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Holland's Theory and Occupational Information

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Holland's (1997) RIASEC model is predicated on the assumption that appropriate vocational choices are a function of a successful match between an individual's vocational personality (e.g., Social) and the work environment (e.g., high interpersonal contact). Therefore, the use of the RIASEC model in career guidance requires a method for linking an individual's interests, operationalized as his or her RIASEC profile, to the occupational demands which must also be expressed in RIASEC codes. In this paper, we review the use of Holland's RIASEC model in career delivery systems and demonstrate how individual interests were linked to specific occupations in two large occupational information systems.

The world of work is diverse and dynamic. A variety of disciplines depend on accurate descriptions of thousands of occupations (Miller, Treiman, Cain, & Roos, 1980). These disciplines include labor economics, manpower planning, occupational forecasting, job analysis, compensation, and career guidance. In addition, market researchers rely on occupational information for market segmentation (Coleman, 1983). To meet their goals, many of these disciplines depend on occupational data sources and the associated retrieval systems. Large files of work-related information have been developed and maintained by various U.S. Government agencies including the Census Bureau, the Department of Labor, and the Department of Defense. Commercial enterprises and state governments have also developed or adapted occupational information data for use in career guidance and job placement.

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Historically, occupational information sources have been books. The Dictionary of Occupational Titles (DOT), U.S. Department of Labor publication (Employment and Training Administration, 1991) is the seminal and most well known source for occupational information. This book provides descriptions and information for over 12,000 occupations. Any source, such as the DOT, which seeks to be a comprehensive occupational information source, faces formidable challenges in remaining current (Miller et al., 1980). Occupations change over time due to technology and market forces. The advent of computers brought the golden age of occupational information systems. Computers permit the easy storage of large occupational data files. Software interfaces to the data files make the information readily accessible. As with book-based occupational information sources, computerized systems face challenges associated with occupational change over time, but a computerized source of occupational information may be updated and disseminated more easily than book data sources. Consistent with this trend toward computerized systems, the Department of Labor has recently released O*NET 98, a computerized occupational information source that replaces the DOT as the most current comprehensive source of information (Personal communication, Donna Dye, March 16, 1998).

Although occupational information sources are of benefit to researchers in a wide variety of disciplines, a primary applied use of these systems is in career guidance (Miller et al., 1980). Vocational counseling educates individuals concerning the world of work by providing information on occupations, encourages individuals to use information concerning occupations, and assists individuals in locating occupations that are consistent with their individual characteristics. Occupational information sources used in career guidance are often termed career information delivery systems. The primary users of such systems are high school and college students facing the transition from school to work. These students typically have access to these systems through the career guidance and placement offices of their schools. Adults seeking a career change also utilize occupational information systems. Career information delivery systems are frequently found in employment and training agencies, prisons, rehabilitation agencies, and libraries. Many states have their own career information delivery systems and there are also many non-profit and commercial vendors who offer such systems. The Association of Computer-Based Systems for Career Information offers a directory of computerized systems (Association of Computer-Based Systems for Career Information, 1998).

In career guidance, the relationship between an individual and an occupation is referred to as congruence (Gati, 1989; Osipow, 1987) and correspondence (Dawis & Lofquist, 1984). Congruence exists to the extent that a person matches his or her job in terms of some predefined characteristics. These characteristics are expressed in an isomorphic manner in both occupations and people. For example, people have varying levels of cognitive ability and jobs have varying levels of cognitive demands. Likewise, people vary in their occupational and life interests and occupations vary in their capacity to satisfy an individual's interests.

Career information delivery systems are designed to help individuals identify occupations which are congruent with their vocational personality. These delivery systems typically define congruency along multiple characteristics including interests, abilities, values, and education.

