JOURNAL OF VOCATIONAL BEHAVIOR **48,** 85–95 (1996)
ARTICLE NO. 0009

# REJOINDER

# Contributions of the Spherical Representation of Vocational Interests

TERENCE J. G. TRACEY AND JAMES ROUNDS

*University of Illinois at Urbana-Champaign*

Comments of Borgen and Donnay (1996), Gonzalez (1996), Gottfredson (1996), Harmon (1996), Hansen (1996), and Prediger (1996) are addressed as they relate to the common themes of the contributions of the spherical model, the utility of a spherical representation of interests, the presence of a perfect sphere, and method issues. We argue that the model has empirical support but perhaps is more valuable as a heuristic for subsequent conceptualization and research. 

We thank Borgen, Donnay, Gonzalez, Gottfredson, Harmon, Hansen, and Prediger for their comments regarding our manuscript on the spherical representation of interests. Their comments were many and far reaching. Space precludes our responding to all or even most of the points raised, but we will focus on a few. First, we summarize what we view as the major contributions of our sphere, an issue to which many of the comments were addressed. Then we address the specific issues of utility, the presence of a perfect sphere, and our different methodological focus.

## CONTRIBUTIONS OF OUR SPHERICAL MODEL

In 1956, Ann Roe proposed eight categories of occupations and organized them in a circular structure. Her model has had considerable impact on how vocational interests are viewed. In 1968, John Holland and Doug Whitney found a way to order the relations among six personality types and called the structure a hexagon. Holland's model has been the basis of numerous scales and has served as the major model of vocational psychology (Borgen, 1986). We (Tracey & Rounds, 1996) have proposed a spherical structure to account for vocational preferences. In some ways we see the applications of our model to be similar to those applications of Roe and Holland—new scale development and occupational taxonomies. Like Roe and Holland, our work

Correspondence and reprint requests should be addressed to Terence J. G. Tracey, 210 Education, University of Illinois, 1310 South Sixth Street, Champaign, IL 61820.



0001-8791/96 $12.00

follows in the footsteps of E. K. Strong, Guilford, and others and clearly works off of Roe's and Holland's idea that vocational preferences are best organized in a circular fashion. Unlike Roe and Holland, we have relied on the research approaches of interpersonal theorists and methodology advances in structural research. We view our spherical model as unique in its view of interest types as arbitrary abstractions and its incorporation of prestige into circular interest models, resulting in a spherical structure.

## INTEREST TYPES AS ARBITRARY ABSTRACTIONS

We demonstrated that vocational interests are arranged in a continuous circular structure rather than as six or eight types as proposed by Roe and Holland. Roe's and Holland's categories are embedded in this structure. In this sphere paper and a subsequent paper (Tracey & Rounds, 1995), we have demonstrated that interest items are continuously arranged around a circle. Thus the circle can be sliced in eighths (to approximate Roe's fields) or in sixths (to approximate Holland's types), or fourths (to approximate Prediger's four dimensional anchors of people, data, things, and ideas). Any and all slices of the circle will yield equally valid representations of interest. There is nothing inherently superior in a six or eight type representation.

We have argued (Tracey & Rounds, 1995) that since the number of types used to represent the interest circle is arbitrary, that other criteria should be used in terms of selecting the number of types. Although there is an appeal to using a six or eight type representation (e.g., this number is within the 7 plus or minus 2 bits of information we can keep in the foreground at any time), it may be better to adapt the number of types to the test taker than adopt a ''one set of types fits all'' attitude. With advances in computer adaptive testing, it is easily possible to vary the number of types, or interest breadth, to match the test taker's needs, a point made by Harmon. Individuals with very little self-knowledge may benefit best by more global representations of interest types; while more knowledgeable individuals may be better suited with much more specified and narrow types at certain places of the circle. In keeping with this view of the vocational interest circle being divided up into a number of different types of varying widths, we proposed a model of concentric circles of interests (Tracey & Rounds, 1995) and this model is depicted in Fig. 1. Figure 1 shows a variety of different interest slices that can be generated from the interest circle, depending on the width of each type desired. We see no need to automatically adhere to any one set number of types.

