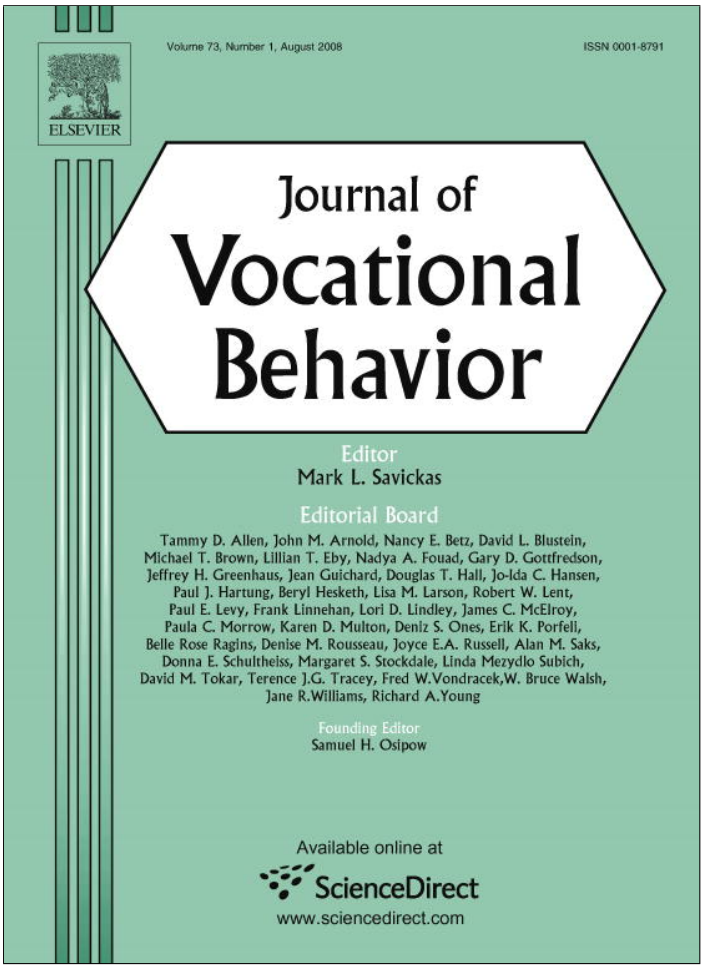

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Monograph

Development and initial validation of public domain Basic Interest Markers ☆,☆☆,★

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Abstract

Goldberg (Goldberg, L. R. (1999). A broad-bandwidth, public-domain, personality inventory measuring the lower-level facets of several five-factor models. In: I. Mervielde, I. Deary, F. De Fruyt, & F. Ostendorf (Eds.), *Personality psychology in Europe* (Vol. 7, pp. 7–28). Tilburg, The Netherlands: Tilburg University Press) has argued that the commercialization of personality measures limits the range of questions investigated in empirical research. We propose that the commercialization of interest measures has had a similar effect on research in vocational psychology. Following Goldberg's example of developing public-domain personality markers, we also propose that the development of public-domain interest markers would facilitate new directions in career-related research. The present study outlines the development and validation of a set of public-domain *Basic Interest Markers* (BIMs) that are freely available on a website. Using Day and Rounds' (Day, Susan. X, & Rounds, J. (1997). A little more than kin, and less than kind: Basic interests in vocational research and career counseling. *Career Development Quarterly*, *45*, 207–220) basic interest taxonomy, 343 items and 31 BIM scales were generated. Validity evidence is presented from correlations with the General Occupational Themes and Basic Interest Scales of the Strong Interest Inventory (Harmon, L. W., Hansen, J. C., Borgen, F. H., & Hammer, A. L. (1994). *Strong Interest Inventory applications and technical guide*. Stanford, CA: Stanford University Press). Discriminant validity is demonstrated by the capacity for the BIMs to differentiate major field of education or training. Implications for research and use in applied settings are discussed.

Keywords: Basic interests; Public-domain measures; Vocational interests; Scale development; Individual differences

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1. Introduction

The development of a large pool of interest items in an academic setting was an important catalyst for the emergence of modern career assessment inventories. During Clarence S. Yoakum's 1919–20 graduate seminar at the Carnegie Institute of Technology, approximately 1000 items were prepared for measuring interests (Fryer, 1931). These items were designed to measure preferences for situations, and were divided into age-based categories from early childhood through the adolescent period, and for adults up to thirty years of age. As discussed by Fryer (1931, p. 60–87), these items served as the foundation for the development of a series of interest measures. From Yoakum's item pool came the Carnegie Interest Inventory (Ream, 1924), Freyd's (1922) Occupational Interests, the Preference Interest Questionnaire (Craig, 1924), the Interest Report Blank (Cowdery, 1926), Kornhauser's (1927) General Interest Inventory, the Purdue Interest Report Blank (Remmers, 1929), Manson's (1931) Occupational Interest Blank for Women, and the Strong Vocational Interest Blank (SVIB; Strong, 1926, 1943). Of these measures, the SVIB became the most well known and most commercially successful, in part due to the sophisticated empirically keyed scales developed by E. K. Strong (Campbell, 1971). Without the initial spark of Yoakum's seminar and items, however, Strong would not have been in a position to develop his more sophisticated scoring techniques for the SVIB while working at Stanford.

Although there is limited information on the motives of Yoakum and those who followed in the wake of his graduate seminar, it seems unlikely that the driving force behind this early research was an awareness of the tremendous commercial potential of interest inventories. Instead, the focus was on understanding the career development process or helping individuals make more effective choices. As noted by H. H. Remmers:

> "Every year there is an appreciable number of freshmen who come to our universities with various sorts of misconceptions about the sort of life work which they wish to follow... Were there available at the beginning of the student's university career even a fairly reliable index of his [*sic*] vocational interests supplementary to indices of mental capacity, scholastic aptitudes, and such other measures as may be related to vocational success or failure, it would be a valuable additional tool in the armamentarium of the teacher or the vocational counselor" (Remmers, 1929, p. 106–107).

As interest measures became commercialized, the range of tools available to counselors increased, including a number of well-validated measures, such as the Strong Interest Inventory (Donnay, Morris, Schaubhut, & Thompson, 2005), the unisex edition of the ACT interest inventory (ACT, 1995), the Self-Directed Search (Holland, Fritzsche, & Powell, 1997) and the Kuder Career Search (Zytowski, 2001). Additionally, test publishes provide a wide range of supplemental information, including test and user's manuals, interpretive aids, and so forth, that can be used to serve the needs of students and other clients in applied settings by linking interests with majors and career options.

When the current state of interest research is contrasted with events in the years initially following Yoakum's seminar, it would appear that there is an asymmetrical relationship between research and commerce for psychological measures. As demonstrated by the emergence of numerous interest measures after the seminar, research can serve as a catalyst for developing new commercial assessment tools that expand the range of services offered in applied settings. However, over time these commercial measures may impede further scientific progress. A similar interaction between research and commerce can be seen in the area of personality assessment. As noted by Goldberg (1999; Goldberg, Johnson, Eber, Hogan, Ashon, Cloninger, and Gough, 2006), when a personality measure falls under a commercial copyright, this effectively limits the range of research questions that can be examined. Additionally, the cost of conducting research becomes prohibitive when using published measures, especially for graduate students and others with limited financial resources.

Although the publishers of interest measures have generally been supportive of research, the use of commercial measures effectively circumscribes the range of research questions that can be addressed. Commercial measures are relatively inflexible, making it difficult to revise or change the items; as a result, there are limited opportunities for comparative validity studies or the development of new interest models. Not surprisingly, interest models may lag behind emerging developments in the world of work (Rounds & Day, 1999), including the new knowledge-based economy, which places different demands on individuals, businesses, and

educational institutions (Burton-Jones, 2001). The solution, therefore, is to create a healthier distance between research and commerce, a strategy that Goldberg (1999) has pursued for personality assessment by developing a pool of public domain items that are freely available to researchers over the world-wide web. We propose to follow the example of Goldberg's personality-based work in the field of vocational psychology by developing a pool of public domain interest items.

2. The state of interest assessment

2.1. Holland's RIASEC types

Holland's (1959, 1997) RIASEC model of vocational personality types and work environments have clearly emerged as the dominant theory underlying interest assessment (Campbell & Borgen, 1999; Rounds & Day, 1999). Although Holland's model has established utility for career counseling and in other applied settings, it has been suggested that the six types are not sufficient to represent the entire range of individual differences in interests (Armstrong, Smith, Donnay, & Rounds, 2004; Deng, Armstrong, & Rounds, 2007; Donnay & Borgen, 1996). Rounds (1995) has reviewed the major factor analytic research of interest structure, including studies by Guilford, Christensen, Bond, and Sutton (1954), Jackson (1977), Kuder (1977), Droege and Hawk (1977), and Rounds and Dawis (1979). Although each study reviewed included Holland-like factors, there is consistent evidence that more than six factors are needed to represent the full range of interests. Guilford et al. (1954) identified 12 interest factors, Jackson (1977) identified 28 primary and eight second order work role factors, Kuder (1977) identified 16 factors, Droege and Hawk (1977) identified 11 factors, and Rounds and Dawis (1979) identified 14 factors for men using the Strong and 13 factors for women. Based on the results of factor analytic studies of interests, Rounds (1995) concluded that Holland-based models "do not adequately represent the complexity of the interest space when viewed from the perspective of basic interest dimensions" (p. 177), and recommended using measures of basic interests to create a more representative model of the world of work. In short, because Holland uses six types to encompass the entire range of vocational interests, the RIASEC categories may be too broad to adequately represent the full range of individual differences in interests.

