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A Comparison of Factor Analysis and Pattern Analysis of the Loyola National Institute of Mental Health Attitude Scale

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A COMPARISON OF FACTOR ANALYSIS AND PATTERN ANALYSIS OF THE LOYOLA NATIONAL INSTITUTE OF MENTAL HEALTH ATTITUDE SCALE

by

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LIFE

A. H. Rittenhouse was born in Wilmington, Delaware on Christmas, 1925. He was graduated from Wilmington High School in January of 1944, and served in the United States Navy from March of 1944 until June of 1946. The Bachelor of Arts and Master of Arts were conferred by the University of Delaware in 1950 and 1952, respectively.

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Graduate studies at Loyola University were begun in September of 1958. He was a research assistant for Loyola's National Institute for Religion and Mental Health Project from September of 1959 to June of 1960.

While studying for his Doctor's degree, he completed his internship at the Child Guidance Clinic Marion County, Inc., in Indianapolis, Indiana.

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Horace J. A. Rimoldi, M. D., Ph.D., gave the initiative to the statistical treatment, while my wife provided the enduring confidence of her unwavering presence and her spiritual faith.

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CHAPTER I

INTRODUCTION AND PURPOSE

The general purpose of this study is to examine and compare two methods of analyzing attitudes. The data analyzed are secondary in importance to the techniques utilized. If the two techniques can be demonstrated to be comparable, then some objective evidence will be provided for the new method as an effective technique for describing and comparing the results of psychological tests which lend themselves to a profile analysis, whether they be measures of attitudes, intelligence, interests, abilities, achievements, or aptitudes.

As the number of psychological tests with multiple scores increased, the need for objective measurements and comparisons of such profiles witnessed the development of different measures of the relationship of the variables comprising the profiles--correlational, factor analytical, and mean differences (Nunnally, 1962). All approaches agreed, however, that the most efficient method had to consider, as much as possible, all of the information available from the profiles. No method can consider all possible information, but Rimoldi and Grib (1959) described a method which includes an additional

observation-- the individual's omission of a response or non-endorsement of an item. Grib (1961) utilized this technique to analyze selected aspects of the Rorschach. As with any new technique, it must be subjected to additional research and under variable experimental or controlled conditions. This provided partial impetus for the present investigation.

Data from the Loyola National Institute of Mental Health Attitude scale (Webb, 1959) were factor analyzed (Thurstone, 1947) and the factors extracted. The same data were then re-scored and analyzed according to the technique developed by Rimoldi and Grib (1959). These results were then re-factor analyzed and the factors extracted again. By this method, the attitudes, factors and loadings could be examined and then subjected to comparison. Thus, this research can be considered more exploratory of the techniques and factors, rather than viewed as predictive of attitudes, per se.

The primary concern of the study is to evaluate the effectiveness of pattern analysis as an objective and quantitative technique for describing and comparing profiles yielded by instruments of psychological measurement. However, since the data utilized are from the Loyola National Institute of Mental Health Attitude Scale (Webb, 1959), important but subsidiary questions about attitudes will be evaluated also.

Thus, the specific purposes of this research are: Primarily, to determine if this method of pattern analysis provides a more comprehensive yet objective and quantitative basis for describing and comparing profiles of psychological measurements; and will this technique yield essentially the same factors as those extracted when factor analyzing the data in its original form. If so, then a firmer basis is provided for pattern analysis as an objective and quantitative technique. Studies designed to demonstrate or examine these aspects of the method of pattern analysis by Rimoldi and Grib (1959) were not found in the review of the related literature. Secondarily, to investigate the pattern or profiles of responses to the Loyola N.I.M.H. Attitude Scale to determine if different patterns are present; also, are the patterns of high scoring subjects the same or different from low scoring individuals on this attitude scale?

CHAPTER II

REVIEW OF THE LITERATURE

Continuing a long line of research aimed at describing behavior has resulted in a variety of different tools of psychological measurement such as tests of intelligence and achievement, attitude scales, and vocational interests inventories. Many of today's tools of psychological measurement comprise partial scores such as the Kuder Preference Record, or sub-tests as in the Wechsler scales of intelligence, which can be interpreted apart from the total score to which they contribute. Thus, in many excellent multiple score techniques, a profile of the subtests, or of the partial scores becomes available--a profile which may or may not be interpreted with or without relationship to the actual scores on the tests or scales. In some instances, especially in clinical psychology, interpretation focuses more upon the profile or pattern of scores than upon the individual scores, and the pattern or profile can be interpreted separately or simultaneously with or without relationship to each other.

The added advantages of multiple scores and patterns and profiles available to the clinicians armamentarium intensified the statistical and/or mathematical need of providing quantifiable and/or objective

means for describing and comparing such patterns or profiles. From the initial intuitive and then arbitrary approaches, psychology has developed many complicated techniques for measuring and comparing profiles (Milholland, 1964).

Earlier attempts of comparing and analyzing profiles were somewhat arbitrary. DuMas (1946) provided a method of determining profile similarity which, admittedly, was not a precise measure, but attempted to eliminate some of the arbitrariness by using the ratio of corresponding slopes (profile segments) to the total number of profile segments. However, extended research with this technique does not appear in the literature.

A major accomplishment in the predictive use of pattern and profile analysis was achieved by Lubin and Osburn (1957) when they described a "method of pattern analysis . . . for the case of dichotomous items and a quantitative criterion." They also employed a method to evaluate the validity of scales greater than zero. Lykken (1956) did not believe it possible to develop a single index of profile similarity and proposed the use of nonlinear functions. However, Michael (1959) considered the "use of the traditional linear model in multiple regression" to be as serviceable as any present or future but more complicated methods.

Later, Block, et al (1951), under the tutelage of McNemar

utilized analysis of variance as a method for evaluating "group psychometric patterns." This excellent general method is limited in its application to "normal score distributions with equal variance for each group on each variable." Therefore, it could not be applied to scores (or patterns) which do not distribute themselves normally. Wirt (1956) in a pattern analysis of responses to the Rorschach dramatically illustrates the tedious questionable utilization of this procedure on data which are not normally distributed. To wit:

> Since this technique requires normal distributions, it was necessary to combine determinant scores after Cass (1951) and to convert the raw scores into normal scores by McCall's T-score transformation. (Guilford, 1942)

Working independently but almost simultaneously, Osgood and Suci (1952) and Cronbach and Gleser (1953) developed similar methods of measuring the relationship between profiles. Unable to achieve this with correlational procedures, the <u>difference method</u> was developed. Cronbach and Gleser (1953) have since proposed this D measure of profile similarity as the basic method. Nunnally (1962) also recommends this linear multiple discriminant function for distinguishing profiles. Briefly, it involves the square root of the mean differences. But it's primary focus is still on scalability and measurement of distances between the items.

Modifications and critiques about the methods of factoring such

profiles have followed from Bechtoldt (1960), Haggard (1959, 1960) to Hays' (1962) concern about "averages" and then Thompson's (1962) conclusion that "There is room both for mathematically exact solutions and for judgmental rotation." More evaluations of recent progress to date have been covered by White and Saltz (1957), Michael (1959) and Milholland (1964). In agreement with Nunnally (1962), most investigators have observed that the majority of the methods attempt to consider most of the available information in the profiles, such as "level, shape, and dispersion," or "elevation, scatter and shape," (Cronbach and Gleser, 1953). However, most of the methods do not consider or utilize datum wherein the individual does not respond. Also, emphasis is usually on scalability, so that the individual's score provides information about the items to which he responded, but not about the items to which he did not respond.

Rimoldi and Grib (1959) developed a technique to describe and compare patterns which appears to have a potential for a wider application, while also including the all-important datum (or observation) when the individual does not respond, choose, or endorse an item or items. It was extended by them (1960), and then utilized by Grib (1961) to study the patterns of Rorschach movement responses. Tabor (1959) and Mohrbacher (1961) employed the method to investigate interpretive and diagnostic processes, respectively. Although these studies

are examples of the utilization of pattern analysis to different data, it was not their purpose to compare its results with other approaches in order to provide some evidence of the technique as a quantitative method for characterizing profiles. In his own study, Grib stated:

> While the method of pattern analysis . . . does not pretend to be a complete solution to the problem of handing Rorschac data statistically, it is felt (my italics) that it does provide an objective quantitative basis for characterizing and comparing patterns . . . (Grib, 1960, p. 5).

To attempt to provide some objective evidence that this is a meaningful quantitative technique is one of the primary purposes of this investigation.

The technique of Rimoldi and Grib (1959) provides an Index of Agreement which varies from zero through unity, and provides an objective method of characterizing an individual's or group's pattern of responses and/or non-responses. This index is a function of the individual weights of each response and non-response, while the weights are a function of the total pattern or profile of responses and non-responses. Thus, the individuals (i.e., their scores) provide their own pattern or profile for comparison, rather than being projected against some arbitrary or vague "average profile."

This is one of the primary methods employed in the present study. Data from the Loyola National Institute of Mental Health Attitude Scale

(Webb, 1959) was scored and factor analyzed by the method of principal components (Covely & Lohnes, 1962), and then the method of pattern analysis developed by Rimoldi and Grib (1959) was applied to the same N.I.M.H. data and re-analyzed to determine if the same or different factored structure obtained. If the same factors and/or loadings resulted, then this could be interpreted as providing additional bases that pattern analysis is a meaningful technique as an objective and quantitative tool for evaluating profiles. Future research based on this technique could then proceed on a more confident methodological and statistical foundation.

If different factor structures were found, then an extensive study of the basis for, and some possible explanations of such discrepancies would have had to be executed. This would have had to involve detailed comparisons of the divergent factors and loadings yielded by both factor analyses. Whether such possible differences would be a function of the extracted factors, the attitude scale, or the technique of pattern analysis itself, would be of the utmost importance.

