

A Test of Holland's Environment Formulations

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One hundred and eighty-one occupations, for which reinforcer rating data were available, were classified into the six Holland environment models. Mean reinforcer scale scores were found to differ significantly among the six environments on 17 reinforcer scales, on 12 of which there were significant pairwise differences. Comparison of hypothesized and observed rank orderings of the six environments showed significant agreement on eight reinforcer scales. Comparison of mean score differences between alternating environments with those between opposite or adjacent environments were significantly in the hypothesized direction for three reinforcer scales. Multidimensional scaling of the six environments using correlation and d^2 as measures of similarity showed the appropriateness of a two-dimensional solution, with an RCSI_{AE} or REAISC ordering (compared with Holland's postulated RIASEC ordering). Position Analysis Questionnaire mean factor scores for five Holland environments were found not to fit a two-dimensional configuration. It is concluded that these occupational reinforcer and behavioral requirement data provide at best only modest support for Holland's environment formulations.

Holland's theory of careers (Holland, 1959, 1966, 1973), initially concerned with vocational choice, has been broadened to a theory of personality (Osipow, 1973). Accordingly, Holland's concepts of personality type and environment model have been restructured and simplified and his typology revised (Holland, 1973). The heuristic value of these revisions is indicated by the more than 175 studies conducted to investigate various aspects and applications of Holland's theory. The majority of these studies dealt with Hol-

land's personality type formulations. Fewer investigations were about Holland's environment formulations, and most of these focused on educational environments (Holland, 1973; Walsh, 1973). The present study, an examination of Holland's environment formulations, is about the occupational environment.

In his view of the environment, Holland (1973) asserts that the characteristics of the environment are reflected in the nature of its members. Since there are six personality types, there should be six environment models. Each environment model is characterized by different demands and opportunities that stimulate activities, foster competencies, encourage perceptions, and reward values. Each environment model reinforces the traits of the corresponding personality type. Furthermore, the six environment models are so related that they can be represented as a hexagon. The hexagon model embodies Holland's key assumptions of "calculus" and "consistency." Calculus defines the relationships among environment models such that the distances between the environments are "inversely pro-

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portional to the theoretical relationship(s) between them" (Holland, 1973, p. 5). The hexagon model depicts the three levels of consistency: (a) Adjacent environments on the hexagon are most consistent, (b) opposite environments are least consistent, and (c) all other environmental pairings on the hexagon represent intermediate levels of consistency.

Several methods have been used to investigate Holland's environment formulations. The most common method was to compare personality measurements on employed workers in occupations representing environment models (Andrews, 1973; Bates, Parker, & McCoy, 1970; Fabry, 1975, 1976; Fishburne & Walsh, 1976; Gaffey & Walsh, 1974; Harvey & Whinfield, 1973; Horton & Walsh, 1976; Hughes, 1972; Lacey, 1971; Morrison & Arnold, 1974; O'Brien & Walsh, 1976; Osipow, 1970; Schuldt & Stahmann, 1971; Walsh, Horton, & Gaffey, 1977; Werner, 1969; Wigginton & Apostol, 1973). The results of these studies have generally been in the direction hypothesized by Holland's theory.

Some studies (Bates, Parker, & McCoy, 1970; Hughes, 1972; Kerlin, 1976; Werner, 1969; Wiggins, 1976) have investigated job performance, tenure, and satisfaction of workers in different environments in the light of expectations from Holland's theory, but except for Wiggins' (1976) findings these have generally reported negative results.

Few studies investigating Holland's environment formulations have used data other than personality measurements. Holland, Viernstein, Kuo, Karweit, and Blum (1972) classified 832 occupations, for which Position Analysis Questionnaire (PAQ) data were available, into five of the six Holland environment models. They found significant differences in mean PAQ factor scores among the five groups of occupations. When five PAQ factors were chosen to represent the five Holland environments and the occupations reclassified with these five factors, the percentage of correct classification was 54% versus a chance expectation of 20% (Holland, 1973).

