

Development of the O*NET™ Interest Profiler

**Phil Lewis and David Rivkin
National O*NET Consortium**



**National Center for O*NET Development
Employment Security Commission
Post Office Box 27625
Raleigh, North Carolina 27611
e-mail: onet@ncmail.net**

1999

Table of Contents

	Page
<i>Acknowledgments</i>	iii
Introduction	1
Phase 1: Review of Existing DOL Instruments	3
Phase 2: Review/Revision/Tryout of Existing Items	3
Initial Pilot Study	3
Phase 3: Item Taxonomy Development	4
Work Content Area Development	4
Training Level Development	5
Item Type Selection	5
Taxonomy Targets	6
Phase 4: Placement of Retained Items/Creation of New Items	6
Placement of Items	6
Development of New Items	6
Pilot Study	7
Phase 5: Item Screens	7
Retranslation	7
Sensitivity	8
Comprehensibility	8
Familiarity	8
Training Requirement	9
Duplication	9
Copyright	9
Phase 6: Item Tryout and Scale Development	10
Sampling Plan	10
Participants	10
Procedures	11
Item Analyses	11
Scale Analyses	11
Characteristics of Scales/Instrument	12
Taxonomy Coverage	12
Psychometric Characteristics	13
Gender and Race/Ethnic Bias	13
Phase 7: Format Design	14
Item Response Format	14
Instrument Layout	15
Client Feedback on Instrument Layout	15
Next Steps	16
<i>References</i>	17

Table of Contents (continued)

	Page
<i>Tables</i>	19
Table 1: Interest Profiler and Interest-Finder Scale Means, Standard Deviations, Coefficient Alphas, and Scale Intercorrelations	20
Table 2: Subgroup Score Overlap for the O*NET Interest Profiler and Interest-Finder Scales	21
<i>Figures</i>	25
Figure 1 Overview of the Interest Profiler Taxonomy, Version 3.0	26
Figure 2 Overview of the Modified Specific Vocational Preparation Scale (MSVP)	28
Figure 3 Familiarity Screen Rating Scale	29

Acknowledgments

The O*NET Interest Profiler was produced and funded by the O*NET project of the U.S. Department of Labor, Employment and Training Administration, Office of Policy and Research (OPR) under the direction of Gerard F. Fiala, Administrator. The O*NET project is directed by Jim Woods, Office of Policy and Research, and Donna Dye, Office of Workforce Security.

The instrument was created through Department of Labor grants with the National O*NET Consortium, National Center for O*NET Development; the North Carolina Employment Security Commission, Southern Assessment Research and Development Center; the Utah Department of Employment Security, Western Assessment Research and Development Center; the New York Department of Labor, Eastern Assessment Research and Development Center; and the Michigan Employment Security Commission, Northern Assessment Research and Development Center.

The development of the O*NET Interest Profiler was directed by Phil Lewis and David Rivkin. Eight research phases were conducted in support of the development of the instrument, each of which required multiple steps and the participation of a wide variety of staff, contractors, and pilot sites. Grateful acknowledgment for their prominent roles in this process is made to Jeannie Stroupe, Dr. James Rounds, Ann Kump, Diana Williams, Ronald Boese, Dr. Brian Young, Helen Tannenbaum, Maureen Mendick, Brenda Dunn, and Jerry Pickett. A special thanks is given to Dr. René V. Dawis for the technical contribution and guidance he provided at the conception of and throughout the project.

Introduction

The O*NET Interest Profiler (IP) is a new vocational interest assessment measure. It is one of the U.S. Department of Labor's (DOL) O*NET Career Exploration Tools. The tool serves as a replacement for the USES Interest Inventory (U.S. Department of Labor, 1981) and the Interest Checklist (U.S. Department of Labor, 1979b). Using the IP, clients receive accurate, reliable profiles of their vocational interests. These profiles enhance self-knowledge and career awareness, and they directly link the client to the entire world of work through more than 900 occupations referenced within O*NET.

The O*NET Interest Profiler is based on the most up-to-date knowledge of vocational theory and practice. The instrument is composed of 180 items describing work activities that represent a wide variety of occupations as well as a broad range of training levels. It measures interest areas that are compatible with Holland's (1985a) R-I-A-S-E-C constructs: Realistic, Investigative, Artistic, Social, Enterprising, and Conventional. The RIASEC typology is grounded in a rich and extensive research history, is widely accepted and used by counselors, and is well received by clients when used in either automated or paper-and-pencil inventories.

This report describes the initial research conducted by the National Center for O*NET Development to develop the O*NET Interest Profiler. This research was sponsored by the U.S. Department of Labor's Office of Policy and Research.

Four primary goals were addressed in developing the O*NET Interest Profiler:

- 1) Create an instrument that reliably and accurately measures the Holland (1985a) typology. Steps were built into the process to create items with strong psychometric characteristics, to develop reliable scales, to gather evidence of measurement and construct validity, and to design an instrument format that clients could understand and score accurately.
- 2) Develop a fair and unbiased instrument. This was critical. DOL, along with its umbrella agencies and initiatives, provides career-related assistance to a broad range of individuals. A strong effort was made to minimize the likelihood of the instrument offending any individuals or leading to restrictive career options for particular subgroups. Steps were included to ensure that language and content was inoffensive and familiar to the population of client users. In addition, the endorsement rates of items were closely examined throughout the process in an attempt to reduce spurious group differences, providing individuals with a balanced opportunity to identify each interest area.
- 3) Provide clients with examples of work activities representing the entire world of work. A detailed taxonomy was developed to ensure that a variety of occupations and training-level requirements were included in the instrument.
- 4) Develop a self-administered, self-interpreted instrument. Due to the reduction in the number of counselors in the field, a goal was to develop an instrument that could

help clients make career exploration decisions on their own or with little outside assistance.

This report includes a description of the first seven phases of the O*NET Interest Profiler's development process:

- 1) Review of Existing DOL Interest Instruments,
- 2) Review/Revision/Tryout of Existing Items,
- 3) Item Taxonomy Development,
- 4) Placement of Retained Items/Creation of New Items,
- 5) Item Screening Process,
- 6) Item Tryout and Scale Development, and
- 7) Format Design.