2.2. Basic interests

The taxonomy of interest measurement can be divided into three levels, based on the specificity of the range of interest being represented (Hansen, 1984). In this taxonomy, basic interest represent an intermediate level of aggregation, lying between the specific occupation level and the general interest factor level (Day & Rounds, 1997). At the basic interest level, work activities are grouped together to transcend specific situations or job descriptions by identifying shared properties of occupations such as context, setting, objects of interest, and processes. Basic interests span across specific job titles, making this level of the taxonomy more flexible than measures of interest in specific occupational titles. Basic interests also allow for finer distinctions between areas of vocational interests than what is possible with general factor level measures such as Holland's (1959, 1997) interest types. An additional advantage of basic interests is that they provide a level of flexibility that corresponds to changes in the labor market associated with a transition to a knowledge–based economy (Burton-Jones, 2001). In this context, basic interests offer individuals the opportunity to maintain some sense of career coherence on the basis of a set of activities they value (Day & Rounds, 1997). Despite the potential utility of basic interests, this level of the interest taxonomy has received less research attention, most notable, models of basic interest structure remain under-investigated (Rounds & Day, 1999).

The first set of widely used basic interest measures were developed by Campbell, Borgen, Eastes, Johansson, and Peterson (1968) for the Strong Vocational Interest Blank (SVIB; Campbell, 1971; Strong, 1943). This set of basic interest scales were created to provide interpretive information to enhance the use of the Strong's empirically developed Occupational Scales, by providing insight into the "organization of an individual's choices" (Campbell et al., 1968, pp. 54). Campbell et al. (1968) noted that the Occupational Scales were effective for identifying potential interest in specific occupational titles, but the heterogeneous content of these scales made it difficult to expand the interpretation of results to other occupations. By grouping

items into homogenous content areas, the basic interest scales provide a structured, standardized way to begin a discussion of how interests can be expanded beyond the scope of a specific occupation.

Although the initial presentation of the SVIB basic interest scales suggested new directions for research and clinical practice, these measures quickly became overshadowed by the emergence of Holland's (1959, 1997) structure as the dominant model in vocational psychology. In particular, the dramatic overhaul of the SVIB to include Holland-based scales in its 1974 revision (Campbell, 1974) effectively undercut the basic interest scales (Day & Rounds, 1997). Despite being overshadowed by Holland's theory, over time research has emerged supporting the utility of basic interests. When examining the validity of the Basic Interest Scales (BISs) of the 1994 edition of the Strong Interest Inventory (SII), in comparison to the Holland based General Occupational Themes (GOTs), Donnay and Borgen (1996) found the basic interest scales to be the most valid predictors of occupational group membership, concluding that "basic interest scales more effectively deal with the reality of a complex multivariate space" (p. 288). Ralston, Borgen, Rottinghaus, and Donnay (2004) and Gasser, Larson, and Borgen (2007) reported similar results demonstrating that specific interest scales, such as the BISs, are highly useful in predicting choice of major filed of education and training than six GOTs in the 1994 and 2004 editions of the SII. Despite their potential effectiveness in applied settings, the BISs in the 1994 edition of the Strong are described as "subdivisions of the General Occupational Themes" (Harmon, Hansen, Borgen, & Hammer, 1994, p. 69).

In commercial interest measures, basic interests continue to be marginalized in favor of the Holland types. For example, in the SII Basic Interests are described as subdivisions of the six Holland RIASEC types (see Harmon et al., 1994, p. 69), and when SII results are presented to individuals, basic interest scores are grouped by Holland type, as are the results for the Occupational Scales. In this interpretive framework, basic interests are used as facet scales to clarify an individual's interests in the six Holland categories. Although the current practice of using basic interests as RIASEC facet scales is potentially useful in career counseling and applied settings (Johnansson, 1986), the true potential of these measures to represent individual differences in interests may be obscured by the imposition of the Holland framework. To advance the science of interest measurement, what is needed are a set of basic interest scales that are not bound to the Holland types or circumscribed by existing scales.

3. The Goldberg variations: Development of basic interest makers

In the personality assessment field, the research on personality assessment has progressed at a dismally slow pace since the first personality inventories were developed over 75 years ago (Goldberg, 1999). Goldberg attributed the lack of progress, in part, to the control of the publishers of commercial inventories who may regard certain scientific activities as detrimental to their business. For example, most publishers disallow the reproduction of their copyrighted inventories on public domain websites, and there is a tendency for commercial inventory publishers to discourage test development and comparative-validity studies that may undermine investments in current measures. As such, Goldberg (1999) suggested that placing a set of personality items in the public domain might free researchers from the constraints imposed by copyrighted personality inventories. Since the development of the public-domain International Personality Item Pool (IPIP; Goldberg, 1999), it has accumulated over 80 publications and was translated into 25 other languages. The growing popularity of the IPIP can be attributed to the a number of factors: It is cost free, its items can be obtained instantaneously via the internet, the combinations of items used in each scale are not protected as proprietary information, and items can be presented in any order, interspersed with other items, reworded, translated into other languages, and administered on the World Wide Web without asking permission of anyone (Goldberg et al., 2006).

Similarly, in the field of vocational psychology, the commercial nature of the dominant measures has provided limited opportunity for comparative validity studies or the development of new interest models. Therefore, we propose a variation on Goldberg's IPIP model, that is, the development of interest-based measures for research purposes that can be posted on the internet. These *Interest Markers* can be obtained freely without extra cost, available easily for inspection, translated into other languages, and administrated without asking permission. The utility of a website for the development and dissemination of interest and other career-related assessment tools can be seen in the U.S. Department of Labor's Occupational Information Network

(O*NET; www.onetcenter.org). Unlike the O*NET measures, which are designed for use in career counseling and other applied settings, these public-domain and web-based Basic Interest Markers are designed primarily for research purposes, with the goal of advancing the science of vocational assessment.

4. The present study

The purpose of the present study is to develop and validate a set of public-domain basic interest items and scales, Basic Interest Markers (BIMs). We began by identifying basic interest domains and generate items that tapped into these domains. Using the 28 basic interest definitions created by Day and Rounds (1997), we first generated items that contain short and contextualized verbal activity phrases. After each of the two administrations of the initial item pools, we checked the distribution of the items and examined the scales to ensure unidimensionality and homogeneity. After two rounds of revisions, the finalized BIM item pool was used for validity and structural studies. We used two sets of content scales from the Strong Interest Inventory to show that the BIMs have expected relations with the General Occupational Themes and Basic Interest Scales. Next, we used the discriminant analysis to demonstrate that the profiles generated from BIMs would adequately differentiate major field of education or training. Finally, we developed a hierarchical model of the BIMs using cluster analysis.

5. Scale development

5.1. Initial development of Basic Interest Markers (BIMs)

Beginning with the 28 basic interest definitions created by Day and Rounds (1997), nine counseling psychology graduate students were trained to generate initial 440 vocational interest items. two additional basic interest domains were created (i.e., Manual Labor and Information Technology), resulting in 30 BIM scales. Similar to Goldberg's (1999) IPIP, the format chosen for BIM items is a short and contextualized verbal activity phrase that tapped into each basic interest domain.

The 440 initial BIM items were listed randomly and administered to 216 college students enrolled in a career development course and an advanced psychology course attending a large Midwestern university in April 2004 (138 women and 78 men; mean age = 20.13). The racial breakdown of this sample is as follows: 130 Whites/Caucasians (60%), 42 Blacks/African Americans (19%), 19 Asians/Asian Americans (9%), 16 Latinos/Hispanics (7%), 1 Native American (1%), 7 multi/biracial and others (3%), and 1 unknown (1%).

Participants were given the following instructions, "This inventory contains a list of activities to help you explore your vocational interests. Please indicate how much you would like to do each activity by circling the number that most closely represents how you feel about it." The response format is a five-point scale: 1 = *strongly dislike*, 2 = *dislike*, 3 = *neutral*, 4 = *like*, and 5 = *strongly like*.

We inspected item means, standard deviations, and response distributions to eliminate items that were highly skewed or conveyed little information. To achieve the goal of homogeneity or unidimensionality, Clark and Watson (1995) recommended examining the inter-item correlations with each scale and suggested these correlations to be moderate in magnitude and should cluster narrowly around the mean value. Accordingly, inter-item correlations within each BIM scales were inspected to retain items that broadly measure each basic interest domain but are sufficiently correlated for the homogeneous scales. We deleted the items with most of inter-item correlations below .25. Another method to achieve unidimensionality is by factor-analyzing the items (Clark & Watson, 1995). As such, a principal axis factoring, with maximum likelihood estimation and no rotation, was performed. We examined the scree plots and factor loadings of the first two or three factors and deleted items with loadings of the first factor below .35, as suggested by Clark and Watson (1995). In addition, we added few items for the Family Activities, Law, and Personal Services scales to better capture these domains. We also revised a few items and took off items that contain study and course relevant activities from most scales as they would potentially tap into another basic interest domain (e.g., teaching). After examinations and revisions, 103 items were deleted, 10 items were revised, and 23 new items were created, resulting in a revised 370-item, 30-scale BIMs.

5.2. Follow-up data collection and second revision of the BIMs

The revised 370-item BIMs were administrated to another sample of 169 college students in the career development course (96 women and 73 men; M age = 18.93) at the same university in November, 2004. The racial breakdown of the sample is as follows: 95 Whites/Caucasians (56%), 34 Blacks/African Americans (20%), 14 Asians/Asian Americans (9%), 19 Latinos/Hispanics (11%), 7 multi/biracial and others (4%).

We used the same psychometric methodologies for this dataset. After examination of the means, standard, deviations, scree plots and factor loadings, a total of 28 items were deleted, one item was revised in the Finance scale and one new item was created for the Social Science scale to better capture these domains. We split the Law and Politics scale into two scales since these areas seemed to tap into separate domains. The Law scale had 11 items taken from the previous scale. For the Politics scale, we wrote 8 new items. Because we created a new Politics scale, multivariate imputation with expectation-maximization method was used to impute the Politics scale score for sample 1 ($n = 216$). The updated BIMs contain 31 scales and 343 items (see Appendix A for list of scales and psychometric characteristics). The full set of BIM items and scales are available freely on a public domain website called the "Interest Item Pool" (http://netfiles.uiuc.edu/jrounds/IIP/home.htm).

