24	-1.95	n.s.
Conformity	312.29	144.25	357.45	122.94	-1.59	n.s.
Logic	335.91	142.04	346.12	125.20	-0.36	n.s.

Table 7. Part 2 Comparison of Gender without Asians: Males vs. Females

	Male (n=32)		Female (n=54)			
	M	Std.	M	Std.	t	Sig. (t)
Dominance	402.91	126.60	347.70	136.12	1.86	n.s.
Extroversion	350.81	146.84	339.78	142.08	0.34	n.s.
Pace	351.94	152.29	405.28	111.32	-1.87	n.s.
Conformity	316.22	145.52	362.93	119.48	-1.61	n.s.
Logic	345.22	141.08	349.26	127.92	-0.14	n.s.

Table 8. Part 2 Comparison of Ethnic with Asians: Whites vs. Non-Whites

	Male (n=37)		Female (n=55)			
	M	Std.	M	Std.	t	Sig. (t)
Dominance	373.19	120.84	350.91	144.56	0.77	n.s.
Extroversion	386.24	127.06	306.98	143.60	2.72	$p < .01$
Pace	404.97	127.69	366.56	131.33	1.39	n.s.
Conformity	351.12	128.55	333.80	135.42	0.61	n.s.
Logic	358.62	123.08	331.40	136.07	0.98	n.s.

Table 9. h 2 Comparison of Ethnic without Asians: Whites vs. Non-Whites

	Male (n=31)		Female (n=55)			
	M	Std.	M	Std.	t	Sig. (t)
Dominance	399.00	110.44	350.91	144.56	1.61	n.s.
Extroversion	409.35	118.24	306.98	143.60	3.37	$p < .01$
Pace	418.90	122.11	366.56	131.33	1.82	n.s.
Conformity	366.39	121.87	333.80	135.42	1.11	n.s.
Logic	376.77	121.65	331.40	136.07	1.54	n.s.

Curriculum Vitae

Kurt Kraiger, Ph.D. **December, 1992**

Education

Institution	Date	Degree	Major
University of Cincinnati	1975-1979	B.A.	Psychology
The Ohio State University	1979-1982	M.A.	Psychology
The Ohio State University	1982-1983	Ph.D.	Psychology

Professional Experience

1992 – Present	Director, Center for Applied Psychology, University of Colorado at Denver
1992 – Present	Senior Research Associate, International Learning Systems, Golden, CO
1991 – Present	Associate Professor of Psychology, University of Colorado at Denver
1983 – 1991	Assistant Professor of Psychology, University of Colorado at Denver
1989 – 1990	Visiting Assistant Professor of Organizational Behavior, University of California – Berkeley
1989 – 1990	Senior Consultant, Human Resources Solutions, Orinda CA
1981 – 1983	Teaching Assistant, Department of Psychology, The Ohio State University
1980 – 1983	Personnel Analyst, City of Columbus, OH

Professional Service

Editor, The Industrial-Organizational Psychologist (1992)

Editor, Training Research Journal (1992)

Associate Editor, The Industrial-Organizational Psychologist (1990 – 1992)

Associate Editor, Careers Division Newsletter, Academy of Management (1989 – 1990)

Reviewer (1985 – 1992):

Journal of Applied Psychology

Personnel Psychology

Organizational Behavior & Human Decision Processes

Motivation and Emotion

Basic and Applied Social Psychology

International Journal of Applied Psychology

Division 14 Program Committee, American Psychological Association (1988 – 1989)

Division 14 Program Committee, Society for I/O Psychology (1987 – 1991)

Division 14 Program Committee, Planning Sub-Committee, Society for I/O Psychology (1988, 1991)

Division 14 Training and Education Committee, Society for I/O Psychology (1991 – 1992)

Professional Organizations

Academy of Management

American Psychological Society

Society for Industrial and Organizational Psychology

PDP Research and Development Division
Professional DynaMetric Programs, Inc.

Guidelines for Conducting Validation Studies in Organizations

REPORT PREPARED BY:
Kurt Kraiger, Ph.D.[1]
Director, Center for Applied Psychology
University of Colorado at Denver
Denver, CO 80217-3364
June 1995

[1]Kurt Kraiger, Ph.D. Completed Doctorate at The Ohio State University, 1983.

Table of Contents

Guidelines for Conducting Validation Studies in Organizations

The purpose of this report is to present guidelines and technical requirements for conducting validation studies of the PDP ProScan® and JobScan® for use as a selection tool in organizations. Much of the report is drawn from the Principles for the Validation and Use of Personnel Selection Procedures (Society for Industrial-Organizational Psychology, 1987), as well as the author's knowledge of best practices and emerging constitutional and case law. The guidelines and technical requirements should be followed as closely as possible whenever the ProScan® and/or JobScan® are being used for the first time in organizations.

It should be noted that what is considered acceptable practices for validation research has been gradually refined over the years. In addition, the courts historically have been inconsistent in their expectations or requirements for validation research. Consequently, there is no one correct method of conducting a validation study. Moreover, it is impossible from a legal perspective to specify how many guidelines must be followed, or which are the most critical, in deciding whether a validation study is acceptable. Accordingly, the onus is on the researcher to conduct the best possible validation study, given resources, circumstances, etc., and let the "legal chips" fly where they may.

This report is organized as follows:

Section 1.0 presents a discussion of factors in choosing a validation strategy.

Section 2.0 provides specific guidelines for conducting one recommended approach, the criterion-related validity strategy.

Section 3.0 provides a general overview of a second recommended approach, validity generalization.

Section 4.0 provide guidelines for reporting the results of a validation study.

1.0 Choice of a Validation Design

Validation studies are conducted to establish that a test is valid for its intended purpose. Validity means that the tests measure the intended construct (e.g., Dominance or Extroversion) or that it successfully accomplishes an intended use (e.g., predicting subsequent success on the

job). There are four ways to establish the validity of a test for use as a selection instrument in organizations:

- Construct validation strategies
- Criterion-related validation strategies
- Content-oriented validation strategies
- Validity generalization

For the reasons detailed below, it is recommended that for the immediate future, PDP focus on criterion-related validity strategies for its ProScan® and JobScan®. As positive findings are accumulated over multiple studies, a validity generalization approach may be adopted. In the subsequent paragraphs reasons are offered for not recommending the other two validity strategies. Following those explanations, guidelines for conducting criterion-related validity studies, and an introduction to validity generalization studies are provided.

1.1 Construct Validation Strategies

Construct-oriented approaches are considered the ultimate validation strategy, but place a huge burden on the sponsoring organization.

Construct-oriented approaches require the researcher to specify a nomological network—a system of interrelated hypotheses, laws, propositions, etc. about how traits of the test are related to each other and other variables (Cronbach & Meehl, 1955). The network is then evaluated by accumulating evidence from multiple empirical studies. Because of the systematic and time-consuming nature of construct-oriented validation strategies, few organizations have ever attempted to establish the validity of a selection test through a construct-oriented approach.

1.2 Content-Oriented Validation Strategies

A content validation strategy requires the researcher to show a logical, or judgment-based, relationship between characteristics measured by a test and requirements of the job. For example, given the primary behavioral traits measured by the PDP ProScan® (Dominance, Extroversion, Patience, and Conformity), a content validity strategy might require a job analysis for the position to

be tested, followed by ratings by human resource experts that those same behavioral traits are critical to job performance.

There are three reasons why a content validation strategy is not recommended for PDP:

1. The approach would require some form of job analysis in every organization in which the PDP measures would be used; this requirement may not be feasible.
2. While content validity evidence alone has been acceptable in some discrimination suits, generally the courts have preferred criterion-related strategies over content-oriented strategies in establishing the validity of selection tests.
3. Content-oriented strategies do not enable researchers to accumulate positive findings over studies; that is, with the use of this approach, a validation study would have to be conducted each time the ProScan® is applied to a new job or new organization. In contrast, the criterion-related approach enables researchers to aggregate findings over studies, and lessens the need for future empirical research.

Because of the weaknesses of the construct-oriented and content-oriented approaches, it is recommended that PDP pursue a criterion-related validation approach in the future.

