Journal of Vocational Behavior **56,** 363–379 (2000)
doi:10.1006/jvbe.1999.1720, available online at http://www.idealibrary.com on IDEAL®

Application of Three Dimensions of Vocational Interests to the Strong Interest Inventory

Sif Einarsdóttir and James Rounds

University of Illinois at Urbana–Champaign

The present study evaluated whether three dimensions underlie responses to the Strong Interest Inventory (SII; Hansen & Campbell, 1985). A multidimensional scaling analysis was applied to the responses of college students (404 women and 244 men) to 110 occupational title items in the SII. The results supported a three-dimensional structure of vocational interests. In both the male and female samples the dimensions of Data/Ideas and People/Things emerged. The third dimension was interpreted as Sex-type. We discuss the implications of this conclusion for the use of the SII, especially how the third dimension may influence the interpretation of inventory results.

In the vocational interest field, the most widely studied and applied model is Holland's (1973, 1985, 1997) hexagonal structure of six interest types (Realistic, Investigative, Artistic, Social, Enterprising, and Conventional; referred to as RIASEC). Prediger (1976, 1982) has proposed that two dimensions—People/Things and Data/Ideas—capture the relationship among the RIASEC categories. Recently, Tracey and Rounds (1996) proposed that a third dimension—Prestige—influences responses to occupational items used in interest inventories. The present study evaluated the dimensional claims made by Prediger and by Tracey and Rounds with the Strong Interest Inventory (SII; Hansen & Campbell, 1985; Harmon, Hansen, Borgen, & Hammer, 1994).

THREE DIMENSIONS OF VOCATIONAL INTERESTS

Prediger (1976, 1982) proposed that the relationships among the six personality types in Holland's theory can be summarized by two theoretically based bipolar dimensions, which he named People/Things and Data/Ideas. Prediger's dimensions have been an important complement to Holland's hexagonal model, allowing the mapping of people and occupations in an interest space. These

This article is based on a master's thesis submitted by the first author to the University of Illinois at Urbana–Champaign. We thank Terence J. G. Tracey, Lenore W. Harmon, and Ann Losoff for their helpful comments on earlier drafts of this article.

Address correspondence and reprint requests to Sif Einarsdóttir or James Rounds, Department of Educational Psychology, University of Illinois at Urbana–Champaign, 1310 S. Sixth Street, Champaign, IL 61820.

0001-8791/00 $35.00

occupational maps, called the World-of-Work Map (Prediger, Swaney, & Mau, 1993), are used in conjunction with the ACT Interest Inventory to link job families with an individual's test results. Swaney (1995) reports that recently some 4 million students used the World-of-Work Map in understanding their vocational interest test results.

The People/Things dimension is well known in the vocational interest literature and was, for example, extracted by Strong (1943), but the Data/Ideas dimension was first proposed by Prediger. These two dimensions reflect different work-task categories that are characteristic of different occupations. When mapped onto Holland's RIASEC model the People axis is located on Holland's Social type and the Things axis on the Realistic type. The Data axis intersects the midpoint between the Enterprising and Conventional types and the other end of the dimension (Ideas) intersects the midpoint between the Investigative and Artistic types. Structural studies using RIASEC scale scores (Prediger, 1982; Rounds & Tracey, 1993) have usually detected two dimensions beyond a general factor. These studies support Prediger's contention that two dimensions can be used to represent Holland's hexagon, but both the orientation of those dimensions in relation to the six categories and their meaning is still a matter of debate (Rounds & Day, 1999).

Tracey and Rounds (1996) proposed that a third dimension of prestige also influences the responses to vocational interest items. Occupational prestige is a construct that does not have any one clear definition and has many referents: socioeconomic status, level of training, difficulty, and responsibility. Tracey and Rounds argue that prestige, or social status of occupations, is likely to be influencing the responses to interest items. To support their inclusion of prestige in a model of vocational interests, they point out that though prestige has rarely been included in structural models of vocational interests, it is the most common and basic aspect of evaluating occupations. A prestige dimension would indicate that there are individual differences in the preference for the prestige level of an occupation. For example the extraction of a People/Things dimension indicates that people differ in how much they like working with people vs things. Similarly, the responses to an interest inventory might reflect that some people like highly prestigious occupations but that others prefer moderate- or low-prestige occupations.

Gottfredson's (1981, 1996) theory of circumscription is one of the few theories that tries to explain the influences of prestige, sex-type, and interests on occupational preferences. Prestige is an important aspect when occupations are evaluated. People also perceive occupations in terms of the masculine or feminine traits that they are believed to require (Shinar, 1975; Yanico, 1979). Studies in this area indicate that sexual stereotypes of occupations are held in agreement by both men and women and that stereotyping has moderated somewhat since the 1970s (Shinar, 1975; White, Kruczek, Brown, & White, 1989). It has also been shown that there is a high correspondence between the sexual stereotyping of

occupations and the proportion of men and women in occupations (Cooper, Doverspike, & Barrett, 1985; White et al., 1989).

A major problem in studying Gottfredson's theory has been that interests, prestige, and sex-type are confounded (Fitzgerald, Fassinger, & Betz, 1995; Hesketh, Elmslie, & Kaldor, 1990). Male sex-typed occupations are distributed over the full range of prestige but female occupations are found at moderate- and low-prestige levels (Gottfredson, 1981; Hesketh, Hesketh, Hansen, & Goranson, 1995). Because sex-type and prestige are confounded, it is not likely that they will be detected as two separate dimensions in structural studies. Harmon (1996) suggests that it would have been interesting to see if the same dimensions in Tracey and Rounds' (1996) study had resulted if the items had been chosen to represent variations on sex-type and not only on prestige. It is possible that the third dimension reflects not only prestige but possibly sex-type as well.

