Research Article

THE STRUCTURE OF VOCATIONAL INTERESTS FOR DIVERSE RACIAL-ETHNIC GROUPS

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Abstract—*We investigated differences in the circular structure of Holland's interest types across racial-ethnic groups (African Americans, Mexican Americans, Asian Americans, Native Americans, and Caucasians; N = 11,610). The samples consisted of college-bound persons who completed the revised Unisex Edition of the ACT Interest Inventory (UNIACT; Swaney, 1995), as well as a comparison group of 10th graders (N = 4,133) in the 1992 UNIACT norms sample. Analyses using a randomization test of hypothesized order, targeted principal components, and three-way multidimensional scaling suggest that Holland's model adequately represents the interest structures of both sexes in all the diverse samples.*

In the United States, interest inventory development has been based on the responses of mostly white, middle-class Americans. So have theories of vocational interests. Whether these inventories and theories should be applied to a population that was not used in their development is, of course, a question that needs addressing. Recent research has questioned the use of interest inventories with ethnic groups in the United States: It appears that the structure of scale scores based on whites' responses does not hold for responses from ethnic minorities (e.g., Dawis, 1992; Rounds & Tracey, 1996; Wakefield, Yom, Doughtie, Chang, & Ralston, 1975). Yet similarity of structure is presupposed when scores are interpreted across persons of differing racial-ethnic backgrounds (Ben-Porath, 1990). Thus, a critical question is left unresolved. Two possible reasons for research findings of discrepancies between structures for the white majority and ethnic minorities exist:

1. It could be that minority groups have such different experiential backgrounds that the relationships between their likes and dislikes for career-related activities are distinct from the majority's. Even within ethnic groups, experiential backgrounds may contribute to differences between the sexes. This explanation implies that there are minority-specific processes affecting perception and thus producing different covariance structures among groups. Such an implication is serious: It suggests fundamental psychological differences, contributing to psychologists' ongoing debate regarding diversity (Rowe, Vazsonyi, & Flannery, 1994).
2. In contrast, it could be that ethnic minority groups have not been sampled reliably in research that finds differences in structure. Recently, Swanson (1992) suggested that negative findings may be due to the use of small, unrepresentative minority samples. The difficulty of obtaining sizable general samples of ethnically and racially diverse groups is frequently discussed in ethics and multicultural literature (e.g., Blanck, Bellack, Rosnow, Rotheram-Borus, & Schooler, 1992; Dana, 1993). Furthermore, the sampling situation is often suspect. Results from people with little motivation to take an inventory seriously may produce a dangerously high incidence of random responses.

This study concerns testing the second reason in order to shed light on the first. We obtained from the ACT (formerly American College Testing) archives a very large multiethnic sample of people who registered for the ACT Assessment Program. The ACT Assessment Program is designed to facilitate students' transition from high school to college. Registrants (approximately 1.4 million per year) attend more than 20,300 high schools nationwide. We assume that people participating in the ACT Assessment have a good deal of investment in completing the instruments responsibly, giving us more confidence in their responses than we have in other sampling situations.

Since the 1970s, Holland's (1973, 1985) two-dimensional model has prevailed as the best representation of vocational interests. The six general interest types in Holland's model, followed in parentheses by their corresponding letters, are these: Realistic (R), Investigative (I), Artistic (A), Social (S), Enterprising (E), and Conventional (C)—thence the acronym RIASEC. Holland's theory postulates that these six types are related to each other in a circular structure, as shown in Figure 1. Holland and other scholars frequently represent the ideal relationships among the six types as a *circumplex* or hexagon (Rounds, 1995; Tracey & Rounds, 1993). From the 1950s on, circumplex models have rivaled other traditional structures, such as factor and cluster models, in many domains, including affect (Russell, 1980), personality traits (Conte & Plutchik, 1981), interpersonal behavior (Leary, 1957) and problems (Alden, Wiggins, & Pincus, 1990), personality disorders (Romney & Bynner, 1989), maternal behavior (Schaefer, 1959), and vocational choice (Roe, 1956). As other circumplex models do (Plutchik & Conte, 1997), Holland's RIASEC arrangement reflects the closeness or distance of the conceptual relationships among the types. For example, on Holland's circle, the R interest type appears opposite the S type, indicating that these two do not have much in common, whereas the R and I types appear next to each other, indicating shared qualities.