2.0 Guidelines for Conducting Criterion-Related Validity Studies

Preliminary Concepts

A criterion-related validity study requires the researcher to establish an empirical relation between scores on a test (e.g., ProScan® dimension scores), and scores on a criterion, or measure of job performance. Typically, this relationship is expressed as a correlation (between test scores and criterion performance). Criterion-related validity studies are intuitively appealing since they demonstrate directly whether a selection test works as intended; that is, such studies investigate how well a test predicts who will be good performers on the job. There are two basic criterion-related validity designs. In a concurrent validity design, the selection test is administered to current incumbents at the same time job performance is measured. In a predictive validity design, the selection test is administered to applicants, and job performance is measured at some point later in time. Obviously, the predictive validity design is preferable, since it mirrors how the selection

test is used in practice. However, for a variety of reasons, predictive validity designs are difficult to conduct. Fortunately, courts have generally preferred predictive designs, but have accepted either.

It is recommended that predictive designs be used if feasible; however, either a predictive or concurrent design are acceptable in a legal challenge of the test.

The following are the steps for conducting a criterion-related validity study. In these, the terms "selection test" and "predictor" refer to the PDP ProScan®.

2.1 Conduct a Job Analysis

Prior to any validation design, there should be some form of job analysis, a systematic (i.e., research-based) examination of the job and the context in which it is performed.

The job analysis should describe the job in terms of critical tasks and/or behaviors (e.g., the JobScan®).

The results of the job analysis should be logically or empirically related to selection of the test items or criterion instrument Example: For a validation study of the use of the PDP ProScan® for selecting insurance agents, interviews with key subject matter experts identify total calls per week, presentations per month, and total monthly sales as important factors in agents' success, and measures of these variables are selected as criterion variables.

2.2 Develop Criterion Variables

As noted above, criterion variables are measures of job performance, or indicators of success for the job in question. Supervisory performance ratings, total sales, number of accidents, or job tenure are examples of criterion measures. Criterion variables may be selected from existing measures kept by the organization, or developed specifically for the criterion-related validity design. Criterion variables should demonstrate as many of the following characteristics as possible:

Criteria should represent important job behaviors or work outputs as indicated by the job analysis.

There should be adequate safeguards to reduce the possibility of bias or criterion contamination (e.g., supervisors giving higher ratings to well-liked subordinates, or accident rates varying by shift).

If multiple criteria are combined into a composite, there should be a rationale decision rule for their combination.

The variables should show adequate reliability Example: For a validation study involving truck drivers, job tenure, accidents, and miles driven per day were identified by management as relevant indicators of driver success.

2.3 Select a Sample

A relevant, adequate-sized sample should be identified for data collection. The sample should demonstrate the following characteristics:

The sample should resemble the applicant population in terms of demographic distributions (age, sex, race), experience and ability levels; thus, a concurrent validity study performed on older, more experienced workers may not be appropriate.

The sample should be large enough to provide adequate statistical power for showing that the test predicts performance; as a general rule of thumb, the sample size should be 10 to 20 times the sum of the number of predictor variables (e.g., dimensions on the ProScan®) plus the number of criterion variables in any one analysis.

If data from separate samples are combined, there should be logical or empirical evidence that the jobs and workers are similar on the variables that research has shown to affect validity.

2.4 Collect Data on Predictor and Criterion Variables

Note that whether predictor data are collected before or at the same time as criterion variables determines whether a predictive or concurrent validation design is employed. Important safeguards for the data collection phase include:

Consistent procedures for the administration and scoring of predictor variables should be applied to all subjects in the sample (e.g., it may not be possible to combine data from persons taking the test as a selection screen and from persons taking the same test as a vocational guidance tool).

If criterion variables are collected for this study, it is appropriate (and advantageous) to

inform raters that the data are being collected for research purposes only. It is not appropriate to use criterion data collected before the predictors were administered.

Raters providing criterion judgments should have no knowledge of subjects' performance on the predictor tests. Example: The PDP ProScan® was administered one year ago to a sample of applicants for managerial positions. A rating form eliciting judgments of managerial performance are given to the supervisors of those promoted to manager; supervisors are unaware of the managers' test scores, and are told their ratings will not be seen by the organization, but will be used only for purposes of the validation study.

2.5 Analyze the Data

Data analysis is conducted to estimate the magnitude and significance of the predictor-criterion relationship, to rule out extraneous explanations, and to investigate the possibility of disparate impact. Analyses should include:

Calculation of a "validity coefficient": a correlation coefficient or multiple regression coefficient, indicating the magnitude of the relationship between the predictor variable(s) and criterion variable(s).

Separate correlation/regression analyses for each unique criterion variable, or a canonical correlation between predictors and criterion variables analyzed as a set or a single correlation/regression analyses with a single composite of criterion variables (provided there is a rationale for their combination—see 2.2 above).

A test of statistical significance for each validity coefficient; i.e., a test that the validity coefficient is statistically different than zero.

Adjustments in the validity coefficient for the effects of range restriction in the predictor and/or criterion unreliability, provided either is known to the researchers (note though that statistical significance is calculated on the uncorrected validity coefficient).

Adverse impact analyses by comparing the selection ratios (number hired/number of applicants) given the recommended cutoff score for each protected group.

Adequate safeguards that the data and analyses are free from keypunching, coding, and

computational errors. Example: A multiple regression analysis is performed by regressing each of the PDP ProScan® behavioral traits on a measure of total sales dollars. The resulting multiple regression coefficient, given the sample size, is tested for statistical significance.

2.6 Conduct a Cross Validation Study

Cross validation refers to a process by which the results of a validity analysis are replicated in a second sample (or "hold-out" sample from the first study).

If only a total predictor score is correlated with criterion performance, than it is sufficient to simply repeat the analyses in a second sample and determine whether similar validities are obtained.

If specific weights are assigned to predictor variables (or, in the case of the ProScan®, specific windows for selection), than those values should be replicated in the cross validation study.

3.0 Guidelines for Conducting a Validity Generalization Study

In several recent lower court decisions, judges have upheld the use of validity generalization studies to document the validity of selection tests. A validity generalization study, or meta-analysis, is a strategy for aggregating results from multiple studies to show the relationship between two variables. In effect, a validity generalization study treats study outcomes like subjects' responses in a typical study. For example, if the ProScan® was used for the same job in three organizations, and produced validity coefficients (with samples sizes in parentheses) of .40 (n=100), .50 (n=200), .30 (n=100), then through validity generalization, the weighted average validity of the test would be [(.40*100)+(.50*200)+(.30*100)]/[100+200+100) or .425.

A complete description of the process for conducting a validity generalization study is beyond the scope of this report. The rudiments of the process are described however, since the method would seem to be one that PDP can apply, given the multiple organizations in which the ProScan® or JobScan® have been used. The basic steps for conducting a validity generalization study are as follows:

3.1 Record Data

For each available study (e.g., a report showing the validity of the test), record as much as possible regarding:

author's or report name

sample size

criterion variables (type, reliability, etc.)

applicant population (demographics, experience, etc.)

statistical analyses (e.g., validity coefficients, variable means and standard deviations)

3.2 Determine Grouping for Analyses

For the predictor variables, it is assumed that all studies to be aggregated used the ProScan® or JobScan®, and these studies can be grouped together. For the criterion variables, studies should be grouped according to broad similarities in the measured constructs (e.g., performance, tenure, safety).

3.3 Aggregate Statistics

Within each grouping of variables, major statistics (e.g., validity coefficients) can be aggregated by computing a weighted average and standard deviation across study results. Results are weighted by study sample size.

The weighted average indicates the best estimate of the population value for the statistic (e.g., the relationship between test scores and job performance).

The weighted standard deviation can be used to compute confidence intervals about the weighted average; the confidence intervals can be used for statistical significance tests on the weighted average.

4.0 Reporting Guidelines

When reporting the results of any validation study, certain guidelines should be followed, both to ensure legal compliance, and to provide sufficient documentation to permit professional review or enable replication. The following is a checklist of information to be provided in a technical report for a validation study.

Documentation—Reports should include the name of the author, date of the study, a job description, and a description of the criterion measures; a name, address, and phone number for a contact person should be provided.

General information about validity—Explanations should be provided for the choice of the validation strategy, how the selection procedure was defined, and how jobs were selected for inclusion in the study.

Sample characteristics—Reports should provide a description of the research sample, including demographic information and ways in which it may differ from the applicant sample.

Criterion measures—Describe what constructs were presumed to be measured by the actual criterion measures; how the data were measured or collected; what the reliability of the measures were; how multiple criteria were combined into a composite; what steps were taken to ensure that criterion measures were fair to members of different protected groups.