## INCORPORATION OF PRESTIGE WITH THE INTEREST CIRCLE

Our second contribution is to make explicit the importance of prestige to interest response variation by incorporating it into the model. Again, we follow in the footsteps of Roe who incorporated ''level'' in her occupational classification and Strong and Holland who recognized the importance of prestige by creating separate scales, Occupational Level (OL) and Status,

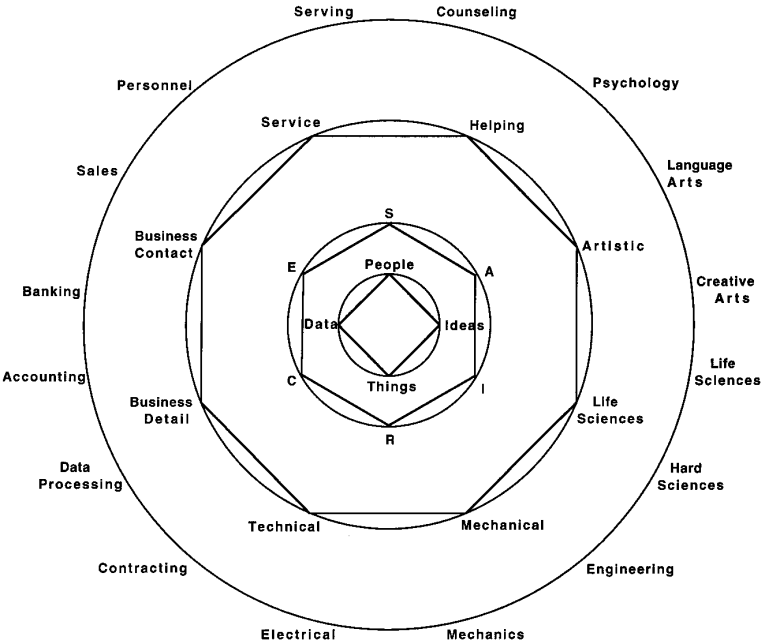


FIG. 1. Representation of the concentric circle model of vocational interests (from Tracey & Rounds, (1995). The arbitrary nature of Holland's RIASEC types: A concentric circles structure. *Journal of Counseling Psychology*. Copyright 1995 by the American Psychological Association, reprinted with permission).

respectively. With the incorporation of a prestige dimension, it was found that we could best represent interest response variation in three dimensions—as a sphere. And again we follow in Strong's footsteps who experimented with a three dimensional model, that he called a globe.

Further in keeping with Roe and Holland, we sought a construct descriptor that was applicable for both individual interests and occupations. Prediger questions whether prestige is an appropriate name for an individual interest dimension, preferring instead level of aspiration. Although level of aspiration appears plausible, the label does not incorporate all theoretically relevant constructs. The prestige construct could easily entail several components separate from aspiration: preference for public recognition and esteem, or desire for high income. Prestige interest is broad enough to cover most all interpretations and is preferable due to its commensurate presence in the structure of occupations.

## UTILITY OF SPHERICAL REPRESENTATION OF VOCATIONAL INTERESTS

We wish to make it clear that we are proposing a model to use in thinking about vocational interests. We are not proposing the IOP as *the* measure of