Holland's RIASEC model (Holland, 1997) is the primary interest model and has largely been incorporated into career information delivery systems for three reasons. First, Holland's RIASEC model is easy to understand and communicate. Most career information delivery systems are designed to be accessed by the user with little assistance from a career counselor or teacher. Thus, any interest model employed must be user-friendly for a wide range of individuals. The second reason for the predominance of the RIASEC model is the availability of well-developed yet inexpensive assessment tools that individual's can use to identify their interests. Two of the best known instruments are the Self-Directed Search (Holland, Powell, Fritzsche, 1994) and the Vocational Preference Inventory (Holland, 1985). The third reason for the dominance of the RIASEC model is the variety of information sources which link the RIASEC codes to specific occupations. The most complete information source is The Dictionary of Holland Occupational Codes (Gottfredson & Holland, 1996) which provides three letter RIASEC codes for occupations classified into a variety of occupational taxonomies, including Dictionary of Occupational Titles codes (Employment and Training Administration, 1991), Occupational Outlook Handbook codes (Bureau of Labor Statistics, 1996), Standard Occupational Classification codes (Office of Federal Statistical Policy Standards, 1980) and Classification of Instructional Programs codes (National Center for Education Statistics, 1991). A variety of research supports the description of occupations using RIASEC codes (Gottfredson, 1991; Gottfredson & Holland, 1996; Prediger & Vansickle, 1992; Tracey & Rounds, 1992).

There are at least 50 career information delivery systems, almost all of which incorporate the RIASEC taxonomy. In this paper, we review the implementation of the RIASEC into two of the most visible tools that can be used for career information delivery: The Department of Defense ASVAB Career Exploration Program (Department of Defense, 1992a) and the Department of Labor's new O*NET system (Department of Labor, 1998). We describe each system and detail how the RIASEC taxonomy has been integrated. These two systems were selected because they incorporated the RIASEC taxonomy in a systematic and rigorous manner and can thus be models to emulate. Furthermore, the two systems offer classic examples of methodologies often employed to link person characteristics to job demands. An additional consideration in the choice of the Department of Defense program is that it is the largest career guidance program in the United States, influencing the lives of more than one million youth per year. The O*NET system was included because it has been a major initiative of the Department of Labor. O*NET is a system for collecting, organizing, and disseminating occupational information. Although the O*NET developers do not consider the first official release of O*NET (O*NET 98) to be a career infor-

mation delivery system (personal communication, from Donna Dye, March 16, 1998), individuals can use it to explore occupations and developers of career information delivery systems can use it to enhance their products.

DEPARTMENT OF DEFENSE CAREER EXPLORATION PROGRAM

The Department of Defense ASVAB Career Exploration Program is a career guidance and military recruitment program offered free of charge to the high schools in the United States. The program is intended for use with students in the 10th, 11th, and 12th grades, as well as in postsecondary schools. Its origins date to 1968 when a military aptitude test, The Armed Services Vocational Aptitude Battery was first offered to the nation's schools. Over the years, this testing program evolved into a full-featured career guidance program. The current program is designed to provide support to schools by facilitating educational and career counseling for students. The program is also used to help the military services identify students with the potential to enter the military and for assignment to various military training programs (Department of Defense, 1992a).

The Department of Defense ASVAB Career Exploration Program consists of a variety of career guidance resources for schools and students (Department of Defense, 1992a). High school counselors are provided with a manual which describes the program, provides aides in the use of the program, and suggests a variety of supplemental career guidance activities that can be coordinated by the school counselor (Department of Defense, 1992a).

For the students, there are several assessment devices incorporated into the Department of Defense ASVAB Career Exploration Program. The first is the Armed Services Vocational Aptitude Battery. This test is the most widely-used multiple aptitude battery in the United States. The test is supported by norms based on a nationally representative sample of United States youths 16 to 23 years of age. A student workbook (Department of Defense, 1992b) provides the student with substantial interpretative guidance on their aptitude results. The remaining assessment devices are contained in this student workbook. The primary instrument in the workbook is an inventory to assess a student's interest in terms of the RIASEC taxonomy. The initial workbooks contained the Self-Directed Search. Later editions of the workbook contained a parallel form of the Self-Directed Search, called the Interest Finder (Wall & Baker, 1997; Wall, Wise & Baker, 1996). The students complete and score the interest inventory and are given substantial written guidance in the interpretation of their RIASEC scores. The workbook also helps the students self-assess their educational aspirations, their degree of interest in military occupations, and their primary work values. With respect to work values, the students are presented with definitions of 13 work values: challenge, creativity, helping others, income, independence, outdoor work, prestige, public contact, security, variety, working in a group, little physical activity, and physically challenging activity. Students are asked to identify up to 4 work values which they consider important (Department of Defense, 1992b).