Toenjes and Borgen (1974) classified 148 occupations into the six Holland environments and found significant mean differences in rated occupational reinforcer characteris-

tics on 15 of the 21 reinforcer dimensions. Plotting the six groups in discriminant space formed by the reinforcer dimensions, the authors found the groups arranged in the order postulated by Holland, although not quite in the configuration of a hexagon.

Toenjes and Borgen had used *T* scores (scale-by-scale conversion) in their analysis. When scale means for each Holland environment group were rank ordered by *T* scores, these rankings were found (by the present authors) to correlate (Spearman rho) from .07 (for the Realistic group) to .61 (for the Conventional group), with rankings using the conventional adjusted scale values. Since the multiple discriminant function method uses information on level (mean) rather than shape (rank order), the Toenjes and Borgen data were reanalyzed by the method of multidimensional scaling (which uses shape information). The results were much less supportive of the Holland theory. Additionally, it was discovered that disagreements in the classification of occupations into Holland environments occurred between Toenjes-Borgen and the present authors for 23 of the 148 occupations, almost half of these disagreements for occupations classified by Toenjes and Borgen as Investigative. With the availability of occupational reinforcer information on 33 additional occupations and because of the paucity of studies on Holland's environment formulations using occupational (and not personality) data, the present study was undertaken.

The objectives of the present study were, first, to assess the differences among the six Holland environment models in terms of occupational reinforcers, second, to test the conformity of observed differences in occupational reinforcer characteristics to a set of a priori hypotheses about the environments, and finally, to test the fit of Holland's hexagon model to the data on occupational reinforcers and behavioral requirements.

Method

Data

Occupational reinforcer data used in this study were obtained with the Minnesota Job Description Questionnaire. With this instrument, 21 reinforcers

Table 1
Scheffé Test of Mean Reinforcer Scale Scores Between Any Two Holland Environments, by Reinforcer Scale

Reinforcer scale	Rank					
	6	5	4	3	2	1
Ability Utilization	.79(C) _a	1.04(R) _a	1.34(S) _b	1.40(E) _b	1.41(I) _b	1.61(A) _b
Achievement	.87(C) _a	1.02(R) _a	1.20(E) _{a,b}	1.28(S) _b	1.35(I) _b	1.52(A) _b
Activity	.63(E) _a	.71(I) _a	.72(A) _a	.75(R) _a	.75(S) _a	.88(C) _a
Advancement	.35(S) _a	.51(R) _a	.62(I) _a	.72(A) _a	.73(E) _a	.74(C) _a
Authority	-.35(C) _a	-.28(R) _a	-.26(E) _a	-.15(S) _a	-.03(I) _a	-.03(A) _a
Autonomy	.58(R) _a	.60(C) _{a,b}	.84(A) _{a,b}	.90(S) _b	.97(E) _b	.99(I) _b
Company Policies/ Practices	.30(I) _a	.59(A) _{a,b}	.64(S) _b	.71(C) _b	.76(R) _b	.89(E) _b
Compensation	.28(S) _a	.49(C) _{a,b}	.58(A) _{a,b}	.66(I) _{a,b}	.69(R) _b	.79(E) _b
Co-workers	.67(A) _a	.72(R) _a	.74(I) _a	.77(E) _a	.81(C) _a	.83(S) _a
Creativity	.14(C) _a	.45(R) _a	.93(S) _b	.94(I) _b	.97(E) _b	1.21(A) _b
Independence	.48(I) _a	.48(S) _a	.51(C) _a	.52(R) _a	.55(E) _a	.70(A) _a
Moral Values	.63(R) _a	.67(C) _{a,b}	.72(E) _{a,b}	.73(A) _{a,b}	.74(I) _b	.78(S) _b
Recognition	.76(C) _a	.78(R) _a	.78(S) _a	.85(I) _a	1.01(A) _a	1.04(E) _a
Responsibility	.35(C) _a	.57(R) _{a,b}	1.00(S) _{b,c}	1.03(A) _{b,c}	1.04(E) _c	1.13(I) _c
Security	1.01(A) _a	1.06(I) _a	1.10(E) _a	1.12(S) _a	1.19(R) _a	1.30(C) _a
Social Service	.62(R) _a	.84(A) _{a,b}	.98(C) _b	1.03(E) _b	1.24(I) _{b,c}	1.53(S) _c
Social Status	-.12(C) _a	-.03(R) _a	.21(E) _{a,b}	.22(A) _{a,b}	.25(S) _b	.37(I) _b
Supervision—Human Relations	.37(I) _a	.50(A) _{a,b}	.57(S) _{a,b}	.61(C) _{a,b}	.65(R) _b	.78(E) _b
Supervision—Technical	.24(I) _a	.42(S) _{a,b}	.50(A) _{a,b}	.62(C) _b	.63(R) _b	.70(E) _b
Variety	.39(C) _a	.57(R) _a	.66(I) _a	.66(E) _a	.78(S) _a	.86(A) _a
Working Conditions	.89(R) _a	.90(S) _a	.93(I) _a	1.00(C) _a	1.04(E) _a	1.09(A) _a