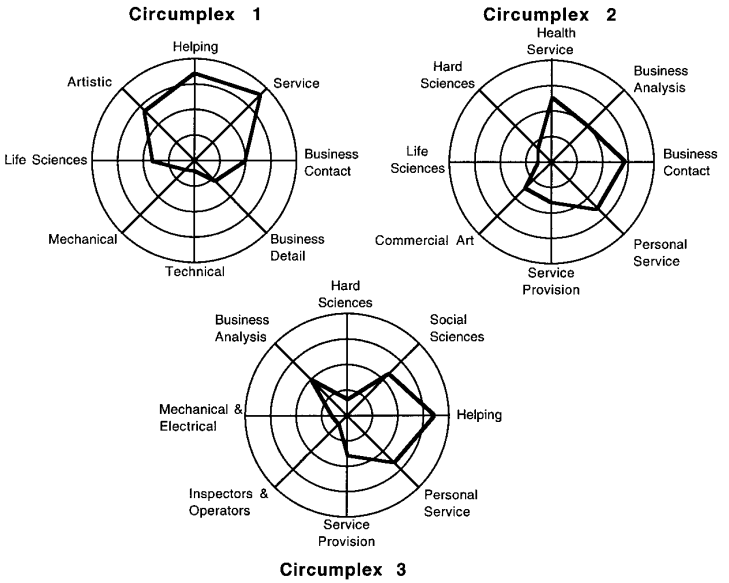


FIG. 2. Representation of one method of reporting sphere scores embedded in circular context.

interests. We will focus our responses to the model aspects of our study. Several of the comments focused on the utility of the model, from Hansen arguing that 24 scales is too many, precluding easy grasp, to Prediger and Gottfredson calling for a representation only in three-dimensional space, forgoing the spherical structure.

As we argued above, our usage of 24 scales (eight types for each of the three orthogonal circumplexes) is arbitrary. We could have used 10, 12, or even 4 types per circumplex. The specific number of types adopted was used to exemplify the structure. Regardless, there are means that these 24 scales could be described so that they can be readily understood by all, especially if they are reported in a manner incorporating the spherical structure. At least three options present themselves regarding interpretation. First, scores could be graphically represented on each of the three circumplexes in a manner similar to Leary's (1957) presentation of interpersonal circumplex scores. An example of a possible profile is presented in Fig. 2. This graphic depiction provides an easy method of understanding the scores and their interrelation. Each scale is plotted on its radius, with a zero score on a scale falling at the center of the circle, and more extreme scores falling closer to the perimeter. Then the specific scales could be connected by a line (the darkened lines in Fig. 2) which would represent that individual's profile. Quickly sections of the circle that were more extreme could be focused on (as well as inconsistencies in scale profiles such as high scores from opposite sides of the circle). For example, on Circumplex 1 in Fig. 2, it is apparent that the individual

scores most highly on service, helping and artistic interest scales, whereas the other scales are close to the center and thus of little importance. A similar graphic depiction could certainly be used with the RIASEC types.

Another interpretive option was presented by Harmon. She stated that one could use prestige as the primary sorting variable and then present the scores that apply to that slice of the sphere. If someone scores near middle on prestige, the eight scales comprising the equator of the sphere would be reported. If someone scores moderately high on prestige, the four scales part way up the sphere (comprising the Tropic of Cancer) could be reported. By using prestige as a screening variable, more specific information relevant to the individual could be presented.

With adaptive testing and computer scoring of instruments currently available, it is possible to report scores not as separate values but as sections of the sphere. Instead of providing the test takers with all 24 scores, it might prove more valuable to provide them with the coordinates of their highest interests, i.e., the spot on the globe where they fall. The individuals could then search that specific section and neighboring sections within a certain radius for possible occupations or careers. If the spherical model holds, and we have supported its presence, it is possible to combine all 24 scales into one point. This determination of one point in three-dimensional space for each individual is similar to Prediger and Vansickle's (1992) two dimensional mapping in its application of the geometric basis of the structure.

## PRESENCE OF A PERFECT SPHERE

Gottfredson, Harmon, and Hansen questioned whether our sphere was indeed a sphere. As mentioned by Gottfredson, there will be hills and valleys in a sphere of vocational interests and it would be valuable to know where these exist. Because of this irregular topography, Gottfredson prefers to view interests as a three dimensional structure instead of a sphere. We wish to point out that the topography of the sphere is not that irregular. In keeping with the globe analogy, the relative distance from the Earth's center to any point on the surface is far greater than the differences of points on the surface relative to one another. Hills and valleys are only minor wrinkles on the surface of the globe. The relative flattening of the prestige dimension at the north and south pole, should be interpreted in this vein. As with the flattening at the north and south poles in the earth and its hills and valleys, we typically still hold to the spherical nature of our planet.

Further, we think that abandoning the sphere for a less-specified three-dimensional model is a step backward. What matters is that the types can be organized on a sphere. The sphere carries far more information about the similarity and differences among different interest types (based simply on their relative distances from each other) than does simply adding prestige to the RIASEC circumplex.