The individual assessment instruments are linked to occupations using the OCCU-FIND, a four page worksheet listing more than 200 occupations. These occupations, which were selected to be representative of the full range of occupations, are displayed as columns on the OCCU-FIND worksheet. The assessment variables, which include a summary aptitude score, RIASEC codes, educational aspirations, military occupation interest, and work values, are represented in rows. Congruence between occupations and assessment variables are represented by stars printed in latent-image ink which is initially invisible to the student. Students receive a special pen to highlight the rows of the worksheet that correspond to their assessment results. For example, if a student's RIASEC codes were ECR, he or she would highlight the three rows corresponding to E, C, and R. The highlighting develops the latent-image ink, revealing stars. The more stars that are visible for an occupation, the greater the probability of congruence between that occupation and the student. Students are encouraged to explore careers for which many stars are visible.

The implementation of the RIASEC into the Department of Defense ASVAB Career Exploration Program required the assessment of both individuals and occupations within the RIASEC model. The assessment of students was straightforward. The student completed an inventory which assessed their interest within the RIASEC framework. The assessment of the occupations with respect to RIASEC was a more complicated process. The information presented here concerning occupational linkages is based on the senior author's knowledge of the process gained from participating in the project. No account of the development of the classification has been published.

Occupations can be defined at various levels of aggregation. For example, the Dictionary of Occupational Titles describes many types of engineers ranging from aeronautical-design engineers to waste-management engineers. This level of detailed occupational differentiation can serve many purposes but it is generally ill-suited for initial stages of career explorations. The occupations presented in the Career Exploration Program are at a higher level of aggregation. For example, the OCCU-FIND listed "engineer" as the sole engineering occupation. To obtain RIASEC codes for the OCCU-FIND occupations, the developers identified the DOT occupations subsumed under the more general OCCU-FIND occupations and then used the Dictionary of Holland Occupational Codes to identify the primary RIASEC code for these subsumed Dictionary of Occupational Title occupations. An initial primary RIASEC code assignment was made for each OCCU-FIND occupation by identifying the most frequent primary RIASEC code among the subordinate Dictionary of Occupational Title occupations. This effort involved a data file associated with an early edition of the Dictionary of Holland Occupational Codes (Gottfredson & Holland, 1996). These initial codes were then reviewed by a panel of occupational experts familiar with the RIASEC taxonomy who through consensus derived the final primary RIASEC code to be assigned to the occupation. This primary RIASEC category was the sole RIASEC code used in the assignment of OCCU-FIND occupations to the RIASEC taxonomy.

When the Department of Defense ASVAB Career Exploration Program switched from using the Self-Directed Search to it own interest measure, it re-established its RIASEC linkages to the OCCU-FIND occupations (personal communication from Alan Nicewander, March 11, 1999; personal communication from Janet Wall, March 19, 1999). A panel of raters were formed for this purpose. All panel members were recognized experts in either career counseling or job analysis and all were very familiar with Holland's RIASEC taxonomy. The raters were asked to identify the RIASEC high point code for each OCCU-FIND occupation. Although rater agreement statistics were not available to these authors, near perfect agreement was reported.

For the new RIASEC occupational linkages, three lines of concurrent validity evidence were offered. First, the codes agreed substantially with those reported in the technical manual of the Position Classification Inventory (Gottfredson & Holland, 1991), a job analysis instrument used to assign RIASEC codes to occupations. Second, the codes were also in substantial agreement with codes reported in the Strong Interest Inventory (Harmon, Hansen, Borgen, Hammer, 1994). Third, the Position Classification Inventory was completed by multiple incumbents in several OCCU-FIND occupations. Those Position Classification Inventory results were consistent with the RIASEC occupational assignments made by the judges (Personal communication from Janet Wall, March 19, 1999).