An eighth phase of research focused on the reliability, validity, and scoring aspects of the instrument (see Rounds, Walker, Day, Hubert, Lewis, and Rivkin, 1999).

The following sections describe the purpose, major steps, and outcomes of each development phase.

Phase 1: Review of Existing DOL Instruments

Before initiating the development of the O*NET Interest Profiler, DOL's existing interest instruments, including the U.S. Employment Service (USES) Interest Inventory (U.S. Department of Labor, 1981), the Interest Checklist (U.S. Department of Labor, 1979b), and the Job Search Inventory (New York State Job Service, 1985), were reviewed as possible candidates for inclusion in the new DOL interest instrument. It was concluded that these instruments have several shortcomings, including:

- 1) a proportion of items that contained dated language and content,
- 2) scoring systems not easily transferred to self-assessment settings,
- 3) a lack of adequate data on important psychometric characteristics (e.g., reliability, validity), and
- 4) interpretation and client feedback that is *not* based on the latest developments in vocational interest theory, measurement, and research.

While none of the instruments merited use in its entirety, all three contained items that represented a wide variety of work activities. In addition, many of the items were in a format that could be compatible with the new instrument. Therefore, the three instruments' items were pooled together and used as the initial starting point for the development of the O*NET Interest Profiler.

Phase 2: Review/Revision/Tryout of Existing Items

The purpose of this development phase was to identify existing items that could be included in the new instrument. A pool of 453 items was drawn from the USES Interest Inventory, the Interest Checklist, and the Job Search Inventory. Four judges with experience in test development were trained in Holland's (1985a) vocational personality theory and the taxonomy. The judges reviewed the items. Items were removed or made candidates for revision based on the following set of criteria: 1) biased or offensive to individuals or subgroups, 2) non-work activity items (e.g., job titles, life experiences), 3) dated work activities, 4) work activities with an extremely narrow focus, 5) obsolete language, and 6) duplicate items.

As a result of the item review, 281 existing items were retained. In addition to removing items, judges were encouraged to make revisions to items based on the criteria listed above and also to modify items in order to include additional examples of work activities. As a result, 288 new items were created, leading to a pool of 569 items.

Initial Pilot Study

The pool of 569 items was subjected to a small pilot test to examine the items' endorsement rates. A total of 128 individuals from high schools, employment service

offices, and other state agencies participated. Individuals were paid \$15 to reimburse them for travel expenses. The sample was fairly heterogeneous in terms of gender (43 male participants, 74 female participants), age (14 to 73), and employment status (79 full-time employed workers, 22 students, 19 unemployed workers)¹. There was, however, a very low representation of minority groups (112 White Non-Hispanics, 16 all other groups combined). Endorsement rates of items were reviewed. Items with extreme means or large gender differences were removed or made candidates for revision. The primary reason for deleting items, however, was the comparison of endorsement rates for items with similar content (i.e., the item with similar content, but a more extreme endorsement rate, would be eliminated). After this initial pilot study, a pool of 532 items was retained.

Phase 3: Item Taxonomy Development

A taxonomy was created to provide structure to the process of developing and selecting items for the IP, helping to ensure that a variety of items representing the world of work would be included in the final instrument (see Figure 1). Once the taxonomy was developed, the pool of items generated from Phase 2 would be placed into the structure. Then, areas within the taxonomy that did not have enough items would be identified, indicating that new items would have to be developed.

The six RIASEC constructs served as the over-arching structure of the taxonomy. Within each RIASEC construct, work content areas were identified. In addition, five levels of training requirement were described and served as a target within each construct. Finally, work activity statements were used as the stimulus or item type to gather interest information. Each of these steps is described below.

Work Content Area Development

The purposes for the work content areas were: 1) to provide additional structure and definition to each construct and 2) to ensure that a wide variety of work activities was represented within each construct.

A range of 8 to 20 work content areas was assigned to each RIASEC construct. Work content areas were primarily based on the 66 Work Groups present in the *Guide for Occupational Exploration* (GOE; U.S. Department of Labor, 1979a). The GOE Work Group structure was selected for the starting point of this stage of the taxonomy development because of its extensive coverage of the world of work, along with its well developed work definitions and examples.

¹ There are cases of missing data. Thus, totals do not equal 128, the total sample size for the initial pilot test.

Four judges with expert knowledge of the GOE were trained in Holland's (1985a) vocational personality theory. Judges independently attempted to assign each of the 66 Work Groups to one RIASEC construct. All assignments with less than 100% rater agreement were flagged and discussed until consensus was reached. Jones' (1980) description of the relationship between Holland codes and GOE Work Groups served as an additional source of information.

Modifications of the GOE Work Group structure were necessary in order to have work content areas that: 1) fit under one RIASEC construct, 2) covered the work activities of the current world of work, and 3) contained up-to-date descriptions of work activities. Changes to the structure included: altering the titles and/or definitions of some Work Groups, removing some Work Groups, and creating additional Work Groups (as shown in Figure 1). A total of 68 work content areas was assigned to the six RIASEC constructs.

Training Level Development

The purpose of the five training-level requirements was to increase the likelihood that interest items describing work activities with a variety of complexity were represented within each RIASEC construct. The training levels were derived from the Specific Vocational Preparation scale (SVP; U.S. Department of Labor, 1991). The original 9-point scale was collapsed into 5 broad levels that are more conducive to training level requirement's role in the taxonomy (see Figure 2). As Figure 2 indicates, the 5-point training level scale ranges from *up to and including 6 months* of training (1) to *over 4 years* of training (5). This covers the broad range of preparation required for occupations throughout the world of work.

Item Type Selection

Items for the O*NET Interest Profiler were written as work activity statements. Prior to this decision, a wide variety of other item types were considered, including descriptions of: 1) training, 2) experience, 3) occupational titles, and 4) general activities (i.e., non work-related). Training and experience statements were not included because they would conflict with the content and purpose of the O*NET Job Zone (see Oswald, Campbell, McCloy, Rivkin, and Lewis, 1999). The O*NET Job Zone is a career counseling aide designed to help clients identify occupations with requirements that match their current or projected levels of education, training, and job experience. Occupational title statements were not used due to concerns about their susceptibility to stereotypes and impressions, which could lead to greater endorsement rate differences between gender and race/ethnic groups. Finally, general activity statements were not included because of their lack of a direct connection to the world of work. Work activity statements were selected because they appeared to be free from the problems associated with the other possible item types and they could easily be related to the workplace.

