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The Spherical Representation of Vocational Interests

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We report the development, examination, and replication of a spherical structure of vocational interests. A sample of 266 undergraduate students were asked to give their preferences to a sample of 229 occupational titles. The principal components analysis conducted on the item level responses supported the presence of the prestige component in addition to the general, people/things, and data/ideas components typically associated with interest data. Twenty-four subscales were created for geometrically defined combinations of the prestige, people/things, and data/ideas components and these subscales were found to lie on the surface of the sphere. This spherical representation was then examined on independent samples of college ($N = 223$) and high school students ($N = 370$). Strong support was yielded for the structure.

There are a variety of models proposed for the structure of vocational interests (e.g., Gati, 1991; Guilford, Christensen, Bond, & Sutton, 1954; Meir, 1973; Roe, 1956), but for the past 20 years the model proposed by John Holland (1973, 1985a) has received the most attention in the literature. His model has become the standard model for conceptualizing vocational interests and environments (Borgen, 1986). Most major interest inventories have been revised to yield scores comparable to Holland's model.

Holland proposed that there are six personality types and occupational environments: Realistic (R), Investigative (I), Artistic (A), Social (S), Enterprising (E), and Conventional (C) (hereafter collectively represented by the term RIASEC). These RIASEC personality types are reflected in occupational interest preferences and skills, and the relations among the types can be represented by a circle, with proximity reflecting the degree of relation. The circular nature of the six types has received extensive examination (e.g., Gati, 1991; Prediger, 1982; Rounds & Tracey, 1993, 1995; Rounds & Zevon, 1983). Holland has further specified that the six types are arranged in a hexagon,

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i.e., a circular ordering with equal intervals, otherwise known as a circumplex (Guttman, 1954). In a structural meta-analysis of 104 different RIASEC samples across a variety of instruments, Tracey and Rounds (1993) found support for this circumplex structure of RIASEC scales in U.S. samples. However, less support has been generated cross-culturally. Rounds and Tracey (1995) found that RIASEC scales did not fit the circumplex model for either international or U.S. ethnic minority samples.

We propose a spherical model of vocational interests as an extension of Holland's (1973, 1985a) RIASEC model. Specifically, we propose that a prestige dimension exists in interest data that is orthogonal to the People/Things and Data/Ideas dimensions (Prediger, 1982) underlying the RIASEC circle of interests. Further, we propose that when viewed in three dimensions, a sphere results. The purpose of this study is to examine interest data for the presence of a prestige dimension, and if the presence of a prestige dimension is supported, then to determine if the data adhere to a spherical model, and finally to construct scales to represent this structure.

PRESTIGE IN VOCATIONAL INTERESTS

Occupational prestige is a broad construct with many referents such as status (Holland, 1985b), prestige (Gottfredson, 1980; Hodge, Siegel, & Rossi, 1964; Stevens & Hoisington, 1987), socioeconomic status (Stevens & Cho, 1985), level of training (Holland, 1985a), occupational level (Campbell, 1971), and level of difficulty and responsibility (Roe, 1956). The variables of social status, prestige, education level, behavioral control, and responsibility are highly related (Crites, 1969; Gottfredson, 1980; Roe, 1956) and are thus indicative of the same underlying construct. Prestige is the name most often invoked when studies allow the respondents to determine the perceptual space of occupations (Rounds & Zevon, 1983).

The presence of prestige is yielded in occupational ratings (e.g., Hodge et al., 1964) as well as less structured examinations of the cognitive maps used to evaluate occupations (see Rounds & Zevon, 1983). The stability and generalizability of rankings of status or prestige have long been supported (Coxon & Jones, 1978; Crites, 1969; Hodge et al., 1964; Plata, 1975; Reeb, 1974). In addition, Reeb (1974) found that this dimension of prestige was yielded regardless of occupational interests of the respondents. Few other results are as robust as the repeated finding of the presence of prestige in the subjective perceptions of occupations, but its presence has not been incorporated as a major dimension in current interest models.

One possible reason for the failure to focus on a major prestige component in occupational interest data is that prestige is typically viewed as an aspect of values and not interests. Dawis (1991) notes that the major distinction between interests and values is that values focus on the relative importance of things to a person, whereas interests focus on the relative liking/disliking of things. This view of the major distinction between values and interests as being scale response driven has been echoed by Vansickle and Prediger (1991). Given the different focus (importance versus liking) of values and interests, Dawis argues that the content of values and interests differ mostly because some contents lend themselves more to one item format than the other, not because there may be any inherent content differences.

Another possible reason for the failure to incorporate prestige into interest models stems from three methodological artifacts. The first is a tendency to sample occupations from a restricted range of the prestige domain. Many factor-analytic studies strive to represent the types posited by Holland or some other set of basic interest scales. Items are selected only if they are indicative of the types. Researchers typically do not attempt to sample items that also represent the prestige dimension. If items of varying prestige levels are not selected for inclusion in any instrument, then a prestige dimension will not be revealed, regardless of method or analysis.

Even when the items included in a RIASEC instrument vary in prestige, this prestige variance is often confounded with the specific RIASEC scales. For example, the R and C types tend to have a greater proportion of lower prestige occupations than the other scales. When the variance in prestige is related to the different RIASEC scales, then any analysis that pulls out the RIASEC structure will simultaneously extract the variance associated with prestige. Failure to sample prestige variance evenly across the RIASEC scales could result in failure to detect the prestige factor.

Even if the items vary in prestige and this variance is equal across interest type, analyses that examine the relations among the scale scores and ignore item level variation in prestige will not identify prestige as a salient dimension. Most studies of the structure of interests (e.g., Gati, 1991; Rounds & Tracey, 1993, 1995; Tracey & Rounds, 1993, 1994) have examined scale scores. However, where studies have been done using items and having a fairly adequate sample of the domain of interests, support has been provided of the presence of prestige in preference data (e.g., Meir, 1973).

To provide an adequate assessment of the presence of the prestige dimension in vocational interests, we sampled a wider range of prestige items than typically included in interest inventories, attempted to balance the prestige over interest types and conducted the analyses at the item level. We examined occupational preferences (specifically, the extent of liking of different occupational titles) because this item type should have the highest probability of revealing the prestige factor.

THREE–DIMENSIONAL STRUCTURE OF INTERESTS

Holland's RIASEC types exist in two-dimensional space (Prediger, 1982; Prediger & Vansickle, 1992; Rounds & Tracey, 1993). If prestige is found to exist in occupational preference data, then a third dimension is necessary. The addition of a prestige dimension to the RIASEC circle could yield a variety of different structures, the three most obvious models being the cylinder, the cone, and the sphere.

A cylindrical structure would have the RIASEC types existing identically across all levels of prestige. High prestige interests would have a circular RIASEC structure, as would both middle and low level prestige interests. Cross-sectional slicing of the cylinder at any prestige level would yield a similar circular structure of interests. The implication of the cylindrical model is that the assessment of RIASEC types and prestige can be done independently; an individual's RIASEC scores should not vary across different levels of prestige (i.e., someone who scores highly on the R scale composed of high prestige items should also score highly on the R scale composed of low prestige items). Lack of consideration of prestige would result in an incomplete representation of interests but the RIASEC scale data should still be representative of the person's interests.

This cylindrical structure closely resembles the ''truncated cone'' structure proposed by Roe and Klos (1969). They view the circular structure among interest types (represented by eight interest fields) as not varying in content across level of prestige (termed level of responsibility by them), with the differentiation in interest fields greatest at high levels of responsibility and least at low levels of responsibility. The cone is truncated because Roe views it as never reaching a point where there is no differentiation among fields. The implications of the truncated cone are very similar to those of the cylinder, where prestige level would not greatly affect the circular structure of interests, but failure to include prestige would result in an incomplete representation of interests.

A spherical representation has very different implications regarding the conceptualization and assessment of interests. In a spherical model, the relations of RIASEC interest scales to each other vary as a function of prestige. The circumplex structure of the RIASEC scales will be most evident at moderate levels of prestige. There will be less differentiation among RIASEC scales at high and low prestige levels, and the differences among interest scales would disappear at the extreme levels of prestige. For example, all very high prestige occupations would be responded to similarly, regardless of RIASEC type.

Also the presence of a sphere implies that there may exist other interest types beside the RIASEC types. Any two dimensions could be examined for a circular structure of interests. Not only would a circular structure of interests exist on the People/Things-Data/Ideas circle (Prediger, 1982) as the RIASEC types do, but also other types could be found on the People/Things-Prestige circle and the Data/Ideas-Prestige circle.

The implication of the spherical model to assessment is that prestige needs to be incorporated in all interest assessments because prestige is related to scores on RIASEC scales. If vocational interests do exist in a spherical pattern, assessing RIASEC types at different prestige levels would result in different

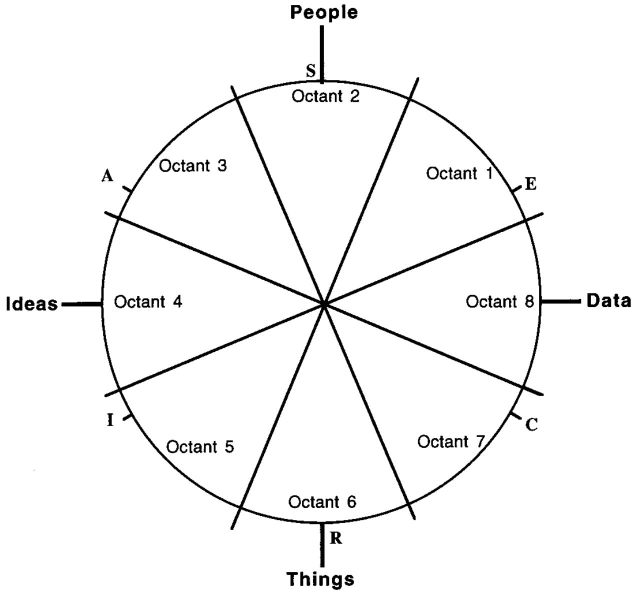

FIG. 1. Spatial representation of Holland's RIASEC types, Prediger's Data/Ideas and People/Things axes and octants.

RIASEC profiles. Failure to account for prestige can thus result in inaccurate profiles, especially at the more extreme values of prestige.

There is little in the literature to indicate whether spherical, cylindrical, truncated cone, or another model best accounts for vocational interest data. However, recent examinations of the relations between circumplex and factor models in the personality area have demonstrated that spherical structures do exist (e.g., Hofstee, de Raad, & Goldberg, 1992; Saucier, 1992). We hypothesized that, like the personality area, vocational interests can be validly represented using a sphere of interest types. If the prestige dimension is supported, then a sphere composed of the RIASEC circle (defined by the People/Things and Data/Ideas dimensions) and the independent Prestige dimension was hypothesized to exist.