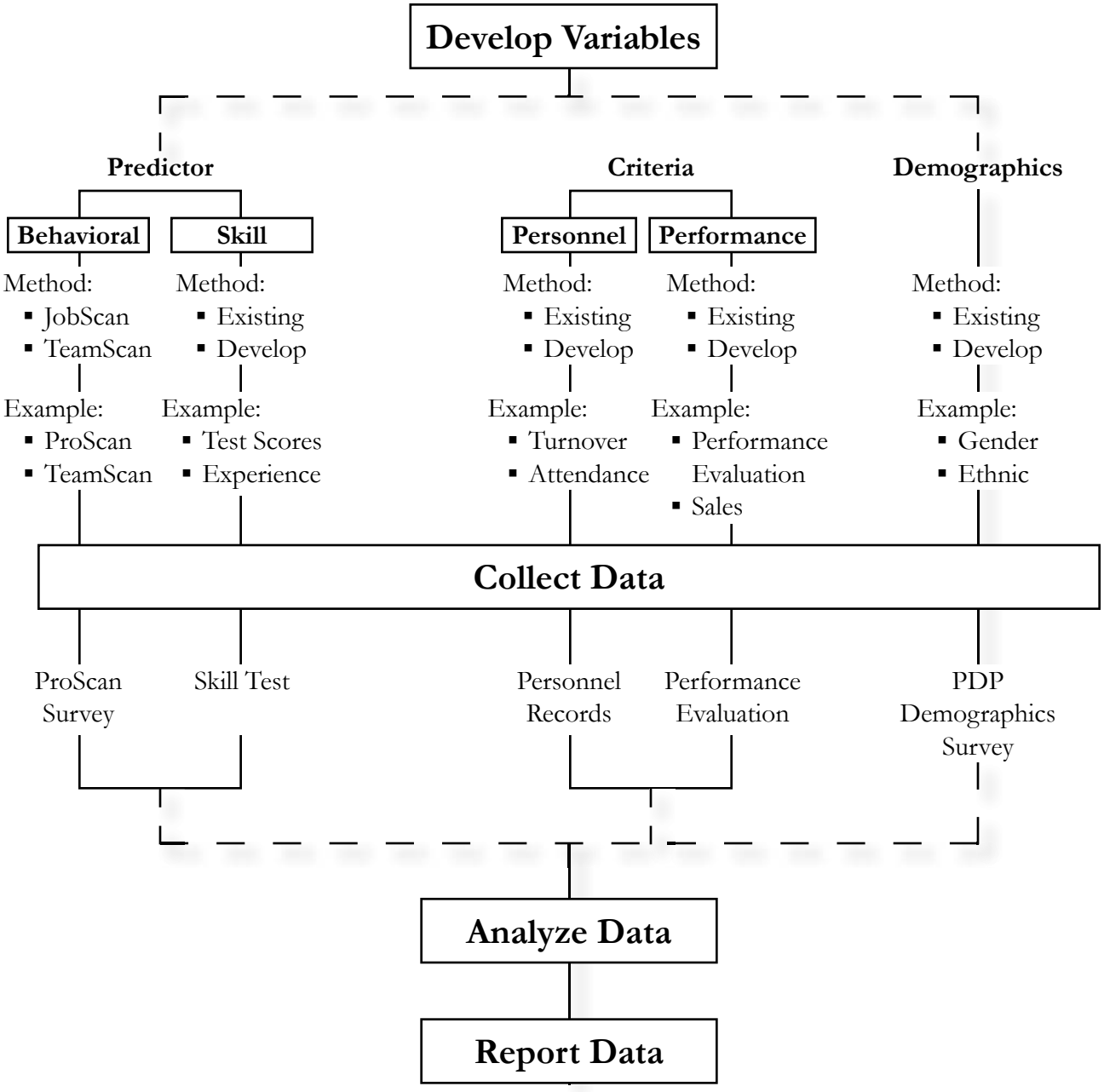
Data analyses and results—Data analysis methods should be described in detail, including any corrections to statistics; all summary data which bear on the conclusions drawn by the researcher should be presented; any findings which may qualify the conclusions of the research should also be presented.

5.0 References

Cronbach, L.J. & Meehl, P.E. (1955). Construct validity in psychological tests. Psychological Bulletin, 52, 281-302.

Society for Industrial and Organizational Psychology (1987). Principles for the validation and use of personnel selection procedures (3rd Ed). College Park, MD: Author.

Validation/Adverse Impact Flow Chart



Apply findings to Predictive Validation

How to Identify Criteria Variables
(reference "Criteria Identification Form")

Step 1: Establishing Goals

Define Goal: Goals can consist of two types: current and future. Current goals are those that relate to the current goals of the organization, typically profit or level of service. Future goals typically relate to personnel and product development.

In this initial stage it is helpful to list all potentially relevant goals, even if they are not included in the final personnel evaluation system.

Weight: After all of the goals have been established, assign a percentage value as to the importance of the goal. The total should be 100%.

Step 2: Establishing Criteria

Identifying: Keeping in mind the goals defined above, identifying criteria can be simplified. Think of what you are keeping track of right now that would identify top performers from low performers. Particular attention should be placed on the goals that have heavy weightings.

Additionally, it is important the criteria be reliable, that is the data can be consistently collected and that it actually measures if the goal is being reached.

Goal Number: In this column, fill in the goal's number (from above) for which this criterion relates. There can be more than one criterion per goal. The purpose of this is to help ensure important goals are adequately represented.

Check Items: Clarify the nature of the criteria, by filling in the appropriate column for each criterion.

Current/Future

Current: In a for-profit organization, maximization of profit is typically the primary goal. Non-profit organizations show more variability, but the primary goal is typically the number of clients served, the units produces, etc.

Future: Many organizations establish goals for the future which may include new product development, reduced production costs, etc.

Objective/Subjective

Objective: Criterion that is based on a numeric value. An example would be the number of units produced per hour. The advantage of such measures is they are independent of the biases of the observer. The disadvantage is they are not always available.

Subjective: Based on the judgments of one or more persons. Even in the case of subjective measures, it is necessary they be rendered into a numeric value for statistical analysis.

Direct/Indirect

Direct: These criteria that directly relate to the relevant goal and are generally preferred because they tend towards obvious validity. For example, units sold would be a direct measure of maximizing profits.

Indirect: Sometimes it is impossible to employ direct measures since they do not or cannot exist. The PDP ProScan® is an example where behavioral traits are revealed by response patterns to words which bear no obvious relevance to the traits. The problem is that, unlike the PDP instrument, indirect measures are frequently not valid.

Weight: Assign weights to each criterion, with the column totalling 100%. When assigning the weights, careful attention should be paid to the value assigned to the corresponding goal. Additionally, attention should be paid to the check columns. Generally, higher weights should be given to criteria that are objective and direct. For many organizations, current goals also receive higher weight values.

This column is also useful in determining if a criteria has fallen into the "ease trap,"* which is revealed when the weight assigned to a criterion is significantly larger than the weight assigned to the corresponding goal.

* "Ease Trap" refers to the fact that many organizations choose criteria not because they are particularly relevant, but because they a convenient to collect.

Criteria Identification Form

Position: _____

Goals	Weight
1.	
2.	
3.	
4.	
5.	
6.	
7.	

Criteria e.g. for an assistant, words typed per minute	Goal Number	Current/ Future	Objective/ Subjective	Direct/ Indirect	Weight

Criteria Collection Data Form

Criterion: Performance, Skills, Personnel

Page: _____

Study: _____

Company: _____

Site: _____ Date: _____

Sample Group: _____ Collector: _____

Name	ID#	Variable: _____	Variable: _____	Variable: _____	Variable: _____	Variable: _____

For writing style clarification, please write 0 1 2 3 4 5 6 7 8 9: _____

Standard Deviations in Testing

Special Note: Technically defined, the ProScan® Survey is a test much the same as the fact that the government has said a job application form is a test. Questions (such as your name, etc.) to be answered by marking on the paper do in fact constitute a test. PDP® cannot recommend too strongly that with your organization you always refer to the instrument as a **SURVEY**, not a test.

Have you re-surveyed individuals because they questioned the PDP results? If you did and differences occurred, this is what can happen in the field of testing of which everyone using PDP needs to be aware. Perhaps an analogy relating to clinical blood pressure testing will best make the point.

Supposition A

You go to your doctor for a regular physical. Among the many tests performed is the customary blood pressure test. The pressure checks out to be 120/80 which is considered very normal. The confirmation of your "feeling good" and the results of the other tests prompt the doctor to say "you're as fit as a fiddle; let's schedule another checkup in 12 months."

