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!"

References

Cattell, R. B., "The Principal Trait Clusters for Describing Personality," Psychological Bulletin, 1945, 42 (3), 126-139.

Cattell, R. B., Saunders, D. R., & Stice, G. F. The 16 Personality Factor Questionnaire. Champaign, Illinois: Institute for Personality and Ability Testing, 1950.

Daniels, A. S., The Predictive Index. Wellesley Hills, Massachusetts: Praendex Incorporated, 1973, 1-4.

Eysenck, H. J., Dimensions of Personality. London: Routledge and Kegan Paul, 1947.

Fiske, D. W., "Consistency of the Factorial Structures of Personality Ratings from Different Sources," Journal of Abnormal and Social Psychology, 1949.

Guilford, J. P. and Guilford, R. B., "A Factor Analysis of Personality," Psychological Monographs, 1954, 69 (4).

Horst, P., Personality: Measurement of Dimensions. San Francisco: Jossey-Bass, 1968.

Houston, S. R. and Solomon, D., Human Resources Index Occupational Survey, Research Monograph, 1 & 2, 1977, pp. 1-8 & 1-9.

Houston, S. R. and Solomon, D., Personal Dynamics Profiles Occupational Survey, Research Monograph, 3, 4 & 5, 1978-1983, pp. 1-7 & 1-11.

Jung, C. G., Psychological Types. New York: Harcourt, 1933.

Likert, R., "The Method of Constructing an Attitude Scale," Archives of Psychology, 1932, 22(140), 44-45.

Nesselroade, J. R. & Baltes, P. B. "On a dilemma of comparative factor analysis. A study of factor matching based on random data." Educational and Psychological Measurement, 1970, 30, 935-948.

Roscoe, J. T., Fundamental Research Statistics for the Behavioral Sciences. New York: Holt, Rinehart & Winston, 1975.

Solomon, Dudley and Houston, S. R., "Self Index Descriptors:" A paper presented at the 54th Annual Winter Conference, University of Colorado, January 1982.

Thurstone, L. L., "The Vectors of the Mind," Psychological Review, 1934, 41(1).

Veldman, D. J. & Parker, G. V. "Adjective Rating Scales for Self Description," Multivariate Behavioral Research, 1970, 5, 295-302.

Veldman, D. J., Fortran Programming for the Behavioral Sciences. New York: Holt, Rinehart & Winston, 1967.

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)