DEPARTMENT OF LABOR O*NET SYSTEM

For over 60 years, The U.S. Department of Labor has developed and maintained the Dictionary of Occupational Titles (Employment and Training Administration, 1991). Their efforts have been appreciated by many. In a review organized by the National Research Council, the authors concluded that there is a substantial need for the types of information provided in the Dictionary of Occupational Titles (Miller, Treiman, Cain, & Roos, 1980). However, the same report also concluded that the Department of Labor should improve its work procedures and products to more fully meet the needs for occupational information. In recognition of the needs to improve the quality of occupational information, The Department of Labor has begun the development of a replacement for the DOT. This replacement is the Occupational Information Network which is more frequently known as O*NET. O*NET 98 is the first official release of O*NET. This O*NET product is an occupational information file with a user-friendly interface permitting a variety of occupational searches for career exploration and other applications.[1]

The O*NET system is organized around a content model shown in Fig. 1. The

[1] In this paper, we describe O*NET as a useful tool for career information delivery. The O*NET web site (http://www.doleta.gov/programs/onet/) presents text suggesting that O*NET can serve the needs of students exploring career options, people changing jobs, as well as career and rehabilitation counselors. Thus, its classification as a career information resource is warranted. However, the O*NET developers noted that the O*NET was not designed to be a career information delivery system but is a broader-based system for collecting, organizing, and disseminating occupational information (Donna Dye, personal communication, March 16, 1999).

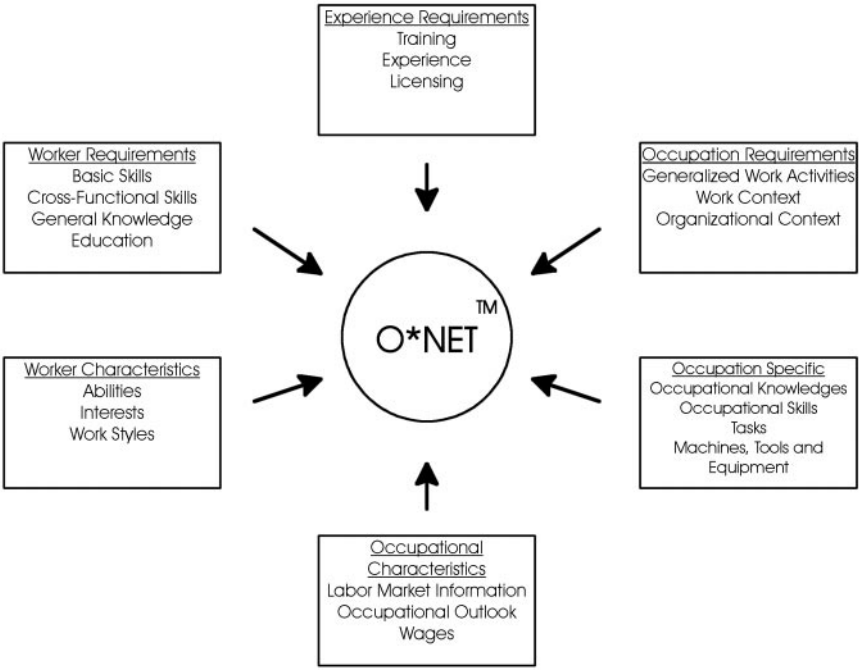

FIG. 1. The O*NET Content Model. *Adapted from http://www.doleta.gov/programs/onet/database.htm. February 1, 1999.*

primary content areas in the model are worker characteristics, worker requirements, experience requirements, occupation requirements, occupation specific information, and occupation characteristics. Within worker characteristics, lie the individual attributes of abilities, interest, and work values (Department of Labor, 1998). As with any large project, the O*NET is evolving in stages. Three versions of O*NET have been developed (personal communication from Donna Dye, March 16, 1999). An O*NET prototype was developed by American Institutes for Research (Peterson, Mumford, Borman, Jeanneret, & Fleishman, 1995) but was never released by the Department of Labor. An O*NET beta version was released in December, 1997. The first official release of O*NET, O*NET 98, was released in December, 1998. Sager (1997) described the approach used to link the RIASEC codes to the O*NET occupations in the prototype of O*NET. In this prototype, the Occupational Employment Statistics (OES) occupation (Bureau of Labor Statistics, 1996) RIASEC codes were taken from the Holland Dictionary of Holland Occupational Codes (Gottfredson & Holland, 1996).