Walsh's (1963) review of factor analytic studies of attitude measures demonstrated that only four meaningful factors are usually extracted, and that the largest factor was the one usually identified as social desirability. Taylor (1961) found this to be true for

attitude scales also. Walsh (1963), in a study of such a response set with a larger sample of subjects and scales, was unable to confirm this finding. Even Webb (1959), when selecting items for the final version of the Loyola attitude scale, selected both favorable and unfavorable statements

> to minimize the possibility of a response set which might be generated if the subjects respond only to one type of statement (Webb, 1959, p. 27).

Consequently, an attempt was made to determine if the tendency to give socially desirable responses can also be demonstrated in the present investigation. This was accomplished by studying the extracted factors to learn if they comprised only one type of statement that was positive toward psychiatry.

CHAPTER III

METHOD AND PROCEDURE

The responses of 120 Roman Catholic seminarians to the Loyola N.I.M.H. Attitude Scale (Webb, 1959) provided the data for the present investigation. This scale is comprised of 35 items designed to measure Catholic seminarians' attitudes toward psychiatry (see Appendix I for the items of the Scale). There are 16 positively phrased and 19 negatively phrased items which are scored zero through 4, representing endorsements of an item ranging from "Strongly Agree" through "Strongly Disagree". In a preliminary study of this scale (Loyola N.I.M.H. Project, 1960) on 979 seminarians from twenty-one different Catholic seminaries in the United States, the resulting scores on the attitude scale indicated a mildly positive attitude towards psychiatry for each seminary and for all twenty one when considered as a single group. There were no significant differences between the means of the scale score for any group. Consequently, in an attempt to maximize similarities and differences, the attitude scales of the sixty seminarians with the highest raw scores (and scale values) and the sixty with the lowest raw scores (and scale values) were selected for this study. As an exploratory technique, this also provided leeway for variances when the data were subjected to factor analytic procedures.

Selecting those subjects with raw scores from zero through 71 (which is the same as scale values from 0 through 2.0) yielded sixty-three seminarians in this range. Eight of them had raw scores of 71, so three were randomly eliminated from the study. This comprised the "Lower Sixty" group. Selecting the "Upper Sixty" group yielded fifty-nine with raw scores ranging from 108 through 135 (scale values from 3.1 through 3.9). The next ten subjects had identical scores of 107. One of these were randomly assigned to the high scoring group in order to have sixty subjects in each of the extreme groups studied. The raw scores and scale values of each of these 120 subjects are presented in Appendix II.

The mean scale value for all 120 subjects was 2.5, a mildly positive position halfway between "Agree & Disagree Equally" and "Agree" on the attitude scale. The mean scale values for each of the two groups separately are 3.2 for the Upper Sixty, and 1.8 for the Lower Sixty. This corresponds to a positive "Agree" for the Upper group, and a barely neutral "Agree & Disagree Equally" for the Lower group on the scale's continuum from "Strongly Agree" (a scale value of 4.0) to "Strongly Disagree" (a scale value of zero).

The N.I.M.H. Attitude Scale contains 35 items (see Appendix I) scored from zero to four. The responses of all 120 subjects were tabulated and the median computed for each item (Appendix III). The scale

Value of each of the 35 items for all of the 120 subjects was then converted to plus (+) or minus (-) in order to dichotomize the data to conform to the technique of Rimoldi and Grib (1959). Following this, tetrachoric correlations (Chesire, et al, 1951) were computed. With 35 items, this yielded a matrix of 595 intercorrelations to be factor analyzed. This table ofintercorrelations is presented in Appendix IV.

These tetrachoric correlations were then factor analyzed. The Varimax procedure was used on the IBM 7040 Computer at the Indiana University Medical Center. Varimax first computes the means, standard deviations, and correlations. Using unity in the diagonals is the Varimax method of solving the communality problem, although it leads to some increase in the residual and specific error. It computes eigen values and eigen vectors from the correlation matrix. Then it examines the eigen values and sets limits on the number of factors to be rotated. Orthogonal rotations are performed on the factor matrix, and then the rotated factor matrix is printed. The resulting factor loading provides some answers to the first question about whether or not the Loyola N.I.M.H. Attitude Scale yields meaningful attitudes.

The next phase of the study involved re-scoring the converted (+ or -) attitude scale scores by weighting them according to the procedures of pattern analysis method of Rimoldi and Grib (1959). The design of this second phase was to set up the matrix of the 35 attitude

Scale Items by the 120 subjects. Positive responses were scored X and minus responses were scored O. Next the weights for each cell was determined, wherein:

$$X = \frac{R\,C}{T} \qquad \text{and} \qquad O = \frac{\bar{R}\,\bar{C}}{\bar{T}}$$

and R = number of filled-in cells in that row,

C = number of filled-in cells in that column,

T = total of filled in cells,

$\bar{R}$ = number of empty cells in that row,

$\bar{C}$ = number of empty cells in that column,

$\bar{T}$ = total of empty cells.

This provided the data for the patterns of the high and low scoring groups, as well as for the entire group of 120 subjects. An index of agreement, which varies from zero to 1.0, was computed to provide an objective and quantitative basis for the comparison of the profiles of the two groups. A descriptive example of the method determining the pattern analysis weights and for computing the index of agreement is provided in Appendix VII. Consult Rimoldi and Grib (1960a; 1960b) for a more complete and detailed explanation of the application of this technique. This provided information for the second question about whether the high and low scoring groups produce different patterns or profiles.

The next step was to factor analyze these data. The weights were correlated and factor analyzed according to the Varimax procedure described for the first analysis on page 13. The resulting factors (attitudes) were then identified and compared with the extracted factors identified in the first analysis. If the identified factors were similar, then this could be interpreted as providing some additional quantitative bases for pattern analysis as a more comprehensive and objective tool for comparing and describing profiles. If the factored structures were dissimilar, a close study of the nature of such differences would be of especial significance.

Comparing extracted factors was not the only method utilized. Burt (1948) employed unadjusted correlations between two sets of factor coefficients. This method was further developed by Tucker (1960), and his formula for a "coefficient of congruence" was employed to compare the two factored structures. After comparing the two different factored structures, this was considered to be an indication of pattern analysis as a valuable and meaningful technique.

CHAPTER IV

RESULTS AND DISCUSSION

The results of the rotated factor analysis of the first[a] analysis of the attitude scale, i.e., of the 595 tetrachoric intercorrelations in Appendix IV, are depicted in Table 1. Of the 12 factors extracted, the highest loading by each item of the attitude scale on each factor is underlined. The criterion for meaningful factors was high loadings on at least four scale items plus a simultaneous higher proportion of the total explained variance. This criterion was not determined until after all the loadings had been examined, and when the factors with the higher loadings appeared to possess some similarities which could be interpreted.

Interpretation of the Factors

The highest loadings of the rotated factor matrix in Table 1 are summarized in Table 2 in order to present a clearer visualization of the structure of the factors. The proportion of the variance explained by each factor is presented in the bottom row of both Tables 1 and 2.

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[a]"First" refers to the analysis of the data in its original form; "Second" refers to the analysis of the data after it has been re-scored according to the pattern analysis technique of Rimoldi and Grib (1959).

It can be seen readily that factor I_1[a] is the most understandable and meaningful factor; it contains the higher loadings on more items (6), and accounts for the highest variance of any single factor, i.e., 4.680.

Factor I_1

Scale Item		Loading
30	Psychiatry because of its exclusive concern with abnormal individuals is of little use to the priest.	.838
9	Current psychiatric practice allows people to express sexual impulses without moral inhibition.	.793
3	Psychiatry ignores the supernatural side of man.	.778
5	Psychiatry denies free will in man's conduct by its emphasis on unconscious motivation.	.751
19	Psychiatrists place an exaggerated emphasis on sex.	.601
31	Psychiatry considers religion a mass delusion to be eliminated through analysis.	

All of the attitude scale items on this factor, I_1, have to do with the Catholic seminarians' feeling that psychiatry emphasizes an amoral (not-immoral), sensuously oriented, non-religious aspect of man's nature--briefly, an anti-/or non-supernatural approach to man.

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[a]The subscripts I_1 and II_1, etc., refer to the factors identified by the factor analysis of the initial scoring methods. The subscripts I_2 and II_2, etc., refer to the factors identified by the factoring of the same data after being re-scored by the pattern analysis technique of Rimoldi and Grib (1959).

Table 1

First[a] Rotated Factor Matrix[b] Loadings

	Factor					
Scale Item	I	II	III	IV	V	VI
1	136	-338	134	-118	-020	-270
2	076	-108	065	-088	-139	-308
3	778	032	068	-143	-235	-288
4	245	-011	107	078	-139	-103
5	751	012	136	010	-137	-233
6	180	041	022	-186	148	-561
7	305	168	-058	-220	-127	-212
8	-011	992	-019	-061	-161	-013
9	793	105	-457	101	-158	-178
10	149	-081	123	-084	-021	-164
11	147	123	-007	-184	-140	-106

Table 1 (cont'd)

First[a] Rotated Factor Matrix[b] Loadings

	Factor					
Scale Item	I	II	III	IV	V	VI
12	071	-091	-151	-331	-275	-106
13	109	436	-048	-357	-017	-382
14	289	004	-004	-057	382	-118
15	209	070	027	-048	-450	020
16	395	033	203	-172	-385	-285
17	288	198	-038	-103	-769	-226
18	290	-144	068	043	-217	-822
19	601	121	092	-172	-398	-207
20	115	326	-053	-138	-069	-002
21	258	042	025	-147	-111	-126
22	221	137	201	-063	-146	-090

Table 1 (cont'd)

First[a] Rotated Factor Matrix[b] Loadings

	Factor					
Scale Item	I	II	III	IV	V	VI
23	221	-028	009	-160	-167	-096
24	232	200	031	-015	-075	-057
25	288	066	078	-423	-063	-213
26	242	187	013	-067	126	-176
27	359	088	051	-317	-068	-103
28	280	055	132	-044	-135	-303
29	214	168	136	-028	041	-268
30	838	-180	115	-269	105	-075
31	491	161	-015	-224	-195	-307
32	070	017	004	-935	-083	019
33	188	124	081	-240	-183	-201

Table 1 (cont'd)

First[a] Rotated Factor Matrix[b] Loadings

	Factor					
Scale Item	I	II	III	IV	V	VI
34	362	200	152	-551	018	-026
35	244	-431	653	-373	-074	-423
Variance	4.68	2.00	.91	2.31	1.80	2.95

[a] "First" refers to the analysis of the original data; "Second" refers to the analysis of the data after it was scored according to the pattern analysis technique of Rimoldi & Orib (1959).

