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Mapping Career Groups on Basic Interest Dimensions

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ABSTRACT

This report demonstrates a mapping procedure for investigating the construct validity of interest inventories that assess Holland's six types. The 1989 revision of the ACT Interest Inventory (UNIACT) was used to assess the interests of 1,078 Grade 12 students and 725 adults, age 25 or older. Respondents were allocated to career groups on the basis of career choice (Grade 12) or current occupation (adults). The interests of 27 career groups were mapped onto Holland's hexagon using scores for the underlying data/ideas and things/people dimensions. Expected group locations were determined via expert judgment for 11 of these groups. Mean interest scores were also profiled. Results from both samples provided evidence supporting the construct validity of UNIACT--e.g., career group locations on the hexagon generally agreed with experts' judgments and common sense. Results are discussed in terms of the advantages of the mapping procedure over multiple-score profiles.

MAPPING CAREER GROUPS ON BASIC INTEREST DIMENSIONS

One commonly used procedure for investigating the validity of an interest inventory is to examine the interest score profiles of various occupational groups in light of expectations based on theory, expert judgment, and/or common sense. If expectations are confirmed, then the construct validity of the inventory is supported. For example, Holland's (1985a) theory of careers postulates six types of vocational interests ("personalities"). Evidence of construct validity is obtained if the six-score interest profiles for career groups (e.g., occupations) conform to expectations based on Holland's theory.

Profiles have been used repeatedly to investigate the validity of a number of widely-used interest inventories that report scores based on Holland's types. Examples of these inventories, and profile-based validity studies, are the Strong-Campbell Interest Inventory (SCII; e.g., Betz & Taylor, 1982), the Self-Directed Search (e.g., Benninger & Walsh, 1980), and the Unisex Edition of the ACT Interest Inventory (UNIACT; e.g., Lamb & Prediger, 1981). Yet, despite the popularity of profiles, investigators do have other options. This report demonstrates a procedure for examining construct validity by mapping career groups onto Holland's hexagonal model of interests and occupations. The procedure has important advantages over profiles and applies to any interest inventory that assesses Holland's six types.

Mapping the interests of occupational groups is not new (e.g., see Strong, 1959). A spatial configuration of occupations based on scores for Holland's types was reported by Cole, Whitney, and Holland (1971). The Cole et al. approach to mapping has received little attention over the past 20 years, perhaps due to their use of an abstract, little-known statistical procedure (configural analysis). Nevertheless, Cole et al. emphasized several important uses of "a visual occupational map" (1971, p. 8) in vocational

research. For example, distance between occupations on the map can be used to study the similarity of occupations (e.g., see Prediger, 1981). Likewise, map distance can also be used as a measure of the congruence between an individual and an occupation (e.g., see Swaney & Prediger, 1985).

Although Holland and his colleagues did not follow-up on their mapping procedure, other staff members at American College Testing (ACT) subsequently developed the World-of-Work Map (ACT, 1988; Prediger, 1976). This empirically based extension of Holland's (1985a) hexagon, shown in Appendix A, maps groups of related occupations ("job families") onto the dimensions underlying Holland's hexagon. It is used in various career planning services to link counselee interests to occupational options. The Map of College Majors (Lamb & Prediger, 1981), a forerunner of the World-of-Work Map, shows the locations of 52 college majors on the two dimensions.

Dimensions Underlying Holland's Hexagon

Holland's six types and their hexagonal relationship are shown in Figure 1. Social (S) occupations (or interests), for example, are most similar to (closest to) Artistic (A) and Enterprising (E) occupations. Social occupations are least similar to Realistic (R) occupations, which are on the opposite side of the hexagon. Similarity to Conventional (C) and Investigative (I) occupations is intermediate. In general, proximities of the six types of occupations (or interests) indicate degree of similarity.

Because a hexagon is two-dimensional, two dimensions are sufficient to describe the relationships between Holland's six types. Although Holland's theory does not address the nature of these dimensions, empirical evidence provided by Prediger (1982) and Rounds (in press) suggests that two theory-

based work task dimensions--data/ideas and things/people--underly the hexagon. The locations of Holland's types on these two foundational dimensions are shown in Figure 2.