PRESTIGE AND SEX-TYPE IN THE STRONG INTEREST INVENTORY

Neither occupational prestige nor sex-type is included as an explicit scale when interpreting the Strong Interest Inventory. Nevertheless, there is some evidence that indicates that those two factors, together or separately, might be influencing the responses to the inventory. Tracey and Rounds' (1996) detection of a third dimension that correlated highly with prestige indicators supports the notion that prestige may influence responses to a pool of occupational items similar to those used in the SII. Another reason to expect prestige to influence SII responses is the early pioneering work of Strong (1943). Strong was interested in whether the interests of unskilled workers differed from workers in higher level occupations (e.g., professionals and businessmen). He constructed the Occupational Level scale (OL) using items that empirically discriminated between low-skilled and high-skilled groups of working men. The OL scale implies that prestige accounted for some of the variance in the early versions of the inventory. Carkhuff and Drasgow (1963), after reviewing research on the OL scale, concluded that the scale measures the occupational level to which individual interests correspond. Similarly, Strong constructed a scale he called Masculinity–Femininity (MF) by choosing items that differentiated men from women. The MF scale implies that there are sex differences in responses to the SII items.

In the reactions to Tracey and Rounds' (1996) spherical model of vocational interests Borgen and Donnay (1996), Hansen (1996), and Prediger (1996) noted the close resemblance of the model to some of Strong's original work 50 years ago. Strong concluded after a series of factor-analytic studies of occupations that four factors best represented the variation among the items. After rotating the factors he retained three factors and used them to map the occupations on the surface of a sphere. Occupational Level and Masculinity–Femininity were both used as potential coordinates in Strong's sphere (Hansen, 1996; Strong, 1943). In the light of Strong's detection of variance that possibly reflects occupational prestige and sex-type in interest items as well as Tracey and Rounds' (1996)

three-dimensional representation of occupational interests, we expected that the dimensions of People/Things, Data/Ideas, and Prestige and/or Sex-type would be found to explain responses to the SII.

In the present study, a multidimensional scaling technique was applied to the occupational titles in the Strong Interest Inventory. The occupational title items were analyzed because prestige and sex-type are among the aspects commonly used to evaluate (Crites, 1969) and stereotype occupations (Gottfredson, 1981). Occupational prestige is also commonly found in studies of occupational perception (Rounds & Zevon, 1983; Shivy, Rounds, & Jones, 1999). The occupational title items are therefore more likely than other types of SII items to reveal a third dimension of prestige and/or sex-type.

METHOD

Participants

The participants were 648 college students at a large Midwestern university: 404 women (63%) and 244 men (37%). The mean age of the participants was 19 years ($SD = .97$). The students completed the SII as a part of their coursework in their career-exploration course. We were not able to obtain information about ethnic background from the participants. However, typically the career-exploration course has approximately 65% Caucasian students, 24% African-American students, 7% Asian-American students, and 4% Latino/Latina students.

Measure

Occupational title items from the Strong Interest Inventory (SII; Hansen & Campbell, 1985) were used. Specifically, the students responded to "Part I, Occupations" (item numbers 1–131) on a 3-point scale (*like* = 1, *indifferent* = 2, *dislike* = 3).

Procedures

None of the students had more than three items missing on the 131 occupational title items. If three items or fewer were missing from a participant's responses, the missing item responses were replaced with the item's mean score derived from the responses to the occupational items of those students that completed the missing item.

Each occupational title in the SII was matched to two measures of occupational prestige, one measure of sex-type, and to Holland's RIASEC codes to evaluate whether the extracted dimensions can be interpreted as Data/Ideas, People/Things, and Prestige or Sex-type. One of the prestige rankings used to code the SII occupations was Stevens and Hoisington (1987) measure of perceived occupational prestige and is simply referred to here as Occupational Prestige (OP). We also used a second prestige scale, called the Socioeconomic Indicator (SEI; Stevens & Cho, 1985). SEI is a more objective measure based on

occupational level, education, and earnings. Yanico (1979) proposed that a Male Dominance Index (MDI) based on the percentage of men in each occupation could be used as a measure of the sex-type of occupations. In this study information about the percentage of women in each occupation, from labor market statistics published by the U.S. Department of Labor in 1998, was used as a measure of Sex-type.

Two vocational psychologists coded the occupations in the SII with the occupational titles used in the two Prestige measures (OP and SEI), the Sex-type index, and the Dictionary of Holland's Occupational Codes (Gottfredson & Holland, 1989). Both Prestige indices and the Sex-type index are based on the same occupational classification system. Because the indices use a categorization of occupations that does not correspond perfectly to the occupations found in the SII, a score for Prestige and Sex-type could not be assigned to all the 131 occupational titles used in the SII. For 98 of the 131 occupational titles in the SII, the raters agreed on a match for identical titles or equivalent titles (e.g., realtor and real estate agent) for the Prestige and Sex-type indices. The raters concurred that 21 occupations (e.g., auto racer, and professional gambler) could not be matched and they disagreed on 12 occupations. The raters resolved the disagreements by discussion and recoded the occupations. Overall, there was 90.8% (119/131 occupations) agreement between coders.