EIGHT INTEREST TYPES

Translation of six circularly arranged RIASEC scores to the dimensions underlying a circular model is not easy. There is no clear way of moving from the dimensions to the types. For example, the People/Things dimension defines the differences between S and R types; the Data/Ideas dimension is not salient for these two types (see Fig. 1). But there is no similar clarity on the relation of the types to the Data/Ideas dimension. There are no types that clearly manifest Data or Ideas. E and C equal moderate amounts of data in them, as A and I have equal moderate amounts of ideas represented (see Fig. 1). The exact amount each type contributes to the balance of the dimensions is less straightforward.

An eight-type model would allow easier translation between the dimensional and circular representations. Four of the types would be pure examples of the dimensional poles (i.e., People, Things, Data, Ideas) and the other four would be easily grasped as having equal amounts of two poles (i.e., People–Ideas, People–Data, Things–Ideas, and Things–Data). The differences between Holland's six RIASEC scales and an eight scale (octant) representation of the circumplex defined by Prediger's People/Things and Data/Ideas dimensions are depicted in Fig. 1. We chose an eight-type representation of interests rather than Holland's six RIASEC types because the eight types provide an easier translation between the circular and dimensional models. We do not necessarily view eight types as intrinsically superior to six.

Although it has been demonstrated that RIASEC scales are arranged in a circle (e.g., Tracey & Rounds, 1993), there is no evidence that the items comprising these scales are arranged in a circular manner. We sought to determine if the interest items themselves are arranged in a uniform circular manner and whether the items cluster around the RIASEC types proposed by Holland (1973, 1985a) or whether they are uniformly represented around the circle. If the items are uniformly distributed in a circular manner on the People/Things and Data/Ideas dimensions, then any aggregation of points on the circle (e.g., 5, 8, 10 or 12 types instead of the six RIASEC types) would equally represent the interest circle. Trapnell (1989) used the Vocational Preference Inventory (Holland, 1978) to examine the plausibility of the circumplex structure independent of the presence of the six RIASEC types. He generated eight interest scales and found that a circumplex was as valid for the eight interest scales as it was for the six type scales. Trapnell's results indicate that Holland's six types may only be convenient representative points of interests that are generally circularly arranged.

In summary, the purposes of this study were to determine (a) if prestige existed in vocational interest data, and (b) if the presence of prestige was supported, whether a spherical structure existed when the RIASEC circumplex was combined with prestige. We investigated the efficacy of representing interests using an eight type circular structure because the use of eight types enables easier translation back and forth between a circular and a dimensional representation than six types.

STUDY 1

Method

Sample

Two hundred sixty-six college students (125 males and 141 females, mean age 19.3 years [SD = 1.8]) from two midwestern state universities participated in the study.

Instruments

The Vocational Preference Inventory (VPI, Holland, 1985b). The VPI consists of a listing of occupational titles which are responded to using a ''like or dislike'' format. From these items, 11 scale scores are generated by summing keyed ''like'' responses: the six RIASEC scales (Realistic, Investigative, Artistic, Social, Enterprising, and Conventional) and Acquiescence, Status, Infrequency, Masculinity, and Self-Control. There are extensive reliability (both internal consistency and stability) and validity support for the scales (see Holland, 1985a).

Only the 118 items that comprised the six RIASEC scales and the three supplementary scales of Acquiescence, Status, and Infrequency were used. Also the response format was varied from the standard like versus dislike to a seven point scale (1 = strongly dislike, 4 = indifferent, 7 = strongly like) to maximize item discrimination and increase item variance. Internal consistency estimates (αs) for the present sample on the six RIASEC scales varied from .90 to .95, with a mean of .92.

A list of 111 occupation titles were added to the VPI item pool by the authors to augment the occupational titles provided in the VPI. Because the VPI may underrepresent nonprofessional occupations (Rounds, in press), and because the VPI is designed to assess only the six RIASEC types (i.e., not occupations that may lie between the six types), we selected items that would possibly not be ''pure'' examples of the RIASEC types and/or were of a less professional, more skilled and nonskilled worker level. Trapnell's (1989) work on the circular arrangement of interests was used to suggest possible items that were not ''pure'' RIASEC codes. G. Gottfredson and Holland's (1989) listing of high point codes and general education development levels (GED, which varies from 1 to 6 with 6 representing the greatest amount of education) was used to augment the list of occupations across prestige level. An examination of the distribution of GED levels across the VPI RIASEC scales revealed that high GED levels (i.e., 5s or 6s) were underrepresented for R (mean GED = 3.78) and C (mean GED = 4.36) and overrepresented for the other scales (mean GED of I = 5.93; A = 4.86; S = 5.29, and E = 4.57). We added high GED R and C type occupations and lower GED I, A, S, and E occupations to better balance the GED levels across RIASEC types. The distribution of the entire pool of 229 items by GED level was as follows: 67 had a GED level of 6 (29%), 64 had a GED level of 5 (28%), 50 had a GED level of 4 (22%), 45 had a GED level of 3 (20%), and 3 had a GED level of 2 (1%). For comparison purposes, the GED levels for the subset of VPI RIASEC scales were: 20 at GED level 6 (24%), 37 at GED level 5 (44%), 17 at GED level 4 (20%), and 10 at GED level 3 (12%).

Procedures

All participants were enrolled in introductory psychology, undergraduate education, or a career exploration course. Students signed up for the study and received subject pool credit. The students came to a separately scheduled meeting and completed all materials then. Groups of participants (ranging in size from 2 to 50) were provided with a packet containing a cover letter, a consent form explaining the purpose of the research, and the study measure of occupational interests. All forms were completed in these groups. A total of 275 students participated in the research. Nine participants were removed from the sample because they did not complete all the items.

Analysis

Overview

The analysis of the data involved a five-step sequence. In each instance, proceeding to the next step was contingent upon obtaining the hypothesized result. First, a principal components analysis was performed to determine the component structure of the data and the relative placement of items in interest space. We hypothesized that the component analysis would reveal the presence of a prestige component. Second, the distribution of items around the circles formed by pairs of the three components was examined to determine if a spherical structure existed. We hypothesized that the items would be uniformly distributed around the three circles. Third, octant scales were empirically constructed to represent each of the three circles. No hypothesis was tested at this step. Fourth, the fit of the octant scales to the circle was evaluated statistically. We hypothesized that each of the three sets of octant scales would fit a circular model. Finally, the three sets of octant scales were combined into one sphere and evaluated.

Principal Components Analysis

The presence of a prestige factor was investigated via principal components analysis of the responses to the 229 occupational titles. Even though the number of items relative to the sample size was fairly high, it was appropriate to use principal components with this sample because the ratio of items to components examined was very small (Guadagnoli & Velcier, 1988).

Based on our meta-structural confirmatory factor analysis of 77 different U.S. RIASEC matrices (Rounds & Tracey, 1993) and the work of Prediger (1982) and Trapnell (1989), we anticipated the principal components analysis to reveal a general component defined by high positive loadings on all items, Prediger's (1982) People/Things and Data/Ideas components, and a fourth Prestige component. Rotating any component solution with a strong general component hinders interpretation (Prediger, 1982; Wiggins, Steiger, & Gaelick, 1981) by confounding general response variance with variance associated with components assessing differential content. Since we were interested in variance associated with differential content (i.e., different occupational interest scales), we did not rotate the components. Because the presence and importance of the general component or factor has been adequately detailed elsewhere and its affect on the circumplex structure is minimal (Rounds & Tracey, 1993; Wiggins, Steiger, & Gaelick, 1981), we focused only on the subsequent three expected components.

We used the three substantive components in a pairwise manner to examine the structure of interests. First we tested whether the structure formed by the second and third components (assumed to be People/Things and Data/Ideas and hereafter referred to as Circumplex 1) had a circular distribution of items. Then we examined the structures formed by the second and fourth (Prestige) components (hereafter referred to Circumplex 2) and the third and fourth components (referred to as Circumplex 3), respectively. If the items on all of these planes manifested a circular arrangement, then the cylindrical and conical structures could be ruled out because the postulation of each of these structures argues against a circular distribution on all three planes.

Circular Distribution of Items

We expected the second and third components to define the plane on which the RIASEC circumplex existed. We were interested in the extent to which placement of the 229 occupational titles on this plane had a circular arrangement and whether the occupational titles were uniformly arranged around the circle. The angle of each item in the space defined by the second and third principal components two components was calculated by taking the arc tangent of the ratio of the loadings, and the Neave and Selkirk gap test (Upton & Fingleton, 1989, pp. 248–249) was performed on these angles to test the null hypothesis of a uniform circular distribution (i.e., that the gap between any two neighboring items around the circle is equal and thus all items are evenly distributed around a circle versus the alternative hypothesis of clustered data). The gap test was conducted twice because it examines only angular dispersion and ignores the relative distance from the origin (i.e., the communality or amount of variance accounted for). First, the gap test was conducted on all 229 items and then on the subset of items that had a communality on the second and third components of $>.10$ (representing a loading of .32 on at least one of the components). This second gap test examined the circular uniformity hypothesis for only those items that were well accounted for and thus of most interest. An identical procedure was used in examining the angular dispersion of items on the planes formed by the second and fourth components (i.e., Circumplex 2) and the third and fourth components (i.e., Circumplex 3).

Octant Scale Construction

We empirically constructed an alternative set of octant interest scales by dividing the circle defined by the second and third components into eighths and selecting the 10 items that had the greatest communalities in each segment. The communalities used in this procedure were calculated from the loadings on the two components being examined. This process of scale construction was also applied to Circumplex 2 and Circumplex 3, with eight circularly arranged scales being created on each plane.

Validity of Octant Scales

The validity of the octant scales was examined in both rational and empirical manners. The rational method involved the comparison of the content of these octant scales to the content of the catalogue of general and basic interest factors as reviewed by Rounds (1995) and generated from the major factor analytic studies of interests (i.e., Jackson, 1977; Kuder, 1977; Guilford et al., 1954; Rounds & Dawis, 1979; Droege & Hawk, 1977). Resemblance between the interest scales generated empirically in this study and the general and basic interest scales yielded in the past would support the validity of these octant scales.