Taxonomy Targets

The final goal was to create an instrument with a total of 180 items, with each RIASEC construct measured by 30 items. This number of items was selected because of both practical reasons (i.e., the length of time it would take to complete the instrument) and technical concerns (i.e., adequate and reliable measurement of each construct). It was estimated that a large number of items would either fail to pass the item screen phase or would not be retained after the item tryout/scale development phase of the instrument's development process. Therefore, a high target number of items was established for each RIASEC construct within the taxonomy.

A minimum of 100 items per construct, with equal representation within each work content area, served as the target during item development. The target number of items per work content area was dependent on the RIASEC construct, due to the varying number of work content areas within each RIASEC construct. For example, there was a minimum goal of five items for each of the 19 work content areas within the Realistic construct, while there was a minimum goal of 13 items for each of the 7 work content areas within the Social construct.

Phase 4: Placement of Retained Items/Creation of New Items

Placement of Items

Each of the 532 items in the pool derived after the initial pilot study was placed within the taxonomy. A team of four judges was trained in Holland's (1985a) vocational personality theory and the taxonomy. Judges reviewed the items and independently assigned them to one of the work content areas within a RIASEC construct. Assignment disagreements were flagged, discussed, and resolved. In addition, the assignment of items that had retained their original form (i.e., analogous to an item within one of the three existing DOL interest instruments) was compared to original GOE Work Group designations. Agreement was extremely high, with the few discrepancies being resolved by the team of judges.

Development of New Items

Areas within the taxonomy that did not meet the taxonomy goals (i.e., did not have enough items) were identified. New items were needed to fill these identified areas. A team of four item writers were trained in Holland's (1985a) vocational personality theory and the taxonomy. Each item writer was requested to write new items that met the following criteria:

- 1) filled in areas of the taxonomy that did not meet minimum goals,
- 2) were descriptions of work activities,
- 3) increased the representation of training-level requirement found within the RIASEC construct,
- 4) were inoffensive to individuals and subgroups,

- 5) contained vocabulary comprehensible to individuals with an eighth grade reading level,
- 6) would elicit an endorsement rate that falls between 10 percent and 90 percent,
- 7) would likely reduce spurious gender and race/ethnic endorsement rate differences, and
- 8) would be familiar to individuals from a variety of settings, including: a) entry level and career transition counseling settings; b) urban, rural, and suburban settings; and c) nationwide regional settings. All new items were reviewed and edited by the team of item writers.

Pilot Study

A total of 272 new items was developed, resulting in a pool of 804 items. These items were subjected to a small pilot test. The primary purpose of this study was to examine endorsement rates and eliminate items with duplicate content. A total of 147 individuals from employment service offices and other state agencies participated. Individuals were paid \$15 to reimburse them for travel expenses. The sample was fairly heterogeneous in terms of gender (61 male participants, 86 female participants), minority representation (98 White Non-Hispanics, 49 all other groups combined), age (14 to 66), and employment status (61 full-time employed workers, 58 unemployed workers, 21 students). Endorsement rates of items were reviewed. Items with extreme means, large gender differences, or large race/ethnic differences were removed. The primary source of item deletions, however, was the comparison of endorsement rates for items with similar content. For example, if there were two items covering the same content, the item with more equivalent subgroup endorsement rates was retained. After this second pilot study, a pool of 776 items existed.

Phase 5: Item Screens

The pool of 776 items was subjected to a comprehensive screening process designed to remove items that failed to meet the rigorous standards for inclusion in the O*NET Interest Profiler. Each item was required to pass the seven screens presented below to be included in the next phase of the instrument development.

Retranslation

This screen was conducted to ensure that items truly represented their intended RIASEC construct. Five expert judges in Holland's (1985a) vocational personality theory received a pool of items with no indication of the construct or work content area each item was intended to represent. Judges independently assigned each item to a RIASEC construct. The following sub-pool of items was identified and discussed by the team of judges:

- 1) items for which less than four of the five judges agreed on assignment,
- 2) items for which the assignment made by the judges conflicted with the construct the items were intended to represent, and

- 3) items which one or more judges identified as problematic.

Judges discussed assignment differences, recommended item alterations, and finalized all ratings. Items for which at least four of the five judges agreed on assignment were retained.

It was determined that three work content areas (Barber & Beauty Services: 9.02, Computer Technology: 2.05, Safety & Law Enforcement: 4.01) represent work activities present in multiple RIASEC constructs. For example, Barber & Beauty Services - 9.02 was placed in both the Social and Enterprising constructs. The taxonomy was adjusted accordingly, leading to a total of 71 work content areas (see Figure 1, work content areas identified with an R).

Sensitivity

The purpose of this screening was to ensure that items would not be offensive to particular segments of the potential user population. A panel of six individuals representing diverse race/ethnic and gender groups was convened. The protocol for the screen was derived from guidelines developed by the Educational Testing Service (1987), along with a review of the sensitivity procedures used in the development of the O*NET Ability Profiler (Mellon, Daggett, MacManus, and Moritsch, 1996).

Panel members reviewed each item for possible bias against or offensiveness to racial, ethnic, or gender groups. The panel concluded with a list of suggested item revisions and deletions that were incorporated within the item pool.

Comprehensibility

The estimated range of education for potential client users of the O*NET Interest Profiler begins at the junior high school level; thus, items must be comprehensible to these users. An eighth grade reading level was selected as the goal for the items. *The Living Word Vocabulary* (Dale and O'Rourke, 1981) was used to determine the grade level appropriateness of the vocabulary present in each item. Two sets of inspectors independently identified the grade level assigned to all words present in the pool of items. Agreement between the two sets of inspectors was extremely high, with the few discrepancies being resolved by re-examining the particular words in question.

All items with words exceeding an eighth grade level were identified. For each of these items, one of the following actions was taken: 1) inappropriate grade-level words were replaced with synonyms with a lower grade-level designation, 2) items were entirely rewritten, or 3) items were left intact (i.e., identified word was reviewed by a team of four judges who determined that there was not a suitable, more effective replacement).