6. Validation and structure examination

6.1. Participants and procedures

A sample of 545 participants was used to examine the validity of the 343-item BIMs. The participants were drawn from sample 1: April 2004 ($n = 216$); sample 2: November 2004, ($n = 169$). In addition, we administrated the updated 343-item BIMs to 160 college students in the career development course at the same University in October 2006 (sample 3; 105 women and 55 men; mean age = 19.22). The racial breakdown of sample 3 is as follows: 99 Whites/Caucasians (62%), 33 Blacks/African Americans (20%), 8 Asians/Asian Americans (5%), 11 Latinos/Hispanics (7%), 8 multi/biracial and others (5%), and 1 unknown (1%).

All participants had completed the BIMs as part of a research participation requirement in the course. Of the 545 participants, 473 participants from the career development courses completed the 1994 edition of the SII (Harmon et al., 1994; $n = 316$) and the remaining participants ($n = 157$) completed the 2004 edition of the SII (Donnay et al., 2005; $n = 157$). We obtained informed consent from these 473 participants to get access to their SII results. In the combined sample, 206 (62%) were females and 339 (38%) were males with the M age of 19.49 years and an age range from 17 to 39 years ($SD = 1.83$). The combined sample was distributed across college classes: 252 (46.2%) were freshmen, 136 (25%) sophomores, 32 (5.9%) juniors, 117 (21.5%) seniors, 6 (1.1%) graduate student, and 2 (.3%) unknown. The racial breakdown of the combined sample is as follows: 324 Whites/Caucasians (59.4%), 109 Blacks/African Americans (20%), 41 Asians/Asian Americans (7.5%), 46 Latinos/Hispanics (8.4%), 23 multi/biracial and others (4.3%), and 2 unknown (0.4%). In the combined sample, 359 participants were enrolled in 54 different major fields of study, and 186 participants were either undecided majors or did not report their current major.

6.2. Measures

6.2.1. Basic Interest Markers (BIMs)

The 343-item BIMs were used for the present study. As shown in Table 1, 31 BIM scales yielded a range of Cronbach's coefficient αs from .85 to .95 in the combined sample. These reliabilities are similar to the coefficient αs reported for the Strong Interest Inventory Basic Interest scales (Harmon et al., 1994; Donnay et al., 2005).

6.2.2. Strong Interest Inventory (SII; Harmon et al., 1994; Donnay et al., 2005)

The SII is an empirically-based commercial measure used to assess patterns of vocational interest and preferences for various types of people, environments, and leisure activities. The 1994 SII has 317 items in total. In the newly revised 2004 SII, 124 original items were deleted and 98 new items were developed or revised (Donnay et al., 2005). For the purpose of the present validation study, we primarily focus on two sets of content scales

from the SII, the General Occupational Themes (GOTs) and Basic Interest Scales (BISs). Six GOTs are global measures of an individual's vocational interests and life style preferences that represent Holland's (1997) six personality types: Realistic, Investigative, Artistic, Social, Enterprising, and Conventional. The 1994 and 2004 GOTs scales yielded good internal consistencies with coefficient αs over .90 (Harmon et al., 1994; Donnay et al., 2005). The test–retest reliabilities ranged from .84 to .92 over 3–5 months intervals for the 1994 GOTs (Harmon et al., 1994) and from .84 to .90 over the 2–7 months for the 2004 GOTs (Donnay et al., 2005). The 1994 GOT and 2004 GOT scales are highly correlated with correlations ranging from .90 to .98, suggesting that the six GOTs remain very consistent between two editions of the SII and can be interpreted similarly.

The BISs are more specific measures of vocational interest and lifestyle preference than the six GOTs (Harmon et al., 1994). The 1994 SII has 25 BISs, and the 2004 SII has 30 BISs. Of the 30 2004 BISs, 10 of the scales are new and 20 scales are revised and updated (Donnay et al., 2005). As reported in the 1994 SII manual (Harmon et al., 1994), the 1994 BISs yielded a mean coefficient alpha of .85 ($SD = .05$) and an average test–retest reliability of .84 over a period of 1–6 months ($SD = .05$). The mean alpha of the 2004 BISs was .87 ($SD = .04$) and the average test-retest reliability of the 2004 BISs was .85 ($SD = .04$).

6.3. Overview of validity analyses

6.3.1. Comparison of male and female BIM structure

Prior to validate the BIM scales and examine the basic interest structure, it is important to evaluate the sex differences of the BIM structure because we need to decide whether a combined male and female sample is appropriate for the interpretation of the results. As such, separate correlation matrices were calculated for women and men to examine their similarity of the BIS structure. These correlation matrices were then scaled using the three-way (individual difference) multidimensional scaling (MDS; Borg & Groenen, 1997). The fit index of Variance Accounted For (VAF), stress, and the salience weights were obtained as indices of profile similarity of the BIM structures between women and men.

6.3.2. Correlational analysis

In the present study, the GOTs and BISs from the 1994 and 2004 SII were used to provide evidence for the validity of the BIMs. In particular, we focused on the correlations between the BIM and GOT scales and between the BIM scales and BISs to examine how the newly developed the BIM scales relate to higher-level Holland's interest types assessed by GOT scales and the basic interest domains measured by the BISs.

6.3.3. Discriminant analysis

Multivariate discriminant function analyses were used to assess the ability of the 31 BIM scales to discriminate among different college majors (adopted from Ralston et al., 2004; Gasser et al., 2007). It is important to provide concurrent and predictive evidence that the BIM scales are valid to provide guidance for practice. As there are 54 different major fields of study reported from 186 participants, we classified these majors into 30 categories of major fields based on the similarity in curriculum and training. Of the 30 categories of major fields, 12 categories containing over 10 participants were selected for the discriminant analyses: biology science ($n = 14$), education ($n = 10$), health practice ($n = 36$), humanity ($n = 23$), communication ($n = 29$), business ($n = 18$), advertising ($n = 18$), political science ($n = 13$), psychology ($n = 79$), economics ($n = 11$), accounting ($n = 13$), and finance ($n = 20$). Since the group sizes are unequal, the classification procedure in the discriminant analyses is modified by setting a priori probabilities to group size.

Using multivariate discriminate function analyses, 12 categories of major field were predicted by 31 BIM scales. The effect size for the predictors were indicated by Wilks's λ, which is the proportion of variance not accounted by group membership. In contrast, $1 - \lambda$ indicates the proportion of variance explained by the predictors. Next, we obtained the hit rate from the discriminant analysis by comparing predicted group membership with actual group membership. A chance hit rate is the probability of randomly selecting a particular major field of study. It is calculated by dividing one by the total number of possible major fields. In the present study, the average chance hit rate is one divided by 12 or 8.33%. The hit rate used here is the cross-validation hit rate, a bootstrapping technique that successively leaves each individual out while calculating the hit rates. In the present study, we also compared the concurrent validity of the 6 GOTs with the 31 BIM scales

to demonstrate the specificity of the basic interests in predicting major field of study over the higher-level general interest types.

6.3.4. Cluster analysis

We used hierarchical clustering to explore the basic interest structure generated from the BIMs. Hierarchical clustering is a useful multivariate technique to construct a map of the BIMs based on their interrelations. In the clustering analysis, we sought to group the BIM scales into a series of hierarchically related clusters, where scales within the same cluster are as homogeneous as possible and scales of distinct clusters are as heterogeneous as possible. The resulting hierarchy is represented by a dendrogram (tree structure). The complete-linkage method was used to group the BIMs into hierarchically related clusters.

7. Results

7.1. Descriptive analyses

In the combined sample, all 545 cases were analyzed and the scale scores were obtained by averaging the scale items. We evaluated skewness and kurtosis for each scale by examining their distributions, and we found no substantial violations in the data. Table 1 presents the number of items, means, standard deviations, and internal reliability estimates of the BIM scales. The 31 BIM scales presented had good internal reliabilities with coefficient αs ranged from .85 to .95.

Table 1
Descriptive statistics of the 31 BIM scales ($N = 545$)

BIM Scale	No. of items	*M*	*SD*	α
Athletic coaching	6	3.38	.92	.88
Business	12	3.11	.77	.92
Creative arts	11	3.02	.93	.93
Creative writing	11	2.98	.93	.93
Engineering	11	2.31	.74	.91
Family activity	14	3.76	.69	.90
Finance	12	2.95	.86	.94
Human relations management	11	3.05	.73	.90
Information technology	12	2.60	.76	.92
Law	11	2.86	.86	.94
Life science	10	2.35	.84	.92
Management	9	2.98	.76	.87
Manual labor	13	2.10	.75	.93
Mathematics	10	2.46	.95	.95
Medical service	10	2.91	.81	.89
Outdoor-agriculture	10	2.32	.78	.89
Office work	11	2.79	.73	.89
Performing arts	11	2.95	.88	.91
Personal service	14	2.93	.70	.88
Physical/risk-taking	9	3.11	.81	.85
Physical science	12	2.32	.77	.92
Politics[a]	8	2.94	.80	.91
Professional advising	10	2.96	.78	.90
Protective	11	2.45	.78	.90
Religious activities	12	2.65	.92	.95
Sales	13	2.84	.80	.93
Skilled trades	11	2.22	.86	.94
Social science	10	3.06	.78	.91
Social service	12	3.25	.81	.93
Teaching	10	3.05	.78	.90
Technical writing	10	2.24	.77	.92

[a] These scale scores were derived from imputed values.