The four work tasks (data, ideas, people, things) shown in Figure 2 have been described at length by Prediger (1976, 1981). In summary, data tasks are impersonal tasks involving procedures and transactions that expedite goods/services consumption by people (for example, by organizing, recording, verifying, or transmitting facts, numbers, instructions, etc.). Ideas tasks are intrapersonal tasks involving insights, theories, and new ways of expressing something with, for example, words, paint, equations, or music. People tasks are interpersonal tasks such as caring for, educating, entertaining, serving, persuading, or directing others. Things tasks are nonpersonal tasks involving machines, tools, living things, and materials such as food, wood, or metal. Although any occupation will involve some work with data, ideas, people, and things, only one or two of the work tasks typically predominate.

The primary purpose of this study was to show how the two work task dimensions underlying Holland's hexagon provide a basis for examining the construct validity of interest inventories that assess Holland's six types. Interest inventory scores from high school and adult samples were used to map 27 career groups on the two dimensions and, hence, on Holland's hexagon. The empirical locations were compared to locations based on expert judgment and previous research. As will be shown, degree of agreement provides a convenient index of interest inventory construct validity. Traditional interest profiles are also presented to allow the reader to compare the usefulness of the two procedures for evaluating construct validity.

Method

Instrument

The instrument used in this study was the 1989 revision of UNIACT. The revised UNIACT is a 90-item inventory with six 15-item scales corresponding to Holland's (1985) six interest types. Scale names (and corresponding Holland types) are: Business Contact (E), Business Operations (C), Technical (R), Science (I), Arts (A), and Social Service (S). Items cover work-relevant activities (e.g., write short stories, build a picture frame, conduct a meeting) via a three-choice response format consisting of "dislike", "indifferent", and "like." Scores on the six interest scales are reported as stanines based on national norms. However, for this study T-scores (M = 50, SD = 10) were used to facilitate ranking of scores (described below).

Except for updated items, the revised UNIACT is identical to the original instrument. Revisions included the replacement of: (a) items performing poorly as shown by item analysis data for recent samples, (b) items containing job titles, and (c) items containing activities with which adolescents are unlikely to be familiar (e.g., "run a hotel or motel"). Replacements consisted of items containing familiar work-relevant activities (e.g., "present information before a group") found to perform well as shown by item analysis data for samples of 2,180 Grade 9 students, 3,284 college-bound Grade 11 students, and 3,065 adults. In addition, two levels of UNIACT were developed--a lower level for adolescents (junior and senior high school), and an upper level for older adolescents and adults. Only the upper-level form was used in the present study.

Norms for the upper-level UNIACT are based on a nationally representative sample of 3,585 Grade 12 students who completed the original edition of UNIACT in 1983 (ACT, 1988). Equipercentile equating was conducted on a sample of

1,548 Grade 12 students to identify equivalent scores on the revised and original scales. While not nationally representative, the equating sample consisted of a broad cross-section of students from 12 high schools in 8 states, nationwide.

Coefficient alpha reliabilities for the Grade 12 equating sample range from .85 to .92 for males, and from .86 to .92 for females. Coefficient alpha reliabilities for the adult sample described below range from .84 to .90 for males, and from .83 to .91 for females. Additional information on the redevelopment process and UNIACT's psychometric characteristics is provided by ACT (1988), Lamb and Prediger (1981), and Swaney (1990).

Samples

The data for this study came from two samples, Grade 12 students and adults.

Grade 12 sample. In the Winter of 1988-89, guidance directors at 60 high schools were asked to participate in a study to equate the current form of UNIACT to the newly revised form. UNIACT score reports and interpretive materials, provided at no cost, were promised for each responding student. Schools were given the option to test Grade 11, 12, or both. A total of 20 schools agreed to participate, of which 15 planned to test Grade 12. (Data collected from Grade 11 students are not reported here and will not be mentioned further.) Two schools dropped out of the study, and answer sheets from a third school were received too late to be included in analyses. Thus, a total of 12 high schools participated in the study--two from the West, four from the Midwest, four from the South, and two from the East. The initial Grade 12 sample, which also served as the equating sample discussed above, consisted of 1,548 seniors (750 males and 798 females) having a complete set of UNIACT scores.

Adults. Ten 2-year and 4-year colleges and universities nationwide were contacted in the Spring of 1988 and asked to participate in a study to try out new items for the revision of UNIACT. The eight institutions that agreed to participate supplied ACT with computer tapes containing the names, addresses, birth dates, and academic majors for 44,092 undergraduate students, age 25 or older, who were enrolled any time during the 1987-88 school year. For the purpose of sample selection, each academic major was classified into one of seven categories. Six of the categories were the six ACT job clusters (discussed in more detail below) which parallel the six UNIACT scales and, hence, Holland's types. The seventh category consisted of majors that could not be classified (e.g., general studies).