Three methods were used to examine the empirical adequacy of the octant scores: (a) spatial representation of the scales relative to one another using principal components analysis, (b) a test of the circular order among the octant score correlations, and (c) an assessment of the fit of an exact circumplex using confirmatory factor analysis. Because Circumplex 1 contained both a set of octant scales and the VPI RIASEC scales, a conjoint principal component analysis of both sets of scales was conducted to provide information on the relative placement and similarity of the RIASEC and octant scales on Circumplex 1.

Test of circular order. For the octant scales, the circular order model assumes that each correlation among adjacent types is larger than all other correlations; correlations of types two places apart on the circle are larger than correlations of types three or more places removed; and finally, those correlations of types three places apart on the circle are larger than the correlations of types four places apart on the circle. The circular order model for the octant scales yields 288 unique order predictions, compared to 72 unique order predictions for the six RIASEC scales. We examined the extent to which these 288 octant and 72 RIASEC ordered relation predictions were met using the randomization test of hypothesized order relations (Hubert & Arabie, 1987).

The randomization test determines the fit of the hypothesized order relations to the data matrix, here a correlation matrix, and assesses the significance of this fit relative to the fit of all possible relabelings of the rows and columns of the data matrix (see Rounds, Tracey, & Hubert, 1992, for a thorough discussion of this procedure with circular order models). The randomization test of hypothesized ordered relations yields an exact significance level of the number of predictions met by the data versus the null conjecture of random relabeling, and a correspondence index (CI), which is the proportion of predictions met minus the proportion of predictions violated. The correspondence index can range from $+1$, indicating perfect fit, to -1, indicating that not one prediction was met. A CI value of 0.0 indicates as many predictions were met as violated, and a CI value of .5 indicates that 75% of the predictions were met in the data set while 25% were violated.

Test of circumplex. Confirmatory factor analysis was used to determine if the eight octant and six RIASEC scores were arranged in equal intervals around the circle (i.e., an exact circumplex; see Rounds et al., 1992). Specifically, the correlations between each of the adjacent types were constrained to be equal and no less than the remaining correlations. The correlations between each of the types one step apart on the circle were constrained to be equal and no less than those two steps or more apart. The correlations between scales two steps removed were assumed to be equal and no less than those three steps apart. The fit of this exact circumplex model was examined using LISREL (Joreskog & Sorbom, 1986) with a maximum likelihood method of estimation.

The assessment of the fit of any model to the data in confirmatory factor analysis or structural equation modeling is not as straightforward as a simple statistical test. There are many indicators of model–data fit, but each is flawed in some manner (Tanaka, 1993), so by using several indicators of fit, we hoped to avert the problems associated with any one index. Indices of fit examined were the χ^2 goodness of fit statistic, the Goodness of Fit Index (GFI, Joreskog & Sorbom, 1986), the Bentler and Bonett Normed Fit Index (BBNFI, Bentler & Bonett, 1980), the Tucker–Lewis Index (TLI, Tucker & Lewis, 1973), the Non-Centralized Normed Fit Index (NCNFI, McDonald & Marsh, 1990; also called the Comparative Fit Index, Bentler, 1990), and the Parsimonious Goodness of Fit Index (PGFI, Mulaik et al., 1989). To provide a benchmark of circumplex model fit on RIASEC data, Tracey and Rounds (1993) found that the mean GFI for the RIASEC circumplex across 104 different samples was .91, which was deemed to indicate good fit. Fit index values too much below this value would represent less adequate levels of model–data fit.

Examination of a sphere. It was hypothesized that valid circular structures could be obtained on each of the three circumplexes examined. Combination of these circumplexes should result in a spherical structure. The possible existence of a sphere was examined through the use of a principal components analysis on the octant scales generated for the three circumplexes to obtain a spatial representation of the scales and the randomization test of spherical order relations (Hubert & Arabie, 1987) as above.

Results

Component Structure of Interest Items

Principal components analysis of the 229 items yielded the following eigenvalues (percentage of variance in parentheses) for the first nine components: 37.72 (16.5%), 20.46 (8.7%), 16.67 (7.3%), 12.09 (5.3%), 7.83 (3.4%), 7.44 (3.2%), 5.85 (2.6%), 4.48 (2.0%), and 4.42 (1.8%). Using the criteria of parsimony, scree test, and interpretability, we concluded that four components were sufficient to explain data variation. The first component was the general component that loaded highly and positively on all items. The second and third components resembled Prediger's (1982) Data/Ideas and People/Things components, respectively.

The fourth component had 54 items with loadings greater than $|.30|$, approximately half of which had similar loadings on the second or third component, indicating that the principal components analysis did not approximate a simple solution. Occupations having high prestige and requiring advanced education loaded highly on this component [e.g., lawyer (.47), pediatrician (.36), surgeon (.43), psychiatrist (.42), scientific research worker (.52), and physicist (.48)]. Managerial occupations uniformly loaded around zero on this component. Occupations loading negatively on this component tended to be associated with less education [e.g., travel agent (−.41), truck driver (−.34), bartender (−.39), chauffeur (−.51), waiter (−.37), and escort (−.36)].

We correlated the loadings on all 229 items with several prestige indicators to examine the construct validity of this prestige component. This component correlated .75 with the status scale of the VPI and .66 with the general educational development levels (GED) listed in Gottfredson and Holland (1989). The fourth component correlated .70 with socioeconomic status of occupations obtained from Stevens and Cho (1985) and .74 with prestige level obtained from Stevens and Hoisington (1987). The substantial correlations of this component with status, education level, SES, and prestige levels support its utilization as a measure of prestige.

Uniformity of Items on Each of the Three Planes

The result of the Neave and Selkirk gap test on the distribution of items around the circle formed by the Data/Ideas and People/Things components (i.e., Circumplex 1) was not significant ($z = 0.113$, $p > .05$), indicating that the null hypothesis of a uniform distribution of items around a circle could not be rejected. The examination of the distribution of only those items high in communality ($n = 151$) was also not significant ($z = 1.068$, $p > .05$).

Similar results were obtained in the examination of angular dispersion of items on Circumplex 2 and Circumplex 3. The results of the gap test on the items on Circumplex 2 (i.e., the plane defined by the Data/Ideas and Prestige components) were not significant for either the entire set of 229 items ($z = 0.837$, $p > .05$) nor those items ($n = 142$) high in communality ($z = 0.065$, $p > .05$). The results of the gap test on Circumplex 3 (i.e., the plane defined by People/Things and Prestige components) were also not significant for all items ($z = 0.156$, $p > .05$), nor for those items ($n = 114$) with high communality ($z = 1.201$, $p > .05$). Thus on each of the three planes, the null hypothesis of the occupational titles being equally arranged around the circle could not be rejected.

TABLE 1
Summary of Mean Angular Orientation, Communality and Internal Consistency for Each of the Octant Scales for Each Circumplex

		Circumplex 1			Circumplex 2			Circumplex 3		
Octant	Target angle	Mean angle	Mean[a] h^2	α	Mean angle	Mean[a] h^2	α	Mean angle	Mean[a] h^2	α
1	45	43.6	.25	.85	37.3	.30	.90	37.1	.33	.87
2	90	84.2	.37	.90	94.8	.17	.83	94.2	.19	.89
3	135	140.8	.20	.92	131.5	.27	.91	139.2	.21	.89
4	180	182.1	.24	.92	173.2	.24	.90	177.5	.23	.91
5	225	226.3	.20	.89	218.2	.14	.85	221.5	.14	.89
6	270	259.6	.21	.92	262.0	.14	.80	274.6	.15	.84
7	315	321.1	.32	.91	313.9	.20	.89	315.2	.21	.88
8	360	356.0	.36	.90	358.7	.36	.90	9.9	.35	.90

[a] The communality listed is for only the two components defining the plane of focus. The communality does not represent the total communality over all four components. For example, communality estimates for items on Circumplex 1 (People/Things + Data/Ideas) would be the sum of the squared loadings for only these two dimensions.

Octant Scale Construction

The target angle, mean angle, communality, and internal consistency estimates based on the present sample are presented in Table 1 for the eight empirically constructed octant scales. The items forming each octant in the three circumplexes are reported in Table 2.

Circumplex 1 octant scale content. The mean angles of the eight scales closely matched the target angles, yielding a circular arrangement of types (see Table 1). Each scale reflects its item content and the number one to indicate that it was generated from Circumplex 1. Octant 1 was labeled Service 1 and clearly is related to the provision of services to others and assisting others, in areas ranging from travel to fashion needs (see Table 2). This octant is similar to the Accommodating basic interest described by Droege and Hawk (1977). Octant 2 was labeled Helping 1 as each occupation involved helping others (see Table 2) and is similar to the Helping general interest scale of Jackson (1977) and the Social Welfare factors of Kuder (1977) and Guilford et al. (1954). Octant 3 included many occupations involving artistic endeavors, writing, composing, and sculpting and was labeled Artistic 1. This octant corresponds closely with Holland's artistic type, Droege and Hawk's (1977) and Kuder's (1977) artistic factor and Guilford et al.'s (1954) and Rounds and Dawis (1979) aesthetic factor. Octant 4, labeled Life Sciences 1, focused on outdoors, animals, and science and closely resembles Jackson's (1977) Life Science factor.