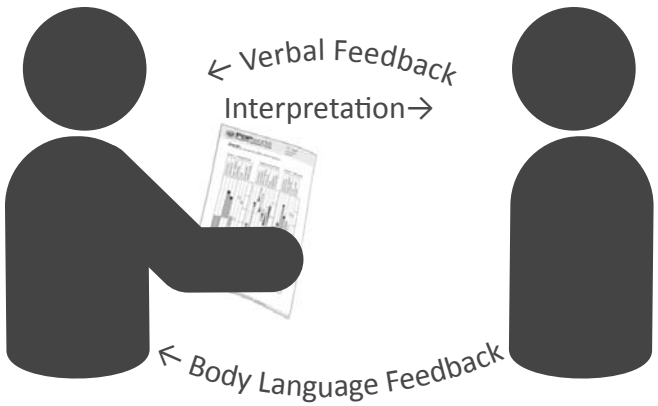
Supposition B

This time, suppose you have been under considerable distress. After going through the same routine, the blood pressure checks out to be 180/60 which is considered very high. The doctor asks some probing questions, looks at the results of the other tests, and concludes that you need to come back in about two weeks for another blood pressure test. In two weeks the stresses of life have eased considerable and the results are 110/70 which is indeed even below the normal range. The concerned doctor suggests one more visit in two weeks just to be safe. On the third visit the results are a bit higher (118/84) but well within the normal range and the doctor says, "Well, I think we have a good picture of this blood pressure now, but let's check it again in 6 months."

How does this fundamental testing analogy pertain to the ProScan Survey?

Just as the doctor confirmed the findings, PDP recommends certified Administrators confirm (verify) the information with the person surveyed. Never form final conclusions in a vacuum without verifying the information with the person.

The Validation Loop



For ProScan, the first administration almost always measures very close to the mean of a specific trait. Therefore, if verification with the person is strong, the information can be useful for at least 6 to 9 months—just like the results the doctor used in Supposition A.

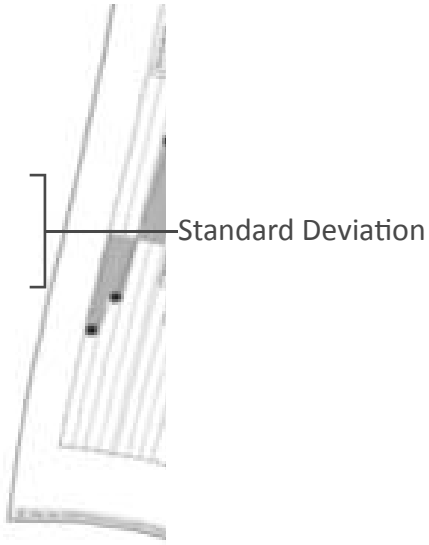
On the other hand, if questions were raised from the ProScan results, you should explore such things as:

1. Has the person been through something traumatic recently?
2. Was it a defensive reaction?
3. Did they follow the survey instructions on Part 2 as well as on Part 1?
4. Was the person trying to second guess the survey?

Upon satisfying these points as best you can, it may be advisable to re-survey. PDP recommends 5 to 10 day intervals between surveys and no more than 4 re-surveys (total 5) in a given series. Next, use JobScan® to calculate a JobModel profile (median) with all of the administrations of surveys for that person. Then, print the JobModel and review the envelopes. What happens is illustrated in the Calculate Median illustration. This is known in tests and measurements as "standard deviation."

Calculate Median: Enveloping

Test Sequence	Blood Pressure	Trait Intensity (Extroversion)
1	180/60	612
2	110/70	550
3	118/84	579
Total Standard Deviation with a Mean of:	136/72	580



Bear in mind that some people are often inconsistent or that some really don't know themselves. This may be what they are compelled, through the stimuli in the survey, to tell you. The ProScan instrument, having been normed in the "Normal" segment of society, is not designed to detect any abnormalities. The above statements are in no way to imply any conditions of abnormality. There are specifically designed tools for pathological purposes available which are in the hands of professional clinicians for those purposes.

If you are careful and constructive in following the recommended survey administration procedures (Ref. Survey Administration), you will certainly minimize the need to re-survey frequently. A survey every 9 – 12 months is important, as conditions change more and more and are evident statistically.

Understanding the PDP® ProScan® Analysis

When conducting a feedback or looking at an individual's *Data Sheet*, observe the "total picture." An important part of the "total picture" is the readership level and stage of life the individual you are observing. It is also important how, where and when the individual to whom you are giving a feedback was raised. A great part of the stress and BASIC profile interpretation will draw upon these early experiences. Refer to Morris Massey's work on establishing value in *The People Puzzle* for additional information.

Trait Development

1. Non-reader (generally ages 0 – 8)
   At this age level, ProScan as a surveying tool is not really useful because the child does not have sufficient understanding of language to be able to respond to ProScan words accurately. However, this is an important age bracket in determining which behavioral profile a child will develop. Over 90% of trait conditioning is accomplished during these years. The primary influence in this conditioning is usually the mother. Secondary influences are the father, family members and peers.
2. Reader—Approximate age brackets for analyst awareness of the flexibility of traits according to general age groups:
   a. Up to age 18—Conditioning Period. Highly susceptible to others' influence. Very flexible ProScan profiles. Most reliable traits are those in the BASIC profile, which reflect what is tending to lock in, but is still somewhat subject to change.
   b. Age 19 to 28—Maturation Period. During this age span, there is a firming up of traits. However, this period is flexible to change.
   c. Age 29 to 38—Solidification Period. During these years, similar reaction to stimuli becomes quite fixed. In this age bracket, a behavioral profile is generally changed only by a significant emotional event.
   d. Age 39 to 42—Re-evaluation Period.
   e. Age 43 to 62—Fixed Period. During these years behavioral traits become strongly ingrained. The behavioral profile of an individual in this age bracket will be affected only by a significant emotional event (see Note).
   f. Age 63 and older—Permanent or "Cast in Bronze" Period. Individuals in this age bracket will rarely experience any change in their behavioral profile, and then only with a strong significant emotional event (see Note).

Note: Ref. Massey. A "significant emotional event" can happen to anyone of any age (not just those 43 and older), which may result in a change of behavior.

Case Study Development of TASK (Energy Styles and Kinetic Energy)

Background

Utilizing years of case studies which observed individuals and their behavior, PDP identified several consistent methods by which individuals approached a task and accomplished a goal. PDP's research experts and behavioral scientists described the findings specifically in terms of the style by which individuals expended energy: "energy styles."

Upon further examination of the case study findings, the measurements were determined to be derivatives of the four cornerstone traits (Dominance, Extroversion, Pace and Conformity) as well as the fifth measurement of Logic (decision making style).

Calculation of TASK

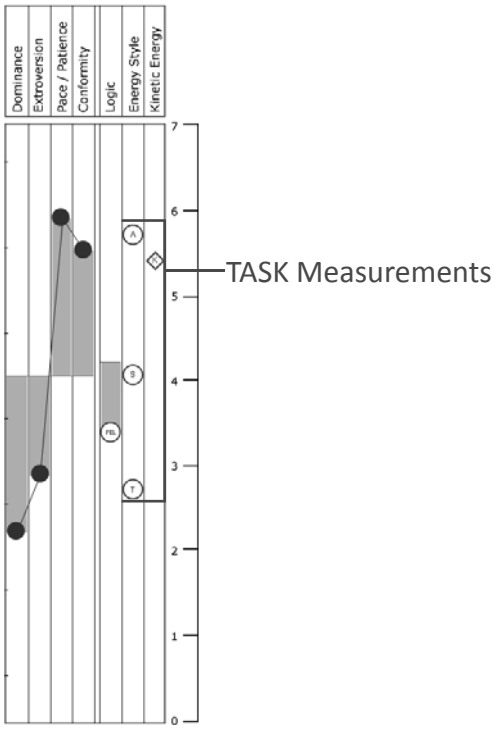
Years of observing people have been refined into measurable scores through a process PDP refers to as automated management conclusions. Computer algorithms calculate the following measurements:

- The *intensity* of each trait and its relationship to the other traits
- The *amplitude*—distance each trait is from the Mid-Line
- The *contribution* of Logic—decision-making style.