Method serves as another aspect in questioning if interests exist on a sphere. We have noticed that when spatial models have been interpreted in

the literature, there appears to be an over-accentuation of minor differences. It is not at all uncommon to find spatial techniques (e.g., multidimensional scaling or factor analysis) applied to interest data (say the RIASEC types) and have the resulting structure examined relative to a ''perfect'' circle. The gap between two types may be slightly larger than between two other types. Results of this sort have led some authors to question the fit of the circle. This interpretation assumes that the point estimates are error-free, which is never the case. Each point estimate in any spatial representation must be viewed as an error laden estimate. Some estimates may be better than others and some not. However, unless statistical tests are applied to point estimates and the models themselves, one needs to be careful in interpreting whether or not any model fits the data based on an ''eyeballing'' of any structure. The hills and valleys of our model could be attributed to point estimate error. Given the statistical support for the sphere model which was replicated across two samples, the alternative interpretation of hills and valleys being attributable to error is probable.

## METHODOLOGICAL CONCERNS

Methodological concerns were raised by several commentators. Prediger noted the arbitrary nature of rotations and thus questioned our comments regarding the arbitrary nature of the axes defining the circumplex. Borgen and Donnay commented on many things but seemed most concerned about our ''arcane'' usage of factor analysis. Gonzalez raised the larger issue of examining the representational space and not just the data patterning.

Prediger questioned our claims that there is no inherently superior orientation of axes underlying the circumplex model of interests, either the RIASEC model or our Circumplex 1. This criticism is directed only somewhat at this study and more at our work on the dimensions underlying the RIASEC types (Rounds & Tracey, 1993). Given space considerations, we cannot go into a presentation of the issues we addressed in that paper, but will focus on a few that are especially appropriate here. Prediger notes that in factor analysis and multidimensional scaling, the orientation of factors in space is arbitrary; any rotation will equally describe the data and other criteria should then be used to determine the underlying dimensions. In this vein, he cites a wealth of literature, mostly on job tasks, that relate to the appropriateness of his dimensions of people/things and data/ideas. His dimensions serve the field well as convenient means of understanding and interpreting the world of work.

We wish to clarify a few misunderstandings. First, Prediger is correct when stating that the orientation of axes is arbitrary in factor analysis and two-way MDS, but this is not necessarily so in three-way MDS (Arabie, Carroll, & DeSarbo, 1987; p. 42) where unique orientations of dimensions can be obtained. Further in any circular arrangement, any set of dimensions will fit equally well. Our argument is that there is nothing inherently superior to Prediger's people/things and data/ideas dimensions. These two dimensions form but one of a myriad of two dimensional orientations that underlie the

interest circle. We have presented Hogan's (1983) ideas of sociability and conscientiousness as heuristic alternatives. Given the interest in the overlap of personality and vocational interests, viewing the dimensions that underlie the interest circumplex as similar to personality dimensions may prove beneficial. Indeed, Prediger himself (1982) has argued that his people/things and data/ideas dimensional orientation is only one of many possibilities.

Borgen and Donnay raise several questions about our usage of factor analysis. We used principal components analysis, not principal axis analysis. Although both principal components analysis and principal axis analysis tend to fall under the general name of factor analysis, there are distinct differences (most of which we do not have the room to cover). However, there are several issues that Borgen and Donnay cover that apply regardless of whether one is focusing on principal components or principal axis. Specifically, they question our eschewal of extracting more factors, our failure to rotate our factor solution, and our ''low'' sample size. By adopting a different perspective regarding the data and thus a different analytic strategy, we demonstrated that a different and perhaps potentially rewarding product could result.

What appears at issue is a basic difference in models used. Hogan (1983) nicely argued that factor list models (espoused by Borgen and Donnay) and circumplex models (examined by us) are very different representations. The factor list model focuses on determining the minimum number of dimensions that can adequately account for a data set. Because parsimony and clarity have appeal, it is desired that these factors be as independent as possible. Hence researchers strive for simple structure in choosing among rotations. These dimensions then form the interpretive base. Factor list models are best in parsimoniously describing large amounts of data.