Central to the O*NET system is the replacement of the DOT with a more general set of Occupational Units (OUs). That is, the occupational demands listed in the O*NET content model (see Fig. 1) are directly linked to one of the 1172

OUs rather than to one of the 12,798 jobs listed in the DOT. Thus, in order to successfully link vocational personalities to the work environments in the O*NET system, RIASEC codes must be assigned to each of the OUs.

The implementation of the RIASEC model in the O*NET 98 release is described by Rounds et al. (1998). This document also describes how the interest component of the O*NET is planned to unfold. Rounds pursued three approaches to link the O*NET Occupational Units to Holland's RIASEC codes. Although the first two procedures utilized a discriminant function analysis and therefore reflect empirical linkages, all three approaches were based on careful, but subjective, evaluations of how various occupations reflect the RIASEC codes.

The first method used by Rounds et al. (1998) to link RIASEC constructs to occupations was reported to be similar to that used by Gottfredson and Holland (1996) in the building of the Holland Dictionary of Occupational Codes. In this method, the first-letter high-point RIASEC code was assigned to a sample (2796) of the 12,798 occupations listed in the DOT by three trained raters. The overall agreement rate for assigning the first-letter, high-point code was 76.82%. In the end, 2128 occupations, which could be reliably assigned to a single RIASEC category, served as the development sample. The purpose of the discriminant function analysis was to generate classification equations which would best separate the set of occupations assigned to the different RIASEC categories using various predictor variables (worker functions, general educational development, aptitudes, temperaments, GOE codes, physical demands, and environmental conditions). Thus, the stepwise analysis first identified the variables which were most necessary for differentiating the occupations delineating the separate RIASEC categories.

Using the classification equations generated from the development sample, the remaining set of occupations were classified into the RIASEC categories. During this classification process, the profile of information from a single unclassified occupation was applied to each of the equations defining the RIASEC categories. This comparison resulted in a set of posterior probabilities for each occupation belonging to each RIASEC category. These posterior probabilities represent the probability that each occupation belongs to the specific RIASEC category. Larger posterior probabilities indicate a stronger link between the occupation and a particular RIASEC category. Thus, each occupation was assigned the high-point RIASEC code which corresponded to the highest posterior probability. The second and third-letter RIASEC codes were summarily determined from the second and third highest posterior probabilities, respectively. In order to obtain the second and third-letter RIASEC codes for occupations used in the development sample, these classified occupations were re-classified with the equations delineating the RIASEC categories.

Since the O*NET system was based on a more general categorization of occupations, Occupational Units (OUs), the occupational-level RIASEC codes had to be cross-linked to the smaller set of Occupational Units. This was accomplished by simply aggregating the occupations according to their appro-

priate OU and then averaging the posterior probabilities within an OU to obtain the corresponding three-letter RIASEC code.

In the second method, this DOT-to-OU crosslinking procedure was re-routed to the front end of the process so that the initial development of the RIASEC categories was based on ratings by three trained experts of the 1172 occupational units (OUs). For all OUs, there was an agreement rate of 71.25%. The development sample consisted of 828 OUs which had been reliably assigned a first-letter RIASEC category. The stepwise discriminant function analysis was then used to identify the subset of variables necessary for classification and create the classification functions. These classification equations were applied directly to the remaining unclassified OUs, and the original OUs in the development sample, to create posterior probabilities reflecting each Occupational Unit's congruence with each RIASEC category.

Rounds et al. (1998) identified a key concern for the O*NET discriminant analyses. For each analysis, the highest probability associated with one of the six RIASEC categories approached 1.0. For example, in the DOT analysis, the probabilities for the most predictive function were over .99 for over 79% of the occupations. For that large group of occupations, there was a probability of .01 or less to be apportioned to the remaining 5 RIASEC categories. This result means that the high point RIASEC code could be assigned with great certainty but that the remaining codes could be assigned with very little certainty. This situation is not problematic for occupation linkages for single character high codes for the RIASEC framework, but it is very problematic for assigning 3 letter codes to occupations. As seen below, it would also prove very problematic for the O*NET developers who sought to break new ground in the linkage of occupations to RIASEC constructs.