Note. Mean scale scores with the same subscript do not differ at $p \leq .05$. Abbreviations follow: Realistic (R), Investigative (I), Artistic (A), Social (S), Enterprising (E), and Conventional (C).

are rated with respect to how well they describe a given occupation (Borgen, Weiss, Tinsley, Dawis, & Lofquist, 1968a, 1968b; Rosen, Hendel, Weiss, Dawis, & Lofquist, 1972). Occupational reinforcer data were available for 181 occupations, sampling a broad range of occupations classified as follows: 55 (30.4%) as professional, technical, and managerial; 37 (20.4%) as clerical and sales; 19 (10.5%) as service; 1 (.6%) as farming, fishery, or forestry; 4 (2.2%) as processing; 17 (9.4%) as machine trades; 10 (5.5%) as benchwork; 25 (13.8%) as structural work; and 13 (7.2%) miscellaneous.

Also used in this study were PAQ data derived from the Holland et al. (1972) study. The PAQ (McCormick, 1976; McCormick, Jeanneret, & Mecham, 1972) was designed to describe human behaviors ("job elements") required in the performance of work. Mean PAQ factor scores for five Holland environments were obtained from Holland et al. (1972, pp. 14-15) and Holland (1973, pp. 76-77). The Artistic environment, represented by only two jobs, was omitted from the analysis.

Procedure

The 181 occupations with reinforcer data were classified into Holland environment models, using

Holland (1973, Appendix E, pp. 136-141) to translate the *Dictionary of Occupational Titles* (1965) codes into Holland occupational codes. The 181 occupations were distributed among the Holland environments as follows: 88 (48.6%) were Realistic, 16 (8.8%) were Investigative, 10 (5.5%) were Artistic, 29 (16%) were Social, 17 (9.4%) were Enterprising, and 21 (11.6%) were Conventional.

One-way analysis of variance, with the Scheffé test for pairwise comparisons, was used to examine the mean scale score differences among the six Holland environment groups on each reinforcer scale. Omega-squared (Hays, 1973) was computed from each analysis of variance to determine the proportion of reinforcer scale variance associated with environment variance.

To specify expectations about reinforcer differences among the Holland environments, a group of raters rank-ordered the six environments in terms of how well a given reinforcer scale statement described them. All seven raters were familiar with Holland's environment formulations and with the reinforcer statements. Average rank determined the rank order of environments for each reinforcer statement, which then constituted the hypothesized expectations about reinforcer differences. Significant ($p \leq .05$) interrater agreement (by Kendall's coefficient of

concordance) in ranking the six environments was obtained for all 21 reinforcer scales, with average interrater correlation ranging from .19 to .88, with a median of .57.