TASK Measurements and descriptions

The **TASK** measurements break down into three energy style measurements of **T**hrust, **A**llegiance and **S**te-nacity, with the **K** being the amount of battery and capacity that fuels and sustains the energy styles—**K**inetic Energy. The measurement descriptions are:

- **Thrust**—Analogous to a rocket. A rocket-launch style with huge energy output; inner-directed, self-starting.
- **Allegiance**—Allegiance to the task. A follow-through, supportive style; dedicated to completing a predetermined project.
- **Ste-nacity**—Analogous to a steam locomotive. A steadfast, tenacious; locomotive-like force that self-initiates, pursues and completes a project. Ste-nacity is a PDP-coined word that combines steadfast and tenacity together into a single word.
- **Kinetic Energy**—The amount of energy a person has to accomplish a task. A person's capacity or fuel—their battery size and charge. Relates to mental energy, emotional energy and/or physical energy.



NOTE: The TASK measurements are graphically displayed as Ⓣ Ⓐ Ⓢ and Ⓚ, with the intensity of the measurement being determined from the base of the DataSheet graphic upward to the TASK measurement. The highest of all three TAS energy styles is determined to be the individual's *primary energy style*, with the *alternative energy style* (used when primary style is exhausted) being the second highest measurement.

Today, management users appreciate the easy to read indicators on an individual in order to provide the best environment for accomplishing mutual goals and approaching a task, as well as for identifying members for special project teams.

About the ProScan Survey

The ProScan Survey was designed with the following elements:

Single-word response	A single-word response instrument provides the least margin of error from a misinterpretation standpoint. Surveys with phrases can be too vague or define too much, thus negating the purposes of a pure "response stimuli" instrument.
Likert scale	The Likert scale provides a 1–5 level of response, allowing degrees or varying response scales for respondents to answer, unlike the "yes or no" type of scale. With a single response of a "yes or no" instrument, a wider margin of error occurs. For example, if a question is left blank, does that mean the respondent: 1) missed the question, 2) may be that way some of the time, or 3) some other reason?

ProScan Survey Translations

Additional languages available for the ProScan Survey (400 Series):

Catalan
Chinese (Simplified)
Chinese (Traditional)
Dutch
Filipino
French
German
Indonesian
Italian
Japanese
Korean
Norwegian
Portuguese
Russian
Spanish
Turkish
Vietnamese

PDP Licensed Technology Translations

Below is a listing of the languages available for the PDPworks software. This enables users to see a language in total; from program screens and messages to the end-result, printed reports.

English
Catalan
Chinese (Simplified)
Chinese (Traditional)
Japanese
Spanish

NOTE: For additional language considerations or concerns, please contact your PDP Representative.

Using the PDP System with Applicants

The PDP ProScan Survey enhances employers' selection decisions.

PDP has been validated according to the guidelines and standards of the American Psychological Association, as well as the principles for validation and personnel selection as endorsed by the Society for Industrial and Organization Psychology.

The ProScan Survey results provide accurate and fair descriptions of relevant work-related abilities, core traits, and basic strengths.

Confidentiality Statement

Results of the PDP ProScan® Survey are kept strictly confidential. The information is made available to authorized personnel, and hiring authorities, with respect to rights of privacy.

Statement of Selection Instrument Use

The PDP ProScan® Survey information assists in hiring decisions to increase the fit between applicants and the organization. The ProScan Survey is one of the many factors this organization uses for determining the qualifications of an applicant for the position being considered.

The PDP instruments are a professionally developed and validated system which measures important factors related to successful job performance. The PDP system complies with the Equal Employment Opportunity Commission's uniform guidelines on employee selection.

Using the PDP System with Employees

PDP enhances employers' understanding, development, and management of individual employees.

PDP has been validated according to the guidelines and standards of the American Psychological Association, as well as the principles for validation and personnel selection as endorsed by the Society for Industrial and Organizational Psychology.

PDP is designed to provide valuable information and understanding to both the employee and the employer. The Comprehensive Report gives a clear, readable interpretation of the survey results and PDP recommends that the Report be made available to each employee—with an opportunity to discuss the Report with a manager.

Employees may have questions about confidentiality, use, and location of the information. The following suggested statement meets this need.

Confidentiality Statement

> The results of the ProScan® Survey are confidential. Each employee may receive a ProScan Comprehensive Report and have the opportunity to confirm the accuracy of the information. Records of this information will be used by authorized personnel for the purpose of understanding, development, and job assignments.
>
> The ProScan Survey is validated and meets all legal standards as a job-related assessment.

Administering the ProScan® Survey

1. Provide a quiet, uninterrupted environment.
2. Refer to the ProScan as a survey rather than as a test to avoid unnecessary anxiety.
3. If the individual is uncertain about a word, ask them to use their own judgment. A statement such as, "simply answer as you think best," is appropriate. The individual should avoid asking others for assistance.
4. Emphasize that there is no time constraint.
   Why: Often the administrator influences the respondent to take the survey the way they would take it. PDP wants the person's true reaction which may be accomplished slowly and cautiously or quickly and furiously.
5. Emphasize that this is not a pass or fail survey and that there are no right or wrong answers. The individual's honest answers are the correct ones.

Administration Options

Paper Form	Print copies of survey using the Printable Forms feature of PDPworks. Feature includes all available language translations.
Invitation	Send a personalized email invitation to an individual to take the survey. Available for ProScan, Applicants and JDAs.
Remote Link	Create a URL to place on a website or to use in emails to large groups. As surveys are completed, they are added to your account and are ready for reporting options.

6. Note that Part 2 directions are different from the directions for Part 1. Watch for the change.
7. New Applicants do not require a feedback. However, all new and current employees both expect and deserve a feedback using a *Personal Development Report*.

SPECIAL NOTE: Technically defined, the PDP survey is a test in the same sense that a job application form is a test. Questions, even as simple as a request for your name which are to be answered by marking on the paper do, in fact, constitute a test. PDP cannot recommend too strongly that within your organization you always refer to the instrument as a **SURVEY**, not a test.

PDP ProScan®

ProScan® Survey
ENGLISH (400 Series)

Date: _____/_____/_____

Department: _____

Name: _____

Job Title: _____

Organization: _____

Manager: _____

Address: _____

Email: _____

1 **Directions:** Mark the response which best describes **HOW YOU FEEL YOU REALLY ARE** on a scale from 1 to 5, with 1 being **NO OR LEAST** and 5 being **YES OR MOST**.

2 **Note NEW Directions:** Mark the response which best describes **HOW YOU FEEL OTHERS EXPECT YOU TO BE OR ACT** on a scale from 1 to 5, with 1 being **NO OR LEAST** and 5 being **YES OR MOST**.

	No				Yes
1. Trustworthy	①	②	③	④	⑤
2. Gentle	①	②	③	④	⑤
3. Spirited	①	②	③	④	⑤
4. Understanding	①	②	③	④	⑤
5. Individualistic	①	②	③	④	⑤
6. Esteemed	①	②	③	④	⑤
7. Earnest	①	②	③	④	⑤
8. Compassionate	①	②	③	④	⑤
9. Convincing	①	②	③	④	⑤
10. Bold	①	②	③	④	⑤
11. Precise	①	②	③	④	⑤
12. Adaptable	①	②	③	④	⑤
13. Organized	①	②	③	④	⑤
14. Aggressive	①	②	③	④	⑤
15. Shy	①	②	③	④	⑤
16. Compelling	①	②	③	④	⑤
17. Calm	①	②	③	④	⑤
18. Daring	①	②	③	④	⑤
19. Spontaneous	①	②	③	④	⑤
20. Outgoing	①	②	③	④	⑤
21. Fussy	①	②	③	④	⑤
22. Talkative	①	②	③	④	⑤
23. Demanding	①	②	③	④	⑤
24. Industrious	①	②	③	④	⑤
25. Generous	①	②	③	④	⑤
26. Careful	①	②	③	④	⑤
27. Pleasant	①	②	③	④	⑤
28. Conventional	①	②	③	④	⑤
29. Warm	①	②	③	④	⑤
30. Efficient	①	②	③	④	⑤