The RIASEC codes were taken from the Dictionary of Holland Occupational Codes. The coders agreed that 107 items had identical or equivalent titles and that 20 items could not be coded. Occupational titles for four items had to be discussed to establish a code, resulting in 96.9% agreement (127/131 occupational items). Because it was not possible to find occupational titles in all three sources that could be matched to all the 131 occupational titles, a total of 110 titles that could be coded on the Prestige and Sex-type indices and assigned a three-letter Holland code were used in the analysis.

People/Things and a Data/Ideas scales were created using Prediger's (1981) algorithm. These scales were used to evaluate how well Prediger's dimensions represent Holland's model. Prediger suggested that People/Things and Data/Ideas scales can be created by giving each occupation a weighted score based on its three-letter Holland code. Prediger's algorithm is:

People/Things score =

$$(2.0 \times \mathrm{R}) + (1.0 \times \mathrm{I}) - (1.0 \times \mathrm{A}) - (2.0 \times \mathrm{S}) - (1.0 \times \mathrm{E}) + (1.0 \times \mathrm{C}).$$

Data/Ideas score =

$$(0.0 \times \mathrm{R}) - (1.7 \times \mathrm{I}) - (1.7 \times \mathrm{A}) + (0.0 \times \mathrm{S}) + (1.7 \times \mathrm{E}) + (1.7 \times \mathrm{C}).$$

Each code letter (RIASEC) in the formulas receives a score of 4, 2, or 1 in descending order for each three-letter code. For example, if an occupation has the three-letter code SIA, a score of 4 was given for S, a score of 2 for I, and a score of 1 for A. For the remaining code letters (e.g., REC) a score of 0 was assigned.

People/Things and Data/Ideas scores were calculated for each of the 110 occupational titles.

RESULTS

Multidimensional scaling (MDS) techniques were used to generate spatial representation of the occupational titles. A three-way (individual differences) scaling (Arabie, Carroll, & Desarbo, 1987) was applied to the female and male similarity data. Specifically, we calculated correlation matrices for the 110 occupational titles for the male and females, separately. Then, these matrices were scaled using the three-way multidimensional scaling program in SYSTAT (1997).

The first step in multidimensional scaling is to determine the dimensionality of the scaling solution. In the present analysis, we attempted to identify the number of dimensions that best represent the relations among the occupational titles. We relied on stress and interpretability of the MDS solution to assist in choosing the appropriate dimensionality. Scaling solutions were computed in two through five dimensions. The stress values for the two to five MDS dimensions for the female sample were .28, .21, .17, and .14, respectively. For the male sample the stress values for two to five MDS dimensions were .31, .22, .18, and .15, respectively. Stress can vary from 0 to 1.00 and is a "badness-of-fit" index with larger values indicating a poorer solution. We then plotted the stress values by the number of dimensions. This plot is similar to a scree plot in factor analysis. When the plot for the stress values and dimensions was inspected an elbow appeared at the three-dimensional MDS solution. The VAF (variance accounted for) for two-dimensional solution is .50 and the VAF is .60 for the three-dimensional solution showing that the third dimension accounted for an additional 10% of the variation. We also compared our results to a Monte Carlo study (Spence & Ogilvie, 1973) that suggests that the stress values for the present three-dimensional solution with over 100 stimuli is appreciably below random stress values.

To explore the interpretability of the scaling solutions, we examined the results from property-vector fitting (Jones & Koehly, 1993; Kruskal & Wish, 1978). Property-vector fitting, sometimes called external scaling, involves multiple linear regression of hypothesized variables onto the MDS configuration. In the present case, we expected the variables of Prestige, Sex-type, Data/Ideas, and People/Things to account for the MDS arrangement of the occupational titles. Property-vector fitting techniques were applied both to the three- and four-dimensional MDS solution to determine the interpretability of these solutions. The location of a property vector is found by a multiple linear regression of the scales (e.g., prestige scales) onto the coordinates from the three- and four-dimensional MDS solutions. Inspection of the regression weights and the squared multiple *R*'s for the property vectors indicated that the three-dimensional solution was more interpretable. In sum, we chose the three-dimensional MDS

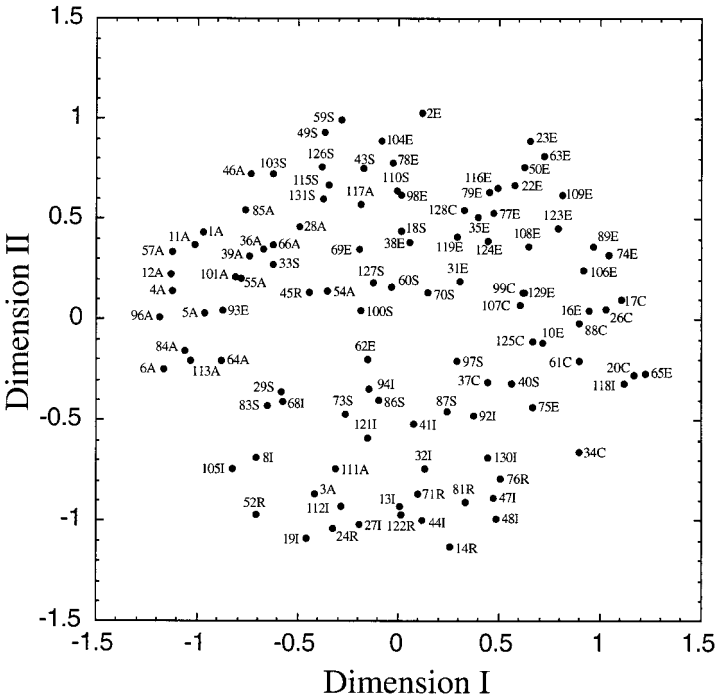

FIG. 1. First and second dimensions of the three-dimensional MDS solution.

solution since the stress values and the results from the property fitting indicate that this solution fits the data best and is most interpretable.