In a metastructural analysis, Rounds and Tracey (1996) found among U.S. ethnic groups a poor fit to Holland's (1985) circular-order model of RIASEC types. Rounds and Tracey's groups included African Americans, Hispanics, American Indians, and Asian Americans sampled from 20 published studies based variously on six different measures of RIASEC scales. The present study reevaluates Holland's RIASEC model with large, college-bound samples of the same four U.S. minority groups and Caucasians, using only one very sound measure of RIASEC scales (Swaney, 1995). This is an improvement over all previous studies because large samples produce more trustworthy correlation matrices with which to test model-data fit.

What exactly does a good model-data fit mean? The circular structure of Holland's (1985) model implies that when people's responses to types are correlated, correlations between adjacent types (e.g., RI,

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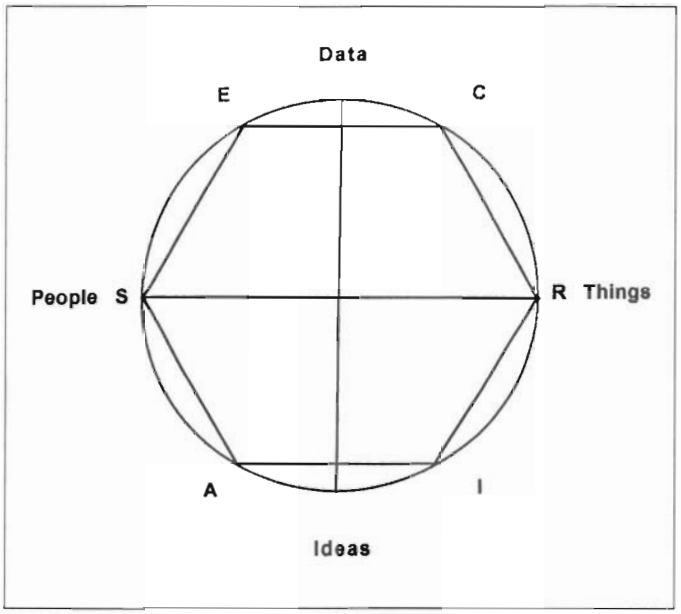

Fig. 1. Holland's circular and hexagonal model showing the relationship between Holland's six types and the data-ideas and things-people dimensions.

AS, CR) will be greater than correlations between alternate types (e.g., RA, AE, CI), which in turn will be greater than correlations between opposite types (e.g., RS, IE). For example (referring to Fig. 1), if a person's main interests lie in R activities, she will probably prefer C and I activities to E and A activities and will prefer any of the others to S activities. If she likes best repairing video cassette recorders (R), she will probably prefer researching their brands (I) and making a table of comparisons among them (C) over selling them (E) or designing their appearance (A), and she will probably rather do any of these things than chat with a sickly relative (S). We compiled correlation matrices for 10 diverse groups to see whether the RIASEC circular-order hypothesis held true for them.

Before we continue, let us emphasize the distinction between structural differences and differences among means in various groups' responses to vocational interest inventories. Although group differences in means have been found (Leong & Brown, 1995), these should not lead us to conclude that there are group differences in underlying structure. Mean differences in interest scores do not imply that the meaning of the stimuli (items) differs among the groups. When a common model is shared by all groups, the mean differences in interest scores may come from differences in life experiences and opportunities (see Rowe, Vazsonyi, & Flannery, 1995, for a similar application to academic achievement). For example, although women endorse S activities at a higher rate than men do, women and men still perceive the same groups of activities as similar: Teaching and social work are more alike than teaching and jet piloting in the eyes of both sexes, no matter which of the activities each sex might prefer. (Readers interested in the group-means aspect of vocational interests may want to refer to Swaney, 1995, for means and standard deviations, by group, for each Holland type.)