Table 2
Intercorrelations of 31 BIM scales ($N = 545$)

BIM Scales	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
1. Athletic coaching	—																														
2. Business	.27	—																													
3. Creative arts	.08	.08	—																												
4. Creative writing	.04	.10	.72	—																											
5. Engineering	.27	.32	.28	.24	—																										
6. Family activity	.14	.21	.27	.16	−.17	—																									
7. Finance	.22	.84	−.07	−.05	.38	.14	—																								
8. Human relations management	.12	.67	.12	.21	.22	.40	.62	—																							
9. Information technology	.22	.49	.15	.17	.76	−.05	.55	.46	—																						
10. Law	.10	.36	.17	.30	.29	.12	.30	.43	.34	—																					
11. Life science	.21	−.02	.29	.22	.55	−.08	.05	.04	.38	.24	—																				
12. Management	.22	.82	.08	.17	.33	.27	.75	.78	.51	.50	.06	—																			
13. Manual labor	.30	.14	.26	.20	.75	−.10	.22	.16	.54	.20	.62	.18	—																		
14. Mathematics	.12	.30	.03	−.02	.52	−.09	.47	.26	.54	.19	.34	.31	.43	—																	
15. Medical service	.25	−.04	.25	.17	.30	.18	.02	.15	.22	.35	.64	.13	.30	.23	—																
16. Outdoor-agriculture	.32	.06	.34	.24	.65	−.03	.11	.11	.41	.14	.77	.11	.79	.29	.46	—															
17. Office work	.13	.62	.07	.11	.41	.23	.65	.69	.58	.24	.14	.68	.42	.42	.06	.26	—														
18. Performing arts	.13	.09	.73	.73	.28	.17	−.04	.18	.18	.29	.27	.15	.27	.07	.28	.29	.11	—													
19. Personal service	.19	.36	.42	.37	.20	.52	.23	.51	.22	.25	.18	.45	.29	.11	.31	.27	.56	.45	—												
20. Physical/risk taking	.53	.20	.32	.19	.47	.08	.16	.10	.32	.26	.40	.18	.44	.17	.36	.52	.09	.29	.19	—											
21. Physical science	.22	.07	.30	.24	.70	−.14	.16	.08	.51	.24	.81	.14	.64	.54	.54	.72	.21	.32	.18	.44	—										
22. Politics	.25	.46	.24	.36	.30	.21	.37	.47	.29	.78	.19	.55	.26	.16	.19	.21	.25	.28	.28	.36	.22	—									
23. Professional advising	.16	.59	.14	.22	.27	.36	.54	.84	.44	.39	.13	.73	.24	.26	.23	.20	.67	.20	.54	.13	.19	.45	—								
24. Protective	.35	.19	.18	.18	.65	−.05	.22	.25	.51	.45	.52	.29	.67	.34	.46	.61	.32	.30	.30	.58	.57	.41	.31	—							
25. Religious activities	.12	.11	.27	.30	.20	.24	.12	.34	.18	.25	.25	.22	.28	.11	.26	.26	.23	.32	.29	.07	.25	.25	.34	.29	—						
26. Sales	.34	.82	.08	.11	.38	.22	.68	.60	.48	.31	.09	.71	.30	.28	.07	.19	.63	.12	.46	.23	.14	.42	.58	.31	.23	—					
27. Skilled trades	.33	.18	.24	.13	.85	−.18	.25	.10	.63	.16	.52	.18	.84	.46	.24	.70	.31	.24	.14	.49	.64	.21	.18	.63	.18	.29	—				
28. Social science	−.01	.08	.44	.49	.17	.33	.03	.50	.17	.37	.33	.26	.20	.09	.44	.29	.21	.44	.42	.18	.30	.37	.51	.27	.43	.11	.10	—			
29. Social service	−.02	.08	.28	.33	−.02	.54	.03	.56	.06	.29	.12	.30	.06	−.02	.42	.12	.24	.28	.49	.02	.06	.26	.55	.16	.49	.15	−.07	.74	—		
30. Teaching	.12	.26	.28	.40	.15	.43	.21	.65	.24	.35	0.13	.48	.15	.14	.30	.16	.41	.32	.48	.08	.15	.38	.67	.21	.38	.28	.08	.70	.74	—	
31. Technical writing	.15	.34	.22	.28	.78	−.12	.37	.34	.71	.29	0.44	.37	.70	.46	.21	.54	.55	.25	.32	.28	.55	.27	.37	.57	.25	.43	.67	.24	.11	.28	—

Note: Correlation coefficients of .11 or higher are significant at .01 level, and correlation coefficients of .09 or higher are significant at .05 level.

7.2. Sex differences in BIM structure

Before performing the validity studies, we evaluated whether there are sex-differences in the BIM structure. Since previous research reported no sex-differences in vocational interest structures (e.g., Anderson, Tracey, & Rounds, 1997), we expected that the BIM structures to be similar across women and men. The correlations of the 31 scales among women and men were calculated separately and were scaled using three-way MDS (Borg & Groenen, 1997). Two dimensions were extracted with several fit indices for female and male samples (Stress = .22 for women and .27 for men; VAF = .70 for women and .56 for men; Dimension 1 weights are .63 for women and .59 for men; Dimension 2 weights are .73 for women and .75 for men). These indices are very similar for female and male samples, indicating that women and men have a common basic interest structures. Therefore, the combined female and male BIM correlation matrix was used in the subsequent analyses.

7.3. Correlational evidence

The relations between the BIM scales and the GOTs and BISs from the 1994 and 2004 SII were used to demonstrate that the BIMs are related in expected ways to similar homogeneous scales. First, the correlations between the BIM scales and the 1994 and 2004 SII GOTs were obtained. As shown in Table 3, we grouped the BIM scales based on the highest correlations with the six GOTs. The BIM scales showed expected convergent and discriminant validity with both versions of the SII. Of the 31 BIM scales with the 1994 GOT scales, almost two-thirds of the scales had the highest correlation with an expected GOT code. For example, Creative Arts, Creative Writing, and Performing Arts have large correlations ($r > .50$) with the Artistic GOT for 1994 SII and small correlations with the remaining GOT scales. In many cases, however, the correlations do not support a one-to-one mapping of BIMs and GOTs. For the 1994 SII, many of the BIM scales have small correlations ($r < .40$) with the GOT scales (i.e., Protective, Information technology, Technical writing, Athletic coaching, Mathematics, Religious activities, Law, and Politics) or correlations ($r > .39$) with more than one GOT scale (i.e., Physical Science, Office Work, and Finance). For the 2004 SII, similar patterns of correlations as found with the 1994 BIM and GOT scales are shown in Table 3. Overall, the BIM and GOT correlations show that the majority of basic interests relate to GOT interests in expected ways but approximately a third of the BIMs can not be adequately classified within the GOT taxonomy, suggesting that basic interests may form a taxonomy that differs from the RIASEC model.

The correlations between the BIM scales and equivalent or similar BISs are presented in Table 4. The correlations ranged from .70s for scales that were more consistent in the item content, such as BIM Law and Performing Arts, to .50s for scales which contents or items are not entirely similar, such as BIM Engineering and Physical Science. The lowest correlation was .42 for the BIM Life Science with 1994 BIS Science and for the BIM Professional Advising and 2005 BIS Human Resources & Training, indicating that these areas tap slightly different domains. Overall, the results suggest that the public-domain BIM scales were related as expected to other measures of basic interests.

7.4. Discriminant evidence

Multivariate discriminant function analyses were used to assess the ability of the 31 BIM scales to discriminate among 12 categories of major field in college. The result indicates that the 31 BIM scales accounted for 95.1% ($1 - \lambda$) of the variance in 12 categories of major field, and the 31 BIM scales correctly predicted major field membership approximately 63.4% of the time, greater than the average hit rate of 8.33%.

We also examined the concurrent validity of the 6 GOTs on the 12 categories of major field. This result indicates that the 6 GOTs accounted for 73.2% ($1 - \lambda$) of the variance among 12 categories of major field, which is much smaller than the variance accounted by BIM scales. In addition, the GOTs correctly predicted major group membership only 40.4% of the time, which also smaller than the hit rate from the BIM scales. Comparing the concurrent validity of the 6 GOTs with the 31 BIM scales, these results demonstrate the better specificity and predictability of the basic interests than the higher-level general interest types. In other words, the basic interest profiles are a superior method in differentiating major fields of study.