[b] Decimal points have been omitted for all entries.

Table 1 (cont'd)

First[a] Rotated Factor Matrix[b] Loadings

	Factor					
Scale Item	VII	VIII	IX	X	XI	XII
1	-107	-572	-204	263	-290	-215
2	-810	-085	-117	107	-159	-111
3	054	006	-217	085	-140	-282
4	-129	050	-237	717	-255	-191
5	-242	-188	-051	263	-159	-292
6	-201	-323	-501	202	-241	-051
7	-189	-294	-207	465	-352	-406
8	043	-111	-159	085	-264	-194
9	-311	-267	-187	263	-158	-055
10	-119	-112	-204	181	-092	-131
11	-054	-821	-157	014	042	-064

Table 1 (cont'd)

First[a] Rotated Factor Matrix[b] Loadings

	Factor					
Scale Item	VII	VIII	IX	X	XI	XII
12	037	-382	-160	416	-149	-439
13	117	034	157	411	-403	-424
14	-370	-340	-136	433	-458	-096
15	-298	-360	-415	151	-289	-389
16	-078	-333	-259	308	-178	-328
17	-137	-214	-007	266	-054	010
18	-268	-077	-086	071	020	-078
19	-238	-293	-290	331	-246	-161
20	-408	028	-120	062	-742	-138
21	-006	-159	-201	789	-015	-106
22	-009	116	-241	254	-425	-695

Table 1 (cont'd)

First[a] Rotated Factor Matrix[b] Loadings

	Factor					
Scale Item	VII	VIII	IX	X	XI	XII
23	-133	-363	-669	264	-081	039
24	-083	-249	-309	220	-129	-189
25	-026	-260	-497	358	-202	-312
26	-269	-340	-111	170	-087	-738
27	001	-128	-148	284	-697	-316
28	131	-448	-230	184	-509	-131
29	-050	126	-780	186	-120	-295
30	096	-134	-276	245	-144	-330
31	-195	-398	157	437	-178	-037
32	-055	-204	-111	030	-172	-038
33	-272	-197	-347	587	-328	-327

Table 1 (cont'd)

First[a] Rotated Factor Matrix[b] Loadings

	Factor					
Scale Item	VII	VIII	IX	X	XI	XII
34	-402	012	-096	435	057	-222
35	-116	-192	-406	373	-239	-246
Variance	1.92	2.92	2.97	3.91	2.89	2.78

[a] "First" refers to the analysis of the original data; "Second" refers to the analysis of the data after it was scored according to the pattern analysis technique of Rimoldi & Grib (1959).

[b] Decimal points have been omitted for all entries.

Table 2

Summary of First[a] Rotated Factor Matrix Loadings[b]

Scale Item	I	II	III	IV	V	VI
1						
2						
3	778					
4						
5	751					
6						-561
7						
8		992				
9	793					
10						
11						

Table 2 (cont'd)

Summary of First[a] Rotated Factor Matrix Loadings[b]

	Factor					
Scale Item	I	II	III	IV	V	VI
12						
13						
14						
15						
16						
17					-769	
18						-822
19	601					
20						
21						
22						

Table 2 (cont'd)

Summary of First[a] Rotated Factor Matrix Loadings[b]

	Factor					
Scale Item	I	II	III	IV	V	VI
23						
24						
25						
26						
27						
28						
29						
30	838					
31						
32				-935		
33						

Table 2 (cont'd)

Summary of First[a] Rotated Factor Matrix Loadings[b]

	Factor					
Scale Item	I	II	III	IV	V	VI
34				-551		
35			-653			
Variance	4.68	2.00	.91	2.31	1.80	2.95

[a] "First" refers to the analysis of the original data; "Second" refers to the analysis of the data after it was scored according to the pattern analysis technique of Rimoldi & Grib (1959).

[b] Decimal points have been omitted for all entries.

Table 2 (cont'd)

Summary of First[a] Rotated Factor Matrix Loadings[b]

	Factor					
Scale Item	VII	VIII	IX	X	XI	XII
1		-572				
2	-810					
3						
4				717		
5						
6			-501			
7						
8						
9						
10						
11		-821				

Table 2 (cont'd)

Summary of First[a] Rotated Factor Matrix Loadings[b]

	Factor					
Scale Item	VII	VIII	IX	X	XI	XII
12						
13						
14						
15						
16						
17						
18						
19						
20					-742	
21				789		
22						-695

Table 2 (cont'd)

Summary of First[a] Rotated Factor Matrix Loadings[b]

	Factor					
Scale Item	VII	VIII	IX	X	XI	XII
23			-669			
24						
25						
26						-738
27					-697	
28					-509	
29			-780			
30						
31						
32						
33				587		

Table 2 (cont'd)

Summary of First[a] Rotated Factor Matrix Loadings[b]

	Factor					
Scale Item	VII	VIII	IX	X	XI	XII
34						
35						
Variance	1.92	2.92	2.97	3.91	2.89	2.78

[a] "First" refers to the analysis of the original data; "Second" refers to the analysis of the data after it was scored according to the pattern analysis technique of Rimoldi & Grib (1959).

[b] Decimal points have been omitted for all entries.

The second meaningful factor, IX_1, with 2.966 of the explained variance, concerned the seminarians' desire to utilize psychiatric understandings in order to function as a more effective priest when dealing with mentally disturbed parishioners.

Factor IX_1

Scale Item		Loadings
29	In dealing with mentally disturbed individual, psychiatry is essential.	-.780
23	In most cases a parishioner who thinks he needs psychiatric help would do better to improve his religious life.	-.669
6	Parishioners should be referred to a psychiatrist as readily as to another medical specialist.	-.501
25	More consistent agreement among psychiatrists is necessary before their teaching can be brought into the seminary.	-.497
35	A priest should not hesitate to refer a parishioner to a psychiatrist.	-.406

That these items received significant positive endorsements by the groups, can be observed from the medians in Appendix III, and from the higher intercorrelations depicted in Appendix IV.

The other extracted factors appear to be less meaningful because of the high loadings on fewer scale items and/or obviously lower proportion of variances.

Thus, an affirmative answer can be given the question about whether the Loyola N.I.M.H. Attitude Scale yields meaningful attitudes. At least two factors have been identified; the Catholic seminarians' concern about what they percieve to be psychiatry's non-supernatural approach to man, and a simultaneous desire to increase their priestly effectiveness by utilizing psychiatric knowledge of human behavior when ministering to mentally disturbed parishioners.

After the 120 subjects' responses to the 35 items of the N.I.M.H. Attitude Scale were tabulated and the median had been computed (Appendix III), in order to convert the scale value to plus (+) or minus (-) so as to dichotomize the data to conform to the technique of Rimoldi and Grib (1959), a "model" pattern for all 120 subjects was constructed from the pattern and weight for each cell. The pattern and weight for each cell, computed according to the method of Rimoldi and Grib (1959), are also enscribed. Where more than fifty percent of the subjects endorsed an item in a positive direction, this appears as an X under the "Plus" column of Table 3, and where more than half of the 120 subjects chose an item on the negative side of the attitude scale, it appears as an X under the "Minus" column of Table 3.

The observed pattern and weights for the two experimental groups, i.e., the Upper Sixty subjects, and the Lower Sixty subjects, were

constructed in a similar manner but separately: The median and weight for each item of the attitude scale was computed separately from the median and weight for each of the 35 items for the Upper Sixty, and then for the Lower Sixty (See Appendices V & VI).

Dividing the sum of all of the weights of the "model" pattern into the sum of the congruent weights for each of the two groups yields an Index of Agreement (Rimoldi and Grib, 1959) of .81 for the Upper Sixty, and 168 for the Lower Sixty. This difference of .13 suggests that the two experimental groups do yield somewhat different patterns or profiles of responses to the Loyola N.I.M.H. Attitude Scale. Whether this difference of .13 is a result of chance or not will have to wait for the development of a method for determining levels of significance such as Rimoldi and Haley (1962) described for comparing the performance of junior and senior medical students with that of experts. However, the two indices of agreement of .81 and .68 do provide an objective and quantifiable description of the different patterns. These two patterns are directly observable by comparison of the patterns of the two experimental groups presented in Table 4.