Circumplexes typically exist in only two dimensions and are characterized by the presence of different types distributed in a circle. As noted, the orientation of the two dimensions is arbitrary and no simple structure is possible because any orientation of factors will produce many types with nonzero loadings on more than one factor. The organization of the types around the circle is the defining and relevant information in circumplex models. All relations among the types are summarized by the circle. The factor list and circumplex models are different means of conceptualizing and examining interests. Borgen and Donnay were using factor list standards in their criticism, even though we were explicitly adopting the circumplex model as a structural guide. Factor list and circumplex models need not be mutually exclusive, however. Recent work in the area of personality has examined the overlap of the Big Five Factors with the Interpersonal Circle (e.g., Hofstee, de Raad, & Goldberg, 1992; Saucier, 1992; Wiggins & Pincus, 1989). We demonstrated how our own circumplex representation could fit with the major factor list results.

Borgen and Donnay criticized us for not rotating our factor solution, as if a simple solution were always the desired outcome. We did not rotate our principal components analysis for several reasons. First, in principal compo-

nents it generally does not make sense to rotate the solution because the data solution is already optimizied. Of course there is a long history of controversy over the merits and pitfalls of rotation in factor analysis, and to glibly assume that rotation is best ignores a highly contentious area. Second, as we argued in this paper and elsewhere (Rounds & Tracey, 1993), there is typically a strong general component in interest data. This general factor has been also noted by Prediger (1982). Although this general factor does not affect the circumplex structure (Rounds & Tracey, 1993), it can have a large effect on any factor rotations. Rotating a data set containing a prominent general factor confounds this general factor with other substantive factors, calling into question the validity of resulting factors. Given this confounding effect of rotation with the general factor, it is typically best to remove the general factor prior to rotation and this is the strategy that is frequently adopted in the personality literature (e.g., Alden, Wiggins, & Pincus, 1990; Borkenau & Amelang, 1985; Wiggins, Steiger, & Gaelick, 1981). Third, had we rotated our factors (after removing the confound of the general factor), we would not have found anything different. As we demonstrated, the items were uniformly arranged around the circles. There was no preferred orientation of factors and no simple structure.

Borgen and Donnay go on to comment that the factor analysis was suspect given the relatively small number of participants and large number of items. As we noted, for our purposes of investigating only the first 4 factors, the numbers of participants and items were appropriate as determined by extensive Monte Carlo examination of principal components analysis (Guadagnoli & Velcier, 1988). Further as noted by Borgen and Donnay, even given our ''arcane'' analysis, the types we found were similar to the factors found in past factor analytic research.

Although Gonzalez appropriately pointed out the differences between data patterns and representational spaces, he failed to note that the data pattern of a sphere would not change across different representations. There is a one-for-one correspondence across representational sets, and the representational set only provides the metric for understanding relations. Further it is not clear why Gonzalez introduces the issue of representational spaces as he makes no attempt to tie it in to our paper or even the analyses of circumplexes he proposes.

Gonzalez proposes three separate properties that should exist in a perfect circle and proceeds to evaluate these using data from a past method paper of ours (Rounds, Tracey, & Hubert, 1992). The properties should be viewed in the context of evaluating circumplex models but really do not relate to the purposes of this sphere paper. Relative to our method paper on evaluating circumplex models (Rounds et al., 1992), we specified two specific circular models, the circular order model and the circumplex model. Gonzalez examines a circumplex model similar to our second circular model (i.e., the circumplex), which is not the model we examined in this sphere paper. He proposes three properties that should hold for a perfect circumplex to fit the data

(although they could be more completely specified), and while he states that tests could be developed to test each of these, only one statistical test is provided. The sole test provided relies on the estimation of the standard error of the eigenvalue to establish the confidence interval. The specific standard error formula used is based on the examination of covariances and not correlations (to which Gonzalez applied it), and hence the validity of its application to eigenvalues based on correlations is unknown.