Familiarity

The work activities described by the items within the final version of the instrument should be recognizable (i.e., familiar) to the entire range of potential clients served by DOL

umbrella agencies and initiatives. Eight focus groups were conducted in four regions of the country. The groups were drawn from employment service offices, community colleges, and technical/trade schools located in urban, suburban, and rural sites. A total of 254 individuals participated. The sample was heterogeneous in terms of gender (127 male participants, 127 female participants), minority representation (127 White Non-Hispanics, 127 all other groups combined), age (18 to 70), and educational level (31 less than high school diploma, 94 high school degree, 72 some college/ associate degree, 37 college degree, 18 advanced degrees). The majority of the sample were unemployed workers (153 unemployed workers, 52 students, 17 full-time employed workers).

Each participant rated the familiarity of the work activities on a 5-point scale, ranging from *not familiar* (1) to *very familiar* (5). Figure 3 provides an example of the scale. The mean and mode familiarity ratings of both the total sample and sub-samples were used to remove items (in general, the cutoff was a mean of 2.0). Focus group discussions also yielded a wealth of qualitative data related to: 1) the currency of the items, 2) the variety of the items, 3) missing work activities, and 4) recommendations related to specific items.

Training Requirement

This screening was conducted to ensure that items represented the broad range of training requirements specified by the taxonomy. Two panels of nine occupational analysts with expert knowledge of the Specific Vocational Preparation scale (SVP; U.S. Department of Labor, 1991) were trained on the use of a modified form of the scale (the original 9-point scale was collapsed into 5 broad levels that are more conducive to training level requirement's role in the taxonomy [see Figure 2]). Each analyst within a panel rated the amount of vocational training required to perform the work activity described by items in a subset of the item pool. Analysts in both panels rated 229 common items. Mean ratings on the common items were compared. The ratings between the two panels were very similar. The average mean difference between panel ratings was .06, and the correlation between the ratings was .98.

The mean, mode, and standard deviation of each item's training level assignment were used to remove items from areas of the taxonomy that were over-represented (i.e., work content areas). The goal was to maximize the variance of training levels represented by items within each RIASEC construct.

Duplication

The purpose of this screening was to eliminate items with identical or nearly identical content. A team of four inspectors reviewed the pool of items to ensure that nearly identical work activities were not present. For example, "type a memo" and "type a letter" would be considered nearly identical, and only one would be retained.

Copyright

Items were compared with those in the 1) Interest-Finder (Defense Manpower Data Center, 1995), 2) Self-Directed Search (Holland, 1985b), 3) Strong Interest Inventory (Hansen and

Campbell, 1985), and 4) UNIACT-R (American College Testing Program, 1995). Two inspectors independently identified duplicate and near duplicate items. Agreement between the inspectors was extremely high, with the few discrepancies being resolved by the team of inspectors. All items that represented potential copyright infringements were removed.

Phase 6: Item Tryout and Scale Development

A total of 226 items failed to pass the seven-stage screening process, resulting in a pool of 500 items. These items were subjected to a large scale item tryout study. The major purpose of this study was to gather information on the psychometric characteristics of the items in the tryout pool. This information would serve to identify those items most likely to constitute an O*NET Interest Profiler with high reliability, low gender and race/ethnic biases, and strong evidence of construct validity. In addition, the Interest-Finder (Defense Manpower Data Center, 1995) was administered to allow for a comparison between the newly created O*NET Interest Profiler and an established interest instrument. The Interest-Finder is a self-scoring assessment instrument designed to help individuals discover their work-related interests (i.e, R-I-A-S-E-C interests).

Sampling Plan

The sampling plan for this study targeted groups of clients most likely to utilize the O*NET Interest Profiler upon its completion. Groups identified included: 1) unemployed workers, 2) junior college and technical/trade school students, 3) high school students, 4) college students, and 5) workers in transition (employed workers looking for different jobs/careers). The sampling plan also called for a high proportion of minority participants, an equivalent number of participants from each gender, and participants drawn from a variety of regions across the United States.

Participants

Data collection sites included employment service offices, high schools, junior colleges, technical/trade schools, universities, and other government agencies located in six states across the country (Florida, Michigan, New York, North Carolina, Texas, and Utah). A total of 1,123 participants provided useable responses. The sample consisted of approximately equal numbers of males (47%: $n = 529$) and females (53%: $n = 594$). A high degree of ethnic diversity was achieved, with African Americans representing 38% of the sample; White Non-Hispanics, 33%; Hispanics, 25%; and individuals from other racial/ethnic descents, 4%.

The sample was also heterogeneous in terms of age (individuals in their twenties totaled 30%; thirties, 27%; forties and fifties, 25%; teens, 15%; and sixties or greater, 3%) and education (individuals with high school degree, 47%; some college through bachelors degree, 27%; less than high school degree, 21%; and at least some graduate school, 5%). With the exception of unemployed workers, who represented 39% of the sample, there was

an approximately equal representation of individuals from a variety of education/employment situations (employed workers, 19%; college students, 17%; junior college/technical/trade school students, 8%; high school students, 8%; other groups, 4%).

Procedures

Participants were administered an O*NET Interest Profiler and an Interest-Finder, a well-established interest measure. Individuals were paid \$15 to reimburse them for travel expenses. The O*NET Interest Profiler consisted of 500 tryout items. To reduce the impact of order effects, two forms of the instrument were created: Form B reversed the order of the pages of Form A. Approximately 50% of the sample received Form A ($n = 558$) and the other 50% received Form B ($n = 565$). Two forms of the Interest-Finder were created: Form 1 included the appropriate RIASEC label and definition listed at the top of each page; Form 2 did not include either the labels or definitions.² Approximately 75% of the sample received Form 1 ($n = 831$) and 25% received Form 2 ($n = 292$). All four forms of the surveys were presented in counterbalanced order. In addition, each participant completed a brief demographics questionnaire, along with a comment sheet eliciting feedback regarding the O*NET Interest Profiler. Data were collected between October and December of 1996.

Comparison of the mean endorsement rates of each item across different locations within the survey packet did not reveal the existence of large order effects. The maximum difference in mean endorsement rates due to order was .12, with the average difference being .03.