Kendall's tau was computed between the expected and observed ordering of environments for each reinforcer scale. These observed orderings were also compared with expectations from Holland's hexagon model, using a variation of the procedure described by Wakefield and Doughtie (1973). According to the hexagon model, the distance between opposite environments should be greater than the distance between the alternating environments, which in turn should be greater than the distances between the adjacent environments. Differences between alternating environment pairs can then be compared with those of adjacent and opposite pairs, and the number of differences observed as occurring in the hypothesized direction can be compared with that expected by using the binomial distribution. Since 54 comparisons could be made, and with the probability of obtaining any one comparison in the predicted direction being .5, 34 of the 54 comparisons must be in the predicted direction to reject (at $p \leq .05$) the hypothesis of random arrangement of the six environments.

Finally, correlational and multidimensional scaling analyses were used to assess the fit of Holland's hexagon model to the reinforcer and PAQ data. The mean reinforcer scale score and the mean PAQ

factor score profiles for the six and five environments, respectively, were separately intercorrelated and the correlation matrices submitted to the TORSCA 9 non-metric scaling program (see Young & Torgerson, 1967). Additionally, the occupational reinforcer data were submitted to a multiple discriminant function analysis to allow comparison with the Toenjes and Borgen (1974) study.

Results

Table 1 shows the mean scale scores for the six Holland environments arranged in rank order for each reinforcer scale and the results of the Scheffé tests. Seventeen of the 21 F ratios were statistically significant (at $p \leq .05$), the omega-squared values ranging from .00 to .37, with a median of .10. Of the 17 statistically significant analyses of variance, 12 met the Scheffé criterion for significant pairwise mean differences. Examination of the data for opposite environments in the hexagon model showed that the Realistic and Social environments were differentiated on the reinforcer scales of Ability Utilization, Achievement, Autonomy, Compensation, Creativity,

Table 2
Kendall's Tau Between Hypothesized and Observed Rank Order of Holland Environments by Reinforcer Scale

Reinforcer scale	Rank order		Kendall's τ	$p =$
	Hypothesized	Observed		
Ability Utilization	IAESRC	AIESRC	.87	.008
Achievement	EIASRC	AISERC	.47	.095
Activity	CRESIA	CSRAIE	.28	.219
Advancement	ERICSA	CEAIRS	.07	.426
Authority	ESICRA	AISERC	.14	.349
Autonomy	AIESRC	IESACR	.47	.095
Company Policies/Practices	CERISA	ERCSAI	.55	.060
Compensation	ERICSA	ERIAS	.73	.020
Co-workers	SCEIRA	SCEIRA	1.00	.003
Creativity	AISERC	AEISRC	.73	.020
Independence	AIRECS	AERCSI	.33	.174
Moral Values	SCRAIE	SIAECR	.14	.349
Recognition	EIASRC	EAISRC	.87	.008
Responsibility	IAESRC	IEASRC	.87	.008
Security	CRIESA	CRSEIA	.69	.026
Social Service	SCEIRA	SIECAR	.47	.095
Social Status	EISACR	ISAERC	.47	.095
Supervision—Human Relations	CREISA	ERCSAI	.33	.174
Supervision—Technical	CREISA	ERCASI	.20	.287
Variety	AIESRC	ASEIRC	.60	.046
Working Conditions	CEISRA	AECISR	.28	.219

Note. Holland codes are as follows: Realistic (R), Investigative (I), Artistic (A), Social (S), Enterprising (E), and Conventional (C).

Moral Values, Social Service, and Social Status; the Artistic and Conventional environments on Ability Utilization, Achievement, Creativity, and Responsibility; and the Investigative and Enterprising environments on Company Policies and Practices, Supervision-Human Relations, and Supervision-Technical.

Comparison of hypothesized and observed orderings for the Holland environments are shown in Table 2. Agreement was found statistically significant for 8 of the 21 scales, for which $\tau \geq .60$. Collating these results with those of Table 1 indicated that four scales, Ability Utilization, Compensation, Creativity, and Responsibility, differentiated significantly between the Holland environments in the hypothesized direction.