Table 3

"Model" Pattern and Weights for all 120 Subjects on Loyola N.I.M.H. Attitude Scale

Attitude Scale Item	PLUS		MINUS	
	Pattern	Weight	Pattern	Weight
1	X	.69		.69
2	X	.69		.69
3		.31	X	.31
4	X	.69		.69
5	X	.69		.69
6	X	.69		.69
7	X	.69		.69
8	X	.69		.69
9		.31	X	.31
10	X	.69		.69
11		.31	X	.31
12		.31	X	.31
13	X	.69		.69
14	X	.69		.69
15		.31	X	.31
16		.31	X	.31
17	X	.69		.69
18	X	.69		.69
19		.31	X	.31
20		.31	X	.31
21	X	.69		.69
22	X	.69		.69
23	X	.69		.69
24	X	.69		.69
25		.31	X	.31
26	X	.69		.69
27	X	.69		.69
28		.31	X	.31
29	X	.69		.69
30	X	.69		.69
31	X	.69		.69
32	X	.69		.69
33	X	.69		.69
34	X	.69		.69
35		.31	X	.31

Table 4

Pattern and Weights for Upper Sixty & Lower Sixty on Loholа N.I.M.H. Attitude Scale

Attitude Scale Item	UPPER SIXTY				LOWER SIXTY			
	Plus		Minus		Plus		Minus	
	Pattern	Weight	Pattern	Weight	Pattern	Weight	Pattern	Weight
1	(X)[a]	.94		.94	(X)	.54		.54
2	(X)	.94		.94	(X)	.54		.54
3	X	.94		.94		.46	(X)	.46
4	(X)	.94		.94	(X)	.54		.54
5	(X)	.94		.94	(X)	.54		.54
6	(X)	.94		.94		.46	X	.46
7	(X)	.94		.94		.46	X	.46
8	(X)	.94		.94		.46	X	.46
9	X	.94		.94		.46	(X)	.46
10	(X)	.94		.94	(X)	.54		.54
11		.96	(X)	.06		.46	(X)	.46
12	X	.94		.94	X	.54		.54
13	(X)	.94		.94		.46	X	.46
14	(X)	.94		.94	(X)	.54		.54
15	X	.94		.94	X	.54		.54
16	X	.94		.94		.46	(X)	.46
17	(X)	.94		.94		.46	X	.46
18	(X)	.94		.94	(X)	.54		.54
19	X	.94		.94		.46	(X)	.46
20	X	.94		.94		.46	(X)	.46
21	(X)	.94		.94	(X)	.54		.54
22	(X)	.94		.94	(X)	.54		.54
23	(X)	.94		.94		.46	X	.46

Table 4 (cont'd)

Pattern and Weights for Upper Sixty and Lower Sixty on Loyola N.I.M.H. Attitude Scale

Attitude Scale Item	UPPER SIXTY				LOWER SIXTY			
	Plus		Minus		Plus		Minus	
	Pattern	Weight	Pattern	Weight	Pattern	Weight	Pattern	Weight
24	(X)	.94		.94	(X)	.54		.54
25	X	.94		.94		.46	(X)	.46
26		.06	X	.06		.46	X	.46
27	(X)	.94		.94	(X)	.54		.54
28	X	.94		.94	X	.54		.54
29	(X)	.94		.94	(X)	.54		.54
30	(X)	.94		.94	(X)	.54		.54
31	(X)	.94		.94		.46	X	.46
32	(X)	.94		.94	(X)	.54		.54
33	(X)	.94		.94	(X)	.54		.54
34	(X)	.94		.94	(X)	.54		.54
35	X	.94		.94		.46	(X)	.46

[a] Parentheses indicate the cells which are the same as in the observed or "model" pattern.

A close scrutiny of the two meaningful extracted factors, especially factor I_1 did not suggest the presence of a tendency to give only socially desirable responses. The items which comprise this factor suggested more of a concern about the use of psychiatry, rather than predominantly positive statements toward psychiatry.

The second step of this investigation involved the factor analysis of the converted (+ or -) attitude scale scores after they had been weighted according to the pattern analysis technique prescribed by Rimoldi and Grib (1959). The Varimax procedure was employed in the factor analysis of these weighted scores. This yielded the factor loadings depicted in Table 5.

The highest and most significant loadings are underlined again. These loadings are highlighted in Table 6 for a more succinct exposition of the more understandable extracted factors. Again, the proportion of the explained variance contributed by each of the factors can be read along the bottom row of each of these two tables.

Factor IX_2 appears to be the most meaningful and understandable factor (or attitude), accounting for the highest proportion, 4.515, of the explained variance, and the highest loadings on the most (6) items. It is extremely important to note that this factor, IX_2, of the second matrix is identical with factor I_1, of the first factor matrix. Both

Table 5

Second[a] Rotated Factor Matrix Loadings[b]

	Variable					
Scale Item	I	II	III	IV	V	VI
1	195	145	645	112	262	281
2	215	142	083	195	302	178
3	123	217	013	239	291	320
4	589	307	115	129	168	400
5	278	208	141	153	236	263
6	240	300	153	-008	573	223
7	403	395	147	110	230	182
8	206	796	-005	221	221	073
9	202	196	176	206	231	200
10	256	123	247	165	260	701
11	198	183	187	222	194	134
12	428	280	337	230	236	126
13	384	554	178	168	314	093
14	336	286	233	-001	198	288
15	202	368	189	322	138	311
16	238	266	239	402	243	255
17	246	289	063	666	195	144
18	180	137	222	279	652	240
19	248	312	202	367	235	239
20	099	688	258	090	059	223
21	653	173	149	276	217	193
22	352	441	057	091	199	435

Table 5 (cont'd)

Second[a] Rotated Factor Matrix Loadings[b]

Scale Item	Variable I	II	III	IV	V	VI
23	229	190	208	171	204	152
24	219	293	077	187	604	216
25	382	299	079	071	253	213
26	243	309	207	055	201	167
27	269	513	428	077	155	232
28	121	331	172	114	259	337
29	286	382	076	100	349	428
30	357	243	211	129	257	372
31	345	247	149	244	255	063
32	252	274	194	161	164	122
33	471	352	151	141	210	307
34	461	318	126	130	200	141
35	365	277	327	080	466	143
Variance	3.54	4.09	1.67	1.66	2.92	2.58

[a] "First" refers to the analysis of the data in its original form; "Second" refers to the analysis of the data after it has been scored according to the pattern analysis technique of Rimoldi & Grib (1959).

[b] Decimal points have been omitted for all entries.

Table 5 (cont'd)

Second[a] Rotated Factor Matrix Loadings[b]

	Variable					
Scale Item	VII	VIII	IX	X	XI	XII
1	131	294	230	164	243	151
2	721	136	216	190	176	187
3	063	058	534	398	209	299
4	160	159	314	046	154	055
5	205	174	656	129	134	221
6	221	306	257	178	321	-010
7	235	252	354	247	205	236
8	000	186	105	115	195	127
9	159	213	698	089	270	048
10	185	152	259	115	124	073
11	151	702	266	178	172	162
12	190	235	179	254	265	245
13	077	133	278	265	004	287
14	365	275	412	226	197	062
15	254	301	246	189	335	233
16	095	209	301	246	283	247
17	179	212	356	136	124	012
18	246	065	328	109	095	167
19	176	161	498	209	309	166
20	402	088	304	149	117	008
21	117	138	237	234	194	140
22	190	170	316	232	161	272

Table 5 (cont'd)

Second[a] Rotated Factor Matrix Loadings[b]

	Variable					
Scale Item	VII	VIII	IX	X	XI	XII
23	172	178	289	152	695	113
24	144	258	287	152	180	213
25	127	269	281	402	414	189
26	259	269	277	100	176	618
27	072	048	394	304	150	182
28	034	435	374	243	181	143
29	152	080	241	124	382	219
30	140	190	478	303	276	115
31	159	319	594	116	105	114
32	231	219	176	711	162	063
33	224	171	344	253	274	129
34	264	100	395	204	261	222
35	153	198	228	282	371	022
Variance	1.78	2.03	4.52	2.07	2.29	1.39

[a] "First" refers to the analysis of the data in its original form; "Second" refers to the analysis of the data after it has been scored according to the pattern analysis technique of Rimoldi & Grib (1959).

[b] Decimal points have been omitted for all entries.

Table 6

Summary of Second Rotated Factor Matrix Loadings[a]

	Factor					
Scale Item	I_2[b]	II_2	III_2	IV_2	V_2	VI_2
1			645			
2						
3						
4	589					
5						
6					573	
7						
8		796				
9						
10						701
11						
12						
13		554				
14						
15						
16				666		
17					652	
18						
19						
20		688				
21	653					
22						

Table 6 (cont'd)

Summary of Second Rotated Factor Matrix Loadings[a]

Scale Item	Factor I_2[b]	II_2	III_2	IV_2	V_2	VI_2
23						
24					604	
25						
26						
27		513				
28						
29						
30						
31						
32						
33	471					
34						
35						
Variance	3.54	4.99	1.67	1.66	2.92	2.58

[a] Decimal points have been omitted from all entries

[b] The subscripts, I_1, & II_1, etc., refer to the factors identified by the factor analysis of initial data. The subscripts I_2 & II_2, etc., refer to the factors identified by the factoring of the same data after re-scored by the pattern analysis technique of Rimoldi & Grib (1959).

Table 6 (cont'd)

Summary of Second Rotated Factor Matrix Loadings[a]

	Factor					
Scale Item	VII_2	$VIII_2$	IX_2[b]	X_2	XI_2	XII_2
1						
2	721					
3			534			
4						
5			656			
6						
7						
8						
9			698			
10						
11		702				
12						
13						
14						
15						
16						
17						
18						
19			498			
20						
21						
22						

Table 6 (cont'd)

Summary of Second Rotated Factor Matrix Loadings[a]

Scale Item	Factor					
	VII_2	$VIII_2$	IX_2[b]	X_2	XI_2	XII_2
23					695	
24						
25					414	
26						618
27						
28						
29						
30			478			
31			594			
32				711		
33						
34						
35						
Variance	4.78	2.03	4.52	2.07	2.29	1.39

[a] Decimal points have been omitted from all entries.