Department of Labor O*NET decision makers sought to develop occupational linkages to all 6 RIASEC constructs and not just link a single high letter code or the 3 highest letter codes. Specifically, for each O*NET occupation, an interest profile consisting of six numerical scores, each reflecting the degree to which an occupation was associated with *each* of the six RIASEC constructs, was created. To achieve this goal of a six-letter RIASEC code, Rounds et al. (1998) pursued a third approach for relating the RIASEC categories to O*NET occupations which relied exclusively on the judgement of expert raters. Specifically, trained raters judged the congruence between each of the 1172 Occupational Units and each RIASEC category on a 1 (not at all characteristic) to 7 (extremely characteristic) rating scale. These ratings yielded a Goodman-Kruskal Gamma coefficient of .81 indicating high inter-rater agreement. For each OU, an averaged RIASEC rating was translated into a proportion by dividing it by the sum of all 6 RIASEC rating means.

Thus, for each occupation, both an ordered six-letter RIASEC code and a six number profile was developed. However, it was decided that only those RIASEC categories with mean proportions greater than .17 would be presented in the Occupational Interest Profile. Typically, this resulted in all profiles having three

(or fewer) RIASEC categories. Since these rating proportions resulted in less extreme probabilities than discriminant analysis, Rounds concluded that the judgement method for assigning RIASEC codes to occupations yielded a more reasonable profile for counseling and research.

SUMMARY OF O*NET METHODS

Given that O*NET policy makers decided to pursue a six code numeric linkage between O*NET occupations and the RIASEC constructs, Rounds et al.'s (1998) first two approaches using discriminant function analysis were not useful. For most O*NET occupations, the discriminant function analysis could only assign a single high code with any confidence. Although Rounds et al. could use the discriminant functions to link the remaining 5 RIASEC constructs with the O*NET occupations, the probabilities associated with those functions were so low that there is little reason to expect that the linkage of the second through sixth Holland constructs would have much reliability or validity.

To meet the needs of the O*NET policy makers, Rounds et al. (1998) relied on a pure rating approach to assign RIASEC codes to the Occupational Units used in the O*NET program. The training offered the expert raters, as well as the procedures for resolving rater discrepancies, demonstrated a clear recognition of the need for good reliability of ratings. Rounds also offered validity evidence of this rater method by demonstrating that the RIASEC classifications were congruent with the Holland coded profiles (Office of Employment Statistics) and the Strong Interest Inventory profiles. Rounds also conducted several analyses in an effort to determine the degree to which each of the three methods produced a structure that was congruent with Holland's circular-order model. Since Rounds consistently found that the rater-based method produced a classification that was more interpretable than the other two approaches, they concluded that this pure judgement method was superior.

Rounds et al. (1998) offered four reasons why a six-construct numeric profile might be viewed as superior to a category profile such as three letter codes used so frequently with the RIASEC taxonomy. First, a numeric profile permits the assessment of the degree of fit between a person and an occupation. Second, the numerical profile can easily be converted into a categorical code. Third, a numeric code is adaptable such that it can accommodate different cut-off rules for whether an occupation fits an individual or whether a particular RIASEC construct is linked to a job. Fourth, a numeric code contains more information than a categorical code.

We are less convinced about the clear superiority of a numeric profile over the traditional categorical linkages than Rounds et al. (1998) for three reasons. First, a categorical RIASEC code is a reasonable way of assessing fit between a person and an occupation and it is unclear whether the quantification of the fit that results from a numeric profile will have much meaning for an individual pursuing career exploration. Second, the fact that a numeric profile can be converted into a categorical code does not make the numerical profile preferred. Third, the

argument that a numeric code contains more information than a categorical code is not a compelling argument unless this additional information is shown to have value for some application. However, we do appreciate Rounds' argument that a numeric code makes it easier to adjust decisions rules (e.g., cut-off scores) concerning person-occupation fit or the extent to which an occupation reflects a RIASEC construct. These adjustable decision rules may be particularly useful in computer-based information delivery systems. For example, a user who is overwhelmed by the number of occupations that fit her interests could adjust the interest matching criteria to further limit the number of occupations to be explored.