Item Analyses

A set of general item-level screens was conducted. First, items with endorsement rates lower than 10% or higher than 75% were eliminated. Next, endorsement rates for males, females, and racial/ethnic groups were computed. The following comparisons were made: 1) male—female, 2) minority—non-minority, 3) White Non-Hispanic— African American, 4) White Non-Hispanic—Hispanic. Items with endorsement rate differences greater than .30 were eliminated. Finally, items were assigned to their appropriate scales, and internal consistency analyses were conducted. Items with corrected item-to-total correlations below .30 were eliminated. An item pool of 461 items was retained after these three screens.

Scale Analyses

The purpose of this stage of the analyses was to select from the pool of items a total of 180 items that would create six internally consistent scales which:

- 1) demonstrated strong conformity to the hexagonal model of Holland's (1985a) theory of vocational interests,
- 2) contained maximum training level and occupation representation, and
- 3) minimized gender and race/ethnic endorsement rate differences.

² Study design requested by the Defense Manpower Data Center (DMDC).

First, a correlational algorithm was developed to rank order the items assigned to each scale in terms of their conformity to structure implied by the hexagonal model. The structure specifies that an item should correlate most highly with its target scale, next strongest with its adjacent scale, less strongly with its alternative scales, and least strongly with its opposite scale. The following algorithm was applied:

$$1 - \text{target scale correlation} - \{ (.5 * \text{opposite scale correlation}) - [.15 * (\text{alternate scale correlation 1} + \text{alternate scale correlation 2})] - [.1 * (\text{adjacent scale correlation 1} + \text{adjacent scale correlation 2})] \}.$$

All item-to-scale correlations were examined. Items were eliminated if their corrected target scale correlation was less than their correlation with another scale. Next, four judges with psychometric backgrounds, as well as training in Holland's (1985a) vocational theory and the O*NET Interest Profiler taxonomy, independently made qualitative selection of items based on the following information: 1) item-to-scale correlations, 2) gender and race/ethnic endorsement rate differences, 3) training level requirement ratings, and 4) work content area assignments. Judges discussed their respective selections and agreed on an initial selection of 30 items per scale.

Starting with the initial 30-item scales, different item combinations within scales were examined to maximize the empirical relationships of items within scales, as well as to minimize the relationship of each item with non-target scale totals. Accordingly, an item was replaced if its removal increased the scale internal reliability (coefficient alpha) or if the item's target scale correlation was less than its correlation with another scale.

Characteristics of Scales/Instrument

Six scales composed of 30 items each were finalized. Twenty-nine of the total 180 items were original items drawn from the three existing DOL interest instruments. Both scale and instrument descriptions are provided in the following sections.

Taxonomy Coverage. An extremely wide representation of work activities was achieved. One or more items were present in approximately 80% of the work content areas of the taxonomy ($n = 60$).

Large differences in the mean level of training requirement for each scale existed. Mean levels for each scale ranged from 1.7 (Realistic) to 4.4 (Investigative), with a median of 2.8. Differences in scale training levels may be due to inherent characteristics of the RIASEC constructs themselves. However, the number of training levels within each scale with a minimum of one item was high, with the median number of levels represented being 4.5. In addition, the total item count of the instrument is heterogeneous in terms of training level representation (30%, Training Level 1; 22%, Training Level 5; 21%, Training Level 4; 14%, Training Level 2; 13%, Training Level 3).

Psychometric Characteristics. All six scales demonstrated a high degree of internal reliability, with coefficient alphas ranging from .95 to .97. The mean, standard deviation, coefficient alpha, and scale intercorrelations for the O*NET Interest Profiler and Interest-Finder are reported in Table 1. The rank order of the scale means for the two measures are quite different (e.g., the Enterprising Scale is ranked fourth in the O*NET Interest Profiler, while it is ranked first in the Interest-Finder). Possible explanations for these differences include a varying degree of training level/complexity between the two instruments and format differences such as: a) presence of construct labels and definitions; b) use of different item types (e.g., work activity statements versus activities, training, and occupational titles); c) response format differences; and d) scale format differences.

Although differences exist between the O*NET Interest Profiler and Interest-Finder, examination of the instruments' scale intercorrelations reveals a very high correlation between corresponding scales, ranging from .71 (Enterprising) to .86 (Conventional), with a median value of .82. Correlations between O*NET Interest Profiler scales and noncorresponding Interest-Finder scales were much lower, ranging from .30 (IP Social and IF Realistic, IP Conventional and IF Realistic) to .62 (IP Enterprising and IF Social), with a median value of .46. Overall, the correlational relationships between the two instruments provide evidence of both convergent and discriminant validity.

Gender and Race/Ethnic Bias. In an attempt to reduce the likelihood of the O*NET Interest Profiler leading to restrictive career options for particular subgroups, an effort was made to select items with balanced endorsement rates (i.e., no mean difference greater than .30). It was important to evaluate the extent to which efforts at the item level transferred into results at the scale level.

For both the O*NET Interest Profiler and Interest-Finder, raw score means of subgroups were examined. Raw score means for subgroups should be similar, and the overlap of each distribution (cf. Tilton, 1937) should be high. Distributions can be considered similar if they overlap more than 75% to 80% (Dunnette, 1966). Table 2 presents the O*NET Interest Profiler and Interest-Finder scale means, standard deviations, and percentage of overlap for the following subgroups: 1) male and female, 2) White Non-Hispanic and African American, and 3) White Non-Hispanic and Hispanic.

Gender balance was evident in both instruments, with the exception of the Realistic Scale. The median overlap for the O*NET Interest Profiler was 89.5%, while the median overlap for the Interest-Finder was 90.5%. Both instruments exhibited a gender overlap below 75% for the Realistic Scale (IP, 68%; IF 66%), indicating that a dissimilar proportion of males are likely to endorse the items within the Realistic Scale. The lack of balance for the Realistic Scales may be reflective of the traditional gender differences that exist within our society.