[b] The subscripts, I_1, & II_1, etc., refer to the factors identified by the factor analysis of initial data. The subscripts I_2 & II_2, etc., refer to the factors identified by the factoring of the same data after re-scored by the pattern analysis technique of Rimoldi & Grib (1959).

have the higher loadings on most items (6), and each accounts for the highest proportion of the explained variance in each of the two factor analyses. This extracted factor was earlier identified as the Catholic seminarians' concern about psychiatry's non-supernatural view of man.

The second apparently most meaningful and identifiable factor extracted from the second analysis is II_2 with high loadings on four (4) items of the Attitude Scale, and has the second highest proportion of the explained variance, 4.086 (see Tables 5 and 6).

Factor II_2

Scale Item		Loading
8	In our complex society it is essential for the priest to have a thorough knowledge of psychiatry.	.796
20	Psychiatric knowledge is essential in adjusting to life in the seminary.	.688
13	Psychiatry is as important as philosophy in seminary training.	.554
27	More emphasis on teaching the findings of psychiatry is needed in the seminary curriculum.	.513

This factor, II_2, which indicates the Catholic seminarians' feeling that a knowledge of psychiatry is necessary to facilitate adjustment to life in general, and to the seminary in particular, was not clearly identified when the data were factor analyzed in its original

form.

The third most clearly defined factor extracted by the second analysis is XI_2, which is nearly identical with the second factor identified in the first analysis, i.e., IX_1. Both have high loadings on the same four (4) items of the Attitude Scale, and both have high proportions of the explained variance, 2.966 and 2.288, respectively. (Although factors X_1 and I_2 have higher variances, the items have fewer high loadings suggesting this to be a residual factor.)

Since the factor analytic procedures applied to the two scoring techniques of the same data yield two practically identical factors, ($I_1 = IX_2$, and $IX_1 = XI_2$), plus one additional factor, (II_2), then this finding is interpreted as evidence that the technique of pattern analysis, as employed by Rimoldi and Grib (1959), is a meaningful technique for an objective and quantitative method of describing and comparing pattern and/or profiles of multiple-score psychological tests which can be dichotomized into present/absent, endorse/not-endorse, etc. cells. The additional factor identified would suggest that this technique of pattern analysis is a more comprehensive method also.

A summary and comparison of both the relevant and non-relevant factors extracted by the two factor analyses of the two different scoring methods of the Loyola N.I.M.H. Attitude Scale are presented.

in Table 7. (Although some of the similar factors have different signs, this is interpreted as an artifact of the scoring procedure.) It is important to note that even the less meaningful factors are q uite similar in factor loadings, and/or in Attitude Scale items. This is interpreted as additional support that the technique of pattern analysis of psychological profiles developed by Rimoldi and Grib (1959), is a meaningful and quantifiable method of characterizing psychological profiles.

The similarities of factor I_1 with IX_2, and factor IX_1 with XI_2, plus a close study of factor II_2, again provides no evidence for the existence of a social desirability response set being significantly operative in the Catholic seminarians' responses on the Loyola N.I.M.H. Attitude Scale.

Although there were similar and relevant factors identified by each of the two factor analyses, the meaningful extracted factors appeared in a different order or position (see Tables 2 and 6). In order to ascertain that the same factors were being identified, regardless of their order, each of the highest twelve unrotated factor loadings from the first factor analysis of the data in its original form was correlated with each of the twelve unrotated factor loadings identified in the second factor analysis of the data after it had been re-scored according to the technique of Rimoldi and Grib (1959).

The method employed was the product-moment correlation based on the deviations from the means. These unexpectedly high correlations are presented in Table 8, and provide support that the same factors are being identified by both factor analyses.

An additional method of comparing the extracted factors of the two factored structures was developed by Burt (1948) by employing unadjusted correlations between the different sets of factor coefficients. Tucker extended this development for the comparison of factor structures, and his formula for a "coefficient of congruence" (Tucker, 1960, p. 256-259) was used to compare the factor loadings from the two sets of data in the present study. This formula is as follows:

$$p = \frac{\sum_{j=1}^{n} a1_{jp} \cdot a2_{jg}}{\sqrt{\left(\sum_{j=1}^{n} a1_{jp}^2\right)\left(\sum_{j=1}^{n} a2_{jg}^2\right)}}$$

where:

$a1_{jp}$ = loading of variable j on factor p of the first analysis,

$a2_{jg}$ = loading of variable j on factor g of the second analysis,

n = the number of variable (the summations are over the variables, and not over individuals).

Table 7

A Summary and Comparison of Relevant Factors[a] Extracted from the Factor Analysis of the Two Different Scoring Techniques

	COMMON FACTORS			
	A		B	
Individual Factors	I_1	IX_1	II_1	II_2
	Scale Item Loading[b]	Scale Item Loading	Scale Item Loading	Scale Item Loading
	30 838	9 698	8 992	8 796
	9 793	5 656		20 688
	3 778	31 594	13 436	13 554
	5 751	3 534		27 513
	19 601	19 498		
	31 491	30 478		
Variance	4.680	4.515	1.988	4.086

Table 7 (cont'd)

A Summary and Comparison of Relevant Factors[a] Extracted from the Factor Analysis of the Two Different Scoring Techniques

	COMMON FACTORS							
	C				D			
Individual Factors	IV_1		X_2		V_1		IV_2	
	Item	Scale Loading[b]	Item	Scale Loading	Item	Scale Loading	Item	Scale Loading
	32	-935	32	711	17	-769	17	666
	34	-551			15	-450	16	402
	25	423	25	402	19	-398	19	367
					16	-385	15	322
Variance	2.305		2.066		1.803		1.663	

Table 7 (cont'd)

A Summary and Comparison of Relevant Factors[a] Extracted from the Factor Analysis of the Two Different Scoring Techniques

	COMMON FACTORS			
	E		F	
Individual Factors	VI_1	V_2	VII_1	VII_2
	Scale Loading[b] Item	Scale Loading Item	Scale Loading Item	Scale Loading Item
	18 -822	18 652	2 -810	2 721
	24 -757	24 604	20 -408	20 402
	6 -651	6 573		
Variance	2.945	2.917	1.955	1.783

Table 7 (cont'd)

A Summary and Comparison of Relevant Factors[a] Extracted from the Factor Analysis of the Two Different Scoring Techniques

	COMMON FACTORS			
	G		H	
Individual Factors	IX_1	XI_2	X_1	I_2
	Scale Item Loading[b]	Scale Item Loading	Scale Item Loading	Scale Item Loading
	29 -780		21 789	21 653
	23 -669		4 717	4 589
	6 -501		33 587	33 471
	25 -497	25 414		
		29 382		
	35 -406	35 371		
Variance	2.966	2.288	3.539	3.539

Table 7 (cont'd)

A Summary and Comparison of Relevant Factors[a] Extracted from the Factor Analysis of the Two Different Scoring Techniques

	COMMON FACTORS			
	I		J	
Individual Factors	XI_1	II_2	XII_1	XII_2
	Scale Item Loading[b]	Scale Item Loading	Scale Item Loading	Scale Item Loading
	20 -742	20 688	26 -738	26 -618
		13 554	22 -695	
	27 -697	27 513		
Variance	2.892	4.086	2.776	1.390

[a] The subscripts I_1 & II_1, etc., refer to the factors identified by the factor analysis of initial data. The subscripts I_2 & II_2, etc., refer to the factors identified by the factoring of the same data after re-scored by the pattern analysis method of Rimoldi & Grib (1959).

[b] Decimal points have been eliminated from all factor loadings.

This measure of agreement between factor loadings on these two sets of data is quite similar to the product-moment correlations computed, except that actual factor loadings were used, and not the deviations from their means. Using the coefficient of congruence method of correlating the rotated factor loadings of the first factor analysis with the rotated factor loadings of the second factor analysis yielded the high and significant correlations presented in Table 9. This is further evidence that the two separate factor analyses are identifying or extracting essentially the same factors.

For a more effective comparison of the correlations yielded by the two techniques (depicted in Tables 8 and 9), they are presented together in Table 10 in parallel columns. Not only did both correlational techniques yield unusually high correlations, they also produced almost identical correlation coefficients. This last comparison appears to leave little question about the similarity of the different factors being identified by the two separate factor analyses in the present investigation.

Table 11 contains the eigen values for each of these twelve (12) factors for each of the two factor analyses, and the proportion of the total variance explained by each. The significant result from this analysis is that the second factor analysis of the data scored by the pattern analysis technique produces a higher eigen value for the first

Table 8

Product-Moment Correlations of Factor Loadings of First Factor Analysis with the Factor Loadings of the Second Factor Analysis

Factor from First Factor Analysis	Factor from Second Factor Analysis	Product-Moment r (Deviations from Means)
1	1	.854
2	2	-.854
3	4	-.918
4	5	-.725
5	6	.776
6	8	-.771
7	7	.847
8	9	.673
9	10	-.573
10	11	-.586
11	12	.579
12	13	.687

Table 9

Coefficients of Congruence (Tucker, 1960) of Rotated Factor Loadings of First Factor Analysis with the Rotated Factor Loadings of the Second Factor Analysis

Factor from First Factor Analysis	Factor from Second Factor Analysis	Coefficient of Congruence
1	9	.948
2	2	.598
3	6	.474
4	10	-.868
5	4	-.872
6	5	-.945
7	7	-.898
8	8	-.924
9	11	-.924
10	1	.965
11	2	-.874
12	12	-.918

Table 10

Highest Correlations of the Factor Loadings from First Factor Analysis with Factor Loadings from the Second Factor Analysis Based on Product-Moment r and Coefficient of Congruence

Factor from First Analysis	Factor from Second Analysis	Product-Moment Correlation Based on Deviations from X's	Based on Tucker's Coefficient of Congruence
1	9	.854	.948
2	2	-.854	.598
3	6	-.918	.474
4	10	-.725	-.868
5	4	.776	-.872
6	5	-.771	-.945
7	7	.847	-.898
8	8	.673	-.924
9	11	-.573	-.924
10	1	-.586	.965
11	2	.579	-.874
12	12	.687	-.918

factor, 24.26777 to 17.46401, and explains a higher proportion of the variance contributed by it, .69336 as compared with .45955. This would indicate that the technique of pattern analysis of Rimoldi and Grib (1959), when factor analyzed, is a stronger and more effective tool for the objective and quantitative description of psychological profiles.