Comparison of mean score differences between alternating environments with those for opposite and adjacent environments showed that the hexagon model fitted the data for the following reinforcer scales (the number of comparisons in the hypothesized direction are given in parentheses): Achievement (34), Authority (37), and Variety (35). Findings for this analysis and for the ordering analysis shown in Table 2 were concurrently significant only for Variety.

Table 3 shows the intercorrelations among the mean reinforcer-scale vectors for the six Holland environments (in the upper triangle) and among the mean PAQ factor vectors for five environments (in the lower triangle). As can be seen from Table 3, neither the reinforcer-defined nor the PAQ-defined

Table 3
Intercorrelations Among the Six Reinforcer-Defined (Upper Triangle) and Five Position Analysis Questionnaire Defined (Lower Triangle) Holland Environments

Holland environment	1	2	3	4	5	6
1. Realistic		.65	.74	.70	.87	.90
2. Investigative	-.60		.89	.91	.84	.55
3. Artistic	—	—		.83	.88	.54
4. Social	-.71	.49	—		.84	.65
5. Enterprising	-.74	.54	—	.74		.73
6. Conventional	-.62	.13	—	.03	-.01	

Table 4
Two-Dimensional TORSCA Solutions for the Six Reinforcer-Defined and Five Position Analysis Questionnaire (PAQ)-Defined Holland Environments

Holland environment	Reinforcer defined		PAQ defined	
	1	2	1	2
Realistic	-.610	-.112	1.145	.052
Investigative	.559	.313	-.079	-.198
Artistic	.036	.670	—	—
Social	.580	-.177	-.444	.060
Enterprising	-.002	.058	-.568	-.193
Conventional	-.563	-.753	-.054	.279

Note. Product-moment correlation was used as the measure of similarity.

correlations met the requirements for a RIA-SEC-ordered hexagon or quasi-circumplex model (Guttman, 1954). However, a reordering of the environments would meet such requirements, this reordering being RCSIAE for the reinforcer correlations, and RIESC for the PAQ correlations.

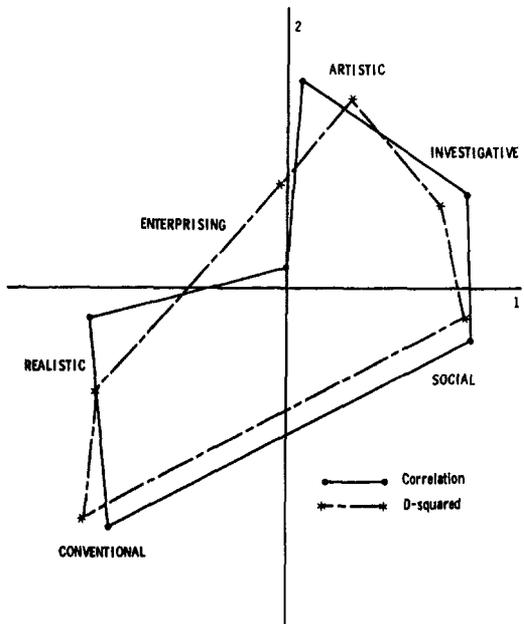


Figure 1. Two-dimensional configuration for the six reinforcer-defined Holland environments, obtained by multidimensional scaling with correlation and d^2 as measures of similarity.

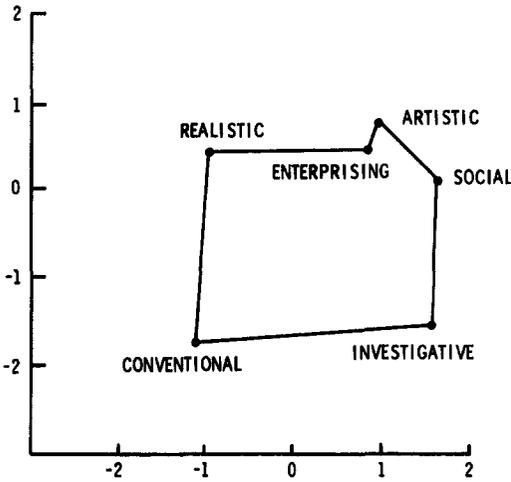


Figure 2. Two-dimensional configuration for the six reinforcer-defined Holland environments obtained by multiple discriminant function analysis.