Table 3
Correlations between the BIMs and SII GOTs

BIM scale	*R*	*I*	*A*	*S*	*E*	*C*
	1994 SII GOT ($n = 316$)					
Skilled trades	**.64**	.21	−.05	−.09	.08	.08
Engineering	**.53**	.25	−.02	−.07	.11	.14
Outdoor-agriculture	**.47**	.27	.08	.04	.02	.01
Manual labor	**.47**	.16	.00	.01	.08	.12
Physical/risk-taking	**.46**	.22	.12	−.01	.04	−.09
Protective	.36	.20	−.03	.09	.09	.14
Information technology	.35	.15	−.06	−.02	.21	.33
Technical writing	.32	.12	.00	.01	.16	.21
Athletic coaching	.28	.08	−.09	.05	.12	.05
Physical science	**.45**	**.47**	.08	.02	.00	.09
Medical service	.18	**.44**	.10	.21	−.01	−.06
Life science	.33	**.41**	.08	.01	−.07	−.06
Mathematics	.32	.39	−.12	.02	.12	.37
Creative arts	.21	.11	**.61**	.14	.10	−.13
Creative writing	.05	.00	**.58**	.16	.09	−.08
Performing arts	.19	.08	**.56**	.14	.17	.00
Social service	−.10	.05	.25	**.59**	.22	.08
Teaching	−.02	.08	.23	**.53**	.25	.19
Family activity	−.02	.04	.30	**.45**	.25	.12
Social science	.08	.20	.39	**.40**	.15	.06
Religious activities	.09	.08	.18	.39	.19	.11
Sales	.10	−.02	−.02	.13	**.52**	.29
Business	.07	−.03	.00	.08	**.50**	.36
Management	.03	.01	.04	.19	**.45**	.37
Human relations management	−.01	.02	.10	.35	**.43**	.36
Personal service	−.01	−.00	.29	.36	**.42**	.19
Professional advising	.05	.07	.13	.35	**.41**	.32
Politics	.10	.08	.09	.14	.18	.05
Law	.01	.11	.11	.13	.15	.07
Office work	.06	−.03	−.05	.17	**.41**	**.50**
Finance	.13	.06	−.15	.05	**.43**	**.48**
	2004 SII GOT ($n = 157$)					
Skilled trades	**.68**	.35	.17	−.01	.02	.24
Engineering	**.62**	**.40**	.23	.05	.07	.35
Physical/risk-taking	**.61**	.28	.18	.01	.18	.21
Manual labor	**.59**	.29	.22	.15	−.01	.19
Outdoor-agriculture	**.56**	.35	.26	.21	.01	.08
Protective	**.53**	.29	.16	.16	−.03	.16
Information technology	**.49**	.38	.21	−.02	.12	.48
Athletic coaching	**.43**	.14	.02	.04	.10	.09
Technical writing	**.43**	.29	.24	.15	.06	.32
Life science	**.41**	**.62**	.22	.13	−.08	.11
Physical science	**.46**	**.60**	.22	.03	−.09	.16
Medical service	.19	**.53**	.13	.25	−.13	−.04
Mathematics	.24	**.46**	.03	−.07	.03	.34
Creative arts	.17	.18	**.71**	.17	.06	−.07
Creative writing	.09	.12	**.66**	.22	.05	−.06
Performing arts	.18	.17	**.63**	.20	.08	−.08
Social science	.09	.29	**.50**	**.50**	.01	.02
Personal service	.02	.05	**.44**	.36	.26	.01
Politics	.10	.03	.31	.16	.26	.09
Law	.08	.13	.28	.14	.14	.12
Social service	−.10	.05	.32	**.68**	−.03	−.13
Teaching	.03	.09	.36	**.55**	.12	−.01
Religious activities	.17	.13	.31	**.42**	.10	.17

(*continued on next page*)

Table 3 (*continued*)

BIM scale	*R*	*I*	*A*	*S*	*E*	*C*
Family activity	−.22	−.11	.25	**.41**	.19	−.14
Professional advising	.05	.07	.18	.35	.34	.23
Sales	.14	.03	.06	.07	**.64**	.33
Business	.12	−.03	.01	−.09	**.61**	**.40**
Management	.04	.02	.07	.15	**.45**	.31
Human relations management	.02	.00	.19	.33	.36	.25
Finance	.18	.10	−.06	−.04	**.48**	**.56**
Office work	.11	.08	.15	.13	.33	**.44**

Note: Correlations equal to and greater than .40 in bold.

7.5. Hierarchical structure

The correlation matrix of the combined sample (see Table 2) was used for the hierarchical cluster analysis. The complete-linkage method was used to explore the basic interest hierarchical structure generated from the

Table 4
Correlations between BIM scales and BISs

BIM scale	1994 BIS	*r*	2004 BIS	*r*
Athletic coaching	Athletics	.65	Athletics	.79
Business	Merchandising	.49	Marketing & Advertising	.53
			Entrepreneurship	.58
Creative arts	Art	.66	Visual Arts and Design	.69
	Applied arts	.63		
	Music/dramatics	.51		
Creative writing	Writing	.62	Writing & Mass Communication	.72
Engineering	Mechanical activities	.54	Mechanics & Construction	.69
Family activity	—[a]	—[a]	—[a]	—[a]
Finance	—[a]	—[a]	Finance and Investing	.68
Human relations management	—[a]	—[a]	Human resources and training	.46
Information technology	Computer activities	.48	Programming and information system	.65
Law	Law/politics	.53	Law	.70
Life science	Science	.42	Science	.63
Management	Organizational management	.54	Management	.43
Manual labor	—[a]	—[a]	—[a]	—[a]
Mathematics	Mathematics	.60	Mathematics	.68
Medical service	Medical service	.56	Healthcare services	.67
Outdoor-agriculture	Nature	.48	Nature and agriculture	.68
	Agriculture	.49		
Office work	Office services	.49	Office management	.51
Performing arts	Music/dramatics	.61	Performing arts	.70
Personal service	—[a]	—[a]	—[a]	—[a]
Physical/risk taking	—[a]	—[a]	—[a]	—[a]
Physical science	Science	.50	Science	.62
Politics	Law/politics	.52	Politics and public speaking	.67
Professional advising	—[a]	—[a]	Human resources and training	.42
Protective	—[a]	—[a]	Protective services	.62
Religious activities	Religious activities	.61	Religion and spirituality	.77
Sales	Sales	.57	Sales	.62
Skilled trades	Mechanical activities	.63	Mechanics & Construction	.70
Social science	—[a]	—[a]	Social science	.63
Social service	Social service	.61	Counseling and Helping	.69
Teaching	Teaching	.50	Teaching and education	.60
Technical writing	—[a]	—[a]	—[a]	—[a]

Note: $n = 316$ for the correlations of BIMs and 1994 BISs; $n = 157$ for the correlations of BIMs and 2004 BISs. All correlations are significant at .01 level.

[a] There is no parallel BIS for the corresponding BIM.

BIMs. As shown in Fig. 1, we grouped 31 BIM scales into a hierarchical taxonomy, starting from the most similar scales joined at lower distance, followed by bigger clusters grouping several smaller clusters together. The distances of the hierarchical clusters were converted from the correlations with ranges from 0 to 2. We identified nine categories at the distance of 0.7, referred to as *interest clusters*: personal service, arts, social service, law–politics, business, physical activity, science, technical, and applied mathematics. The list of BIM scales organized by the interest clusters is presented in Table 5.

The *personal service interest cluster* consists of two BIM scales: family activity and personal service. Both scales represent the activities performed for family members or other people. The *arts interest cluster* consists of three BIM scales: creative arts, performing arts, and creative writing. These three scales appear to be related to the Artistic type defined by Holland (1997) and represent an interest that involves creating and developing visual arts, music, written stories, and performance. The *social service interest cluster* consists of four BIM scales: teaching, social service, religious activities, and social science. The first three scales appear to be related to the traditional Social type defined by Holland. They involve working with, helping, and teaching people in educational, religious, and other social organizations. Social science is affiliated with this interest cluster as it represents research work related to human behavior and social organizations. The *law–politics interest cluster* consists of two BIM scales: law and politics. Both scales involve influencing or persuading people in legal and political matters. The *business interest cluster* consists of seven BIM scales: professional advising, human relations management, office work, finance, business, management, and sales.

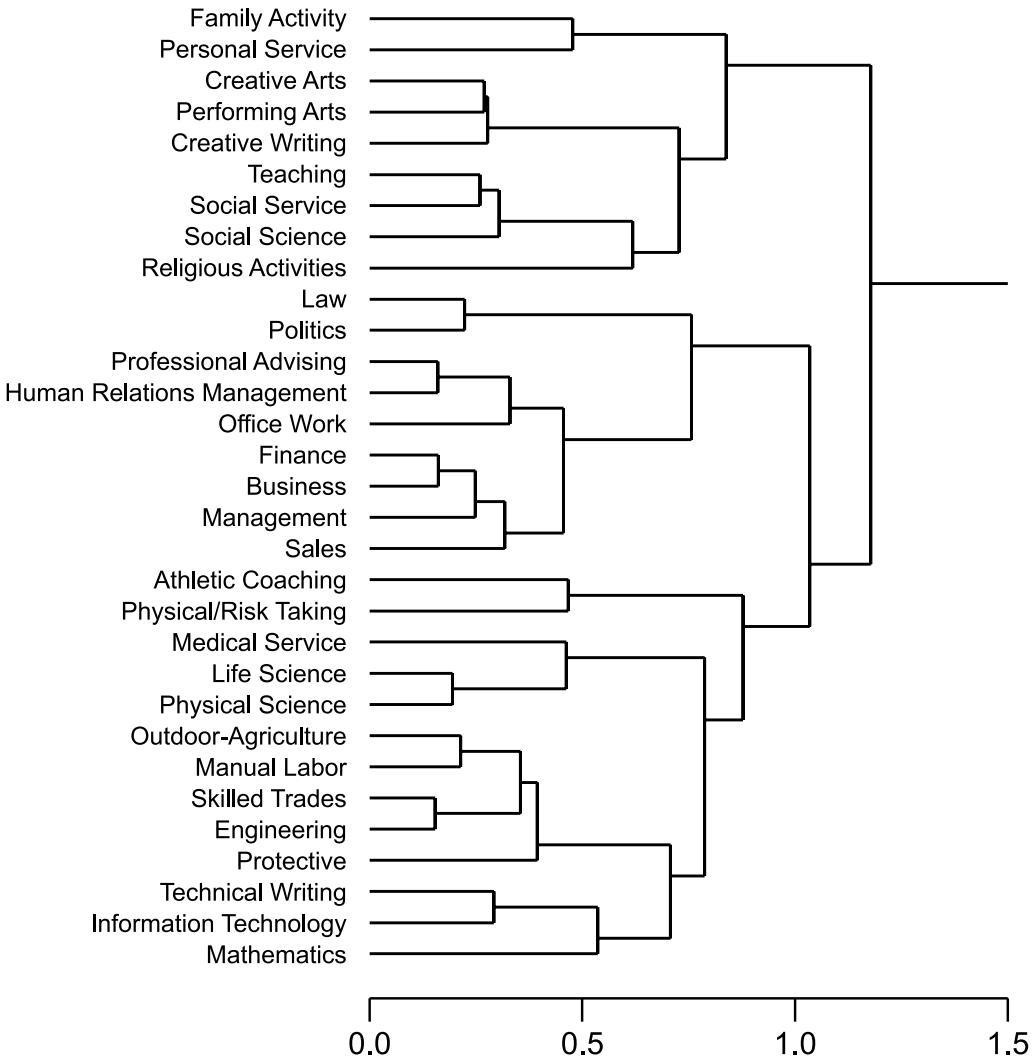

Fig. 1. Hierarchical structure of the BIM scales.