Table 11

Eigen Values and Proportion of Total Variance

for each Factor in the First and Second Factor Analyses

	First Factor Analysis		Second Factor Analysis	
	Eigen Values	Proportion of Total Variance	Eigen Values	Proportion of Total Variance
Factor				
1	17.46401	.45955	24.26777	.69336
2	2.55154	.06714	.97106	.02775
3	2.18056	.05738	.76201	.02177
4	1.85637	.04884	.66499	.01900
5	1.54394	.04063	.59854	.01710
6	1.49865	.03944	.57231	.01635
7	1.27392	.03352	.55488	.01586
8	1.12095	.02949	.48058	.01373
9	1.08435	.02854	.45866	.01310
10	1.02615	.02700	.44125	.01261
11	.91215	.02400	.43625	.01246
12	.76304	.02008	.37753	.01079

CHAPTER V

SUMMARY AND CONCLUSIONS

In an attempt to provide objective methods for describing or quantifying profiles or patterns of a variety of psychological instruments which yield multiple scores, the science of psychology has witnessed the growth of a variety of techniques for characterizing or comparing profiles ranging from the arbitrary, then the ratio of corresponding slopes (Du Mas, 1946), the square of mean differences (Osgood and Suci, 1952), to McNemar's (1951) utilization of the analysis of variance. Most all of the investigators agree with Nunnally (1962) that any technique must utilize, as much as possible, most of the information available from the profiles. Rimoldi and Grib (1959) developed a technique of describing patterns (or profiles) which may have a potential for broader applications. This method provides for the condition when the individual does <u>not</u> choose to endorse an item, while also providing an index of agreement which varies from zero through 1.00 as an objective technique for describing patterns of response and/or non-responses. This method of pattern analysis was applied under different experimental conditions to a variety of data (Tabor, 1959, Mohrbacher, 1961, and Grib, 1961). It was not their intent to demonstrate or provide objective evidence of this technique or a

meaningful and quantifiable method for describing psychological profiles.

In order to evaluate the meaningfulness of this particular technique of pattern analysis as an objective, quantitative, and perhaps more comprehensive method of describing and comparing profiles of psychological measurement, it was necessary to study and compare two methods of analysing attitudes. Since this exploratory investigation utilised data from the Loyola National Institute of Mental Health Attitude Scale (Webb, 1959), it became possible to answer some important but subsidiary questions about the scale itself, as well as about the attitudes identified in this study.

The responses of 120 Catholic seminarians to the Loyola N.I.M.H. Attitude Scale consitituted the data and the subjects. Since this was an hypothesis-free (exploratory) study, the 60 subjects with the highest Attitude Scale scores (Upper Sixty), and the 60 subjects with the lowest scores (Lower Sixty) on this scale were selected from nearly a thousand administrations of this Attitude Scale in twenty-one different Catholic seminaries in order to maximise the variances for the factor analyses of the data. The summarisation of the results of this investigation are reported in the order of the importance of the questions explored in the present investigation.

The two factor analyses of the data, in its original form, and then using the weights computed from the converted (+ or -) attitude scale scores according to the method of Rimoldi and Grib (1959), extracted two identical factors with high loadings on each of the Attitude Scale items which were contained in each of the two factors. Futhermore, the product-moment correlations, and Tucker's "coefficient of congruence" (1960) for each of the two factor analyses were surprisingly high and uniform. These three findings provided considerable evidence that the same factors were being identified by both factor analyses. Thus, this pattern analytic technique did yield the same factor structures as did the data when it was factor analyzed in its original form. More importantly, these results provide evidence that this particular technique of pattern analysis is a reliable psychological method for the objective and quantitative description of profiles.

Not only did both analyses identify the same two meaningful factors, but the second analysis also identified an additional third meaningful factor which was not apparent from the first analysis of the data in its original form. This finding, in conjunction with the higher eigen value, and the higher proportion of the total explained variance revealed by this second factor analysis of the data after having been re-scored according to the pattern analysis of Rimoldi and Grib (1959),

demonstrated it to be a stronger, more effective, and more comprehensive method for the objective and quantitative depiction of psychological profiles of measurements which contain multiple-scores which can be categorized, or categorised through modification as present or absent.

One of the subsidiary questions answered was that the Loyola N.I.M.H. Attitude Scale did yield meaningful attitudes. The three identified were (1) the Catholic seminarians' view of psychiatry as a non-supernatural approach to man, (2) their desire to utilise psychiatric knowledge to be a more effective priest when dealing with disturbed people, and (3) their feeling that a knowledge of psychiatry is necessary for adjustment to life in general, and to the seminary life in particular. One practical implication of this result would be systematic attempts to present positive mental health principles to priests and seminarians in such a manner that they are not perceived or interpreted by them as a threat to their basic spiritual orientation. This is consistent with the concepts and approach of Devlin (1965), and Webb (1959), Herr and Devlin (1958), and Kobler, et al (1960) as a part of an overall attempt by the Loyola National Institute of Mental Health Project on Religion and Mental Health to integrate mental health concepts into religious training (Herr, 1960).

Constructing a model pattern of responses to the Attitude Scale

by all 120 subjects made it possible to compute an Index of Agreement for the Upper and Lower groups. These indexes were .81 and .68, respectively. This provided more information about the original but secondary questions, to wit: that there are different patterns or profiles of responses to the Loyola Attitude Scale as demonstrated by the fact that the high scoring subjects produced different patterns or profiles of responses than did the low scoring group. Whether such differences are a result of chance must await the development of methods for determining levels of significance.

Finally, of the three individual factors, (i.e., attitudes identified), factor I_1, which expressed the seminarians' concern about psychiatry, was not indicative of a response set of social desirability. This suggested that the extracted factors were not comprised of only one type of statement that was positive toward psychiatry. This is quite consistent with the findings of Walsh (1963) in his study of a large sample of subjects and attitude scales.

Briefly and primarily this present investigation has presented additional evidence that the method of pattern analysis developed by Rimoldi and Grib (1959) is a reliable technique for an objective, quantitative, and more comprehensive description and comparison of profiles of multiple-score psychological instruments, the results of which can be dichotomized into present or absent matrices. With the

additional information provided by this investigation, this technique should invite increased utilization in future research on the variety of multiple-score psychological tests currently available in the field of psychology.

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APPENDIX I

Loyola National Institute of Mental Health Attitude Scale (Webb, 1959)

This questionnaire is an attempt to get your opinion on some vital issues. We are interested only in your agreement or disagreement with the following statements, and not in the truth or falsity of them. In some cases you may feel you do not have enough information to make a judgment; in such instances we would like you to make the best judgment possible.

Please read every statement and respond to it in terms of your personal agreement or disagreement according to the following plan:

Strongly agree	Agree	Agree and Disagree equally	Disagree	Strongly disagree
A	B	C	D	E

Please circle the letter indicating your choice.

1. A B C D E A psychiatrist can be effective regardless of his religion.

2. A B C D E There is a close relationship between religious and psychiatric ideals.

3. A B C D E Psychiatry ignores the supernatural side of man.

4. A B C D E A psychiatrist makes one feel uncomfortable because he is always analysing his fellow man.

5. A B C D E Psychiatry denies free will in man's conduct by its own unconscious motivations.

6. A B C D E Parishioners should be referred to a psychiatrist as readily as to another medical specialist.

7. A B C D E There is no conflict between psychiatry and religion.

8. A B C D E In our complex society it is essential for the priest to have a thorough knowledge of psychiatry.

9. A B C D E Current psychiatric practice allows people to express sexual impluses without moral inhibition.

10. A B C D E Common sense is a fitting substitute for psychiatric knowledge.

11. A B C D E There is nothing in present day psychiatry that is contrary to Catholic teaching.

12. A B C D E A good Catholic should never undergo intensive psychiatric analysis.

13. A B C D E Psychiatry is as important as philosophy in seminary teaching.

14. A B C D E Religion and psychiatry are compatible.

15. A B C D E Psychiatrists are likely to misguide a Catholic when problems are involved.

16. A B C D E Psychiatrists often attempt to take the place of the priest.

17. A B C D E Psychiatry today is dominated by a materialistic philosophy of man.

18. A B C D E Psychiatric analysis usually requires too much time for treatment to be recommended to a parishioner.

19. A B C D E Psychiatrists place an exaggerated emphasis on sex.

20. A B C D E Psychiatric knowledge is essential in adjusting to life in the seminary.

21. A B C D E Psychiatry offers few facts and its teachings are mostly hypothetical and uncertain.

22. A B C D E The findings of psychiatry should be taught to help the priest in his confessional work.

23. A B C D E In most cases a parishoner who thinks he needs psychiatric help would do better to improve his religious life.

24. A B C D E Psychiatry is feared only because it is misunderstood.

25. A B C D E More consistent agreement among psychiatrists is necessary before their teaching can be brought into the seminary.