Fold Here

	No				Yes
31. Stable	①	②	③	④	⑤
32. Sympathetic	①	②	③	④	⑤
33. Persistent	①	②	③	④	⑤
34. Agreeable	①	②	③	④	⑤
35. Lively	①	②	③	④	⑤
36. Dedicated	①	②	③	④	⑤
37. Charming	①	②	③	④	⑤
38. Complicated	①	②	③	④	⑤
39. Self-assured	①	②	③	④	⑤
40. Cheerful	①	②	③	④	⑤
41. Dependent	①	②	③	④	⑤
42. Nice	①	②	③	④	⑤
43. Congenial	①	②	③	④	⑤
44. Adventurous	①	②	③	④	⑤
45. Enthusiastic	①	②	③	④	⑤
46. Tolerant	①	②	③	④	⑤
47. Fearless	①	②	③	④	⑤
48. Optimistic	①	②	③	④	⑤
49. Charitable	①	②	③	④	⑤
50. Brave	①	②	③	④	⑤
51. Persuasive	①	②	③	④	⑤
52. Loyal	①	②	③	④	⑤
53. Deliberate	①	②	③	④	⑤
54. Outstanding	①	②	③	④	⑤
55. Impulsive	①	②	③	④	⑤
56. Controlling	①	②	③	④	⑤
57. Soft-hearted	①	②	③	④	⑤
58. Systematic	①	②	③	④	⑤
59. Good-natured	①	②	③	④	⑤
60. Analytical	①	②	③	④	⑤

BE SURE ALL 30 LINES ARE MARKED

BE SURE ALL 30 LINES ARE MARKED

PDP JobScan®

Job Dynamics Analysis (JDA) Survey
ENGLISH (400 Series)

Name: _____ Organization: _____

Your Title: _____ Department: _____

JDA for the Position of: _____ Email: _____

Directions: Mark the response that best describes the intensity of each descriptor that you think is needed at this time for this position.

	No				Yes
1. Requires acquiring and analyzing facts	①	②	③	④	⑤
2. Requires an indirect, highly persuasive style to get things done	①	②	③	④	⑤
3. Requires the ability to take charge in the absence of supervision	①	②	③	④	⑤
4. Requires ability to make decisions on incomplete information or unique situations	①	②	③	④	⑤
5. Requires a talkative, eager approach	①	②	③	④	⑤
6. Requires regularity in performance of specific tasks	①	②	③	④	⑤
7. Requires detailed accuracy in the day-to-day functions	①	②	③	④	⑤
8. Requires a tolerant, patient, steady person	①	②	③	④	⑤
9. Requires analysis and innovations on conceptual matters	①	②	③	④	⑤
10. Requires specific rather than generalized performance	①	②	③	④	⑤
11. Requires the ability to motivate or inspire others to action	①	②	③	④	⑤
12. Requires an ability to cope with existing environment	①	②	③	④	⑤
13. Requires a very conscientious approach to the task or responsibility	①	②	③	④	⑤
14. Requires the ability to evaluate the actual data and information	①	②	③	④	⑤
15. Requires a warm and personal relationship with others	①	②	③	④	⑤
16. Requires firm, authoritative action with strong independence	①	②	③	④	⑤
17. Requires a great deal of understanding of people's problems and needs	①	②	③	④	⑤
18. Requires an optimistic and trusting outlook	①	②	③	④	⑤
19. Requires the confidence of making unpopular decisions	①	②	③	④	⑤
20. Requires adherence to a system and/or rules	①	②	③	④	⑤
21. Requires tangible proof of information used	①	②	③	④	⑤
22. Requires an outgoing, gregarious personality	①	②	③	④	⑤
23. Requires discipline and dedication regardless of self-interests	①	②	③	④	⑤
24. Requires cooperation and willingness to adjust	①	②	③	④	⑤
25. Requires exact precision of control functions and detail checking	①	②	③	④	⑤
26. Requires a penetrating desire to win	①	②	③	④	⑤
27. Requires the willingness to listen to others' problems	①	②	③	④	⑤
28. Requires efficiency and rhythmic pace	①	②	③	④	⑤
29. Requires black or white decisions	①	②	③	④	⑤
30. Requires the objective appraisal of people	①	②	③	④	⑤

BE SURE ALL 30 LINES ARE MARKED

What is employment law?

Federal law prohibits employment discrimination based on:

Race	Age
Color	National Origin
Religion	Citizenship Status
Sex	Disability

Virtually all employers (government, private, employment agencies, labor unions), are affected by the requirements of one or more of these laws. Contractors/subcontractors with the Federal Government may have additional obligation of written affirmative action plans for the employment of special protected classes of employees.

What are these federal laws?

Some of these laws are:

TITLE VII of the Civil Rights Act of 1964 and 1991
Age Discrimination in Employment Act of 1967
The Equal Pay Act of 1963
Rehabilitation Act of 1973
Americans with Disabilities Act of 1990 (Enacted 1992, Amended 2010)

Are there state laws?

Most of the states have enacted laws in addition to the federal laws prohibiting discrimination on the basis of race, religion, sex, national origin, age, or disability. Many of these laws are more comprehensive and restrictive than comparable federal laws.

How are these laws enforced?

The Equal Employment Opportunity Commission (EEOC) is the enforcement agency for Title VII, with the power to investigate the employment practices of private employers and file suits on behalf of individuals.

What are the Uniform Guidelines of Employee Selection Procedures?

Uniform Guidelines of Employee Selection Procedures provide detailed guidance in what enforcement agencies, like the Equal Employment Opportunity Commission (EEOC) will consider when determining whether selection criteria violate federal civil rights laws. The Uniform Guidelines are intended to be consistent with generally accepted professional standards for evaluation standardized tests and other selection procedures, such as those prepared by a joint committee of the American Psychological Association, the American Educational Research Association, and the National Council on Measurement in education.

How do you know if your selection process is legal?

Specific selection criteria for choosing workers must be non-discriminatory on the basis of race, gender, religion, national origin, citizenship status, and disability. All selection criteria have the potential for creating adverse impact on a protected group: tests, interviews, review of education, work samples, physical requirements, evaluations of performance, hiring, promotion, demotion, union membership, retention.

Disparate Treatment—Selection criteria may not intentionally treat members of one protected group differently than those of another.

Disparate Impact—Criterion that appears to be neutral, such as a degree requirement, but that works to the disadvantage of a protected group also may be discriminatory, even if the bias is unintentional, unless it can be shown that the criterion is justified by a valid business necessity.

The test for determining "business necessity" is whether there exists an overriding legitimate business purpose such that the practice is necessary to the safe and efficient operation of the business.

How to Determine Adverse Impact (Disparate Impact)

The Uniform Guidelines adopt a "rule of thumb" as a practical means of determining adverse impact known as the "four-fifths" or "80 percent" rule. Adverse impact is calculated by the following four step process:

1. Determine the rate of selection of each group (divide the number of persons hired from the number of applicants from the protected group).
2. Observe which group has the highest selection rate.
3. Calculate the impact ratios by comparing the selection rate for each group with that of the highest group (divide the selection for each group with that of the highest group).
4. Observe whether the selection rate for any group is substantially less (i.e., usually less that 4/5ths or 80%) than the selection rate for the highest group. If it is, adverse impact is indicated in most circumstances.

Example:

Applicants	Hires	Selection rate, Percent Hired
80 White	48	48/80 or 60%
40 Black	12	12/40 or 30%

A comparison of the black selection rate (30%) with the white selection rate (60%) shows that the black rate is 30/60, or one-half (or 50%) of the white rate. Since the one-half (50%) is less that 4/5ths/80%, ADVERSE IMPACT is usually indicated.

What are the penalties for adverse impact?

If there is an EEOC investigation and discriminatory practices are proven, your company may be liable to:

1. Make retroactive payments to all those affected
2. Re-employ or promote the discriminated individual(s)
3. Hire applicants with back pay to the time of discrimination
4. Pay any attorney fees
5. Lose federal contracts, sub-contracts, or grant funding
6. Discontinue use of the system and develop one that is in compliance

Case example: A medium sized northeastern bank did not keep records of applicants not hired. When adverse impact was found to have taken place, the bank could not support their hiring system. The court ruled the bank had to advertise for any person making application at the bank during this specified period of time those who believed they had been discriminated against could come to the bank and apply for a position. The bank had to hire a certain number of these applicants with back pay starting from that specified period of time (approximately three years.).

Is it EEOC vs. PDP?

The bottom line question is "What is PDP's relationship to Title VII law?"

We have explored the issues around Title VII law and the complexities of its interpretation. It is impossible to fix PDP in a static relationship with EEO legislation, since each case is litigated according to its peculiar and very specific circumstances. As practitioners and representatives of PDP, however, you should be aware of the strengths of PDP as it pertains to Title VII.

First of all, remember there must be adverse impact in the employment system to warrant an EEOC compliance review. Secondly, PDP is a trait- or personality-based instrument. It does NOT have the capability to discriminate against minorities or gender. PDP should never be the sole selection (promotion, etc.) criteria. There would probably be other components such as interviews, employment histories, performance evaluations, etc... Each component would be scrutinized for discriminatory action and that respective component eliminated.