Gonzalez explains that he is focusing on the circumplex instead of the sphere because there are few methods to evaluate a sphere. We also agree that there are few methods in the literature to examine spherical models. The proposal of the circumplex model (Guttman, 1954) served to stimulate methodological innovation. We hope that proposal of spherical models can serve a similar catalytic function.

## BIG 5 COMMENTS

We wish to thank Borgen, Donnay, Gonzalez, Gottfredson, Harmon, Hansen, and Prediger for the time and effort expended in commenting on our manuscript. Although there were many comments made that warranted attention, we could not focus on all. We wish to end by quickly addressing five specific comments.

1. ''Tracey and Rounds (1996) have given us some new items for the toolbox for exploring person–job match, satisfaction, vocational adjustment, and career attainment.'' (Gottfredson, 1996).

Research on person–job fit and outcomes such as satisfaction have almost disappeared from the literature after Assouline and Meir (1987) and Spokane (1985) have reported mean correlations hovering around .20 between interest congruency and satisfaction. The spherical model provides at least another dimension—prestige—to assess congruency and may open possibilities to finding other methods of matching people and occupations.

2. ''In summary, Tracey and Rounds do not report a study of vocational interests. Instead, they report a study of job values (occupational attribute preferences). This is not a lesser study—it is a more encompassing study.'' (Prediger, 1996).

Two major theories of career development--Dawis and Lofquist (1984; Theory of Work Adjustment) and Holland (1985; Theory of Work Personalities and Environments)—have built their theories on one or the other constructs—values and interests, respectively. And in a sense both theories have attempted to account or encompass the other theory's constructs. Possibly, the spherical structure of occupational preferences can bridge the gap between these two career development person–environment orientations.

3. ''Our item-based factor analytic work in revising the 1994 Strong (Harmon et al., 1994) revealed that we could readily replicate more than 20 factors across two large random samples. In short, there is abundant evidence that the independent dimensions of interests number more than those six present in RIASEC.'' (Borgen & Donnay, 1996).

We would like to make a small wager here—the loser presents a colloquium on the structure-of-interests at the others' school—that these Strong Interest content scales and other homogeneous scales (see Rounds, 1995) can be located on spherical structure.

4. ''Other examples of strange item placements probably due to the same sources of error include: ''mathematician'' (an I-type item) in a technical (i.e., R-type) octant, near ''safety inspector;'' ''chemical engineer'' and ''electrical engineer'' in different octants; ''stockbroker'' in a Business Detail (i.e., C-type) octant when it is clearly a Business Contact item (prototypic E-type); and ''real-estate sales'' (prototypic E-type) and ''bank teller'' (prototypic C-type) in the same octant, Business Contact'' (Borgen & Donnay, 1996).

The Holland coding of occupations at times has been fairly contentious (Gottfredson & Holland, 1989, pp. 4, 5). Most major attempts to code occupations have relied on the mean RIASEC scale scores from members of an occupation, i.e., mathematicians score highest on the GOT scale of Investigative. We located occupations around the circle not based on their mean scores but based on interest covariance—relations among the students' responses to occupations. Hence, mathematician is more similar to electrical engineer based on the interest responses of students. So it is not surprising that there are instances where occupations are in slightly different locations on the vocational interest circle.

5. ''It would be interesting to see if a four dimensional solution would have resulted had they varied sex type as systematically as they varied prestige.'' (Harmon, 1996).

It may be impossible to unravel dimensions of sex type and prestige since they seem to be highly confounded (Heskith, Elmslie, & Kaldor, 1990). Nevertheless, Harmon makes an important point concerning the possibility of additional dimensions. Much of what we know about the structure of vocational interests was pioneered by Strong in the 1930s–1940's, Guilford in the early 1950s, Roe in the later 1950s, and Holland in the 1960s. We believe that it is time to systematically reexamine these structural models and hope that other researchers will be willing to take a re-look at current models of vocational interests since much has changed in the world of work since the time of these pioneers.

## REFERENCES

Alden, L. E., Wiggins, J. E., & Pincus, A. L (1990). Construction of circumplex scales for the Inventory of Interpersonal Problems. *Journal of Personality Assessment,* **55,** 521–536.