Octant 5 was labeled Mechanical 1 but it seemed to incorporate some

TABLE 2

Listing of Individual Item Angles, Communalities[a], and Octant Scale for Each of the Three Circumplexes

Occupational title	Circumplex 1			Circumplex 2			Circumplex 3		
	Angle	h^2	Octant scale	Angle	h^2	Octant scale	Angle	h^2	Octant scale
Flight attendant	31.1	.24	1	319.2	.25	7	311.6	.19	7
Travel agency director	33.3	.28	1	325.3	.28	7	313.6	.18	7
Manicurist	34.7	.22	1	341.3	.16		333.9	.09	
Personnel director	37.0	.24	1	22.2	.18		28.4	.11	
Employment counselor	42.3	.23	1	27.5	.16		29.8	.14	
Cosmetologist	44.4	.22	1	336.9	.13		336.5	.13	
Travel agent	44.5	.26	1	312.5	.29	7	312.0	.29	7
Host/hostess	53.5	.27	1	317.6	.17	7	325.9	.25	7
Publicity director	55.8	.22	1	351.3	.07		354.0	.15	
Dir. social service	58.7	.36	1	35.8	.15		23.8	.31	1
Marriage counselor	70.9	.45	2	40.3	.08		16.3	.44	8
School counselor	77.3	.37	2	47.4	.04		13.8	.37	8
Social worker	77.9	.41	2	45.8	.04		12.4	.41	8
Personal counselor	78.8	.47	2	38.1	.03		8.8	.46	8
Audiologist	86.2	.44	2	75.7	.03		14.5	.47	8
Youth camp director	86.5	.31	2	284.8	.02		347.0	.33	8
Psychiatric caseworker	88.2	.29	2	86.8	.09		29.0	.38	1
Educational psychologist	90.0	.32	2	90.0	.15	2	34.4	.47	1
Speech therapist	91.4	.38	2	94.1	.04		18.6	.42	8
Clinical psychologist	95.6	.28	2	96.8	.19	2	39.4	.47	1
Language interpreter	124.5	.14	3	166.4	.05		9.4	.10	

Poet	130.9	.14	3	177.9	.06		1.8	.08	
Journalist	135.7	.17	3	174.5	.09		5.6	.08	
Free-lance writer	135.9	.30	3	183.5	.10		356.4	.14	
Author	142.2	.32	3	171.7	.11		10.6	.12	
Playwright	143.4	.16	3	199.5	.12		334.5	.07	
Sculptor	144.7	.14	3	204.1	.11	5	327.7	.07	
Novelist	146.6	.25	3	179.7	.10		0.4	.07	
Composer	152.2	.16	3	184.2	.13		352.0	.04	
Musician	154.9	.21	3	194.4	.18		331.3	.05	
Zoo veterinarian	159.8	.23	4	171.3	.21	4	22.6	.03	
Oceanographer	170.5	.20	4	188.4	.20	4	318.2	.01	
Zoologist	176.9	.27	4	168.0	.28	4	75.6	.01	
Ecologist	178.0	.22	4	164.5	.23	4	82.9	.02	
Botanist	181.9	.23	4	155.8	.18		94.4	.05	
Biologist	185.1	.22	4	149.2	.16		98.6	.08	
Geologist	191.3	.27	4	169.8	.27	4	138.0	.02	
Fish & wildlife spec.	191.5	.31	4	186.2	.30	4	208.2	.02	
Geographer	192.4	.25	4	167.7	.25	4	135.4	.02	
Anthropologist	193.2	.23	4	169.8	.23	4	142.7	.02	
Chemist	206.4	.16	5	128.8	.33	3	111.8	.23	2
Landscape archit.	209.5	.18	5	215.7	.20	5	231.7	.11	
Meteorologist	213.8	.14	5	161.6	.11		153.7	.06	
Physicist	217.0	.10	5	114.2	.27	3	108.8	.25	2
Carpenter	219.4	.21	5	221.3	.22	5	226.8	.14	
Architect	228.0	.17	5	196.4	.08		194.9	.10	
Chemical engineer	236.8	.23	5	121.0	.26	3	132.4	.16	
Auto mechanic	240.0	.25	5	209.9	.08		198.3	.21	4
Machinist	244.4	.23	5	190.6	.04		185.1	.19	4
Air mechanic	247.7	.29	5	208.6	.06		192.6	.27	4

TABLE 2—*Continued*

Occupational title	Circumplex 1			Circumplex 2			Circumplex 3		
	Angle	h^2	Octant scale	Angle	h^2	Octant scale	Angle	h^2	Octant scale
Elec. technician	248.5	.30	6	170.2	.04		176.1	.26	4
Electrician	248.7	.29	6	192.0	.04		184.7	.25	4
Electrical engineer	251.0	.33	6	131.8	.07		158.9	.34	4
Micro-elec. techn.	252.7	.30	6	132.6	.06		161.3	.30	4
Bldg. contractor	255.6	.17	6	241.3	.05		205.0	.20	5
Power sta. oper.	256.5	.15	6	229.4	.02		195.7	.15	4
Bldg inspector	261.2	.19	6	250.2	.04		203.3	.22	5
Construction insp.	270.6	.16	6	271.1	.05		209.5	.21	5
Safety inspector	276.3	.06	6	42.1	.00		174.3	.06	
Mathematician	278.2	.10	6	80.8	.08		138.3	.17	
IBM equip. operat.	307.1	.28	7	20.3	.11		164.4	.19	4
Stockbroker	312.7	.30	7	33.4	.20		148.6	.22	3
Investment analyst	314.4	.32	7	32.6	.22	1	148.0	.23	3
Cost estimator	314.9	.27	7	23.2	.15		158.3	.17	4
Business program.	315.7	.39	7	32.5	.28	1	146.9	.27	3
Tax expert	320.7	.31	7	31.8	.26	1	142.8	.20	3
Data proc. mgr.	329.2	.33	7	28.3	.31	1	138.0	.16	3
Statistical clerk	330.0	.23	7	25.2	.21		140.8	.10	
CPA	331.9	.36	7	28.4	.36	1	134.7	.16	3
Financial analyst	334.7	.37	7	31.2	.42	1	127.9	.18	3
Bank examiner	337.5	.49	8	14.5	.44	8	147.9	.10	
Banker	338.2	.35	8	17.8	.33	8	141.1	.07	

Bank teller	350.6	.40	8	353.9	.39	8	212.6	.01	
Business consult.	352.8	.36	8	15.6	.38	8	114.1	.03	
Office mgr.	353.4	.33	8	358.2	.33	8	195.6	.00	
Sale mgr.	358.0	.33	8	357.6	.32	8	230.3	.00	
Dept. store mgr.	4.1	.34	8	343.0	.37	8	283.3	.03	
Real-estate sales	7.3	.29	8	354.1	.29	8	321.2	.01	
Hotel mgr.	9.1	.30	8	345.2	.32	8	301.3	.03	
Sales clerk	9.2	.37	8	347.5	.38	8	306.0	.03	
Budget reviewer	342.5	.29		30.4	.36	1	118.1	.12	
Market analyst	321.3	.23		41.5	.25	1	132.1	.20	3
Economist	305.9	.17		57.9	.21	1	130.9	.26	3
Lawyer	354.8	.08		58.4	.30	1	93.1	.12	
Pediatrician	72.0	.11		74.2	.15	2	49.0	.24	
Psychiatrist	85.2	.22		85.0	.19	2	43.4	.41	1
Physician	90.1	.03		90.0	.21	2	68.2	.25	2
Family physician	99.7	.06		95.0	.22	2	63.0	.27	1
Surgeon	223.4	.01		99.0	.19	2	98.6	.19	2
Dentist	204.8	.00		99.1	.11	2	94.2	.10	
Medical lab tech	189.9	.01		108.0	.13	2	93.3	.11	2
Social scientist	111.1	.14		110.4	.14	2	46.1	.24	1
College professor	120.6	.10		113.4	.16	3	53.8	.20	
Science research work	189.5	.13		124.5	.39	3	96.6	.27	2
Geneticist	166.1	.07		130.7	.16	3	78.0	.10	2
Research scientist	188.9	.18		134.6	.36	3	98.8	.19	2
Editor sci. journ.	186.5	.18		140.8	.29	3	98.0	.12	2
Scientific writer	195.6	.19		150.4	.24	3	116.2	.07	
Nat. sci. teacher	161.2	.20		156.5	.22	3	51.9	.05	
Animal scientist	181.4	.21		162.4	.23	4	94.5	.02	

TABLE 2—*Continued*

Occupational title	Circumplex 1 Angle	Circumplex 1 h^2	Circumplex 1 Octant scale	Circumplex 2 Angle	Circumplex 2 h^2	Circumplex 2 Octant scale	Circumplex 3 Angle	Circumplex 3 h^2	Circumplex 3 Octant scale
Astronomer	191.4	.21		184.2	.20	4	199.8	.01	
Portrait artist	148.6	.12		205.8	.11	5	321.6	.05	
Cartoonist	176.8	.12		210.3	.16	5	275.4	.04	
Naturalist	149.4	.12		211.1	.12	5	314.4	.06	
Photographer	159.1	.09		212.4	.11	5	300.9	.04	
Commercial artist	155.0	.06		226.0	.11	5	294.3	.07	
Printmaker	199.2	.04		236.4	.12	5	256.8	.09	
Photoengraver	195.4	.03		238.9	.12	5	260.5	.09	6
Truck driver	251.5	.08		255.4	.13	6	231.9	.19	5
Masseur	116.6	.02		257.1	.10	6	294.6	.12	
Chauffeur	181.8	.01		258.2	.26	6	269.6	.25	6
Bartender	216.9	.01		259.7	.15	6	262.2	.15	6
Escort	238.4	.01		260.1	.13	6	254.0	.14	6
Sight-seeing guide	104.5	.08		260.3	.18	6	303.5	.25	7
Radio/tv announcer	150.0	.00		261.7	.10	6	274.8	.09	
Radio operator	166.0	.00		265.7	.14	6	271.0	.14	6
Picture framer	90.7	.01		269.8	.13	6	283.1	.14	6
Recreation superv.	88.2	.10		271.7	.10	6	314.4	.20	7
Waiter	23.2	.03		294.1	.17	7	280.9	.15	6
Travel guide	62.2	.15		297.5	.16	7	314.6	.24	7

Ticket agent	22.0	.10		313.0	.19	7	290.7	.12	6
Hair stylist	41.6	.14		316.2	.15	7	312.8	.13	7
Reservations agent	21.7	.14		317.0	.23	7	293.1	.13	6
Personal shopper	40.8	.192		326.7	.16	7	322.8	.13	7
Business consult.	352.8	.36		15.6	.38	8	114.1	.03	
Juven delin. expert	80.4	.22		69.5	.05		24.3	.26	1
Sociologist	105.0	.21		113.5	.09		31.7	.27	1
Soc. sci. teacher	112.9	.17		120.2	.11		36.0	.22	1
Politic. scientist	178.8	.02		108.2	.13		89.6	.16	2
Systems analyst	306.0	.22		39.4	.13		149.1	.20	3
Shp. & rec. clerk	311.2	.17		330.9	.09		205.9	.12	5
Locksmith	231.4	.12		231.3	.12		224.9	.14	5
Radar operator	252.4	.02		253.0	.02		225.9	.04	5
Bus driver	276.9	.03		276.0	.04		229.2	.07	5
Security guard	274.7	.04		273.4	.07		234.2	.11	5
Truck gardener	208.1	.06		228.3	.10		244.6	.07	5
Headwaiter	24.7	.02		292.9	.13		281.0	.11	6
Camp director	91.0	.13		268.7	.09		320.7	.22	7
Playground director	80.7	.18		311.1	.01		349.4	.18	8
Vocational counsel.	76.9	.22		54.8	.03		18.2	.24	8
Occupational ther.	79.6	.19		63.1	.03		20.0	.21	8

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[a] The communality listed is for only the two components defining the plane of focus. The communality does not represent the total communality over all four components. For example, communality estimates for items on Circumplex 1 (People/Things + Data/Ideas) would be the sum of the squared loadings for only these two dimensions.

aspects that related to the skilled trades, engineering, and physical science factors of Jackson (see Table 2). It also appeared similar to the mechanical factors of Guilford et al.; Kuder; Rounds and Dawis; and Droege and Hawk. However, it appeared to be capturing a mechanical interest from both a practical (auto mechanic) and a research (chemist, physicist, and chemical engineer) perspective. The focus on detail in the electronics and construction area characterized the occupational titles in octant 6 and thus we labeled it Technical 1. This octant was very similar to the Precision factor of Guilford et al. Octants 7 and 8 both related to business with octant 7 focusing on the specific financial details of business and octant 8 focusing on the management or contact with the public aspects. Borrowing from Strong (1943), these two octants were labeled Business Detail 1 and Business Contact 1, respectively. The Business Detail 1 appears similar to Jackson's Finance, Business, and Office Work factors and Droege and Hawk's Business Detail factor. The Business Contact 1 scale was very similar to Jackson's Sales and Supervision factors, Kuder's Sales factor, Rounds and Dawis' Business Contact factor and Droege and Hawks' Selling factor.