Balanced endorsement rates between White Non-Hispanics and African Americans was evident in both measures: the median overlap for the O*NET Interest Profiler was 81.5%, while the median overlap for the Interest-Finder was 82%. The Social Scale (IP, 76%; IF, 80%) and Conventional Scale (IF, 76%; IP, 79%) exhibited borderline degrees of overlap. The O*NET Interest Profiler's Enterprising Scale was the exception. It exhibited a subgroup overlap below 75% (69%). However, the scale mean was higher for African Americans than for White Non-Hispanics, indicating that a higher proportion of African Americans are likely to endorse the items within the Enterprising Scale. Higher mean scale scores for African Americans also existed in both of the scales with borderline overlap values (IF Conventional, IP Social, IF Enterprising, IP Conventional, IF Social), as well as all other scales, indicating an overall positive response bias. In terms of career counseling, the ramifications of this occurrence appear to be minimal, with African Americans indicating a stronger preference for all six RIASEC interest areas.

Balance endorsement rates between White Non-Hispanics and Hispanics was evident in both measures. The median overlap for the O*NET Interest Profiler was 89%, while the median overlap for the Interest-Finder was also 89%. The Social Scale for both measures exhibited borderline degrees of overlap (IP, 78%; IF, 80%). However, as with the dissimilarity discovered between White Non-Hispanics and African Americans, the differences were due to larger mean scale values for Hispanics, indicating that a higher proportion of Hispanics are likely to endorse the items within the Social Scale. The dissimilarity may reflect cultural differences of the two subgroups.

Phase 7: Format Design

The goal of the format design of the O*NET Interest Profiler was to create an instrument that:

- 1) could be reliably hand-scored by clients taking the instrument on their own;
- 2) would gather information necessary to produce accurate, reliable interest profiles;
- 3) would allow for review of work activities within a RIASEC construct once the instrument was completed; and
- 4) would lend itself to an equivalent computerized form.

Item Response Format

Several different item response formats were considered. The following 3-point response format was selected: *Like*, *Unsure*, *Dislike*. This format was seen as advantageous for three primary reasons:

- 1) The format was well suited for hand scoring. Participants are simply responsible for adding up the number of *Likes*.

- 2) The *Unsure* choice was viewed as an important option. An *Unsure* response is a meaningful option for clients who are not certain whether or not they like or dislike a particular work activity. While the *Unsure* response is not included in the scoring procedure, the option allows clients to avoid making a “forced choice” between two responses that they feel do not adequately capture their interests. In addition, the *Unsure* response could be used in long-term development and maintenance of the O*NET Interest Profiler, with items gathering high *Unsure* responses being reviewed for possible revision or omission.
- 3) This item format maintains continuity with the formats of existing DOL interest instruments, allowing for a smoother transition for those agencies currently using DOL instruments.

Instrument Layout

A wide variety of item layouts was explored. The final layout is a presentation of 15 columns of 12 interest items each. Within each column, sets of items representing one of the interest constructs are presented in the following order: Realistic, Investigative, Artistic, Social, Enterprising, Conventional. Horizontal color bands distinguish the items representing each RIASEC construct. The color bands serve to aid in the scoring of the instrument, as well as allow clients to go back and review the work activity statements within a particular RIASEC construct once they have completed the instrument.

Client Feedback on Instrument Layout

A small pilot test was conducted to evaluate users’ ability to understand and score the O*NET Interest Profiler. In addition, two sets of scoring directions containing different emphases on visual instructions were tested.

Participants were drawn from an employment service office and a welfare agency located in the western region of the United States. Individuals were paid \$15 to reimburse them for travel expenses. A total of 80 participants provided useable data. The sample was heterogeneous in terms of gender (40 males, 40 females), age (16 to 67), and employment status (41 unemployed workers, 28 employed workers, 11 others). In addition, 18 participants were currently students. Participants with lower education levels were purposefully over-sampled (40 high school graduates, 20 less than high school, 19 some college/college degree, 1 advanced degree) in an attempt to create a more rigorous test of the instrument's directions and scoring procedures. There was, however, a very low representation of minority groups (67 White Non-Hispanics, 13 all other groups combined). An approximately equal number of participants received each version of the instrument (52%, Nonvisual Instruction Version; 48%, Visual Instruction Version).

Participants completed one version of the O*NET Interest Profiler, along with a brief demographics questionnaire. In addition, they filled out a questionnaire eliciting feedback about participants’ understanding of the instrument, the process they followed to score the instrument, and their overall impression of the instrument. After completing the instrument,

individuals participated in focus group discussions, enabling more qualitative information to be gathered.

Differences in scoring error rates between the two forms of the instrument were negligible. In addition, feedback generated from the questionnaire revealed little difference between the two forms. Information gathered from focus groups did reveal, however, that some participants relied on the visual directions to understand the instrument, while others found them distracting. Based on the feedback from the pilot study, a new version of the O*NET Interest Profiler was created which placed a "middle of the road" emphasis on visual directions.

Regardless of the version of the instrument they were administered, participants provided overwhelmingly positive feedback related to the O*NET Interest Profiler, with 89% of the participants expressing a desire to take the instrument again when its development is complete, and 81% stating they would recommend the instrument to their friends.

Next Steps

The development of the O*NET Interest Profiler is an ongoing process. A large-scale form tryout and validation study has been conducted. For a description of this phase of the research, refer to *O*NET Interest Profiler: Reliability, Validity, and Self-Scoring* (Rounds, Walker, Day, Hubert, Lewis and Rivkin, 1999). In addition a computerized form of the O*NET Interest Profiler has been developed. For information related to its development, refer to *O*NET Computerized Interest Profiler: Reliability, validity, and comparability*. (Rounds, Mazzeo, Smith, Hubert, Lewis, and Rivkin, 1999).