We next examined the subject weights, sometimes called dimensional weights, from the three-way scaling analysis to determine whether the male and female MDS solutions were similar. The MDS subject weights provide information on the relative salience of each dimension for each sample. Large subject weights for a dimension indicate that greater emphasis is placed upon that dimension than another dimension for a given sample. For the three-dimensional solution the dimension weights, representing the importance of each dimension, for the females were .56, .61, and .52, accounting for 61.4% of the variance, and for males the dimensional weights for dimensions one through three were .54, .52, and .63, respectively, accounting for 58% of the variance. Comparing the dimension weights for men and women indicate that the three-dimensional solution fits the data similarly for the sexes and therefore the combined solution was chosen for interpretation.

The three-dimensional MDS solution for the 110 occupations with their one-letter Holland code is shown in Figs. 1 and 2 (the occupational titles are listed with their respective three-point Holland codes in the Appendix). Figure 1 shows the circular arrangement of the Holland types with an S-E-C-R-I-A

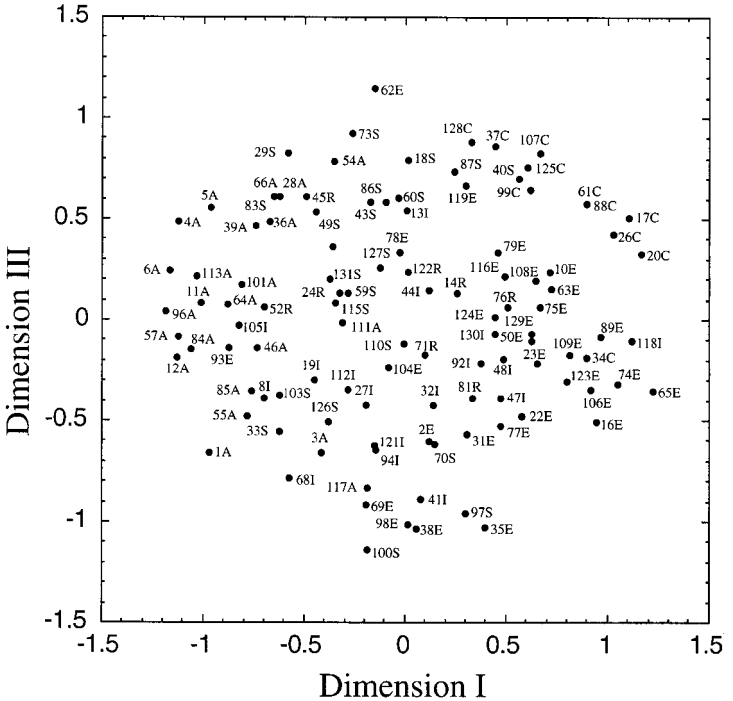

FIG. 2. First and third dimensions of the three-dimensional MDS solution.

clockwise arrangement beginning with Social occupations in the upper left quadrant. It is notable that the items are scattered throughout the space with occupational titles not clustering around the six prototypic RIASEC types. Instead, the items are continuously distributed with a blending from one type to another (cf. Rounds & Day, 1999). Dimension I has Artistic occupations on the left side and Conventional occupations on the right side. Dimension II has Social and Enterprising occupations at the top and Realistic and Investigative occupations at the bottom of the diagram. Figure 2 shows Dimension I crossed with Dimension III. Dimension III has occupations such as housekeeper, librarian, waiter/waitress, courtroom stenographer, and beauty and hair-care consultant on the positive end and occupations such as professional athlete, criminal lawyer, politician, and police officer on the negative end. Tentatively, Dimension III could be accounting for sex-typed preferences contrasting female versus male stereotyped occupations.

Table 1 shows the results of property-vector fitting analysis: regression weights and squared multiple correlations for the fitted property vectors. Property-vector fitting is a common method to assist in interpretation of the MDS dimensions. The properties refer to variables (e.g., Sex-type) that can account for the relations among the RIASEC types and assist in interpretation of the MDS

TABLE 1
Standardized Regression Weights (β) and R^2's for Property Vectors

	Dimensions			
Property	I	II	III	R^2
Data/Ideas	.614	.434	.114	.58*
People/Things	.208	−.754	−.070	.62*
Sex-type	.111	.355	.622	.52*
SEI	−.313	.074	−.539	.40*
OP	−.236	−.045	−.506	.32*

Note. SEI = socioeconomic index; OP = occupational prestige.
* $p < .001$.

space. The moderately high multiple *R*'s squared indicate that each of the five measures seems to be captured in the three-dimensional space. [It should be noted that the number of properties that can be fit into the three-dimensional space (or for a two-dimensional space) is only limited by the number of interpretation that can be applied to the space.] The regression weights from the analysis show that Dimension I can be defined as Data/Ideas and Dimension II as People/Things, with People/Things showing the highest multiple R^2 of .62 and Data/Ideas with a multiple R^2 of .58. The third dimension seems to reflect mainly Sex-type with a squared multiple *R* of .52 but also Prestige with squared multiple *R*'s of .32 and .40.