Circumplex 2 octant scale content. The eight scales on the Data/Ideas and Prestige plane (i.e., Circumplex 2) are presented in Table 2. Octants 4 (Life Sciences 2), and 8 (Business Contact 2) were virtually identical to octants from Circumplex 1 so the same labels were retained. Octant 1, Business Analysis 2, had a fair number of overlapping items with the Business Detail 1 octant from the first circumplex, except that only the more highly prestigious items were retained here (see Table 2). The lower prestige business detail items of statistical clerk, cost estimator, and IBM equipment operator were omitted. Octant 2 (Health Service 2) appears similar in content to the basic interest factor of medical service and medical science from Jackson (1977), Kuder (1977), and Rounds and Dawis (1979). Octant 3 was labeled Hard Sciences 2 to differentiate it from octant 4 (Life Sciences 2) as it is represented by physicists, researchers, scientists, and chemists. This Hard Sciences 2 octant is similar in content to Jackson's physical science factor, Guilford et al.'s scientific interest factor, Rounds and Dawis scientific activity factor and Droege and Hawk's scientific factor. Octant 5 was labeled Commercial Art 2 to differentiate it from the Artistic 1 scale in Circumplex 1 because it covered artistic content but at a lower prestige level which included more provision of artistic services to others.

Octants 6 (Service Provision 2) and 7 (Personal Service 2) focus more on occupations that are lower in prestige, whereas the Service 1 octant on Circumplex 1 had a variety of prestige levels represented. Octant 7 appeared to focus more on more personal services involving more contact between parties whereas octant 6 was more general (including some less personal services as radio/TV announcer, picture framer, and security guard). The Personal Service 2 octant is similar to Jackson's personal service factor.

Circumplex 3 octant scale content. The eight scales developed to represent

Circumplex 3 defined by these components (People/Things and Prestige) are presented in Table 2. Octants 2 (Hard Sciences 3), 3 (Business Analysis 3), 6 (Service Provision 3), 7 (Personal Service 3) and 8 (Helping 3) are fairly similar in item content to the octant scales from Circumplexes 1 and/or 2 bearing the same labels (see Table 2). Octant 1 (Social Science 3) was similar to the general interest factor of helping but had more of a science aspect with the inclusion of social scientist, sociologist, and educational and clinical psychologist. Octant 4 (Mechanical and Electrical Technology 3) appears to be a combination of octants 5 (Mechanical 1) and 6 (Technical 1) from the first circumplex focusing on electrical technology aspects of octant 6 and the practical mechanical aspects of octant 5. This Mechanical and Electrical Technology 3 octant appears to correspond to the mechanical interest factor of Guilford et al., Rounds and Dawis, and Droege and Hawk, and the skilled trades basic interest factor of Jackson and Kuder. Octant 5 (Inspectors and Operators 3) appears to be a collection of two specific types of occupations, various inspectors and those who operate machinery. Each appears fairly practical and characterized by routine. We could find no corresponding basic interest factor to describe this octant other than perhaps Guilford et al.'s outdoor work interest. Each of the occupations appears to be associated with a fair amount of time outdoors, although it is not necessarily a uniquely defining feature.

Examination of Circular Structure of Each Circumplex

Structure of circumplex 1 octant and RIASEC scales. Principal components analysis of the eight octant scores and Holland's six RIASEC scores yielded three components, as expected (general, Data/Ideas, and People/Things). The eigenvalues and variance accounted for (in parentheses) in the first four components were 4.75 (33.9%), 3.58 (25.6%), 2.76 (19.7%), and .91 (6.5%). The three components accounted for 79.3% of the variance. The loadings of the RIASEC and octant types on the second and third components (the first component was the general response component) are depicted in Fig. 2. Both the octant scales and the RIASEC scales demonstrate a circular ordering, with the placement of the octant scales more closely approximating an evenly spaced ordering. Both scale sets represent the same interest space, with the difference being finer definition of interests for the octant scales. The gap between R and C types and S and E has been decreased using the octant scales. The octant Service scale is placed midway between S and E and two separate scales (Technical 1 and Business Detail 1) are placed between R and C. The right half of Circumplex 1 in Fig. 2 is better differentiated in the octant model than the RIASEC model.

The randomization test conducted on the fit of the circular order hypothesis was significant for both the octant data ($p = .0004$) and the RIASEC data ($p = .02$), indicating both data sets fit a circular order model. For the octant data, 280 of the 288 circular order predictions were met, yielding a correspon-

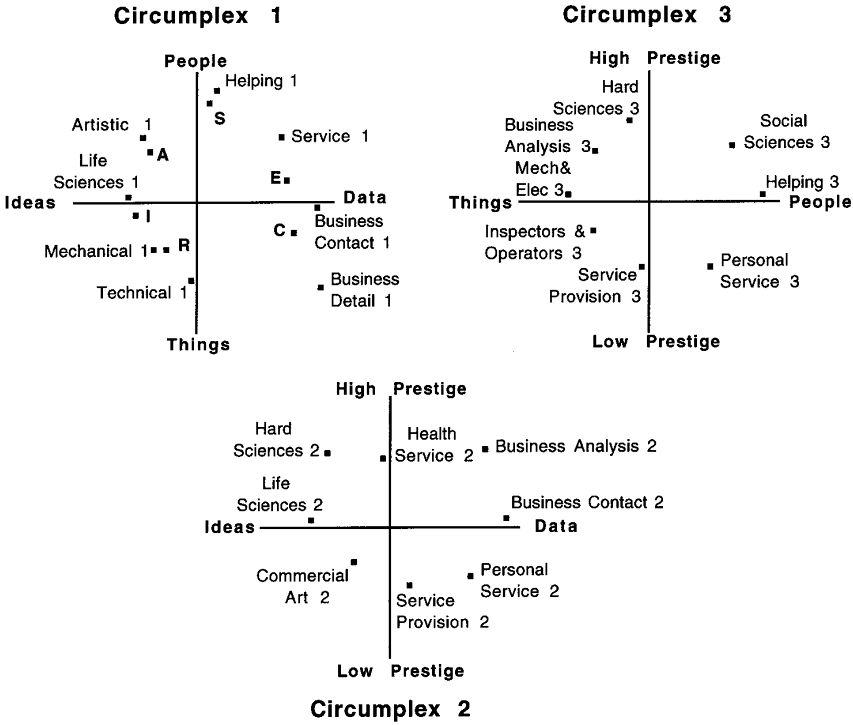

FIG. 2. Graphs of octant scores (and the VPI RIASEC scores for Circumplex 1) generated from the separate principal components analyses conducted on each octant data set.

dence index (CI) of .95. For the RIASEC data, 68 of the 72 circular order predictions were met resulting in a CI value of .90.

The results of the fit of the exact circumplex model to the octant and RIASEC scales are reported in Table 3. For all fit indices other than the GFI, which was equal, the fit of the octant model was better than that obtained for the RIASEC circumplex. However, the octant scales were constructed on this sample while the RIASEC scales were not, so the seemingly superior fit of the octant model over the RIASEC model is most probably attributable to the inclusion of sample error into the octant scale estimates.

Circumplex 2 octant scale structure. The principal components analysis of the eight octant scores yielded three components (general component, Data/Ideas, and Prestige) that accounted for 80.1% of the total variance. The eigenvalues (and variance accounted for) for the first four components were: 2.98 (37.2%), 1.98 (24.8%), 1.46 (18.2%), and .62 (7.8%). The spatial representation of the loadings of the octant scales on the Data/Ideas and Prestige components is presented in Fig. 2. The octant scales are arranged in a circle, however the different distances of the types from the origin indicates that

TABLE 3
Summary of the Goodness of Fit of the Octant Scores for the Circumplex 1, Circumplex 2, and Circumplex 3 Using Confirmatory Factor Analysis (Standardized Parameter Estimates in Parentheses)

	Model		Null						
Model	*df*	χ^2	*df*	χ^2	GFI	TLI	BBNFI	PGFI	NCNFI
Octant circumplex 1 based on components 2 and 3 (.61 .25 −.02 −.11)									
	24	106.79	28	1234.16	.91	.92	.91	.61	.93
VPI RIASEC circumplex (.45 .14 .05)									
	12	77.93	15	427.84	.91	.80	.82	.52	.84
Octant circumplex 2 based on components 2 and 4 (.60 .29 .04 −.04)									
	24	115.57	28	1086.39	.90	.92	.89	.60	.91
Octant circumplex 3 based on components 3 and 4 (.62 .29 .05 −.04)									
	24	114.21	28	1108.73	.90	.90	.90	.60	.91

Note. Abbreviations: GFI, Joreskog and Sorbom (1986) goodness of fit index; TLI, Tucker and Lewis (1973) index; BBNFI, Bentler and Bonett (1980) normed fit index; PGFI, parsimonious fit index (Mulaik et al., 1989); NCNFI, noncentralized normed fit index (McDonald & Marsh, 1990).

some are better accounted for (i.e., have higher communalities) than others. Examination of the mean communalities in Table 1 demonstrates that the Health Service 2 (octant 2), Service Provision 2 (octant 6) and Commercial Art 2 (octant 5) scales had the lowest communalities and the Business Analysis 2 (octant 1), Hard Sciences 2 (octant 3), and Business Contact 2 (octant 8) types had the highest.