METHOD

Sample

The sample consisted of college-bound 11th and 12th graders who registered for the October 1989 ACT Assessment test date. As part of the ACT Assessment registration process, students provide personal information, academic plans, and related data. Of relevance to this study, registrants self-report their racial-ethnic group and complete the Unisex Edition of the ACT Interest Inventory (UNIACT; Swaney, 1995). Cases retained for this study had 90 valid responses to UNIACT items. In addition, 11 of every 12 Caucasian cases in the file were systematically excluded. From the resulting sample of 49,450 cases, random samples consisting of 15% of African Americans and Caucasians and 30% of Asian Americans and Mexican Americans were selected. All Native Americans were retained. These steps resulted in the following numbers of persons per group: African Americans, 1,043 males and 1,702 females; Asian Americans, 890 males and 1,069 females; Mexican Americans, 741 males and 1,068 females; Native Americans, 1,113 males and 1,530 females; and Caucasians, 1,007 males and 1,447 females.

Measures

UNIACT is a 90-item interest inventory intended to help persons identify personally relevant career options. There are six 15-item scales corresponding to Holland's (1985) six types. UNIACT scale names, followed in parentheses by corresponding Holland type, are Science (I), Arts (A), Social Service (S), Business Contact (E), Business Operations (C), and Technical (R). Internal consistency reliability estimates for UNIACT scales range from .83 to .93 for nationally representative samples of students in grades 8, 10, and 12 and for samples of four separate ethnic groups (Swaney, 1995). A three-choice response format (like, indifferent, dislike) is used. Items specify work-relevant activities that are familiar through either participation or observation. The UNIACT is an assessment component of eight ACT programs. Because the UNIACT is an instantiation of Holland's model, our study perforce tested only this model for fit with the data.

Correlation Matrices

Eight UNIACT correlation matrices (a male and female matrix for each of the four minority groups) were analyzed. In addition, two UNIACT correlation matrices for Caucasian male and female samples were analyzed for comparison. Each matrix consisted of intercorrelations among the six UNIACT scales (Holland interest types).

RESULTS AND DISCUSSION

Hubert and Arabie's (1987) randomization test was applied to each of the 10 matrices to evaluate the fit of Holland's circular-order model to the UNIACT data. Using a randomization test of hypothesized order relationships (Rounds, Tracey, & Hubert, 1992; Tracey, 1992), we calculated a correspondence index (CI) for each matrix. The CI is the number of predictions met minus the number unmet divided by the total number of order predictions (in the case of the Holland circle, a total of 72). It ranges from −1 to 1, with 1 indicating a perfect model-data fit. The randomization test also provides a probability value (p)

indicating how likely each CI would be if data were entirely random. These tests provide information about how well the groups' data fit the circular model. Columns 1 and 2 of Table 1 list results of the randomization test.

The CIs, ranging from .61 to .75 (mean of .68), indicate a good model-data fit, with all p values under .04. These CI values compare well with a mean CI of .70 (SD = .14) calculated by Rounds and Tracey (1996) for 73 U.S. benchmark, ethnically mixed samples from studies that used well-established RIASEC measures (N = 41,149).

To evaluate whether the fit of the circular-order model differed between the female and male samples from each group, we conducted a variation of the randomization test of hypothesized order relations, a variation that considers pairs of female and male samples together to analyze differences in fit. The p value for each of the five pairs provides the probability that any observed difference in fit between the males and females was obtained by chance. The p values for our groups were all greater than .05 (ranging from .07 to .37), indicating that any observed gender differences were likely due to chance.

We also applied the difference-of-fit analysis to all other possible pairs drawn from our 10 groups (40 more pairs). The p values of these pairs were also greater than .05 (ranging from .07 to 1.0, with a mean p of .61). These findings indicate strongly that only chance differences were observed.

Targeted Factor Extraction

Although the results of the CI analyses indicate that the intercorrelations for the UNIACT racial-ethnic groups fit Holland's circular model rather well, they do not depict the nature of the fit. That is, the CI analyses do not show the locations of the interest scales on the circular model. Because the circular model has two dimensions, plotting coordinate points based on correlations of the six UNIACT scales with the two dimensions provides a way to compare the scales' actual locations with their locations on the circular model.