References

- American College Testing Program. (1995). *Technical manual: Revised Unisex Edition of the ACT Interest Inventory (UNIACT)*. Iowa City, IA.
- Dale, E., & O'Rourke, J. (1981). *The living word vocabulary*. Chicago: World Book-Childcraft Inc.
- Defense Manpower Data Center. (1995). *Exploring careers: The ASVAB counselor manual*. Monterey, CA: Author.
- Dunnette, M. D. (1966). *Personnel selection and placement*. Belmont, CA: Wadsworth, 1966.
- Educational Testing Service. (1987). *ETS sensitivity review process: An overview*. Princeton, NJ: Author.
- Hansen, J. C. & Campbell D. P. (1985). *Manual for the Strong Interest Inventory*, (4th ed.) Palo Alto, CA: Consulting Psychologists Press.
- Holland, J. L. (1985a). *Making vocational choices: A theory of vocational personalities and work environments* (2nd ed.). Englewood Cliff, NJ: Prentice-Hall.
- Holland, J. L. (1985b). *The Self-Directed Search professional manual*. Odessa, FL: Psychological Assessment Resources.
- Jones, L. K. (1980). Holland's typology and the new Guide for Occupational Exploration: Bridging the gap. *Vocational Guidance Quarterly*, 29, 70-76.
- Mellon, S.J., Daggett, M., MacManus, V., & Moritsch, B. (1996). Development of GATB Forms E and F. In R.A. McCloy, T.L. Russell, & L.L. Wise (Eds.), *GATB improvement project final report*. Washington, DC: U.S. Department of Labor.
- New York State Job Service. (1985). *The Job Search Inventory*.
- Oswald, F., Campbell, J., McCloy, R., Rivkin, D., & Lewis, P. (1999). *Stratifying occupational units by Specific Vocational Preparation*. Raleigh, NC: National Center for O*NET Development.
- Rounds, J., Mazzeo, S., Smith, T., Hubert, L., Lewis, P., & Rivkin, D. (1999). *Development of the O*NET Computerized Interest Profiler. Reliability, validity, and comparability*. Raleigh, NC: National Center for O*NET Development.

Rounds, J., Walker, C., Day, D., Hubert, L., Lewis, P., & Rivkin, D. (1999). *O*NET Interest Profiler: Reliability, validity, and self-scoring*. Raleigh, NC: National Center for O*NET Development.

Tilton, J. W. (1937). Measurement of overlapping. *Journal of Educational Psychology*, 28, 656-662.

U.S. Department of Labor. (1979a). *Guide for Occupational Exploration*. Washington, DC: US Government Printing Office.

U.S. Department of Labor. (1979b). *Interest Check List*. Washington, DC: US Government Printing Office.

U.S. Department of Labor. (1981). *USES Interest Inventory*. Washington, DC: US Government Printing Office.

U.S. Department of Labor. (1991). *The revised handbook for analyzing jobs*. Washington, DC: US Government Printing Office.

Tables

Table 1***Interest Profiler and Interest-Finder Scale Means, Standard Deviations, Coefficient Alphas, and Scale Intercorrelations***

RIASEC Scale ¹	M ²	SD	α	IP-R	IP-I	IP-A	IP-S	IP-E	IP-C	IF-R	IF-I	IF-A	IF-S	IF-E	IF-C
IP-R	10.32 (6)	8.7	.95	---	.56	.38	.40	.59	.39	<u>.83</u> ³	.49	.39	.41	.44	.40
IP-I	13.19 (5)	8.9	.95		---	.56	.57	.52	.43	.50	<u>.80</u>	.56	.59	.56	.40
IP-A	13.46 (3)	9.2	.96			---	.52	.58	.35	.34	.44	<u>.84</u>	.57	.53	.32
IP-S	16.28 (1)	9.5	.96				---	.62	.49	.30	.39	.49	<u>.79</u>	.49	.44
IP-E	13.28 (4)	8.7	.95					---	.66	.47	.39	.53	.62	<u>.71</u>	.61
IP-C	14.80 (2)	10.1	.97						---	.30	.35	.37	.52	.54	<u>.86</u>
IF-R	17.1 (6)	11.3	.95							---	.56	.42	.40	.46	.37
IF-I	19.4 (4)	12.2	.96								---	.53	.53	.54	.40
IF-A	18.6 (5)	11.3	.95									---	.64	.59	.41
IF-S	21.8 (2)	11.4	.95										---	.67	.57
IF-E	22.3 (1)	11.5	.95											---	.62
IF-C	21.2 (3)	13.3	.97												---

Note. IP = Interest Profiler. IF = Interest-Finder. IP-R = IP Realistic scale, IP-I = Investigative scale, IP-A = Artistic scale, IP-S = Social scale, IP-E = Enterprising scale, IP-C = Conventional scale, IF-R = Realistic scale, IF-I = Investigative scale, IF-A = Artistic scale, IF-S = Social scale, IF-E = Enterprising scale, IF-C = Conventional scale. All means, standard deviations, coefficient alphas, and scale intercorrelations are based on a sample size of 1,123. IP scale scores range from 0 - 30. IF scale scores range from 0 - 40.

¹ All correlation coefficients are statistically significant beyond the .001 level.

² Numbers in parentheses following the scale means are the within-measure rank order position of the mean.

³ Correlations between corresponding IP and IF scales are underscored for interpretation purposes.

Table 2**Subgroup Score Overlap for the O*NET Interest Profiler and Interest-Finder Scales**

Scale	O*NET Interest Profiler					Interest-Finder				
	Males		Females		<i>O</i> ^a	Males		Females		<i>O</i> ^a
	Mean	<i>SD</i>	Mean	<i>SD</i>		Mean	<i>SD</i>	Mean	<i>SD</i>	
Realistic	13.78	8.82	7.24	7.33	68*	21.83	10.50	12.91	10.26	66*
Investigative	14.29	8.91	12.20	8.73	90	22.07	12.25	17.10	11.61	83
Artistic	13.34	8.93	13.56	9.39	99	18.32	11.37	18.78	11.30	98
Social	14.79	9.61	17.61	9.16	89	20.78	11.91	22.63	10.94	93
Enterprising	13.62	8.79	12.99	8.65	98	23.70	11.22	20.98	11.58	90
Conventional	13.02	9.93	16.38	10.03	86	19.76	13.31	22.52	13.15	91

Note. O*NET Interest Profiler scale scores range from 0 to 30; Interest-Finder scales range from 0 to 40. All means and standard deviations are based on a sample size of 1123.

^a Percent overlap is based on Dunnette's (1966) table for Tilton's (1937) measure of overlap.

* Overlap less than or equal to 75%, indicating dissimilar distributions.