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

Assouline, M., & Meir, E. I. (1987). Meta-analysis of the relationship between congruence and well-being measures. *Journal of Vocational Behavior,* **31,** 319–332.

Borgen, F. H. (1986). New approaches to the assessment of interests. In W. B. Walsh & S. H. Osipow (Eds.), *Advances in vocational psychology: Vol. 1. The assessment of interests* (pp. 31–54). Hillsdale, NJ: Erlbaum.

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

Borkenau, P., & Amelang, M. (1985). The control of social desirability in personality inventories. A study using the principal-factor deletion technique. *Journal of Research in Personality,* **19,** 44–53.

Dawis, R. V., & Lofquist, L. H. (1984). *A theory of work adjustment*. Minneapolis: University of Minnesota Press.

Gonzalez, R. (1996). Circles and squares, spheres and cubes: What's the deal with circumplex models? *Journal of Vocational Behavior,* **48**(1).

Gottfredson, G. D. (1996). Prestige in vocational interests. *Journal of Vocational Behavior,* **48**(1).

Gottfredson, G. D., & Holland, J. L. (1989). *Dictionary of Holland occupational codes* (2nd ed.). Odessa, FL: Psychological Assessment Resources.

Guttman, L. (1954). A new approach to factor analysis: The radex. In P. R. Lazarsfeld (Ed.), *Mathematical thinking in the social sciences* (pp. 258-348). Glencoe, IL: Free Press.

Guadagnoli, E., & Velcier, W. F. (1988). Relation of sample size to the stability of component patterns. *Psychological Bulletin,* **103,** 265–275.

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

Harmon, L. W. (1996). Lost in space: A response to ''The Spherical Representation of Vocational Interests'' by Tracey and Rounds. *Journal of Vocational Behavior.*

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

Hofstee, W. K. B., de Raad, B., & Goldberg, L. R. (1982). Integration of the Big Five and circumplex approaches to trait structure. *Journal of Personality and Social Psychology,* **63,** 146–163.

Hogan, R. (1983). A socioanalytic theory of personality. In M. M. Page (Ed.), *Nebraska symposium on motivation 1982. Personality: Current theory and research* (pp. 55-89). Lincoln, NE: University of Nebraska Press.

Holland, J. L. (1985). *Vocational Preference Inventory manual* (1985 ed.). Odessa, FL: Psychological Assessment Resources.

Leary, T. (1957). *The interpersonal diagnosis of personality.* New York: Ronald.

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

Prediger, D. J. (1996). Alternative dimensions for the Tracey-Rounds interest sphere. *Journal of Vocational Behavior,* **48**(1).

Prediger, D. J., & Vansickle, T. R. (1992). Locating occupations on Holland's hexagon: Beyond RIASEC. *Journal of Vocational Behavior,* **40,** 111–128.

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

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

Rounds, J. B., Tracey, T. J., & Hubert, L. (1992). Methods for evaluating vocational interest structural hypotheses. *Journal of Vocational Behavior,* **40,** 239–259.

Saucier, G. (1992). Benchmarks: Integrating affective and interpersonal circles with the Big Five personality factors. *Journal of Personality and Social Psychology,* **62,** 1025–1035.

Spokane, A. (1985). A review of research on person-environment congruence in Holland's theory of careers. *Journal of Vocational Behavior,* **26,** 306–343.

Tracey, T. J., & Rounds, J. (1996). The Spherical Representation of Vocational Interests. *Journal of Vocational Behavior,* **48**(1).

Tracey, T. J. G., Rounds, J. (1995). The arbitrary nature of Holland's RIASEC types: A concentric circles structure. *Journal of Counseling Psychology,* **42,** 431–439.

Wiggins, J. S., & Pincus, A. L. (1989). Conceptions of personality disorders and dimensions of personality. *Psychological Assessment,* **1,** 305–316.

Wiggins, J. S., Steiger, J. H., & Gaelick, L. (1981). Evaluating circumplexity in personality data. *Multivariate Behavioral Research,* **16,** 263–289.

Received July 18, 1995