Of the 288 circular order predictions made in the circular order model, 262 were confirmed ($p = .0004$) and the correspondence index was .82. All fit indices from the confirmatory factor analysis indicate that the circumplex model depicting an equal spacing of the octant scales around the circle is an appropriate representation of the data for Circumplex 2 (see Table 3).

Circumplex 3 octant scale structure. Principal components analysis on the octant scale scores yielded three components as expected. The eigenvalues (and variance accounted for) for the first four components were 2.81 (35.1%), 2.05 (25.7%), 1.50 (18.7%), and .64 (8.0%). The first three components (general component, People/Things, and Prestige) accounted for 79.5% of the total variance. The spatial representation of the eight Circumplex 3 scales yielded from the principal components analysis is presented in Fig. 2. The eight scales are arranged in a circular order and the communality (i.e., distance from the origin) is fairly uniform across the eight scales.

The randomization test of the circular order model on the Circumplex 3 octant scales was significant ($p = .0004$). Of the 288 order predictions generated by the circular order model, 268 were met and the correspondence index was .88, indicating a good fit to a circular model. The fit of the octant scales to an exact circumplex structure using confirmatory factor analysis is presented in Table 3 and all indicators supported the circumplex model.

Sphere

When all three circumplexes are integrated into one structure, a sphere results. The spatial representation of the sphere of the 18 interest types is depicted in Fig. 3. The three circumplexes should have six common points in a spherical structure (e.g., Helping 1 with Helping 3) as depicted in Fig. 3. Note that the deleted redundant scales are included in parentheses. The top part of Fig. 3 represents the top of the sphere looking down with the center representing highest prestige. The lower half of Fig. 3 represents the bottom of the sphere looking up with the center representing lowest prestige.

Four of the six pairs of nodal scales were virtually identical in item composition, viz. Business Contact (1 and 2), Helping (1 and 3), Life Sciences (1 and 2), and Service Provision (2 and 3). The Technical 1 and the Mechanical and Electrical Technology 3 scales have roughly 50% item overlap. The proximity of the Hard Sciences 3 and Health Services 2 scales is problematic (see Figure 3). It was expected that Hard Sciences 2 would align with Hard Sciences 3 as there was a high degree of item overlap. Although there is clearly some similarity between the Hard Sciences (2 and 3) and Health Service 2 scales as defined here, the placement of Health Services 2 where the Hard Sciences 3 scale was expected to go represents a deviation from the perfect sphere.

A principal components analysis was done to determine whether the spherical structure was adequately represented by 18 points. The eigenvalues (and variance accounted for) for the first five components were: 5.76 (32.0%), 3.49 (19.4%), 3.34 (18.6%), 2.33 (13.0%), and .94 (5.3%). The first four components accounted for 82.9 percent of the variance. The first four components represented the hypothesized dimensions of: general responding, Data/Ideas, People/Things, and Prestige. Plots of the 18 scales on components 2 and 3, 2 and 4, and 3 and 4 yielded clear circular structures similar to circumplexes 1–3.

The fit of the 18 interest type scales to the sphere presented in Fig. 3 was examined using the randomization test of hypothesized order. This specification of spherical order is extremely restrictive, requiring all planes to be orthogonal. The order relations within each circumplex are assumed to hold (i.e., each of the 288 circumplex order predictions for each circumplex) as well as the order predictions across the circumplexes and around the sphere.

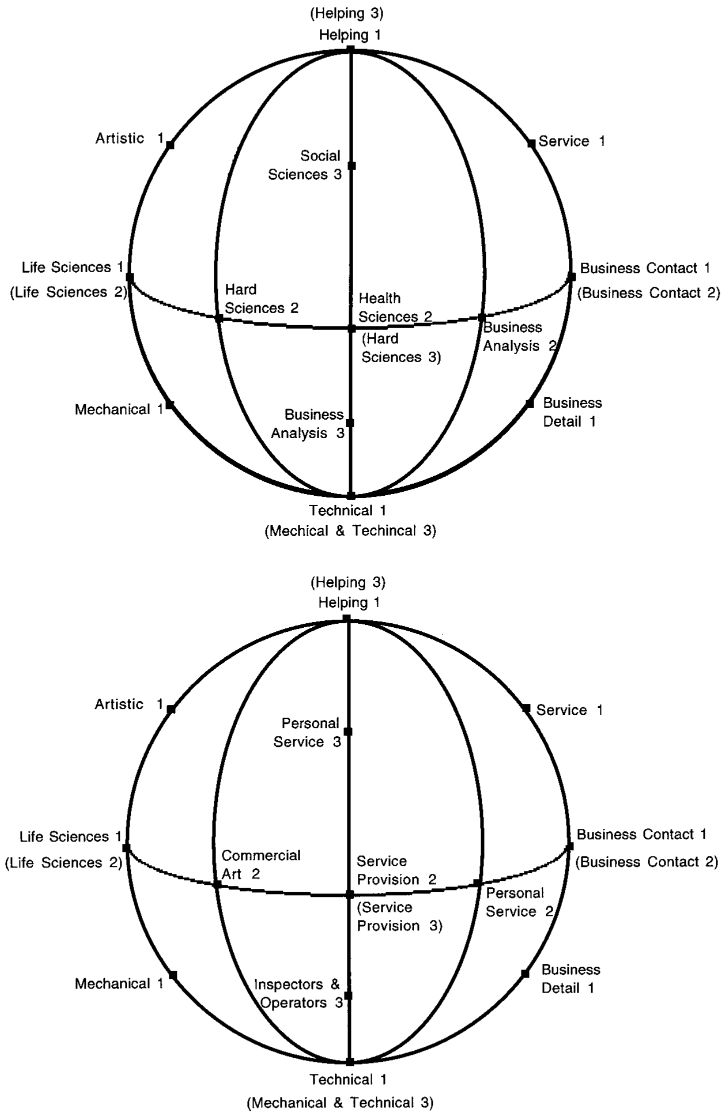

FIG. 3. Spherical representation of interests. Top depiction represents high prestige half of sphere and lower depiction represents lower prestige half of sphere.

Spherical arrangement of these 18 non redundant scales on the surface of a sphere involves 9936 unique order predictions among the correlations of the scales and is thus a very well-specified model. A total of 8134 of the 9936 predictions were met in this data set. The probability level associated with this model–data fit was $p = .0001$ and the correspondence index was .64.

Summary

The results of Study 1 support: (a) the presence of a Prestige component in addition to the typical People/Things and Data/Ideas components in occupational preferences; (b) the uniform distribution of interests on the People–Things and Data–Ideas circumplex (i.e., Circumplex 1); (c) eight types as a viable extension of the six RIASEC types; (d) the presence of three separate circumplexes in occupational preferences which are formed by combining pairs of the People/Things, Data/Ideas, and Prestige components; and (e) the presence of a spherical representation of occupational preferences. These results are limited since the structure was generated empirically using this sample and demonstration of the validity of these conclusions requires cross-validation of this structure on other samples.

STUDY 2

Study 2 was conducted with the goal of cross-validating the three dimensional spherical structure of vocational preferences developed in Study 1. We examined the extent to which the 24 scales generated in study one accurately represented three dimensions of differential content (i.e., People/Things, Data/Ideas, and Prestige), were arranged in the three circumplexes defined in Study 1, and adhered to the spherical model in separate samples of high school and college students. Because a sample of college students is more homogeneous with respect to the potential prestige of eventual occupations, it was hypothesized that the selection effect of applying to, getting admitted, and attending a university could have an effect on the structure of our results, especially as they relate to prestige. A sample of high school students would include students who would presumably be more likely to enter less prestigious occupations and thus may manifest differences in their occupational preferences with respect to prestige.

Similarly we also looked for differences in the structure across gender in each of the samples. Although it is not clear whether there are structural differences between the sexes with respect to Holland's RIASEC types (Hansen, et al., 1993; Rounds, 1995; Tracey & Rounds, 1992, 1993), we thought it was important to examine the potential for gender differences in the current structure.

Method

Sample

The high school sample consisted of 370 students (116 male, 159 female, and the rest not identified; 22% African-American, 7% Latino/a, 10% Asian-American, and 58% White) from a large high school in a moderate sized, industrial midwestern city. The high school sample consisted of 26% freshmen, 49% sophomores and 25% juniors, all of whom were enrolled in general vocational courses. The college sample consisted of 223 students (79 males and 144 females with a mean age of 20.1 years [sd = 1.9]; 8% African-American, 4% Latino/a, 12% Asian-American, and 73% White) who were enrolled in teacher education or career development courses at a large, mid-western state university.

Instrument

Inventory of occupational preferences (IOP). The IOP consisted of the 141 occupational titles and scales listed in Table 2. Participants responded to these items using the same seven point scale (1 = very strongly dislike to 7 = very strongly like) used in Study One. Responses to the items were averaged to yield 24 separate scales of vocational interests forming the three circumplexes defined above. For the present high school and college samples, the internal consistency estimates (αs) for the 24 scales ranged from .85 to .95, with a mean value of .90.

Procedures

College students enrolled in either teacher education courses or career education courses participated in this research to fulfill part of their course requirements. The IOP was administered to groups ranging from 3 to 30. A total of 226 college students participated and complete responses were obtained from a total of 223.

The IOP was administered to the high school students in the vocational training classes by their teachers. A total of 524 students participated. Those respondents that had greater than 10% of the items missing were deleted (n = 101). In cases where there were fewer than 10% of the items missing, we used item means for the sample to replace the missing responses (n = 35). To check on the validity of responses, we used two methods of indicating capricious responding. The IOP uses a seven point format but the response opscan sheet had 10 options. We discarded the data of individuals who used the 8, 9, and 10 options more than once. If two or more of the repeated items were not responded to in a similar manner (i.e., within one scale point of the previous answer on the same item), the responses for that individual were also discarded. Using these two validity indicators, we deleted a total of 53 respondents. A final high school sample of 370 usable questionnaires resulted.

Analysis

The structure of the IOP was examined using both exploratory and confirmatory approaches. The exploratory examination of the structure was carried out using three-way Multidimensional Scaling (MDS). First, the correlation matrices of the scale scores in each sample were transformed into dissimilarities (i.e., $d = \sqrt{2 - 2r}$), following Davison's (1985, p. 97) recommendation, and subjected to three way MDS (Arabie, Carroll, & DeSarbo, 1987) using SINDSCAL (Pruzansky, 1975). To obviate the potential problem of local minima and resulting invalid solutions, the analyses were conducted several times using multiple starting values. Unlike standard two-way MDS, three-way analysis provides the optimal spatial representation of the relations among the scales across samples and can provide dimensions that are not arbitrary in orientation (i.e., cannot be rotated). This capacity to examine the structure across samples was the reason three-way MDS was selected for use in this study rather than the principal components analysis used in the first study. The structure that fit both the college and high school student samples was yielded.