26. A B C D E Too much psychiatry is a bad thing.

27. A B C D E More emphasis on teaching the findings of psychiatry is needed in the seminary curriculum.

28. A B C D E The present seminary curriculum is too crowded to include more teaching of psychiatric knowledge.

29. A B C D E In dealing with mentally disturbed individuals psychiatry is essential.

30. A B C D E Psychiarty because of its exclusive concern with abnormal individuals is of little use to the priest.

31. A B C D E Psychiatry considers religion a mass delusion to be eliminated through analysis.

32. A B C D E The psychiatrist's use of electric shock therapy should be condemned.

33. A B C D E The priest who utilises psychiatric knowledge in his work is a more effective priest.

34. A B C D E Psychiatry is unacceptable because it deals too much with the unkown.

35. A B C D E A priest should not hesitate to refer a parishioner to a psychiatrist.

APPENDIX II

Raw Scores and Scale Values of Upper and Lower Sixty Subjects on Loyola N.I.M.H. Attitude Scale

UPPER SIXTY			LOWER SIXTY		
Subject's Number	Raw Score	Scale Vale	Subject's Number	Raw Score	Scale Value
362	107	3.1	617	33	.9
2	108	3.1	209	51	1.5
8	108	3.1	693	54	1.5
49	108	3.1	472	56	1.6
13	109	3.1	824	56	1.6
28	109	3.1	122	57	1.6
84	109	3.1	171	57	1.6
282	109	3.1	187	57	1.6
364	109	3.1	186	58	1.7
365	109	3.1	56	60	1.7
371	109	3.1	337	60	1.7
378	109	3.1	558	60	1.7
486	109	3.1	607	60	1.7
509	109	3.1	697	60	1.7
537	109	3.1	775	60	1.7
568	109	3.1	747	61	1.7

APPENDIX II (cont'd)

Raw Scores and Scale Values of Upper and Lower Sixty Subjects on Loyola N.I.M.H. Attitude Scale

UPPER SIXTY			LOWER SIXTY		
Subject's Number	Raw Score	Scale Value	Subject's Number	Raw Score	Scale Value
713	109	3.1	778	61	1.7
738	109	3.1	424	62	1.8
751	109	3.1	114	64	1.8
758	109	3.1	253	64	1.8
917	109	3.1	408	64	1.8
945	109	3.1	605	64	1.8
481	110	3.1	55	66	1.9
685	110	3.1	465	65	1.9
53	111	3.2	851	65	1.9
217	111	3.2	172	66	1.9
379	111	3.2	189	66	1.9
423	111	3.2	332	66	1.9
686	111	3.2	523	66	1.9
692	111	3.2	532	66	1.9
969	111	3.2	67	67	1.9
313	112	3.2	266	67	

APPENDIX II (cont'd)

Raw Scores and Scale Values of Upper and Lower Sixty Subjects on Loyola N.I.M.H. Attitude Scale

UPPER SIXTY			LOWER SIXTY		
Subject's Number	Raw Score	Scale Value	Subject's Number	Raw Score	Scale Value
614	112	3.2	331	67	1.9
766	112	3.2	545	67	1.9
132	113	3.2	705	67	1.9
459	113	3.2	412	68	1.9
919	113	3.2	578	68	1.9
226	114	3.3	779	68	1.9
553	114	3.3	183	69	1.9
583	114	3.3	184	69	1.9
719	114	3.3	211	69	1.9
811	114	3.3	634	69	1.9
875	114	3.3	933	69	1.9
514	115	3.3	38	70	2.
868	115	3.3	163	70	2.
273	116	3.3	191	70	2.
376	116	3.3	195	70	2.
701	116	3.3	204	70	2.

APPENDIX II (cont'd)

Raw Scores and Scale Values of Upper and Lower Sixty Subjects on Loyola N.I.M.H. Attitude Scale

UPPER SIXTY			LOWER SIXTY		
Subject's Number	Raw Score	Scale Value	Subject's Number	Raw Score	Scale Value
316	117	3.3	205	70	2.
194	118	3.4	222	70	2.
446	118	3.4	254	70	2.
648	118	3.4	345	70	2.
981	118	3.4	433	70	2.
665	119	3.4	575	70	2.
279	121	3.5	841	70	2.
784	121	3.5	54	71	2.
15	122	3.5	208	71	2.
879	127	3.6	259	71	2.
944	127	3.6	521	71	2.
946	127	3.6	643	71	2.
Total	6780	193.9		3886	110.1
Mean	113.0	3.2		64.7	1.8

Mean for both groups combined (120 S_s) = 2.5

APPENDIX III

Tabulation for the Median for each of the 35 Items on the Loyola N.I.M.H. Attitude Scale

Attitude Scale Item	Scale Value				
	A	B	C	D	E
1	20	44	18	19	19
2	33	45	22	12	8
3	28	30	34	19	9
4	39	40	24	11	6
5	39	43	23	12	3
6	39	26	20	23	12
7	49	17	29	19	6
8	21	21	33	36	9
9	23	34	42	20	1
10	49	33	27	8	3
11	6	14	19	41	40
12	60	29	18	7	6
13	21	10	21	41	27
14	66	30	17	6	1
15	16	26	46	25	7
16	18	38	32	35	6
17	6	30	33	34	17
18	39	48	23	10	0

APPENDIX III (cont'd)

Tabulation for the Median for each of the 35 Items

on the Loyola N.I.M.H. Attitude Scale

Attitude Scale Item	Scale Value				
	A	B	C	D	E
19	19	34	32	27	8
20	9	20	23	45	23
21	34	40	32	12	4
22	55	39	17	5	4
23	32	28	20	32	8
24	40	34	27	14	5
26	22	34	28	23	13
26	15	18	28	36	23
27	40	33	29	8	10
28	21	32	27	28	12
29	60	44	20	4	2
30	72	31	15	1	1
31	49	29	32	7	3
32	44	51	23	1	1
33	50	25	33	10	2
34	46	49	18	5	2
35	41	16	38	20	5

APPENDIX IV

Tetrachoric Intercorrelations[a] of Loyola N.I.M.H. Attitude Scale

Scale Item	1	2	3	4	5	6	7	8	9
1									
2	37								
3	28	29							
4	37	34	42						
5	54	42	79	57					
6	62	42	49	39	43				
7	54	47	65	67	67	65			
8	02	01	22	22	11	37	45		
9	47	46	74	54	85	54	67	22	
10	54	34	38	47	48	49	32	-24	-48
11	41	14	18	19	39	38	47	21	44
12	58	29	43	47	40	47	78	27	37
13	30	20	41	44	48	28	69	72	23
14	54	48	38	48	56	69	72	11	62
15	54	54	53	44	54	52	69	46	62
16	66	37	71	52	72	52	78	36	62
17	27	29	53	39	56	29	53	33	58
18	42	56	49	30	52	64	38	-05	62
19	64	49	72	56	87	57	84	45	88

APPENDIX IV (cont'd)

Tetrachoric Intercorrelations[a] of Loyola N.I.M.H. Attitude Scale

Scale Item	1	2	3	4	5	6	7	8	9
20	18	47	21	37	42	34	61	58	41
21	39	29	42	57	49	39	64	24	53
22	29	24	62	64	56	46	72	45	29
23	55	37	43	40	46	57	51	20	51
24	52	48	61	46	66	75	68	42	55
25	56	43	62	53	60	70	86	43	48
26	52	42	45	34	60	43	67	37	43
27	62	21	61	52	61	51	73	49	55
28	51	26	53	43	52	58	62	27	54
29	29	20	48	53	43	56	50	39	41
30	48	21	80	48	72	51	53	-04	82
31	47	36	57	53	66	52	65	29	76
32	29	23	29	09	12	29	39	18	09
33	65	51	56	74	64	67	83	43	65
34	28	37	42	48	60	50	61	30	51
35	74	41	53	57	50	89	74	-52	62

APPENDIX IV (cont'd)

Tetrachoric Intercorrelations[a] of Loyola N.I.M.H. Attitude Scale

Scale Item	10	11	12	13	14	15	16	17	18
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11	22								
12	14	43							
13	09	15	52						
14	30	31	34	43					
15	33	43	53	26	44				
16	60	48	61	51	50	77			
17	18	42	45	33	10	52	65		
18	42	23	82	31	21	31	59	39	
19	50	41	67	47	57	84	86	78	61

APPENDIX IV (cont'd)

Tetrachoric Intercorrelations[a] of Loyola N.I.M.H. Attitude Scale

Scale Item	10	11	12	13	14	15	16	17	18
20	18	16	33	51	53	39	33	33	13
21	35	21	62	52	58	52	62	46	33
22	54	10	43	69	38	68	59	28	20
23	36	36	53	17	39	54	59	38	28
24	42	42	38	61	49	48	66	48	69
25	47	39	61	51	50	66	70	34	36
26	28	37	60	54	56	54	57	26	34
27	42	17	57	77	64	67	71	34	28
28	43	43	44	47	48	58	63	38	34
29	58	08	26	35	35	43	53	23	36
30	50	28	46	30	48	30	57	19	32
31	27	42	36	50	50	43	59	66	48
32	18	42	43	43	29	33	34	28	01
33	49	35	62	64	72	73	81	54	39
34	52	18	38	52	40	41	57	32	20
35	-26	38	73	44	54	56	64	42	56

APPENDIX IV (cont'd)

Tetrachoric Intercorrelations[a] of Loyola N.I.M.H. Attitude Scale

Scale Item	19	20	21	22	23	24	25	26	27
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									

APPENDIX IV (cont'd)

Tetrachoric Intercorrelations[a] of Loyola N.I.M.H. Attitude Scale

Scale Item	19	20	21	22	23	24	25	26	27
20	50								
21	63	17							
22	58	53	35						
23	68	28	46	22					
24	68	28	50	42	50				
25	74	33	66	70	69	62			
26	54	41	39	63	37	53	57		
27	73	73	50	64	44	45	66	58	
28	65	38	40	48	46	60	68	46	62
29	57	40	39	53	58	59	59	57	44
30	81	22	61	40	50	39	69	34	60
31	79	30	47	34	44	50	53	57	51
32	38	28	23	19	30	16	60	22	48
33	83	50	71	80	60	62	86	60	76
34	66	34	49	40	36	29	60	53	53
35	66	37	57	46	67	72	82	45	69

APPENDIX IV (cont'd)

Tetrachoric Intercorrelations[a] of Loyola N.I.M.H. Attitude Scale

Scale Item	28	29	30	31	32	33	34	35
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								

APPENDIX IV (cont'd)

Tetrachoric Intercorrelations[a] of Loyola N.I.M.H. Attitude Scale

Scale Item	28	29	30	31	32	33	34	35
20								
21								
22								
23								
24								
25								
26								
27								
28								
29	42							
30	44	46						
31	62	09	48					
32	22	16	41	17				
33	63	68	36	69	48			
34	18	36	43	50	55	73		
35	48	63	58	54	54	76	52	

[a] Decimal points have been omitted.