To better understand the location of Holland's types and property vectors, we calculated the average location of the occupations belonging to each of the six RIASEC types from the three-dimensional solution. The mean RIASEC locations and the fitted property vectors are shown in Figs. 3 and 4. The property vectors are plotted from the origin and are projected in the direction in which the higher values of the property occur. The dashed line from the origin shows the reversed direction of the property vector (i.e., the direction in which the lower values of the property occur). The length of the vector corresponds to the variance accounted for with longer vectors accounting for more variation. Inspection of Fig. 3 shows that the Ideas pole seems to lie between the A occupations on one side and the I and R occupations on the other side. The Data pole of the vector is located between the E-type occupations and the C. It is also notable that the People end on the People/Things vector lies on the S-type occupations but the Things end has a mixture of R and I occupations.

The items to a large extent conform to Holland's RIASEC ordering with the exception of the R and I types; they lie much closer than expected. Fouad, Harmon, and Borgen (1997) similarly found the R and I types to be undifferentiated using the RIASEC scale scores from the 1994 version of the SII. An inspection of the three-letter Holland codes (listed in the Appendix) supports the notion that this lack of space between the R and I might be due the characteristics

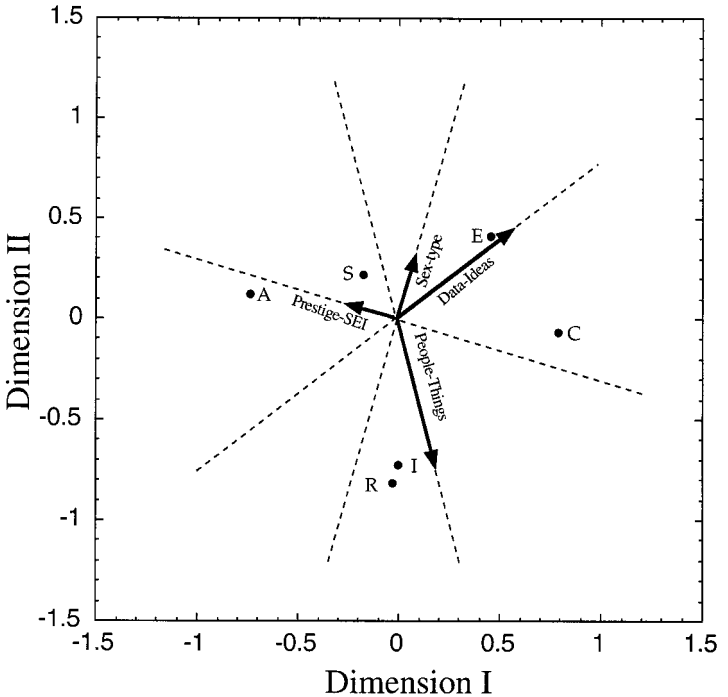

FIG. 3. First and second dimensions with the mean RIASEC scores and the fitted vectors.

of the items used in the SII. Almost all the occupations that are coded R have a second code of I and vice versa for I occupations. These findings seem to correspond to Prediger's proposed relationship of his Data/Ideas and People/Things dimensions to the RIASEC types.

Inspection of Fig. 4 gives an indication of the relationship between Holland types and the third dimension as represented by the fitted vectors. The property vectors representing sex-type account for considerably more variance than the prestige indicators. Inspection of the average location of the types indicates that more C occupations are low prestige and female sex-typed and that I and E occupations tend to be more prestigious and male sex-typed. On the other hand A-, S-, and R-type occupations on the average tend to be neither male nor female sex-typed and are located in the middle of the Prestige and the Sex-type range.

DISCUSSION

The results support the hypothesis that three dimensions underlie the responses to the occupational items in the Strong Interest Inventory for a female and male sample. This finding, using an alternative method than the principal component analysis applied by Tracey and Rounds (1996), indicates that these dimensions are not method specific. The first dimension represents Prediger's Data/Ideas and

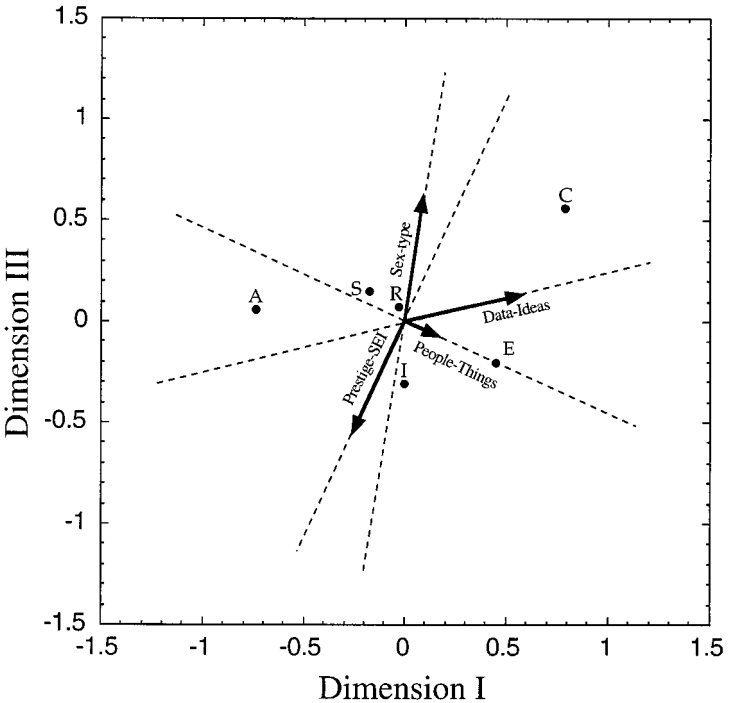

FIG. 4. First and third dimensions with the mean RIASEC scores and the fitted vectors.

the second dimension People/Things. The third dimension reflects mainly Sex-type yet it also relates to Prestige ratings. Sex-type preferences account for 52% of the variation compared to 32 to 40% for Prestige. According to Gottfredson's (1981) theory of compromise and circumscription sex-type is more fundamental than prestige when career decisions are made. For these reasons, we named the third dimension Sex-type.