PDP is a professionally-developed instrument that has been validated according to the mathematical principles described by law. In addition, PDP requires that its users are professionally trained; an aspect that EEOC weighs heavily.

It cannot be said, however, that an employer would not or could not discriminate with the instrument. All an individual need do is NOT hire women or minorities, even if their profile suggested they were suitable. Title VII is explicit on this issue; they place the sole ethical and legal responsibility on the employer. It is up to the employer to use any instrument effectively and without discrimination. It is further the employer's responsibility to validate the instrument in his/her business setting.

The bottom line is that PDP is a valid, nondiscriminatory instrument which would be an asset to any personnel management system!

Laws and Regulations

Law/Regulation	Posting Requirement	Enforcement Agency	Coverage	Summary
Fair Labor Standards Act of 1938 (FLSA)	Yes, work location	U.S. Department of Labor—Wage & Hour Public Contracts Division	All employers	Effective 24 July 2009, federal minimum wage is $7.25/hour. Subminimum wage of $4.25/hour is allowed for teenagers. Overtime of time-and-one-half must be paid after 40 hours/week. Executive, administrative, professional and outside sales employees are exempt. Child labor protection is enforced.
Immigration Reform & Control Act of 1986	Not specified	Special Counsel's Office, U.S. Justice Department	All employers	Employer must verify the employment authorization of newly-hired employees. Two types of documentation are required: documentation of right to work and documentation of identity (1 – 9).
Title VII of the Civil Rights Act of 1964	Yes, hiring and work location	Equal Employment Opportunity Commission (EEOC)	Employers with 15 or more employees	Prohibits discrimination based on race, color, national origin, religion, sex, pregnancy (including childbirth or related condition) in any term, condition or privilege of employment.
Age Discrimination in Employment Act of 1967	Yes, work location	EEOC	Employers with 20 or more employees	Prohibits age discrimination in employment of individuals 40 years of age or older.
Equal Pay Act of 1963	Yes, work location	EEOC	Employers subject to FLSA	Protects men and women who perform substantially equal work in the same establishment from sex-based wage discrimination.

Laws and Regulations (continued)

Law/Regulation	Posting Requirement	Enforcement Agency	Coverage	Summary
Americans with Disabilities Act of 1990 (Amended 2010)	Yes, hiring and work location	EEOC	Employers with 25 or more employees for the first two years, thereafter the law applies to employers with 15 or more employees.	Prohibits employers from discriminating against employees or applicants on the basis of a disability. AIDS, mental illness, drug addiction and alcoholism are considered disabilities. Employer may be required to reasonably accommodate a physical or mental disability unless the accommodation would impose an undue hardship.
OSHA (Federal Guidelines) of 1970	Yes	U.S. Department of Labor—Enforcement actions reviewed by the Occupational Safety & Health Review Commission	All employers	Employer required to furnish safe employment to designated workplace standards; required to have accident prevention program, safety training and scheduled safety inspections.
Title II of the Genetic Information Nondiscrimination Act of 2008 (GINA)	Yes, work location	EEOC	Employers with 15 or more employees	Prohibits employment discrimination based on genetic information about an applicant, employee or former employee. Restricts employers' acquisition of genetic information and strictly limits disclosure of genetic information.

Laws and Regulations (continued)

Law/Regulation	Posting Requirement	Enforcement Agency	Coverage	Summary
Employee Polygraph Protection Act of 2003	Yes, work location	U.S. Department of Labor—Wage & Hour Division	Private, non-security service firms and pharmaceutical manufacturers, distributors and dispensers	Prohibits most private employers from using lie detector tests either for pre-employment screening or during the course of employment.
Family and Medical Leave Act of 2009	Yes, work location	U.S. Department of Labor	Employers who employ 50 or more workers for at least 20 work weeks	Allows employees to balance their work and family obligations by taking reasonable unpaid leave for certain family and medical reasons.
Uniformed Services Employment & Reemployment Rights Act of 2008	Yes, work location	U.S. Department of Labor—Veterans Employment and Training Service (VETS)	Employers with 50 or more employees	Protects the job rights of individuals who voluntarily or involuntarily leave employment positions to undertake military service or certain types of service in the National Disaster Medical System. Protects employers from discriminating against past and present members of the uniformed services, and applicants to the uniformed services.

R. CRAIG SCOTT & ASSOCIATES
LABOR & EMPLOYMENT LAW
LITIGATION & COUNSELING

1301 DOVE STREET, SUITE 420
NEWPORT BEACH, CALIFORNIA 92660

TELEPHONE (714) 222-0166
FACSIMILE (714) 222-0113

October 18, 1995

OUR FILE NUMBER

00290

Mr. David McNicholas
PDP, Inc.
19800 MacArthur Boulevard
Suite 1450
Irvine, California 92715

Dear David:

As you know, I am a lawyer specializing in labor and employment law. I have represented and assisted many Fortune 500 corporations. Over the years, I have assisted clients in all aspects of labor and employment law, including recruiting and hiring practices. You may recall from our previous conversations the many legal issues associated with psychological testing as a pre-employment measure. I am very impressed to see that the PDP has addressed the legal concerns associated with such testing.

I would like to compliment and commend PDP for its diligence in designing a psychological survey with legal integrity Specifically, I was pleased to learn that (1) the PDP is thoroughly and accurately validated based on research and a current norming population of 3 million people; (2) the PDP has successfully reinforced the already solid validation study through its Monograph No. 9 research and documentation; and (3) the PDP is compliant with state and federal discrimination laws as supported by PDP's "Disparate Impact Study." I also was very impressed with PDP's extensive and ongoing validation and research practices to maintain such a high degree of continued accuracy and quality.

As an aside David, I also applaud the PDP for its focus on employees' strengths and unique attributes. The PDP system fosters a much healthier and positive corporate environment and assists employers in seeing the strengths of their applicants and employees -- as opposed to their perceived weaknesses.

Keep up the good work!

Sincerely,

Michael J. Procopio, Esq.

Adverse Impact: Process of determining if an instrument or test discriminates against the various types of protected groups as defined by the federal government. The protected groups are: Race (Ethnic Minorities), Age (People over 40), Disability (Physically challenged), and Religion (Religiously affiliated people). For example, a test which would consistently allow whites to score higher than blacks, would adversely affect the black group since the test would always produce results favoring the whites.

Allegiance: A dedicated and supportive energy style for accomplishing predetermined tasks or goals; a preference to follow through to completion, often because of dedication to a group or organization.

Amplitude: As it relates to the behavioral traits of PDP, amplitude the fullness of a developed behavior, the breadth or range that one has developed the trait as measured from the Mid-Line.

Available Energy: The remaining usable energy after stress and satisfaction (related to daily activities or long-term adjustments) has diminished a person's energy capacity.

Basic/Natural Self: How a person functions when there is freedom to respond in a completely natural way. The most natural and efficient style of behavior.

Behavioral Predictability: The manner in which individuals' behavior can be foretold for a given situation on the basis of their priorities, perceptions and values; humans are creatures of habit (Pavlov 1849-1936).

Central Tendency Norming: Responses that are similar to one another are compared which establishes a better common denominator. By using a like response intensity (responses that are like each other) one gets an accurate relationship of traits to each other (variable) which is more important than relationship of traits to population (fixed).

Concurrent Validity: A criterion-related validity design (Ref. Criterion-Related Validity), collecting the research information all at one time, thus criteria would be current. For example, administering a selection test to current incumbents at the same time job performance is measured.

Conformity: Systems/Quality Assurance Trait. High C—Follow and maintain established systems and procedures perceived to be right; value structure, accuracy and loyalty. Low C—Independence, personal freedom and minimal external controls.

Construct Validity: A method of validity (Ref. Validity), requires the researcher to specify a system of interrelated hypotheses about how items are related to each other and is then evaluated by accumulating evidence from multiple empirical studies.

Content Validity: A method of validity (Ref. Validity), requires the researcher to show a logical, or judgement-based, relationship between characteristics measured by a test and requirements of the job.

Criterion-Related Validity: A method of validity (Ref. Validity), requires the researcher to establish an empirical relation between scores on a test and scores on a criterion, or measure of job performance. Criterion-related validity is appealing since they demonstrate directly whether a test works as intended (i.e., such studies investigate how well a test predicts who will be good performers on the job). There are two basic criterion-related validity designs, concurrent and predictive (Ref. Concurrent and Predictive).