TORSCA solutions were obtained in one through four dimensions for the reinforcer correlations and in one through three dimensions for the PAQ correlations. Kruskal's (1964) stress values for one, two, and three dimensions were .127, .008, and .000, for the reinforcer data and .015, .014, and .002 for the PAQ data, respectively. Stress values indicate goodness of fit: The higher the value, the poorer the fit. Therefore, a two-dimensional representation of the data appeared to be appropriate for the reinforcer data, but not for the PAQ data. Nonetheless, Table 4 shows the two-dimensional solutions for both the reinforcer and PAQ data.

As shown in Table 4 and Figure 1, the TORSCA solution for the data supports an RCSIAE (or REAISC, read clockwise) ordering of Holland environments. As shown in Figure 1, the shape of the two-dimensional configuration does not approximate a hexagon, especially with Enterprising located near the center of the figure.

Figure 1 also shows slight differences in configuration when different indices of similarity are used. In the present instance, product-moment correlation and d^2 were used, the latter index incorporating information on level, shape, and scatter while the former reflected only shape information.

Figure 2 shows the two-dimensional configuration for the reinforcer data when multiple discriminant function is used to plot the Holland environments in two-dimensional space. As Figure 2 shows, the configuration is more square than hexagonal, and the ordering differs from the Holland theory, with Enterprising and Investigative exchanging places. This REASIC ordering also differs slightly from the REAISC ordering of Figure 1, indicating the presence of some method variance.

Table 4 and Figure 3 show the two-dimensional TORSCA solution for the PAQ data. It is clear that Holland's hexagonal model does not fit these data. The Realistic environment is located at the extreme positive end of Axis 1, and Enterprising is between Investigative and Social rather than between Social and Conventional as the Holland model requires.

Discussion

Although Holland's theory is widely used, the validity of its environment formulations has seldom been tested by using measures of the environment rather than of the personality. In this study reinforcer and PAQ data were used to test Holland's environment formulations. The results provided at best only modest support for the formulations. Four reinforcer scales, Ability Utilization, Compensation, Creativity, and Responsibility, showed statistically significant differences between the environments in the hypothesized direction, but none of these ordered the environments in accordance with Holland's consistency assumption.

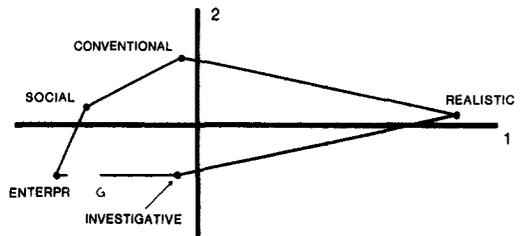


Figure 3. Two-dimensional configuration for the five Position-Analysis-Questionnaire-defined Holland environments obtained by multidimensional scaling.

The findings did demonstrate that at least in the case of reinforcer data, the environments can be organized into a two-dimensional arrangement. However, the ordering found was RCSIAE or REAISC instead of RIASEC as proposed by Holland. The environment intercorrelations based on PAQ data were not amenable to a two-dimensional organization due to the high negative correlations between Realistic and the other four environments.

In Holland's view, it is assumed that incumbents of the environment determine the characteristics of the environment, and therefore the classification of environment models can be made through the incumbents' characteristics. Apparently, description of environment models based on such incumbent characteristics as vocational preferences and vocational interests differs from that based on environment characteristics (as in this study, ratings of the occupational reinforcers and behavioral requirements of environments). A plausible interpretation is that occupational reinforcers and behavioral requirements describe aspects of the environment different from those that are reflected in vocational interests or vocational preferences.

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