Male and female sex-typed occupations are not equally distributed over the prestige range; Prestige and Sex-type of occupations are nonindependent. Male sex-typed occupations vary from high to low prestige, but female sex-typed occupations cluster in the middle to low levels with high-prestige female sex-typed occupations virtually nonexistent (Gottfredson, 1981; Hesketh et al., 1995). Stevens and Hoisington (1987) found that the occupations dominated by women are most often ranked in the lower two thirds of the prestige hierarchy but men's occupations are found through the whole range of prestige. This is why in Strong's (1943) studies the OL and MF scales correlated over .40, reflecting the nonindependence of prestige and sex-type. The detection of a third dimension that is interpreted as sex-type and related to prestige ratings supports Hesketh et al.'s (1990) contention that interests are compound constructs. As compound constructs, interests incorporate elements of both sex-type and prestige. Thus, the

three variables of interests, Prestige, and Sex-type cannot be seen as completely separate and independent.

This study shows that sex-typing is an influential factor in the responses to interest items. Furthermore, it opens up the possibility that the sex-differences in the item and scale level of interest inventories could be due to differences in the influence of sex-typing for men and women. Our results coincide with a recent study (Aros, Henly, & Curtis, 1998) showing that sex-related differences on items strongly relate to the sex-types of the items. It is important to point out that although the analysis in the present study is applied to the occupational items in the 1985 version of the SII, it is likely that three dimensions underlie the responses to the same type of items in the 1994 version (Harmon et al., 1994). The two versions include an almost identical item pool except for 15 new or altered items.

It can only be speculated how sex-type and prestige, together or separately, might influence responses to the SII items. What the presence of the Sex-type dimension in occupational preferences means still remains to be clarified. Differences in prestige have been dealt with in career assessment and counseling by constructing separate interest inventories for lower and higher level occupations. The Career Assessment Inventory (CAI; Johansson, 1986), for example, is designed mainly for use with students who will start work or enter vocational training programs after they graduate from high school. In contrast, the SII used in this study was designed primarily for college students. These results show that a prestige influence can be detected in the SII, a measure that has a pool of occupational items with a restricted range of Prestige. Although prestige and sex-type are involved in vocational preferences, these results do not answer the question about how much influence either occupational prestige or sex-type has on vocational interest responses.

In the present study, the third dimension accounted for 10% of the variation. In Tracey and Rounds (1996) the first two dimensions, labeled People/Things and Data/Ideas, accounted for 8.7 and 7.3% of the variation, respectively, and the third dimension, labeled prestige, accounted for 5.3% of the variation. Does 5.3 or 10% of the variation lead to a practical difference in how individuals respond to interest items? For example, if a Realistic scale has mostly low-prestige occupations and an individual rejects these occupations because he/she prefers high-prestige Realistic occupations, it would be important to have knowledge of the influence of prestige on vocational preferences. But it is unclear from the present study how much importance should be placed on a third dimension, a question that needs to be pursued.

The presence of a third dimension in the SII occupational items has relevance for the validity of the Occupational, Basic Interest, and General Occupational Theme scales used to score the inventory. It is possible, for example, that the six RIASEC scale scores General Occupational Theme (GOT) that are now depicted in two dimensions are influenced by the third dimension of Sex-type and Prestige together or separately. Rounds (1995) raised similar concerns when he showed that gender differences typically found in SII scale-score comparisons are re-

flected in the spatial variation among Basic Interests scales for men, but not for women. The Sex-type dimension detected in the items might be influencing the SII scale scores and their interpretation in some unknown manner.

The presence of a third dimension in the SII has implications for vocational counseling where the inventory is used to assess a client's vocational preferences. Holland's model has been very helpful in organizing and interpreting the results from the SII in counseling yet his model does not assess the influence of occupational sex-type or prestige on the individual's scale scores. A formal assessment of the influence of these factors on the responses has not been available for use in counseling. The presence of a third dimension could mean that an alternative model based on the proposed three dimensions might be used to conceptualize the interest scores more accurately.

The major limitation of the present study lies in the sample used. Both the limited age range of the participants and their educational level could be pertinent to the results obtained. Although Sex-type rankings have been found to be stable over different groups of people, whether a third dimension of Sex-type is to be found in other samples remains to be studied. Another limitation is that the results cannot be generalized beyond the SII occupational items. The question remains whether a third dimension underlies other kinds of items in the SII, e.g., activities and school subjects. Sex-type might be a unique factor in the occupational items or they may form a third dimension underlying the whole inventory. More research is necessary to provide information on both what it means that there is a Sex-type dimension in interest data and how sex-type and prestige together and/or separately influence the responses to vocational interest inventories.