** Overlap less than 81%, but greater than 75%, indicating somewhat dissimilar distributions.

Table 2 (cont.)**Subgroup Score Overlap for the O*NET Interest Profiler and Interest-Finder Scales**

Scale	O*NET Interest Profiler					Interest-Finder				
	White Non-Hispanic		African American		O ^a	White Non-Hispanic		African American		O ^a
	Mean	SD	Mean	SD		Mean	SD	Mean	SD	
Realistic	8.65	7.93	11.77	8.99	85	15.13	10.56	18.57	11.38	87
Investigative	12.28	8.72	12.76	8.74	97	17.73	11.91	19.50	12.30	94
Artistic	11.60	9.09	15.10	9.04	84	16.03	11.21	20.36	11.19	84
Social	12.95	9.55	18.31	8.63	76**	18.06	10.86	23.69	11.38	80**
Enterprising	9.98	7.71	16.46	8.78	69*	18.81	10.95	24.84	11.26	78**
Conventional	12.16	10.11	17.30	9.61	79**	17.51	13.16	25.20	12.33	76**

Note. O*NET Interest Profiler scale scores range from 0 to 30; Interest-Finder scales range from 0 to 40. All means and standard deviations are based on a sample size of 1123.

^a Percent overlap is based on Dunnette's (1966) table for Tilton's (1937) measure of overlap.

* Overlap less than or equal to 75%, indicating dissimilar distributions.

** Overlap less than 81%, but greater than 75%, indicating somewhat dissimilar distributions.

Table 2 (cont.)**Subgroup Score Overlap for the O*NET Interest Profiler and Interest-Finder Scales**

Scale	O*NET Interest Profiler					Interest-Finder				
	White Non-Hispanic		Hispanic		<i>O</i> ^a	White Non-Hispanic		Hispanic		<i>O</i> ^a
	Mean	<i>SD</i>	Mean	<i>SD</i>		Mean	<i>SD</i>	Mean	<i>SD</i>	
Realistic	8.65	7.93	10.47	9.01	91	15.13	10.56	17.15	11.87	92
Investigative	12.28	8.72	14.83	9.12	88	17.73	11.91	21.08	12.10	88
Artistic	11.60	9.09	13.41	9.08	92	16.03	11.21	18.83	11.17	90
Social	12.95	9.55	17.98	9.22	78**	18.06	10.86	23.58	11.04	80**
Enterprising	9.98	7.71	13.11	8.28	84	18.81	10.95	22.72	11.44	86
Conventional	12.16	10.11	14.54	10.05	90	17.51	13.16	19.96	13.40	92

Note. O*NET Interest Profiler scale scores range from 0 to 30; Interest-Finder scales range from 0 to 40. All means and standard deviations are based on a sample size of 1123.

^a Percent overlap is based on Dunnette's (1966) table for Tilton's (1937) measure of overlap.

* Overlap less than or equal to 75%, indicating dissimilar distributions.

** Overlap less than 81%, but greater than 75%, indicating somewhat dissimilar distributions.

Figures

Figure 1.

Overview of the Interest Profiler Taxonomy, Version 3.0

Realistic Scale			Investigative Scale		Artistic Scale	
03.01#	Plants & Animals	Level 3	02.01	Physical Sciences	01.01	Literary Arts
03.02#	"	Level 2	02.02	Life Sciences	01.02	Visual Arts
03.04#	"	Level 1				
03.03	Animal Training & Service		02.03	Medical Sciences	01.03	Performing Arts: Drama
04.02	Security Services		02.04	Laboratory Technology	01.04	Performing Arts: Music
05.04#	Airplane & Ship Operation		02.05+	Computer Technology	01.05	Performing Arts: Dance
05.05*	Craft Technology		05.01	Engineering	01.06	Craft Arts
05.06	Systems Operations		05.02#	Mechanical Systems Management	01.08	Modeling
05.07	Quality Control: Mechanical		05.03*	Engineering Technology	12.02	Physical Feats
05.08	Land & Water Vehicle Operation		11.01*	Mathematics & Statistics		
05.10*	Crafts		11.03	Social Research		
05.11	Equipment Operation		11.06A+	Finance: Design & Interpretation		
05.12#	Basic Mechanical		11.08	Communications		
06.01	Production Technology		11.10	Regulations Enforcement		
			12.00+	General Research		
06.02#	Production Work	Level 2	4.01 R	Safety & Law		
06.04#	"	Level 1				
06.03	Quality Control: Industrial					
09.03	Passenger Services					
09.04#*	Basic Services					

* GOE Work Group Definition Modified # GOE Work Group Title Modified + New Work Content Area **R** Moved Post Retranslation Screen

Figure 1. (cont.)

Overview of the Interest Profiler Taxonomy, Version 3.0

Social Scale		Enterprising Scale		Conventional Scale	
04.01	Safety & Law Enforcement	08.01	Sales Technology	05.09*	Material Control
09.01	Hospitality Services	08.02	General Sales	07.01	Administrative Detail
09.02	Barber & Beauty Services	08.03	Vending	07.02	Mathematical Detail
10.01	Social Services	09.05#*	Attendant/Customer Services	07.03	Financial Detail
10.02	Nursing, Therapy, & Specialized Teaching Services	11.04	Law	07.04	Oral Communications
		11.05	Business Administration	07.05	Records Processing
10.03*	Child & Adult Care	11.06B+	Finance: Buy & Sell	07.06	Clerical Machine Operation
11.02	Educational & Library Services	11.07	Service Administration	07.07	Clerical Handling
12.01	Sports	11.09	Promotion	2.05R	Computer Technology
		11.11	Business Management		
		11.12	Contracts & Claims		
		9.02R	Barber & Beauty Services		

* GOE Work Group Definition Modified # GOE Work Group Title Modified + New Work Content Area R Moved Post Retranslation Screen

Figure 2.

Overview of the Modified Specific Vocational Preparation Scale (MSVP)

Level Time¹

- 1 Up to and including 6 months.²
- 2 Over 6 months up to and including 1 year.
- 3 Over 1 year up to and including 2 years.
- 4 Over 2 years up to and including 4 years.
- 5 Over 4 years.³

NOTE: The levels of this scale are mutually exclusive and do not overlap.

¹ Time that applies to General Educational Development is not considered in estimating Specific Vocational Preparation.

² Represents three collapsed levels of the original SVP scale.

³ Represents two collapsed levels of the original SVP scale.

Figure 3.

Familiarity Screen Rating Scale

Not Familiar	Somewhat Familiar		Very Familiar	
1	2	3	4	5
You don't know what the activity is. You have never heard of the activity.	You know something about the activity, or someone you know performs the activity on his or her job.		You have seen the activity performed a number of times, or you have performed the activity yourself.	