Correlation Coefficient: A measure of the interdependence of two random variables; Degree of relationship and direction between two items; in PDP, the correlation coefficient of a survey word to a trait of action measurement is above .80 (1.0 is perfect).

Demotivator: Element that creates a negative reaction in an individual; a factor that is least desirable.

Disparate Impact: See Adverse Impact.

Distress: Harmful, unpleasant stress; pressure that is difficult to control.

Dominance: Take Charge Trait. High D—Direct, decisive and innovative, competitive, get results and exert or challenge authority. Low D—Supportive, moderate and at peace with others.

DynaMetric Mid-Line: Line of most common fit through information by some statistical base (e.g., mean); a computed value for "Central Tendency Norming." (Ref.: J. T. Roscoe, "Fundamental Research Statistics for the Behavioral Sciences.). Midpoint between the highest and lowest intensity of traits.

DynaMetrics: The measurement of dynamics and relative strengths of a person, job or team to assist in making decisions and achieving desired results.

Empirical: Relying upon or derived from observation or experiment; guided by practical experience.

Energy Drain: The diminishing effect that pressures of stress and satisfaction (from daily activities or long-term adjustments) have on an individual's energy resource.

Energy Style: The method(s) by which one approaches tasks or accomplishes goals—Thrust, Allegiance, Ste-Nacity.

Enveloping: A method that produces one Data Sheet by combining several individual survey responses; the range extending each direction from a trait as a result of the multiple inputs (JDA and/or ProScan responses); the method can be used for JDAs and/or ProScan profiles.

Eustress: Enjoyable, pleasant stress; an energy draining situation that one thrives on.

Extroversion: Social/Relational Trait. High E—Articulate, enthusiastic, interactive, persuasive and influential; seeks opportunity, builds teams and delegates technical tasks. Low E—Contemplative, private and unpretentious.

Factor Analysis: Mathematically comparing numerous descriptors together to distinguish the property or properties and the amount of loading thereof. A statistical method of determining basic components.

Feedback: The explanation of the results of a PDP survey as it communicates the behavioral predictability of a given individual.

Intensity: As it relates to the location of a trait on the data sheet, the height of the trait from the baseline of the data sheet, the amount of push from baseline.

Intensity Level: The degree to which an individual responds to a given stimulus; a person's general aliveness within the environment; the combination of physical and mental factors that comprise the "battery" on which an individual runs in a given 24-hour period, replaceable only by food, rest and relaxation (Ref. Support Capacity).

Introversion: Avoid using this term when referring to individuals with Low Extroversion, as use of the term can lead to psychological labeling.

Kinetic Energy Level: The capacity, battery or innate energy resources of a person; the mental, emotional or physical vigor with which one accomplishes a task.

Likert Scale: The 5-point scale developed by Dr. Likert that was accepted as the most beneficial form of survey response collection methodologies. The 5-point scale gives a range of responses easily understood that a 10-point scale does not (a 10-point scale provides too large of a response range), yet the 5-point scale gives enough of a range to allow a degree of like or dislike, or yes/no that a 2-point scale does not (when a 2-point scale is left unanswered: was it because the subject did not understand the question, or was it that the subject was not one of the two responses available, 2-point scales are susceptible to assumption which increases false meaning).

Logic: The method by which an individual approaches decision-making, whether through fact (analytical processes), through feeling (intuitive sense), or through a balance of fact and feeling.

Mean: Mathematical term, average or the sum of a sample divided by the number in the sample.

Mid-Line: See DynaMetric Mid-Line.

Mid-Line Profile: A person whose traits all fall within 1 sigma/inch total spread. Disposition is to be moderate and adaptable, to adjust natural behavior easily to a variety of situations, or to respond with intensity using either highs or lows of the trait perceived appropriate for a situation, sometimes causing for others a confusion of behavior style.

Motivator: An element that creates a positive reaction in an individual; a factor that is desirable.

Multiple Regression: Use of two or more variables to predict yet another item. There are two components to a multiple regression: the statistical relationship and the error factor.

Normal: The state of being for individuals with no emotional or pathological problems; the state in which an individual can achieve his own goals and desires; in a practical way, the state in which an individual has the ability to exist without being a burden to society; PDP is a survey on normalcy and in no way determines pathological states.

Normal (Probability) Distribution: Bell-shaped, symmetrical curve. Each curve is centered at the mean of the group. The larger the standard deviation (also dispersion) the Bell Curve becomes wider or more spread out. The probability of an observation falling outside the distribution curve's range would practically be zero.

Pace: Patience/Rate of Motion Trait. High P—Focus on steadiness and consistency; persistent and dependable, cautious about change. Low P—Spontaneous and versatile; action-oriented with a sense of urgency.

Patience: See Pace.

Population Norming: The process of constructing norms based on a sample (the group of persons actually tested) that is representative of a cross section of the population. Norms are empirically established by determining what persons in a representative group do on the test. The individual's raw score is then referred to the distribution of scores obtained by the standardization sample, resulting in a fixed population norm. For PDP, the original research population consisted of a sample of working adults with standardization distributed over a 7 sigma scale with 3.5 sigmas on each side of the norm. The additional step of establishing a variable norm through central tendency norming was then achieved. (Ref. *Psychological Testing*, Anastasi, pp. 48, 68, 69.)

Predictive Validity: A criterion-related validity design (Ref. Criterion-Related Validity), collecting criteria after a period of time has passed to see if a test predicts according to the criteria. For example, a selection test is administered to current incumbents and job performance is measured at some point later in time. Predictive validity design is preferable, since it mirrors how the selection test is used in practice. However, for a variety of reasons, predictive validity designs are difficult to conduct.

Predictor/Outward Self: The way a person comes across to others; a prediction of the observable actions a person is likely to show in the current environment.

Priority Environment(s): Measurement of the effort an individual makes to adjust basic, natural behavior because of internal pressures or perceived expectations of people and circumstances in the most important environments at this time.

Profile: Statistically norm-based indications of behavioral traits having meaning when being compared to one or more of the other traits; usually related to the four behavioral traits.

Rho: Greek letter, refers to the correlation coefficient. Degree of relationship between two items.

Satisfaction: The degree to which fulfillment of goals or gratification of needs or desires is felt. High—The sense that effort exerted is bringing results. Low—The sense that goals and aspirations are not being adequately met. Over-expectation—Indication of High Satisfaction, at 1 sigma/inch or longer, that may occur when more is expected of the individual than is perceived to be comfortable or reasonable.

Significance: Relating to scientific research, significance indicates whether there is a relationship between two or more items and that the relationship truly exists rather than being a factor of chance.

Split-Half: Dividing elements in half and comparing to each other, a type of reliability method for research.

Statistically-Based Research: The mathematics of the collection, organization, and interpretation of numerical data. For PDP, numerical data was collected, then through thousands of case studies, the numerical data was then interpreted into results.

Standard Deviation: A measure of variance from the mean. The greater the dispersion of values in a group, the larger the standard deviation. If there is no dispersion, the standard deviation is 0, a single point, instead of a range.

Ste-Nacity: An acronym from "steadfast" and "tenacious;" a persistent pushing, pulling determination to accomplish a task or goal, often because of internal drive; locomotive-like force that self-initiates, pursues and completes a project.

Strength: The most highly developed trait or traits (above the Mid-Line); the relative intensity of a behavioral characteristic in a PDP profile. (NOTE: traits that are not strong are also NOT weak; they are simply less developed.)

Stress: The pressure(s) experienced externally or internally to adjust a natural style of behavior.

Test/Re-Test: Correlation of two sets of responses by the same individual to the same form on two occasions separated by a certain time span, a type of research reliability method.

Theoretically-Based Research: Abstract thought untested in practice, an assumption or guess. A statement or set of statements designed to explain a phenomenon or class of phenomena.

Thrust: Rocket-launch-style with huge energy output to launch a task; inner-directed, self-starting drive to achieve goals.

Trait Pairs: Important trait combinations that result in unique action patterns.

Trait Intensity: See Intensity.

Validation: To substantiate or verify through statistical research that you measure what you purport to measure, research proving validity founded on evidence or fact (Ref. types of validity designs: Concurrent, Construct, Content, Criterion-Related and Predictive).

Validity: The state or quality of being valid; the state of having been proven to have legal force and strength by reason of statistical proof (Ref. types of validity: Concurrent, Construct, Content, Criterion-Related and Predictive).

Variable Norming: See Central Tendency Norming.