The confirmatory approach to the examination of the structure of the IOP was conducted using the randomization test of hypothesized order relations (Hubert & Arabie, 1987) as used in Study 1. The extent to which the circular order model was fit in each of the three circumplexes in each sample was examined. Also, the randomization test was used to assess the fit of the spherical model to the data.

Results

MDS Results

Two-, three-, and four-dimension solutions were generated using the three-way MDS on the 24 scales across the college and high school samples. The variance accounted for (variance accounted for) by the two-, three-, and four-dimension solutions were .77, .87, and .91, respectively. The three-dimensional solution was viewed as the best fit to the data because it conformed to the hypothesized structure and the fourth dimension did not improve fit much relative to the increased complexity of adding another dimension. The three-dimensional solution accounted for 94 and 79% of the variance in the college and high school samples, respectively. The first dimension (which differentiated Helping 1 and Service 1 from Mechanical 1 and Technical 1) accounted for 36% of the variance, while the second dimension (which differentiated Artistic 1 from Business Detail 1 and Business Contact 1) accounted for 32% of the variation. The third dimension was similar to the Prestige dimension and accounted for 19% of the variance. The first two dimensions clearly account for most of the variance; however, the addition of the Prestige dimension is warranted.

The spatial representation of the three dimensional solution is presented in Figure 4. All 24 scales are represented in Fig. 4, but only those scales hypothesized to form a circular structure on each plane of the three-dimensional structure are depicted on each plane. As hypothesized, the scales form three separate circular structures in each of the three planes defined by the pairs of dimensions.

The specific dimensions generated by SINDSCAL differed slightly from Prediger's People/Things and Data/Ideas dimensions that were used to generate the scales in Study 1. Dimension 1 differentiated Helping 1 and Service 1 from Mechanical 1 and Technical 1. Although this dimension resembles People/Things, it also resembles Hogan's (1983) dimension of sociability.

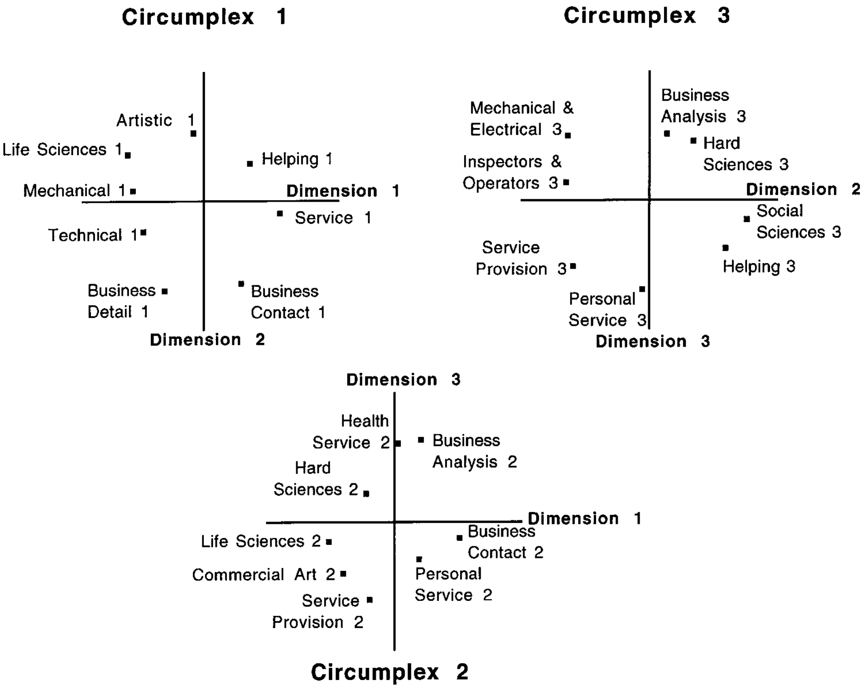

FIG. 4. Plot of the IOP scales on the three circumplexes generated from the three-way MDS on the high school and college samples.

Dimension 2 differentiates Artistic 1 from the two business scales (Contact 1 and Detail 1) and does not appear to be representing Data/Ideas as proposed by Prediger but more conformity as proposed by Hogan. We have demonstrated elsewhere (Rounds & Tracey, 1993) the arbitrary nature of the dimensions underlying the RIASEC circumplex, and these results demonstrate the arbitrary nature of the underlying dimensions of the octant scales. The scales were constructed in Study 1 using Prediger's dimensions but the MDS analysis (which locates the dimensions in space so as to optimally account for variation across samples) yielded a slightly different orientation. Regardless, the key aspect of this analysis is that although the dimensions are not necessarily invariant, the circular structure itself appears to be.

To examine sample differences in fit to the structure, SINDSCAL supplies subject weights which reflect the relative within sample variance accounted for on each dimension. For the college sample, the subject weights were .61, .62, and .35, for dimensions one, two and three, respectively, indicating that the first two dimensions were more important than the third dimension in accounting for data variation. There was relatively less variation on the prestige dimension as there was for the first two dimensions, resulting in a sphere that is somewhat flat on the top and bottom. For the high school sample, the subject weights were .54, .45, and .48 for the three dimensions indicating that each dimension was fairly equal in accounting for variation. The result of the flattening on the prestige dimension for the college sample could be a function of the restriction of range; there could be less variance on prestige preferences in a college sample than would exist in a high school sample.

The structure of the IOP scales as they varied by sex was also examined by performing a three-way MDS analysis on the dissimilarity matrices of the college females, college males, high school females, and high school males simultaneously. The variance accounted for was .71, .83, and .88 for the two-, three-, and four-dimensional solutions, respectively. A three-dimensional solution was retained as the best representation of the data as it resulted in the best compromise between data fit and dimensional parsimony. For the college samples, the three-dimensional solution accounted for 94% of the females variance and 90% of the males. For the high school sample, the percentage of variance accounted for was 71% for the females and 81% for the males. As in the above analysis conducted on the entire sample, the college sample appeared to be better fit by the three-dimensional solution. The variance accounted for by each of the dimensions across all four samples was (in order): .38, .30, and .16 reflecting a similar predominance of the first two dimensions as revealed above.

The main benefit of the three-way MDS examination breaking the samples down by sex is the relative weighting of the dimensions. The subject weights for the female college students were .70, .58, and .30, indicating that dimensions 1 (conformity) and 2 (sociability) accounted for more of the variation than dimension 3 (prestige), however, conformity appeared slightly more important than sociability. The male college sample had subject weights of .58 (conformity), .65 (sociability), and .35 (prestige), indicating that the first two dimensions were most important in accounting for data variation, with sociability slightly more important than conformity. The subject weights for the high school female sample were .50, .47, and .46, indicating that all three dimensions were fairly equal in their importance. The male high school sample had subject weights of .63, .44, and .44, demonstrating that conformity was most salient in data variation and the remaining two dimensions were fairly equal in importance. In general, the subject weight differences across sample mirrored those from the college–high school examination above; the first two dimensions were most salient in the college samples and there was more balance across all three dimensions in the high school samples. There did not appear to be an easily decipherable trend in subject weights attributable to sex.

Confirmatory Randomization Tests

The results from the randomization test of the circular order model on each sample and each circumplex are presented in Table 4. All of the

TABLE 4
Summary of the Randomization Tests of Hypothesized Circular and Spherical Order Relations

	Sample					
			College		High school	
	College	High school	F	M	F	M
Circumplex 1						
Predictions made	288	288	288	288	288	288
Predictions met	278	270	280	264	232	257
p	.0004	.0004	.0004	.0004	.0004	.0004
CI	.931	.875	.944	.883	.611	.785
CI Difference	.028		.056		−.087	
p Difference	.260		.072		.152	
Circumplex 2						
Predictions made	288	288	288	288	288	288
Predictions met	250	250	248	260	232	263
p	.0004	.0004	.0004	.0004	.0008	.0004
CI	.741	.741	.722	.806	.611	.826
CI Difference	.000		−.042		−.108	
p Difference	.500		.254		.025	
Circumplex 3						
Predictions made	288	288	288	288	288	288
Predictions met	242	240	239	241	214	257
p	.0004	.0004	.0008	.0004	.0008	.0004
CI	.681	.667	.660	.674	.486	.785
CI Difference	.007		−.007		−.149	
p Difference	.496		.380		.026	
Sphere						
Predictions made	9936	9936	9936	9936	9936	9936
Predictions met	7631	7338	7588	7541	6971	7076
p	.0000	.0000	.0000	.0000	.0000	.0000
CI	.536	.477	.527	.518	.403	.424

randomization test probability values were significant for the college and high school samples. The fit of the first circumplex was best on both samples (CI = .93 and .88), while the values for the second (CI = .74 and .74) and third circumplex (CI = .68 and .67) were slightly lower (see Table 4). To test for differences between the fit of each circumplex across the samples, a separate randomization test of the difference in model–data fit across the college and high school samples was conducted. None of these difference tests were significant, indicating that each sample fit the data equally well.

The data were also analyzed with respect to gender. Within the college sample, all circumplexes were supported (i.e., $p < .001$) for both females and males in both college and high school samples (see Table 4). The tests for differences in model fit revealed that female and male college students fit the circular model equally well. For the high school sample, there was no difference in model fit for males and females on Circumplex 1, but the male high school sample fit Circumplex 2 and 3 better than the female sample (see Table 4).

Given the support for each of the separate circumplexes, we examined the extent to which these circumplexes could be combined into one sphere. The degree of fit of the spherical model to the 18 nonoverlapping scales depicted in Fig. 3 was examined using a randomization test as done in Study 1. The spherical model was found to significantly fit the data in each sample and the CI values ranged from .54 to .40 (see Table 4).

Discussion

Strong support was yielded for the presence of a spherical structure of vocational interests. Clearly occupational preferences could be represented in three substantive dimensions which, when viewed in pairs, formed three circumplexes. An empirical test of the fit of the data to a perfect sphere supported the presence of a spherical structure. The cross-validation of these results on two separate samples adds support to the generalizability of the spherical representation of vocational interests.

The presence of Prestige as a component in occupational preference data, in addition to the typical general, Data/Ideas, and People/Things components was demonstrated. Respondents were using prestige in their evaluation of their occupational preferences. Although the prestige dimension was the least prominent of the dimensions examined, it accounted for an important part of the variance in responses. The presence of the prestige component runs counter to the naive assumption that, given a choice, everyone would naturally opt for the more prestigious occupations. Individuals do have different preferences when it comes to the desirability of prestige in occupations, but the basis of these preferences is not clear.