CONCLUSION

This special issue has repeatedly noted the substantial research supporting Holland's model and has highlighted many of the important applications of his vocational theory. In this paper, the importance of Holland's work has been indicated by the near universal acceptance of the Holland interest taxonomy in career-oriented occupational information systems. The paper has reviewed the methods by which two major career information systems have incorporated the RIASEC model. It has also highlighted the technical challenges faced by those who seek to link the RIASEC taxonomy to occupations.

REFERENCES

Association of Computer-Based Systems for Career Information (1998). *1998 Directory of state-based career information delivery systems.* Alexandria, VA: Author.

Bureau of Labor Statistics. (1996). *Occupational outlook handbook.* Washington, DC: U.S. Government Printing Office.

Coleman, R.. (1983, December). The continuing significance of social class to marketing. *Journal of Consumer Research,* pp. 265–280.

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

Department of Defense (1992a). *Counselor manual for the Armed Services vocational aptitude battery forms18/19.* Monterey, CA: Author.

Department of Defense (1992b). *Exploring careers: The ASVAB workbook.* Monterey, CA: Author.

Department of Labor (1998). *O*NET 98 viewer users's guide for version 1.0.* Washington, DC: U.S. Government Printing Office.

Division of Occupational Analysis, United States Employment Service, Employment and Training Administration, U.S. Department of Labor (1982). *A guide to job analysis: A 'how-to' publication for occupational analysis.* Washington, DC: Author.

Dye, D. (1999, March 16). Personal communication.

Employment and Training Administration. U.S. Department of Labor (1991). *Dictionary of occupational titles* (4th ed., 2 vol.). Washington, DC: U.S. Government Printing Office.

Gati, I. (1989). Person–environment fit research: Problems and prospects. *Journal of Vocational Behavior,* **35,** 181–193.

Gottfredson, G. D., & Holland, J. L. (1991). *Position Classification Inventory professional manual.* Odessa, FL: Psychological Assessment Resources.

Gottfredson, G. D. (1991, April). *Using the Holland occupational-environmental classification in research and practice.* Paper presented at the American Educational Research Association, Chicago.

Gottfredson, G. D., & Holland, J. L. (1996). *Dictionary of Holland occupational codes*. (3rd ed.). Odessa, FL: Psychological Assessment Resources, Inc.

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

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

Miller, A. R., Treiman, D. J., Cain, S., & Roos, P. A. (1980). *Work, jobs, and occupations: A critical review of the Dictionary of Occupational Titles.* Washington, DC: National Academy Press.

National Center for Education Statistics, U.S. Department of education. (1991). *A classification of instructional programs* (1990 ed.). Washington, DC: U.S. Government Printing Office.

Nicewander, A. (1999, March 11). Personal communication.

Office of Federal Statistical Policy and Standards, U.S. Department of Commerce. (1980). *Standard occupational classification manual.* Washington, DC: U.S. Government Printing Office.

Osipow, S. H. (1987). Applying person–environment theory to vocational behavior. *Journal of Vocational Behavior*, **31,** 333–336.

Peterson, N. G., Mumford, M. D., Borman, W. C., Jeanneret, P. R., & Fleishman, E. A. (1995). *Development of Prototype Occupational Information Network (O*NET) Content Model.* Utah: Utah Department of Workforce Services).

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

Rounds, J., Smith, T., Hubert, L., Lewis, P., & Rivkin, D. (1998). *Development of Occupational Interest Profiles (OIPs) for the O*NET.* Unpublished manuscript.

Sager, C. E. (1997). Occupational interest and values: Evidence for the reliability and validity of the occupational interest codes and the values measures. In N. G. Peterson (Ed.), O*NET final technical report. Volume I. Utah: Utah Department of Workforce Services.

Tracey, T. J., & Rounds, J. (1992). Evaluating the RIASEC circumplex using high-point codes. *Journal of Vocational Behavior*, **41,** 295–311.

Wall, J. (1999, March 19). Personal communication.

Wall, J. E., & Baker, H. E. (1997). The interest-finder: Evidence of validity. *Journal of Career Assessment*, **5,** 255–273.

Wall, J. L., Wise, L. L., & Baker, H. E. (1996). Development of the Interest-Finder: A new RIASEC-based interest inventory. *Measurement and Evaluation in Counseling and Development*, **29,** 134–152.

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