Table 5
Interest clusters and BIM scales

Interest cluster	BIM scale
Personal service	Family activity
	Personal service
Arts	Creative arts
	Performing arts
	Creative writing
Social service	Teaching
	Social service
	Social science
	Religious activities
Law–politics	Law
	Politics
Business	Professional advising
	Human relations management
	Office work
	Finance
	Business
	Management
	Sales
Physical activity	Athletic coaching
	Physical/risk taking
Science	Medical service
	Life science
	Physical science
Technical	Outdoor-agriculture
	Manual labor
	Skilled trades
	Engineering
	Protective
Applied mathematics	Technical writing
	Information technology
	Mathematics

This cluster represents both the Enterprising and Conventional aspects identified by Holland and involves work activities in financial and other business-related contexts. The *physical activity interest cluster* consists of two BIM scales: Athletic coaching and Physical/risk taking. Both scales in this cluster represent interests that involve physical engagement in athletic or novel settings. The *science interest cluster* consists of three BIM scales: medical service, life science, and physical science. These three scales involve scientific and analytic activities in medical, life, and inanimate realms, and appear to be related to the Investigative type identified by Holland. The *technical interest cluster* consists of five BIM scales: outdoor-agriculture, manual labor, skilled trades, engineering, and protective. These scales are traditionally classified as Realistic by Holland, and represent activities that require a certain level of technical and manual skills. Lastly, the *applied mathematics interest cluster* consists of three BIM scales: technical writing, information technology, and mathematics. This cluster represents an interest in quantitative skills related to mathematics, science, and technology.

8. Discussion

The current paper outlines the development of a set of Basic Interest Markers (BIMs) that is available to researchers in the public domain. Inspiration for this project was found in both the history of interest measurement and in recent developments in the area of personality research. We propose that, similar to the effects of Yoakum's 1919–20 graduate seminar on interests, the development of a new set of public domain interest

items can serve as a research catalyst with unforeseen commercial and clinical applications. Goldberg's (1999; Goldberg et al., 2006) work on the development of a set of public domain personality items served as a model for our development of activity-based interest items and scales, and also for the dissemination of our work in the public domain. The success of the IPIP, both in terms of its continued growth and the increasing number of research studies conducted using its items, suggests that the public domain approach to research can reinvigorate an area of inquiry dominated by well established commercial measures. The time has come for vocational researchers to take similar steps.

In the present study, a basic interest taxonomy developed by Day and Rounds (1997) was used as a starting point for generating interest items and scales. Our decision to use Basic Interest Markers reflects research suggesting that Holland's RIASEC types are not sufficient to encompass the full range of individual differences in interests (Armstrong et al., 2004; Donnay & Borgen, 1996; Rounds, 1995). The research presented here suggests that the BIMs are a reliable and valid set of basic interest measures. The examination of the concurrent validity of the BIM scales demonstrated better specificity and predictability in predicting major field of study than the higher-level general interest types. These findings are consistent with the findings from Ralston et al. (2004) and Gasser et al. (2007), which suggest that basic interest measures may be more effective for representing individual differences in interests and for predicting important educational and career-related outcomes. However, given the prevalence of Holland's (1959, 1997) theory in vocational psychology (Campbell & Borgen, 1999) an important follow-up to the current paper will be the development of a set of public domain RIASEC markers to compliment the Basic Interest Markers developed in this paper.

8.1. Implications for research

Goldberg (1999) identified a number of factors that contributed to (what he termed) the slow growth of personality assessment, and proposed that the development of public domain personality markers could help improve the state of personality research. It would appear that there was, and continues to be a need for these types of measures, given the increasing use of the public domain personality items in research cited by Goldberg et al. (2006). We propose that public domain Basic Interest Markers will have similar implications for research in the vocational interest field, because similarly to the personality area, there are factors that may circumscribe the range and types of research questions being investigated. One factor cited by Goldberg (1999) as an inhibiting factor in personality research was the negative attitude towards personality in psychology prompted by Mischel (1968) personality-situation debate. In the more applied area of interest assessment this debate did not take hold, but another important factor cited by Goldberg, the commercialization of the assessment enterprise may be a factor limiting research in vocational psychology.

Goldberg (1999) claims that there are a number of research questions that are either actively or passively disallowed by test publishers. First, test publishers have a bias towards the un-altered use of their measures. Research that would involve selecting, reworking, or otherwise modifying items and scales can be viewed as detrimental to the integrity of the published measure. This limits the types of experimentation that researchers can do with a published measure that may involve new scoring methods or ways to develop new constructs. In vocational psychology, Holland's (1959, 1997) theory has emerged as a dominant model of interest assessment, and test publishers who have enjoyed success with their use Holland-based scales are reluctant to consider alternative frameworks. Second, researchers are typically not allowed to post items online, aside from the controlled-access websites run by some publishers for online assessments, because this makes it difficult for the test publisher to collect royalties. This makes it difficult for researchers working with limited budgets to take full advantage of recently developed online tools for collecting data. Third, scoring keys are protected as proprietary information, and often for good reason, including examples such as the Occupational Scales of the Strong Interest Inventory. This allows for the collecting of scoring fees, protects the investment the test developer has made in collecting the occupational incumbent samples, and, as suggested by Goldberg may also prevent some forms of cheating on personnel selection inventories and other assessments that are used in applied settings. Without access to the scoring keys, however, there is a limit to the types of research questions that can be asked, and it may even be difficult to conceptualize research questions related to these scales. Finally,

Goldberg argues that the test publishers have a vested interest in maintaining the status-quo, and that a test publisher's interests are best served by cultivating a based of loyal users. This mindset is potentially incompatible with research investigating new models and assessment techniques.

Goldberg (1999) puts forward the IPIP as an antidote to the inhibitory effects of commercial test publication in the area of personality assessment. Our development of public domain interest markers should also have a number of implications for research, potentially similar to the effects observed with Goldberg's public domain personality markers. First, the Basic Interest Markers are free to students and others with limited resources, which should help expand the range of individuals who are able to conduct interest research. Second, these scales should help increase both the speed and flexibility of research. By placing a set of basic interest items in the public domain would free researchers from the constraints imposed by copyrighted interest inventories and speed up the research on refinement of interest items, scales, and models. The use of world-wide web allows researchers around the world to collaborate and communicate research findings on the public forum without regard to geographical locations. And third, these scales should increase our ability to ask different research questions. The BIM items are short and contextualized interest activity phrases. This format would allow for more contextual specificity for each item and the chosen domain. These Basic Interest Markers are not bonded with higher order interest scales, which would increase research attention on the use of basic interest taxonomy in vocational counseling. There would also be the potential for the development of new interest models (Armstrong et al., 2004) and for linking these scales to other measures in an integrated models of individual differences (Armstrong & Rounds, in press).

8.2. Implications for applied settings

The Basic Interest Markers presented in this paper were designed for research purposes and, in their current form, are not designed for use in career counseling and other applied settings. Although validity evidence is presented for the scales, this information is designed to show the relevance of the underlying constructs for research purposes. Additional work would have to be done on the development of norm groups for diverse populations, and interpretive materials would have to be developed, before these scales could be used effectively with clients. One of the most notable strengths of the assessment tools offered by commercial test publishers is the range of interpretive and other supporting materials and resources typically provided with career-related measures. The purpose of the Basic Interest Markers is not to compete with commercial test publishers in the areas where they are successful, but instead to augment commercial measures with a set of scales that are more suitable for a wide range of research purposes. Over time, these scales may serve as a catalyst for the development of new assessment tools, similar to the effects seen from Yoakum's 1919–1920 graduate seminar on interests, and the more recent contribution by Goldberg and colleagues in the personality area.

8.3. Future directions

Although the current study provides initial validity evidence for the BIMs, there are a number of issues that need to be addressed in future research. Foremost is the question of how well the present 31 basic interests represent the domain of vocational interests. Are there additional basic interests that are important for studying careers? Another issue that requires further investigation is the relations between basic interests, the higher-order clusters identified, and the Holland types. Much of what researchers know about vocational interests is based on college students; there is a need to recruit samples from a variety of settings. As suggested by cross-cultural research using Goldberg's (1999) personality measures, in addition to providing validity evidence for the BIMs, research with diverse populations also provides answers to important questions about the role of culture and social factors in the development of identity. Furthermore, cross-cultural research may be an important source of new ideas and items for the ongoing development of measures and new models of interest structure. Finally, there is the issue of whether to broaden the present public domain site to other vocational measures. For example, many of the career decision-making measures are commercial. Expanding the types of measures on public domain sites is a topic that needs a broad discussion among researchers.