APPENDIX V

Tabulation of Median for each of the 35 Items on the Loyola N.I.M.H. Attitude Scale for the Upper Sixty Group

Attitude Scale Item	Scale Value				
	A	B	C	D	E
1	19	29	6	5	1
2	27	24	7	1	1
3	26	20	11	1	2
4	34	21	4		1
5	37	21	2		
6	36	14	6	4	
7	44	12	3	1	
8	18	14	16	11	1
9	22	24	11	3	
10	42	11	6	1	
11	4	13	12	22	9
12	54	4		1	1
13	30	9	9	16	6
14	55	3	2		
15	15	23	18	2	2
16	17	33	8	1	1
17	6	30	14	8	2

APPENDIX V (cont'd)

Tabulation of Median for each of the 35 Items

on the Loyola N.I.M.H. Attitude

Scale for the Upper Sixty Group

Attitude Scale Item	Scale Value				
	A	B	C	D	E
18	38	17	4	1	
19	19	31	9	1	
20	9	19	11	16	5
21	33	20	4	2	1
22	50	10			
23	31	14	9	4	2
24	37	17	4	1	1
25	22	27	9	2	
26	15	15	16	11	3
27	38	18	3		1
28	20	23	6	9	2
29	44	14	1	1	
30	59	1			
31	45	9	6		
32	37	18	5		
33	49	11			
34	42	15	2		1
35	40	9	10		

APPENDIX VI

Tabulation of Median for each of the 35 Items on the Loyola N.I.M.H. Attitude Scale for the Lower Sixty Group

Attitude Scale Item	Scale Value				
	A	B	C	D	E
1	1	15	12	14	18
2	6	21	15	11	7
3	2	10	23	18	7
4	5	19	20	11	5
5	2	22	21	12	3
6	3	12	14	19	12
7	5	5	26	18	6
8	3	7	17	25	8
9	1	10	31	17	1
10	7	22	21	7	3
11	2	1	7	19	31
12	6	25	18	6	5
13	1	1	12	25	21
14	11	27	15	6	1
15	1	3	28	23	5
16	1	5	24	24	6
17			19	26	15

APPENDIX VI (cont'd)

Tabulation of Median for each of the 35 Items

on the Loyola N.I.M.H. Attitude

Scale for the Lower Sixty Group

Attitude Scale Item	Scale Value				
	A	B	C	D	E
18	1	31	19	9	
19		3	23	26	8
20		1	12	29	18
21	1	20	26	10	3
22	5	29	17	5	4
23	1	14	11	28	6
24	3	17	23	13	4
25		7	19	21	13
26		3	12	25	20
27	2	15	26	8	19
28	1	9	21	19	10
29	6	30	19	3	2
30	13	30	15	1	1
31	4	20	26	7	3
32	7	3	18	1	1
33	1	14	33	10	2
34	4	34	16	5	1
35	1	7	28	19	5

APPENDIX VII

An Example of the Procedure of Pattern Analysis (Crib, 1961)

Let Figure 1 represent an experimentally observed pattern in a system of four subjects and four stimuli. Responses of the subjects are designated as X cells or empty cells according to whether a particular trait is present (choice of stimulus, endorsing an item, etc.) or absent (not choosing the stimulus, not giving a movement response, etc.). If the trait is present an X is entered in the cell; if it is not present, or not chosen, the cell is left empty.

		Stimuli 1	2	3	4	X cells	empty cells
Subjects	a	X				1	3
	b	X	X			2	2
	c	X	X	X		3	1
	d	X	X	X	X	4	0
X cells		4	3	2	1	10	
empty cells		0	1	2	3		6

Fig. 1 Observed pattern of responses.

APPENDIX VII (cont'd)

An Example of the Procedure of Pattern Analysis (Grib, 1961)

Characterization of Patterns

A set of weights can be defined in order to characterise the patterns of response illustrated in Figure 1 (Rimoldi and Grib, 1960a). These weights are defined in terms of the designation of a cell as the intersection of a row and a column, such that the total contribution of the corresponding arrays (i.e., both subject and stimulus) is taken into account. Since the X cells and empty cells represent qualitatively different phenomena (i.e., the presence or absence of a particular trait or attribute) the weights for each type of cell (X or empty) are determined separately. For all X cells, the weight is defined as the total number of X cells in the corresponding row multiplied by the total number of X cells in the corresponding column, and this product divided by the total number of X cells in the entire matrix. The formula, as given by Rimoldi and Grib (1960a) is:

$$W_{X_{ij}} = \frac{R_i C_j}{T}$$

where:

APPENDIX VII (cont'd)

An Example of the Procedure of Pattern Analysis
(Grib, 1961)

$W_{X_{ij}}$ = weight of X cell in row i and column j.

R_i = Number of X cells in row i.

C_j = Number of X cells in column j.

T = Total number of X cells in entire matrix.

Similarly, for all empty cells, the weight is defined by Rinoldi and Grib (1960a) as:

$$W_{O_{ij}} = \frac{\bar{R}_i \bar{C}_j}{\bar{T}}$$

where:

$W_{O_{ij}}$ = weight of empty cell in row i and column j.

$\bar{R}_i$ = number of empty cells in row i.

$\bar{C}_j$ = number of empty cells in column j.

$\bar{T}$ = total number of empty cells in entire matrix.

APPENDIX VII (cont'd)

An Example of the Procedure of Pattern Analysis (Grib, 1961)

The complete table of weights for the example in Figure 1 is presented in Figure 2. The weights in parentheses refer to the weights of X cells.

		Stimuli			
		1	2	3	4
Subjects	a	(.4)	.5	1.0	1.5
	b	(.8)	(.6)	.67	1.0
	c	(1.2)	(.9)	(.6)	.5
	d	(1.6)	(1.2)	(.8)	(.4)

Fig. 2 Quantitative characterisation of observed pattern of responses illustrated in Figure 1.

The weighted matrix presented in Figure 2 is the quantitative ahcaracterisation of the response patterns illustrated in Figure 1.

Comparison of Patterns

Suppose we now wish to evaluate the agreement of another set of responses, as presented in Figure 3, with the pattern shown in Figure 1.

APPENDIX VII (cont'd)

An Example of the Procedure of Pattern Analysis
(Grib, 1961)

Stimuli

Subjects	1	2	3	4
a'	x			
b'	x		X	
c'	x	X		X
d'	x	X	X	X

Fig. 3. Pattern of responses to be compared with pattern illustrated in Figure 3.

A measure of agreement between patterns is provided by the Index of Agreement, which expresses the agreement as a ratio which varies from 1.00 (complete agreement) to 0 (complete disagreement or largest possible deviation).

The Index of Agreement is calculated as follows:

1. The sums of weights of the cells which are congruent (i.e., are the same, X or empty) in both patterns is determined. The weights employed are those of the "model" or criterion pattern (i.e., the weights of Figure 2 in this example).

APPENDIX VII (cont'd)

An Example of the Procedure of Pattern Analysis
(Grib, 1961)

2. The sums of all the weights of the cells of the criterion pattern (Figure 2) is calculated.

3. The totals of (1) and (2) are corrected for the minimum possible agreement between the patterns by subtracting from each of them the minimum sum of weights of congruent cells possible within the system of the patterns.

4. The Index of Agreement is the ratio between the corrected sums of (1) and (2). That is:

$$\text{Index of Agreement} = \frac{\left(\begin{array}{c}\text{sum of weights}\\ \text{of congruent cells}\end{array}\right) - \left(\begin{array}{c}\text{minimum possible}\\ \text{sum of weights}\\ \text{of congruent cells}\end{array}\right)}{\left(\begin{array}{c}\text{total weight of}\\ \text{model pattern}\end{array}\right) - \left(\begin{array}{c}\text{minimum possible}\\ \text{sum of weights}\\ \text{of congruent cells}\end{array}\right)}$$

In our example, the values of the various calculations are as follows:

1. The sum of the weights of cells which are congruent in both patterns (i.e., all cells except b2, b3, c3, and c4) is 11.30.

2. The sum of the weights of the criterion pattern (Figure 4) is 13.67.

3. The minimum sum of weights possible for congruent cells is 7.00.

4. The Index of Agreement is $\frac{11.30 - 7.00}{13.67 - 7.00} = \frac{4.30}{6.67} = .64$

APPROVAL SHEET

The dissertation submitted by A. H. Rittenhouse has been read and approved by a board of four members of the Department of Psychology.

The final copies have been examined by the directors of the dissertation and the signatures which appear below verifies the fact that any necessary changes have been incorporated, and that the dissertation is now given final approval with reference to content, form, and mechanical accuracy.

The dissertation is therefore accepted in partial fulfillment of the requirements for the Degree of Doctor of Philosophy.

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