APPENDIX

The 110 SII Occupational Items with Three-Letter Holland Codes

1. Actor/Actress	AES
2. Advertising executive	ESA
3. Architect	AIR
4. Art museum director	AES
5. Art teacher	ASE
6. Artist	ASE
8. Astronomer	IRE
10. Auctioneer	EAS
11. Author of children's books	AES
12. Author of novels	AES
13. Author of technical books	IRS
14. Auto mechanic	RSE
16. Auto salesperson	ESR
17. Bank teller	CSE
18. Beauty and hair-care consultant	SER
19. Biologist	ISR
20. Bookkeeper	CRE

APPENDIX—*Continued*

22. Business teacher	ESR
23. Buyer of merchandise	ESA
24. Carpenter	REI
26. Cashier in bank	CSE
27. Chemist	IRE
28. Children's clothes designer	AER
29. Worker in religious vocation	SEA
31. City planner	ESI
32. Civil engineer	IRE
33. College professor	SEI
34. Computer operator	CSR
35. Corporation lawyer	ESA
36. Costume designer	ASR
37. Courtroom stenographer	CSE
38. Criminal lawyer	ESA
39. Dancing teacher	ASE
40. Dental assistant	SAI
41. Dentist	ISR
43. Dietitian	SIE
44. Drafting technician	IRE
45. Dressmaker/Tailor	RSE
46. Editor	AES
47. Electrical engineer	IRE
48. Electronics technician	IRE
49. Elementary school teacher	SEC
50. Employment manager	ESC
52. Farmer	REI
54. Florist	AER
55. Foreign correspondent	ASE
57. Free-lance writer	AES
59. High-school teacher	SAE
60. Home economics teacher	SAE
61. Hospital records clerk	CSR
62. Housekeeper	ESR
63. Hotel manager	ESR
64. Illustrator	AES
65. Income tax accountant	ECS
66. Interior decorator	AES
68. Jet pilot	IRE
69. Judge	ESA
70. Labor arbitrator	SEA
71. Laboratory technician	RIE
73. Librarian	SAI
74. Life insurance agent	ESR
75. Machine shop supervisor	ERS

APPENDIX—*Continued*

76. Machinist	RIE
77. Manager, Chamber of Commerce	ESR
78. Manager, child care center	ESA
79. Manager, clothing store	ESA
81. Mechanical engineer	RIS
83. Religious leader	SAI
84. Musician	ASI
85. Newspaper reporter	ASE
86. Nurse	SIA
87. Nurse's aide/Orderly	SER
88. Office clerk	CRS
89. Office manager	ESR
92. Pharmacist	IES
93. Photographer	ESA
94. Physician	ISR
96. Poet	AES
97. Police officer	SER
98. Politician	ESR
99. Private secretary	CSE
100. Professional athlete	SRC
101. Professional dancer	AER
103. Psychologist	SIA
104. Public relation director	EAS
105. Rancher	IRS
106. Realtor	ESR
107. Receptionist	CSE
108. Retailer	ESR
109. Sales manager	ESA
110. School principal	SEI
111. Scientific illustrator	AIE
112. Scientific research worker	IRE
113. Sculptor	AER
115. Social worker	SEA
116. Specialty salesperson	ESA
117. Sports reporter	ASE
118. Statistician	IRE
119. Flight attendant	ESA
121. Surgeon	IRA
122. Toolmaker	RIE
123. Traveling salesperson	ESA
124. Travel bureau manager	ESR
125. Typist	CSE
126. TV announcer	SCE
127. Vocational counselor	SEC
128. Waiter/Waitress	CES

APPENDIX—*Continued*

129. Wholesaler	ESA
130. X-ray technician	IRS
131. Youth organization staff member	SEA

REFERENCES

Arabie, P., Carroll, J. D., & Desarbo, W. S. (1987). *Three-way scaling and clustering.* Newbury Park, CA: Sage.

Aros, J. R., Henly, G. A., & Curtis, N. T. (1998). Occupational sextype and sex differences in vocational preferences-measured interest relationships. *Journal of Vocational Behavior,* **53,** 227–242.

Borgen, F. H., & Donnay, A. C. (1996). Slicing the vocational interest pie one more time: Comment on Tracey and Rounds. *Journal of Vocational Behavior,* **48,** 42–52.

Carkhuff, R. R., & Drasgow, J. (1963). The confusing literature on the OL scale of the SVIB. *Journal of Counseling Psychology,* **10,** 283–288.

Cooper, E., Doverspike, D., & Barrett, G. V. (1985). Comparison of different methods of determining the sex-type of an occupation. *Psychological Reports,* **57,** 747–750.

Crites, J. O. (1969). *Vocational psychology: The study of vocational behavior and development.* New York: McGraw–Hill.

Fitzgerald, L. F., Fassinger, R. E., & Betz, N. E. (1995). Theoretical advances in the study of womens career development. In W. B. Walsh & S. H. Osipow (Eds.), *Handbook of vocational psychology: Theory research and practice* (pp. 67–109). Hillsdale, NJ: Erlbaum.

Fouad, N. A., Harmon, L. W., & Borgen, F. H. (1997). Structure of interests in employed male and female members of U.S. racial-ethnic minority and nonminority groups. *Journal of Counseling Psychology,* **44,** 339–345.

Gottfredson, L. (1981). Circumscription and compromise: A developmental theory of occupational aspirations. *Journal of Counseling Psychology,* **28,** 545–579.

Gottfredson, L. (1996). Gottfredson theory of circumscription and compromise. In B. Brown, L. Brooks, et al. (Eds.), *Career choice and development* (3rd ed., pp. 179–233). San Francisco: Jossey–Bass.

Gottfredson, G. D., & Holland, J. L. (1989). *Dictionary of Holland occupational codes.* Odessa, FL: Psychological Assessment Resources.

Hansen, J. C. (1996). What goes around comes around. *Journal of Vocational Behavior,* **48,** 73–76.

Hansen, J. C., & Campbell, D. P. (1985). *Manual for the SVIB-SCII* (4th ed.). Palo Alto, CA: Consulting Psychologist Press.