Appendix A. Basic Interest Markers Scale definitions and items

(Available at https://netfiles.uiuc.edu/jrounds/IIP/home.htm)

(1) *Athletic coaching: Involvement in teaching exercise, sports, and games*
1. Participate in competitive sports
2. Provide physical fitness training
3. Coach a sports team
4. Explain a sport to other people
5. Referee a sporting event
6. Take a course in athletic training

(2) *Business: Dealing with structured wholesale and retail activities*
1. Understand the qualities of an effective business
2. Develop business systems
3. Learn about the needs of the marketplace
4. Think of ideas to increase the sales for a company
5. Implementing quality review procedures in a company
6. Develop strategies for advertising campaigns and sales promotions
7. Set prices on goods based on forecasts of customer demand
8. Plan the expansion of a company
9. Set up an office in a new city
10. Set up business transactions between companies
11. Negotiate a business deal
12. Develop relationship with external suppliers

(3) *Creative Arts: Activities involving the visual arts or music*
1. Sketch a picture
2. Take a film-making course
3. Design a creative work of art
4. Design a piece of artistic furniture
5. Design costumes for a movie or play
6. Participate in an art show
7. Develop a portfolio of artwork
8. Write an original musical piece
9. Visit an art gallery
10. Create a sculpture
11. Study painting

(4) *Creative writing: Developing and creating stories*
1. Study creative writing
2. Write a script for a TV drama
3. Write a celebrity biography
4. Write a novel
5. Develop a script for a movie
6. Edit a newspaper article
7. Compose short stories
8. Write a true-life story
9. Write a play for a theater
10. Be on a team of writers for a situational comedy
11. Write children books

(5) *Engineering: Developing and using technology to produce and maintain things*

1. Modify an equipment design to reduce sound level
2. Develop more user-friendly machines
3. Redesign an engine to improve fuel efficiency
4. Maintain the main generator in a power plant
5. Test a new cooling system
6. Design electronic systems
7. Improve the efficiency of an assembly process
8. Design structures that can withstand heavy stresses
9. Analyze problems in aircraft design
10. Design a highway overpass
11. Design a diagnostic routine for a power plant

(6) *Family activity: Performing domestic activities*

1. Take care of children at home
2. Redecorate the living room
3. Play with your children
4. Maintain the attractiveness of the house
5. Prepare exciting meals for your family
6. Meet the needs of my partner and children
7. Arrange transportation for your child's and friend's play activities
8. Provide a comfortable home for my family
9. Take the family on a picnic
10. Arrange play dates for your child
11. Cook for your friends and family
12. Take the family on a vacation
13. Keep the home looking comfortable
14. Read a story to your child

(7) *Finance: Managing assets and debts*

1. Understand economics principles
2. Understand the role of finance in business
3. Work with financial data
4. Create a budget
5. Study how to generate business profits
6. Analyze financial information
7. Project future expenditure
8. Analyze a person's credit history
9. Provide advice about investments
10. Evaluate the quality of an investment
11. Arrange business loans
12. Learn about money management

(8) *Human relations management: Arranging positive interpersonal settings within organizations*

1. Meet with workers to mediate disagreements
2. Explain new company policies to workers
3. Organize a diversity workshop for a company
4. Assess employee opinions of the company
5. Investigate employees' job satisfaction
6. Direct activities to improve office communication
7. Provide human relations training

8. Facilitate relationships between management and employees
9. Review organizational policy matters on equal employment opportunity
10. Organize activities to raise employees' morale
11. Structure an employee disciplinary action

(9) *Information technology: Using computers and electronic devices for communication*
1. Design a technology system for distance learning
2. Acquire the latest electronic technology
3. Maintain network hardware and software
4. Maintain a website for an organization
5. Keep up-to-date on the latest software
6. Take a course on network administration
7. Design a computer system for an organization
8. Use computers to archive historical documents
9. Create a computer database
10. Improve computer network efficiency
11. Modify existing software
12. Install a new computer system

(10) *Law: Researching, documenting, and debating legal matters*
1. Research case law
2. Find precedents related to a legal case
3. Obtain a license to practice law
4. Rule on the admissibility of evidence in court
5. Work to improve the legal system
6. Interpret the constitutionality of a law
7. Gather evidence for a trial
8. Present arguments to a jury
9. Prepare legal documents
10. Defend a client against a legal charge (in a courtroom)
11. Arbitrate legal disputes between parties

(11) *Life science: Research, development, and consulting activities relating to plants and animals*
1. Learn about the life cycle of an animal species
2. Breed animals in a laboratory
3. Dissect an animal
4. Track the migratory patterns of birds
5. Study the diet of an animal species
6. Investigate human gene structure
7. Identify and classify bacteria
8. Collect plant samples
9. Study how plants grow
10. Conduct research with growing bacteria

(12) *Management: Planning, organizing, and coordinating the activities of others*
1. Direct the business affairs of a university
2. Direct all sales activities for a company
3. Plan and coordinate a convention for a professional association
4. Administer city government
5. Plan and direct training and staff development for a business
6. Serve as a president of a university
7. Direct and coordinate the work activities of subordinates

8. Coordinate the activities of all departments in a bank
9. Direct the operations of a medium size company

(13) *Manual labor: Performing work that requires routine physical activity*
1. Load and unload freight materials
2. Deliver office furniture
3. Transport people's belongings from one place to another
4. Drive a nail into wood
5. Clean offices
6. Stack lumber in piles
7. Dig a hole for a fence
8. Clean up trash or debris
9. Feed items into a machine
10. Separate items by weight or size
11. Feed and groom livestock
12. Use hands to lift, carry, and pull objects
13. Use vacuums and shovels to clean working areas

(14) *Mathematics: Working with quantitative concepts and mathematical formulas*
1. Solve an algebraic equation
2. Develop mathematical formulas
3. Understand applications of calculus
4. Learn about a new branch of mathematics
5. Graph an equation
6. Take a course in advance mathematics
7. Solve geometric proofs
8. Apply mathematical techniques to practical problems
9. Calculate the probability of winning a contest
10. Use mathematical theorems to solve problems

(15) *Medical service: Applying medical knowledge and skills to the diagnosis, prevention, & treatment of disease and injury*
1. Research new drugs to cure cancer
2. Explain how viruses infect the human body
3. Determine the cause of an illness
4. Perform surgery
5. Provide physical therapy
6. Diagnose mental illness
7. Examine a patient in a clinic
8. Provide first aid
9. Prescribe medication to relieve pain
10. Treat injured animals

(16) *Outdoor-Agriculture: Working in outdoor settings with animals and plants*
1. Protect crops from diseases and pests
2. Feed and water animals in a zoo
3. Raise livestock on a farm
4. Learn about soil and climate requirements of specialty crops
5. Work on a dairy farm
6. Install a crop irrigation system
7. Harvest trees for timber
8. Care for and plant trees

9. Work on a commercial fishing vessel
10. Work in the outdoors

(17) *Office Work: Performing clerical tasks*
1. Perform office work
2. Develop procedures to improve office efficiency
3. Operate commonly-used office machines
4. Improve a system for handling employee reimbursements
5. Order and maintain an inventory of office supplies
6. Provide customer service
7. Design an office filing system
8. Record meeting minutes
9. Schedule, maintain, and update appointments
10. Organize files and documents
11. Prepare payrolls

(18) *Performing Arts: Performing for an audience*
1. Study one of the performing arts
2. Participate in a musical performance
3. Act in a television commercial
4. Sing on a stage
5. Perform magic tricks on stage
6. Act in a play
7. Appear in a talent show
8. Direct the performance of actors
9. Conduct an orchestra
10. Take a screen test for a movie
11. Act in a movie

(19) *Personal service: Performing everyday tasks for others*
1. Wait on tables in a neighborhood restaurant
2. Plan the food and drinks for a business meeting
3. Provide personal services to airplane passengers
4. Serve beverages in a club
5. Provide a client with a manicure
6. Greet guests and answer questions about activities in a hotel
7. Arrange travel plans and accommodations
8. Style hair in a salon
9. Plan parties for weddings and other special occasions
10. Help a client plan an exercise program
11. Help a client plan a vacation to Europe
12. Lead a tour to points of interest in a large city
13. Fit and alter clothes for a customer
14. Work with clients to meet romantic partners

(20) *Physical/risk taking: Taking risks and seeking novel situations*
1. Do work that is dangerous and exciting
2. Discover uncharted territories
3. International travel to countries where there is armed conflict
4. Scuba-dive among unexplored coral reefs
5. Have some adventure during every work day
6. Participate in high-speed chases

7. Parachute jump from an airplane
8. Rescue someone stranded on a mountain
9. Participate in extreme sports

(21) *Physical science: Research, development, and consulting activities relating to inanimate materials*
1. Study the laws of gravity
2. Investigate the molecular structure of substances
3. Search for new solar systems
4. Study the nature of quantum physics
5. Measure the speed of electrons
6. Study the movement of planets
7. Test chemical reactions
8. Study rock and mineral formations
9. Describe the structure of an organic compound
10. Study why earthquakes occur
11. Use meteorological information to predict the weather
12. Take a course in the physical sciences

(22) *Politics: Influencing ideas of individuals and governing a group of people in a political realm*
1. Persuade people to vote for your candidate
2. Work in a political campaign
3. Influence voters to support your ideas
4. Debate the merits of political candidates
5. Argue for or against an idea
6. Run for a political office
7. Write legislation
8. Give a speech supporting your candidate

(23) *Professional advising: Advising people in meeting professional goals*
1. Advise people in meeting their professional goals
2. Assist people in planning for retirement
3. Conduct a workshop on time management
4. Coach people to prepare them for an interview
5. Provide consultation for colleagues
6. Apply professional skills in a consulting role
7. Provide skill development training
8. Conduct career planning workshops
9. Assess organizational development needs
10. Recommend changes in how a company operates

(24) *Protective: Guarding, ensuring safety, and enforcing rules and laws*
1. Search for explosives in an airport
2. Make inspections to be sure that laws are not broken
3. Patrol an area to maintain security
4. Direct traffic after an accident
5. Take a person into custody on an arrest warrant
6. Guard a government building
7. Patrol borders to stop illegal immigration
8. Respond to emergency calls for help
9. Conduct surveillance of suspects
10. Escort individuals for their own protection
11. Learn fire-fighting techniques

(25) *Religious activities: Leading spiritual groups, altruistic teaching*
1. Read a religious text
2. Help children understand religious teachings
3. Provide spiritual guidance
4. Develop my spirituality
5. Train to be a member of a religious ministry
6. Interpret religious writings
7. Conduct religious ceremonies
8. Participate in a prayer group
9. Attend a religious ceremony
10. Explain a religious text to people
11. Pray
12. Take a class about religion