One interpretation of the prestige dimension is that it refers to an individual's level of aspiration (Darley, 1941, Strong, 1943), reflecting the ''socioeconomic level of activity at which an individual's interests would most likely be satisfied'' (Layton, 1958, p. 18). Another possible interpretation is that this prestige dimension is related to self-assessment of abilities (i.e., one may not view oneself as having the abilities to achieve high prestige and thus alters one's preferences accordingly). Still another interpretation is that preference for prestige is related to cultural preference (i.e., preference for a more blue-collar lifestyle than a more professional lifestyle). More research is needed to understand the genesis and interpretation of this prestige dimension.

We focused exclusively on occupational preferences in this study because we thought that this would be the type of item that would most likely yield a prestige dimension. It may be that the prestige dimension would not be manifested if another type of interest assessment were used. Some instruments eschew occupational preferences for other formats, (e.g., activity preferences in the UNIACT). More research is needed on the extent to which prestige is evident in other interest item types (e.g., activities, school subjects, majors, activities, and competencies).

The finding of the prestige factor is perhaps the most important result and harkens back to Roe's (1956; Roe & Klos, 1969) original classification of occupations. In her cylindrical or ''truncated cone'' (Roe & Klos, 1969) model, she had eight types of fields arranged in a circle and independent of these fields were levels which involved the extent of responsibility and skill involved in the occupation. We used eight scales, but the scales were different in content from those proposed by Roe. Our Technical 1, Business Contact 1, and Business Detail 1 octants resemble Roe's Technical, Business, and Organization fields, respectively. The Life Sciences 1 octant appears to be a blend of Roe's Science and Outdoors fields. The major differences are the lack of correspondence in the artistic and social areas. There is only one artistic octant, and it is not clear how it relates to Roe's two fields of General Culture and Arts and Entertainment. The two ''social'' octants of Helping 1 and Service 1 appear to be more specific breakdowns of Roe's Service field. Thus the contents of our octants and Roe's fields differ in important ways. Furthermore, the data do not fit Roe's circular ordering of fields, and they do not fit Meir's (1973) reordering of her fields as well as the fit of the octant scales or Holland's RIASEC scales (Tracey & Rounds, 1994).

Even if Roe's eight fields were identical to the ones we generated, her truncated cone represents the relations among fields very differently than does our sphere. The cone implies that the fields are valid representations of interests at all levels of responsibility. This was not supported in our study. Instead, we found support for the covariation of prestige with the circular structure and this pattern of covariation resembled a sphere.

The sphere can best be conceptualized as an occupational interest globe, with the prestige dimension being represented by the north pole–south pole axis. The RIASEC circumplex (or our Circumplex 1) would be analogous to the equator. The greatest difference among interest types (with respect to the People/Things and Data/Ideas dimensions) exists at the equator. As one moves away from the equator, the interest types are less differentiated and blend more. For example, the Tropic of Cancer is less differentiated than the equator. With increasing or decreasing Prestige, the importance and salience of the People/Things and Data/Ideas dimensions (and their circumplex) decrease. At the north and south poles (i.e., extreme prestige), all that exists to define interests is prestige, be it high or low and the distinctions among RIASEC types become meaningless. For example, as one moves down the globe toward low prestige (see Fig. 3), service occupational preferences predominate and the specifics of different types of service become less distinct. Given this model, those endorsing moderate levels of prestige maximally differentiate RIASEC types and our Circumplex 1 octant scales, and one would expect interest tests focusing only on the People/Things and Data/Ideas dimensions (i.e., Holland's RIASEC types) to be least predictive or valid for individuals that deviate from the moderate levels of prestige preference. The standard RIASEC measures would be appropriate for individuals scoring at moderate levels of prestige (i.e., near the equator).

The results of this study support the view of Holland's RIASEC types as arbitrary abstractions that constitute only one of an infinite number of possible representative points on the circle of vocational interests. Eight empirically derived types did as well as Holland's RIASEC types in accounting for the circumplex nature of interests. We have demonstrated elsewhere (Rounds & Tracey, 1993, 1995; Tracey & Rounds, 1992, 1993) that the RIASEC scales adequately fit a circular structure, for U.S. populations, but the uniformity of item distribution on Circumplex 1 and the relatively similar fit of the octant and RIASEC scales to the circular structure raise questions about the unique presence of the RIASEC types. Examination of the octant types reveals that Holland's Realistic and Social types cover fairly large sections of the circle. What typically comprised Realistic has links to both octants 5 (Mechanical 1) and 6 (Technical 1). Similarly, the octants 1 (Helping) and 2 (Service 1) cover different aspects of Holland's Social type. The presence of these wide bands of Holland's types calls into question their internal consistency and their value (e.g., Rounds, 1995). By adopting only six types to represent the circle of interests, costs to content fidelity are perhaps being made.

As argued above, dividing each circle into eight categories or scales, rather than the six proposed by Holland, results in a more straightforward correspondence to the underlying dimensions of the circumplex. Nevertheless, we view choice of eight categories as arbitrary. Given the circular arrangement of items on each of the circumplexes, we could have generated scales for 4, 10, 12, or 16 points on the circle. The types represent ''fuzzy sets'' (Rosch & Mervis, 1975) or prototypes (Broughton, 1990). They serve as convenient points to allow categorization of vocational interests, but there is a wealth of overlap among types. The selection of the specific types to use is thus a function of their utility, parsimony, and heuristic value. Holland's RIASEC types have served the field well, but a typology having eight types can be more easily interpreted with respect to the two underlying dimensions because each type is either a ''pure'' example of one pole of the dimensions or an even mix of the two underlying dimensions.

Another advantage of using eight types over the six RIASEC types is that there may be a greater correspondence to the circumplex models yielded in the personality area. There are currently a number of circumplex models in personality research; indeed, there has even been recent work in expanding personality models into spheres (e.g., Hofstee, de Raad, & Goldberg, 1993; Saucier, 1992). Currently, the two predominate circumplex models in the personality domain involve interpersonal behavior (Kiesler, 1983; Tracey, 1993; Wiggins, 1979) and mood (Conte & Plutchik, 1981). Holland (1985b) and others (Schneider, 1987; Tracey & Rounds, 1993) have argued that vocational interest may reflect interpersonal aspects of personality.

Hogan (1983) posited that Holland's circumplex of vocational types and the interpersonal circumplex both were indicative of the same underlying ''deep structure'' of interpersonal processes. The centrality of the interpersonal circumplex to many different personality constructs has been noted by Gurtman (1992). Broughton, Trapnell, and Boyes (1991) recently found impressive correspondence between the interpersonal circumplex model of personality and occupational interest groups, supporting the possibility that similar ''deep structure'' underlies both. Schneider, Ryan, Tracey and Rounds (in press) have found that the interpersonal circle and RIASEC structure share a common affiliation dimension. Foa and Foa (1974) have hypothesized that the interpersonal variables included in most circumplex models can be viewed as a set of cognitive categories used for processing social information. More work is needed to understand if the interpersonal and vocational circumplexes are related in more than structural similarity. Adopting an eight-type model will facilitate the examination of the potential overlap of these models.

Almost all of the 24 scales generated from the three circumplexes had clear correspondence with the basic and general interest scales yielded by Rounds' (1995) catalogue of basic interests of the major factor analytic studies (i.e., Jackson, 1977; Kuder, 1977; Guilford et al., 1954; Rounds & Dawis, 1979; and Droege & Hawk, 1977). The octant scales have clear precedence in the literature and logical consistency, supporting the construct replication (Lykken, 1968) of the scales. Future attempts could be made to sample interests from the circle to even better represent the common factors or basic interest groups.

Our repeated reference to Prediger's (1982) Data/Ideas and People/Things dimensions as the dimensions underlying Circumplex 1 is a matter of convenience. There should be no attempt to construe these results to support the presence of these dimensions. As we have demonstrated elsewhere (Rounds & Tracey, 1993), any orientation or rotation of factors will yield the same RIASEC circle. The key aspect in the RIASEC circle is the circular order relations themselves, not the underlying dimensions. Although we used Prediger's dimensions in Study 1 to help generate the octant scales for Circumplex 1, our results in Study 2 more closely resembled Hogan's (1983) 30° rotation of Prediger's dimensions in which sociability differentiates S and E from R and I and conformity which differentiates C and A. However, regardless of orientation of underlying dimensions, the circumplex structure itself held for Circumplex 1, and that was the important result of the study.

The relative importance of the prestige dimension was not as great as that of the two dimensions defining Circumplex 1. The relatively smaller amount of variance accounted for by prestige may reflect a restriction in the sampling of prestige items or the intrinsic importance of the three dimensions in accounting for variation in occupational preferences. If prestige actually will not account for as much variance as the other two dimensions in the sphere, the resulting structure is one of a sphere with flattened poles. The specific orientation of dimensions used to describe this equator is arbitrary; however, if the flatness of the north and south pole of the sphere is replicable, the same arbitrary orientation cannot be said to exist with respect to prestige. The orientation of dimensions of Circumplex 1 varied across study, but the third dimension prestige was orthogonal to the plane on which Circumplex 1 and the RIASEC scales exist. Once Circumplex 1 is located in space, Prestige will be orthogonal to this plane.

The examination of the sex differences revealed that the data from all groups fit the models represented by the three circumplexes, but the degree of fit for the male high school students was better than for the females for Circumplexes 2 and 3. No such differences existed in the college sample, so additional research is needed to determine if this sex difference is related to age or an artifact of sampling.

The lack of sex differences in the fit of Circumplex 1 (the one occupying the same plane as Holland’s RIASEC scales) runs counter to some of the past research examining structural differences in RIASEC scales across the sexes (e.g., Hansen, Collins, Swanson, & Fouad, 1993). However, other studies have found no differences (e.g., Tracey & Rounds, 1993). It may be that the eight scale structure of the IOP on the first circumplex is more robust with respect to sex differences than the six RIASEC scales. Future research on the possibility of sex differences in the structure of the IOP, relative to the RIASEC scales is needed.

This study presents the possibility of viewing vocational interests in a different manner and suggests the possibility that assessment of individual differences in vocational interest patterns may be inaccurate or at least incomplete if it fails to incorporate the prestige dimension. Further work is needed to validate the spherical structure found in the present study, to develop scales to assess it, to examine the relation of this model to circumplex models of personality, and to evaluate its utility.

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