Harmon, L. W. (1996). Lost in space: A response to "The spherical representation of vocational interests." *Journal of Vocational Behavior,* **48,** 53–58.

Harmon, L. W., Hansen, J. C., Borgen, F. H., & Hammer, A. L. (1994). *Strong Interest Inventory: Applications and technical guide.* Palo Alto, CA: Consulting Psychologists Press.

Hesketh, B., Elmslie, S., & Kaldor, W. (1990). Career compromise: An alternative account to Gottfredson's theory. *Journal of Counseling Psychology,* **37,** 49–56.

Hesketh, B., Hesketh, T., Hansen. J. C., & Goranson, D. (1995). Use of fuzzy variables in developing the new scales from the Strong Interest Inventory. *Journal of Counseling Psychology,* **42,** 85–99.

Holland, J. L. (1973). *Making vocational choices: A theory of careers.* Englewood Cliffs, NJ: Prentice Hall.

Holland, J. L. (1985). *Making vocational choices: A theory of vocational personalities and work environments* (2nd ed.). Englewood Cliffs, NJ: Prentice Hall.

Holland, J. L. (1997). *Making vocational choices: A theory of vocational personalities and work environments* (3rd ed.). Englewood Cliffs, NJ: Prentice Hall.

Johansson, C. B. (1986). *Career Assessment Inventory: The Enhanced Version.* Minneapolis, MN: National Computer Systems.

Jones, L. E., & Koehly, L. M. (1993). Multidimensional scaling. In G. Keren & C. Lewis (Eds.), *A handbook for data analysis in the behavioral sciences: Methodological issues* (pp. 95–163). Hillsdale, NJ: Erlbaum.

Kruskal, J. B., & Wish, M. (1978). *Multidimensional scaling.* Newbury Park, CA: Sage.

Prediger, D. J. (1976). A world-of work map for career exploration. *Vocational Guidance Quarterly,* **24,** 192–208.

Prediger, D. J. (1981). Mapping occupations and interests: A graphic aid for vocational guidance and research. *Vocational Guidance Quarterly,* **30,** 21–36.

Prediger, D. J. (1982). Dimensions underlying Holland's hexagon: Missing link between interests and occupations? *Journal of Vocational Behavior,* **21,** 259–287.

Prediger, D. (1996). Alternative dimensions for the Tracey–Rounds interest sphere. *Journal of Vocational Behavior,* **48,** 59–67.

Prediger, D., Swaney, K., & Mau, W.-C. (1993). Extending Holland's hexagon: Procedures, counseling applications, and research. *Journal of Counseling and Development,* **71,** 422–428.

Rounds, J. B. (1995). Vocational interests: Evaluation of structural hypotheses. In D. Lubinski & R. V. Dawis (Eds.), *Assessing individual differences in human behavior: New concepts, methods, and findings* (pp. 177–232). Palo Alto, CA: Consulting Psychologists Press.

Rounds, J., & Day, S. X (1999). Describing, evaluating, and creating vocational interest structures. In M. L. Savickas & A. R. Spokane (Eds.), *Vocational interests: Their meaning, measurement and use in counseling* (pp. 103–133). Palo Alto, CA: Davies–Black.

Rounds, J. B., & Tracey, T. J. (1993). Prediger's dimensional representation of Holland's RIASEC circumplex. *Journal of Applied Psychology,* **78,** 875–890.

Rounds, J. B., & Zevon, M. B. (1983). Multidimensional scaling research in vocational psychology. *Applied Psychological Measurement,* **7,** 491–510.

Shinar, E. H. (1975). Sexual stereotypes of occupations. *Journal of Vocational Behavior,* **7,** 99–111.

Shivy, V. A., Rounds, J., & Jones, L. E. (1999). Applying vocational interest models to naturally occurring occupational perceptions. *Journal of Counseling Psychology,* **46,** 1–12.

Spence, I., & Ogilvie, J. C. (1973). A table of expected stress values for random rankings in nonmetric multidimensional scaling. *Multivariate Behavioral Research,* **8,** 511–517.

Stevens, G., & Cho, J. H. (1985). Socioeconomic indexes and the new 1980 census occupational classification scheme. *Social Science Research,* **14,** 142–168.

Stevens, G., & Hoisington, E. (1987). Occupational prestige and the 1980 U.S. labor force. *Social Science Research,* **16,** 74–105.

Strong, A. K., Jr. (1943). *Vocational interests of men and women.* Stanford, CA: Stanford Univ. Press.

Swaney, K. B. (1995). *Technical manual: Revised Unisex edition of the ACT Interest Inventory (UNIACT).* Iowa City, IA: American College Testing.

SYSTAT (1997). *SYSTAT 7.0 for Windows.* Chicago, IL: SPSS Inc.

Tracey, T. J., & Rounds, J. B. (1996). The spherical representation of vocational interests. *Journal of Vocational Behavior,* **48,** 1–41.

U.S. Department of Labor (1998). In FERRET: Federal, electronic research and review extraction tool (On-line). *Current Population Survey.* Available: http//ferret.bls.census.gov/items/value/valu_20635.htm.

White, M. J., Kruczek, T. A., Brown, M. T., & White, G. B. (1989). Occupational sex stereotypes among college students. *Journal of Vocational Behavior,* **34,** 289–298.

Yanico, B. J. (1979). *Male Dominance Index values for occupations, post-secondary curricula, and apprenticeship training program.* Unpublished manuscript, Southern Illinois University at Carbondale.

Received: December 24, 1998