(26) *Sales: Selling marketing products*
1. Describe features and benefits of a product or service you sell
2. Increase sales in your sales territory
3. Work in a position that offers a commission based on sales
4. Convince people about the usefulness of a new gadget
5. Promote sales of medical equipment to physicians
6. Sell services and equipment
7. Determine customer needs
8. Explain products to customers
9. Persuade customers to spend money
10. Sell commercial property
11. Sell a new product to consumers
12. Learn new sales tactics
13. Be a sales representative for a retail business

(27) *Skilled Trades: Building, repairing, using tools and materials*
1. Install the piping and fixtures of a drainage system
2. Use tools to repair factory equipment
3. Repair the engine of an automobile
4. Construct wooden cabinets
5. Diagnose malfunctions in automotive engines
6. Maintain manufacturing equipment in an industrial plant
7. Install the electrical wiring in a house
8. Replace defective telephone lines
9. Learn how to operate power tools
10. Use building materials to construct a wall
11. Weld together metal components of products

(28) *Social sciences: Research, development, and consulting activities relevant to human behavior and social organizations*
1. Learn about human behavior
2. Develop a theory about human behavior
3. Investigate cultural practices
4. Conduct social science experiments
5. Study child-rearing problems
6. Compare cultural differences among groups
7. Analyze the effects of discrimination on minority groups
8. Review the interpersonal relationship literature

9. Study class structures of a society
10. Study intersections among people in a group

(29) *Social service: Helping people cope with problems*
1. Assist people with disabilities to find employment
2. Help families to adopt a child
3. Counsel families in crisis
4. Help the homeless find shelter
5. Help people find community resources
6. Provide childcare services
7. Organize a social support group
8. Volunteer for a community service center
9. Help children from disadvantaged background adjust to school
10. Counsel clients with personal problems
11. Provide services to individuals with disabilities
12. Help people overcome social problems

(30) *Teaching: Instructing people*
1. Develop a lecture
2. Design tests to evaluate students' learning
3. Take a teacher development workshop
4. Create an effective classroom atmosphere
5. Interact with students in a classroom setting
6. Facilitate students' discussions
7. Design an active learning activity
8. Conduct seminars
9. Offer feedback on student papers
10. Supervise high school students' research projects

(31) *Technical writing: Writing for business and record-keeping purposes*
1. Write complex technical information in an understandable way
2. Write instructional manual for a piece of equipment
3. Write directions for how to operate a VCR
4. Plan and edit technical manuals
5. Write a manual on how to operate a cell phone
6. Write instructions on how to assemble a toy
7. Prepare a manual for a computer program
8. Write a user guide on practically anything
9. Create manufacturer's catalogs
10. Write operating documents for an organization

References

ACT, (1995). *UNIACT technical manual*. Iowa City, IA: UNIACT.

Anderson, M., Tracey, T., & Rounds, J. (1997). Examining the invariance of Holland's vocational interest model across gender. *Journal of Vocational Behavior, 50*, 349–364.

Armstrong, P. I., & Rounds, J. (in press). Vocational psychology and individual differences. In S. D. Brown & R. W. Lent (Eds.), *Handbook of counseling psychology* (4th ed.). Hoboken, NJ: Wiley.

Armstrong, P. I., Smith, T. J., Donnay, D. A. C., & Rounds, J. (2004). The strong ring: A basic interest model of occupational structure. *Journal of Counseling Psychology, 51*, 299–313.

Borg, I., & Groenen, P. (1997). Modern multidimensional scaling: Theory and applications. New York: Springer-Verlag.

Burton-Jones, A. (2001). Knowledge capitalism: Business, work, and learning in the new economy. New York, NY: Oxford University Press.
Campbell, D. P. (1971). Handbook for the strong vocational interest blank. Stanford, CA: Stanford University Press.
Campbell, D. P. (1974). Manual for the SVIB-SCII. Stanford, CA: Stanford University Press.
Campbell, D. P., & Borgen, F. H. (1999). Holland's theory and the development of interest inventories. *Journal of Vocational Behavior, 55*, 86–101.
Campbell, D. P., Borgen, F. H., Eastes, S. H., Johansson, C. B., & Peterson, R. A. (1968). A set of basic interest scales for the strong vocational interest blank for men. *Journal of Applied Psychology Monograph, 52*(6, Whole No. 2), 1–54.
Clark, L. A., & Watson, D. (1995). Constructing validity: Basic issues in objective scale development. *Psychological Assessment, 7*, 309–319.
Cowdery, K. M. (1926). Measurement of professional attitudes. *Journal of Personnel Research, 5*, 131–141.
Craig, D. R. (1924). The preference-interest questionnaire in selecting retail saleswomen. *Journal of Personnel Research, 3*, 366–374.
Day, Susan X., & Rounds, J. (1997). "A little more than kin, and less than kind": Basic interests in vocational research and career counseling. *Career Development Quarterly, 45*, 207–220.
Deng, C.-P., Armstrong, P. I., & Rounds, J. (2007). The fit of Holland's RIASEC model to US occupations. *Journal of Vocational Behavior, 71*, 1–21.
Donnay, D. A. C., & Borgen, F. H. (1996). Validity, structure, and content of the 1994 Strong interest inventory. *Journal of Counseling Psychology, 43*, 275–291.
Donnay, D. A. C., Morris, M. L., Schaubhut, N. A., & Thompson, R. C. (2005). Strong Interest Inventory manual: Research, development, and strategies for interpretation. Mountain View, CA: CPP.
Droege, R. C., & Hawk, J. (1977). Development of a U.S. Employment Services interest inventory. *Journal of Employment Counseling, 14*, 65–71.
Freyd, M. (1922). The measurement of interests in vocational selection. *Journal of Personnel Research, 1*, 319–328.
Fryer, D. (1931). Measurement of interests. New York, NY: Henry Holt.
Gasser, C. E., Larson, L. M., & Borgen, F. H. (2007). Concurrent validity of the 2005 Strong Interest Inventory: An examination of gender and major field of study. *Journal of Career Assessment, 15*, 23–43.
Goldberg, L. R. (1999). A broad-bandwidth, public-domain, personality inventory measuring the lower-level facets of several five-factor models. In I. Mervielde, I. Deary, F. De Fruyt, & F. Ostendorf (Eds.). *Personality psychology in Europe* (Vol. 7, pp. 7–28). Tilburg, The Netherlands: Tilburg University Press.
Goldberg, L. R., Johnson, J. A., Eber, H. W., Hogan, R., Ashton, M. C., Cloninger, C. R., et al. (2006). The International Personality Item Pool and the future of public-domain personality measures. *Journal of Research in Personality, 40*, 84–96.
Guilford, J. P., Christensen, P. R., Bond, N. A., & Sutton, M. A. (1954). A factor analysis study of human interests. *Psychological Monographs, 68*(375), 38.
Hansen, J. C. (1984). The measurement of vocational interests: Issues and future directions. In S. D. Brown & R. W. Lent (Eds.), *Handbook of counseling psychology* (pp. 99–136). New York: Wiley.
Harmon, L. W., Hansen, J. C., Borgen, F. H., & Hammer, A. L. (1994). Strong Interest Inventory applications and technical guide. Stanford, CA: Stanford University Press.
Holland, J. L. (1959). A theory of vocational choice. *Journal of Counseling Psychology, 6*, 35–45.
Holland, J. L. (1997). Making vocational choices (3rd ed.). Odessa, FL: Psychological Assessment Resources.
Holland, J. L., Fritzsche, B. A., & Powell, A. B. (1997). The Self-Directed Search technical manual. Odessa, FL: Psychological Assessment Resources.
Jackson, D. N. (1977). Manual for the Jackson Vocational Interest survey. Port Huron, MI: Research Psychologists Press.
Johnansson, C. B. (1986). Career assessment inventory: The enhanced version. Minneapolis: National Computer Systems.
Kornhauser, A. W. (1927). Results from a quantitative questionnaire on likes and dislikes used with a group of college freshmen. *Journal of Applied Psychology, 11*, 85–94.
Kuder, F. G. (1977). Activity interests and occupational choice. Chicago: Science Research Associates.
Manson, G. E. (1931). Occupational interests and personality requirements of women in business and the professions. *Michigan Business Studies, 3*, 280–409.
Mischel, W. (1968). Personality and assessment. New York: Wiley.
Ralston, C. A., Borgen, F. H., Rottinghaus, P. J., & Donnay, D. A. C. (2004). Specificity in interest measurement: Basic Interest Scales and major field of study. *Journal of Vocational Behavior, 62*, 203–216.
Ream, M. J. (1924). *Ability to sell. Personnel Research Series (II)*. Oxford, England: Williams and Wilkins.
Remmers, H. H. (1929). The measurement of interest differences between students of engineering and of agriculture. *Journal of Applied Psychology, 13*, 105–119.
Rounds, J. (1995). Vocational interests: Evaluating structural hypotheses. In D. J. Lubinski & R. V. Dawis (Eds.). *Assessing individual differences in human behavior: New concepts, methods, and findings* (pp. 177–232). Palo Alto, CA: Davies-Black.
Rounds, J., & Day, Susan X. (1999). Describing, evaluating, and creating vocational interest structures. In M. L. Savickas & A. R. Spokane (Eds.). *Vocational interests: Meaning, measurement, and counseling use* (pp. 103–133). Palo Alto, CA: Davies-Black.
Rounds, J. B., Jr., & Dawis, R. V. (1979). Factor analysis of strong vocational interest blank items. *Journal of Applied Psychology, 64*, 132–143.
Strong, E. K. (1926). An interest test for personnel managers. *Journal of Personnel Research, 5*, 194–204.
Strong, E. K. (1943). *Vocational interests of men and women*. Stanford, CA: Stanford University Press.
Zytowski, D. G. (2001). *Kuder career search: User's manual*. Adel, IA: National Career Assessment Services.