As summarized by Prediger (1996), non-intercorrelation-based studies of interest structure (e.g., studies using job-analysis data, studies showing the locations of occupations on the circular model) support the data-ideas and things-people dimensions labeled on Figure 1. Hence, these dimensions were used to compare scale configurations among the 10 racial-ethnic groups and between the groups and the circular model.

In a targeted-principal-components procedure described by Overall (1962), we used Cartesian coordinates for Holland types on the data-ideas and things-people dimensions as targets in the extraction of the Data-Ideas and Things-People factors. In addition, the Response Style (i.e., yea- vs. nay-saying) factor common to basic interest scales using Likert-type responses (e.g., see Prediger, 1982; Rounds & Tracey, 1993) was extracted through use of a target vector of ones. The variance accounted for by the three targeted dimensions was highly similar (ratio of 99% to 100%) to the maximum variance accounted for by three dimensions in a regular principal-components analysis (Prediger, 1982, discusses the basis for this comparison).

Figure 2 is based on the correlations of Holland types with the Data-Ideas and Things-People factors. The configurations are similar across the racial-ethnic groups, and they approximate the theory-based circular configuration about as well as the configurations obtained by Prediger (1982) for general (non-racial-ethnic) samples.

Multidimensional Scaling

The results suggest that Holland's circular model adequately represents the interest structures of both sexes in all four minority samples. These samples' response patterns were markedly similar to those of Caucasians. To investigate possible differences among groups further, we derived a three-way multidimensional solution for our groups through SINDSCAL (Arabie, Carroll, & DeSarbo, 1987; Pruzansky, 1975), a computer program that allows comparison of individual differences within the framework of shared dimensions. (In our case, the "individuals" are our groups.) As column 3 of Table 1 shows, the variance accounted for by a two-dimensional solution in RIASEC order ranges from .88 to .93 (mean of .91), suggesting quite satisfactory model-data fits for all groups. Figure 3, a subject weights matrix from SINDSCAL, shows where the groups stand in relation to each other on the two dimensions of the multidimensional solution, and they are clearly congeneric.

SINDSCAL also derives an overall plot reflecting the placement of the six types when the whole sample, including all groups, is scaled. This melting-pot plot (Fig. 4) provides another visual confirmation of the circular-order model shared by all the groups.

Table 1. *Results of randomization tests and three-way multidimensional scaling*

Group	Randomization test: Correspondence index	Randomization test: p	Variance accounted for (three-way multidimensional scaling)
African-American men	.75	.02	.88
African-American women	.64	.02	.92
Asian-American men	.72	.02	.90
Asian-American women	.67	.02	.92
Native-American men	.75	.03	.90
Native-American women	.64	.03	.93
Mexican-American men	.72	.02	.88
Mexican-American women	.61	.02	.92
Caucasian men	.67	.02	.92
Caucasian women	.61	.02	.92

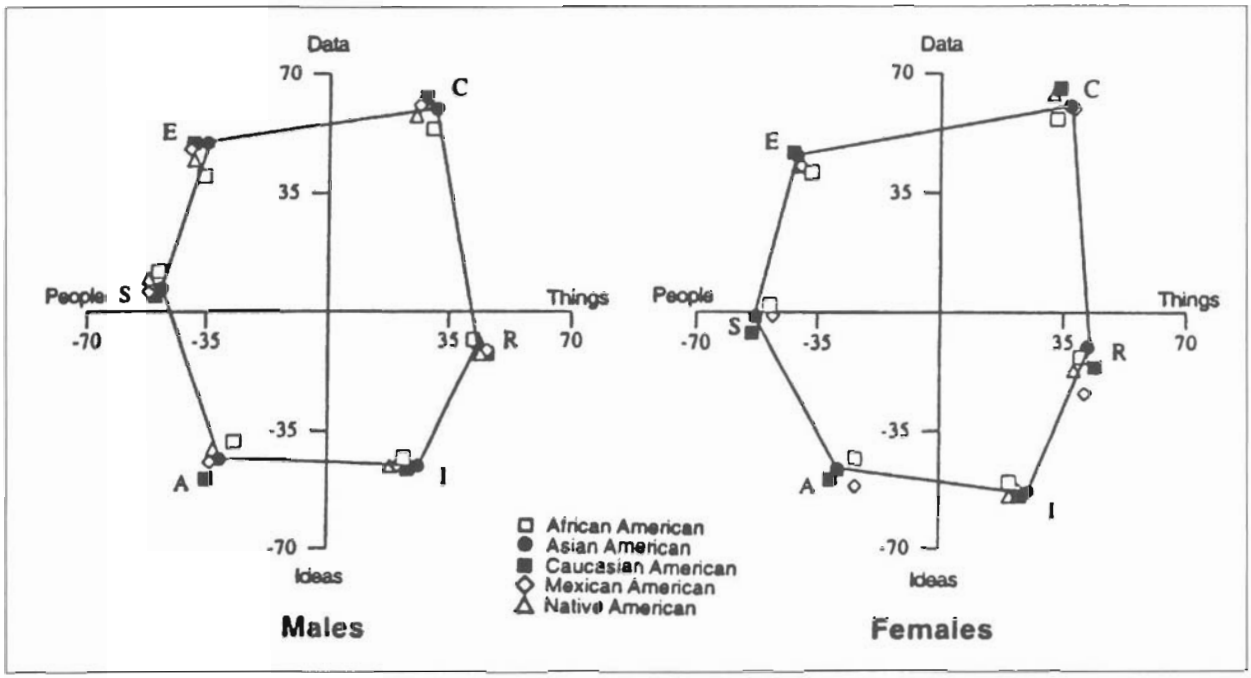

Fig. 2. Plots of factor loadings, separate by sex, for each racial-ethnic group. Locations of adjacent scales for the Asian-American group are connected by straight lines to show the hexagonal approximation of the loadings.

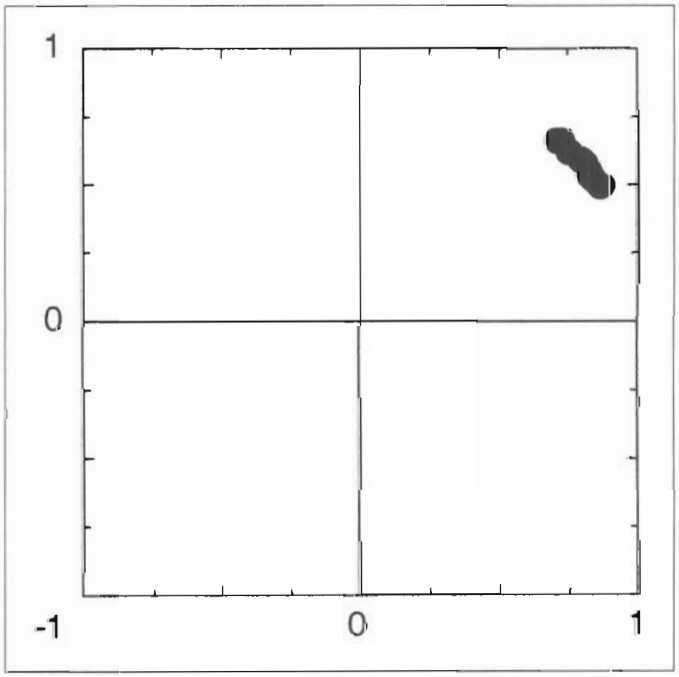

Fig. 3. Plot of subject weights for the 10 groups (males and females from 5 racial-ethnic groups) showing the uniformity of all the groups' locations on the data-ideas and things-people dimensions. Weights on these dimensions range from .690 to .840 and .463 to .630, respectively.

Issues of Interpretation

Rounds and Tracey (1996) came to a very different conclusion from our study's: The mean CI of their ethnic samples was .54, in marked contrast with our study's mean CI of .68 (close to Rounds and Tracey's mean CI of .70 for benchmark samples). Our findings suggest that large, motivated, cross-sectional samples (in this case, thousands of college-bound students throughout the United States) may be the key to finding good fits to Holland's model. Bolstering this argument, 38,000 employed adults grouped by ethnic-racial description and by sex gave Strong Interest Inventory responses that fit the circular model in a recent analysis by Fouad, Harmon, and Borgen (in press).

In addition, the UNIACT instrument may elicit responses that are freer of influence by occupational prestige and opportunity than the responses other instruments elicit because the UNIACT uses names of activities rather than names of occupations as stimuli. It may be that some dissimilar structure found among groups in other studies came from using inventories that gave occupational titles as items, and that different groups varied in their responses to those titles, clouding the possibility that they did not vary in responses to the underlying activities.

Our sample consisted of college-bound students, successful high schoolers who perhaps are thoroughly assimilated into the mainstream way of looking at vocational interests. It is possible that racial-ethnic groups of students having a wider range of academic skills and plans may display more disparities in model-data fit. To test this possibility in a limited way, we performed the randomization test of hypothesized order on correlation matrices from African-American, Hispanic, and Caucasian 10th-grade students ($N = 4,133$) in the nationally representative 1992 UNIACT norms sample (Swaney, 1995). Because of the relatively small sizes of the African-American and Hispanic groups,

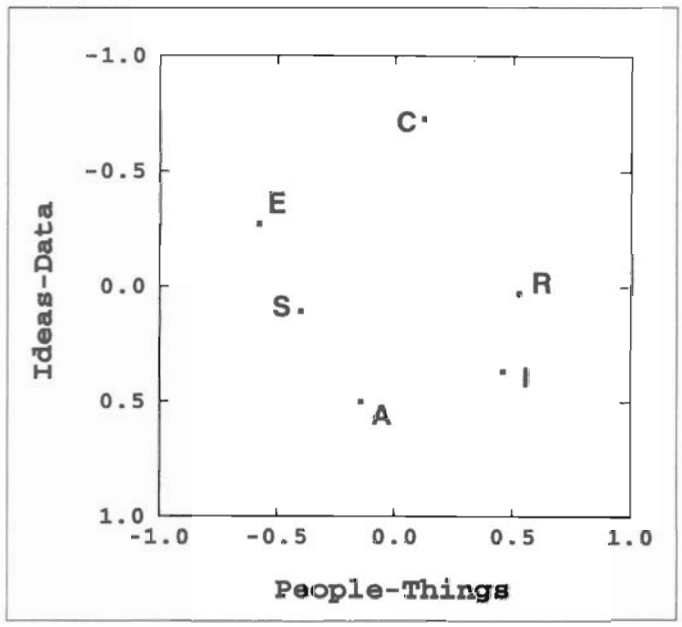

Fig. 4. SINDSCAL melting-pot plot showing average positions of the Holland types across the 10 groups.

combined-sex scale intercorrelations were used in the analyses. The CI and p values were .72 (p = .02) for Caucasians, .65 (p = .03) for Hispanics, and .65 (p = .03) for African Americans. The 10th graders all fit similarly regardless of ethnic group. This similarity between the 10th- and 12th-grade samples suggests that the consistency we found among diverse 12th graders was not due to their shared status as good students. Tenth graders, including students of all ability levels, had comparable CI values.

Thus, this study clarified the plausibility of both possible reasons for previous findings of variance across ethnic groups. If, as our results suggest, there are no significant racial-ethnic differences in RIASEC structure, differences in RIASEC scale scores among minority groups simply reflect group differences in occupational preferences rather than in weltanschauung. By analogy, although we each have our own preference in ice cream, we would probably all identify the flavors of chocolate, vanilla, and strawberry the same way in a blindfold test. We share the same ice-cream worldview despite having individual favorites (and individual chances of getting the one we want). Correspondingly, the structure of minority vocational interests seems to be well represented by Holland's RIASEC model: The UNIACT and possibly other measures based on such theories have validity for diverse groups in the United States.

Furthermore, our results indicate that unless samples are sound, one cannot have confidence in disparities observed in research studies. Questionable sampling, not real variations in structure, caused apparent dissimilarities. This conclusion gravely tempers the way one should look at any research report of ethnic-racial differences in the structure of vocational interests.

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