A mailing list was generated by randomly selecting 1,900 cases from each of six of the seven academic major categories. Because there were only 648 majors in the Technical Job Cluster, all of these cases were included in the mailing list, resulting in a total of 12,048 mailing list cases. Adults in the sample received the interest items and a cover letter requesting their response to each item. Respondents were promised free score reports and interpretive materials. Reminder postcards were sent to all Technical majors one week after the first mailing and to all nonrespondent males three weeks after the first mailing. (A lower response rate was anticipated for males.)

Responses were received from 3,085 persons. The response rate (26% of the mailing list sample) is similar to that obtained in the development of SCII Occupational Scales (Hansen & Campbell, 1985, p. 48). Prior to data analyses, 17 cases were excluded due to missing gender code on the UNIACT answer sheet or fewer than 10 UNIACT item responses for one or more scales. In addition, three cases with invalid birth dates were identified and excluded. These initial screens resulted in a sample of 3,065 adults (1,061

males and 2,004 females) with a complete set of data. Respondents ranged in age from 25 to 77 (Mdn = 33).

Analyses indicated that the sample responding to the mailing was representative of the mailing list sample with regard to age, college attended, and academic major. For example, the median age of the mailing list sample and the respondent sample did not differ appreciably (32 versus 33 years, respectively). With regard to academic major, the mailing list sample consisted of six categories, each containing about 15.8% of the cases, and a smaller category, Technical, with the remaining 5.4% of the cases. For respondents, categories of academic major (and percentage of cases) were Business Contact (15.8%), Business Operations (15.4%), Science (14.5%), Arts (17.1%), Social Services (16.6%), unclassifiable (15.5%), and Technical (5.2%). Finally, both samples contained about 64% females.

Establishing Career Groups

Career groups were formed using ACT's Occupational Classification System (ACT-OCS; ACT, 1988). The ACT-OCS organizes occupations across two levels of specificity. At the more general level, occupations are grouped into six job clusters that are similar to Holland's (1985a) occupational types. Job cluster titles are identical to UNIACT scale titles. At the second level, each job cluster subsumes from 2 to 6 job families; there are a total of 23 job families across the 6 job clusters. The job families group occupations according to similarities of work tasks, worker interests, purpose of work, and work setting.

Grade 12 sample. When students completed UNIACT, they responded to the following open-ended question: "You may have some career choices in mind for the future. Which career are you thinking about most?" Each student's career choice

was assigned to a job family (and hence, job cluster). Students reporting missing or unclassifiable career choices (n = 159) were excluded from data analyses.

Students were asked to indicate career choice certainty by responding to the following question: "How sure are you that the career choice you selected will still be your first choice one year from now?" Students who indicated they were very or fairly certain that their career choice would be the same one year later (n = 1,180) were retained for the study.

Career choice ("occupational preference," vocational aspiration," etc.) has had a long history as a validation criterion in interest research (e.g., see Holland & Gottfredson, 1975; Holland, Gottfredson, & Baker, 1990; Holland & Lutz, 1968). In response to a question regarding their use of vocational aspiration as a validation criterion, Holland et al. (1990) cite data showing that "aspirants for particular occupations resemble the employed adults in the same occupations" (p. 341).

Adult sample. As with the Grade 12 sample, adults were asked to report their career choice and level of certainty. They were also asked to report their occupation if they were currently employed at least half-time. Occupations and career choices were allocated to the job clusters and job families cited above. Of the 3,065 respondents with a complete set of data, 1,101 were employed less than half-time, were unemployed, or reported an unclassifiable occupation. These cases were excluded, leaving 1,964 cases in the sample. An indication of job satisfaction was obtained by requiring each case to meet two screens. First, current occupation had to agree with career choice. That is, they had to be in the same job cluster. Second, respondents had to report they were "very" or "fairly" sure that their career choice would still be the same one year later. The first requirement excluded 887 cases

and the second requirement excluded 308 cases. These screens resulted in a sample of 769 adults.

The term career group will be used throughout this report to refer to the job family allocation for career choice (Grade 12) or current occupation (adults). A total of 27 career groups--18 for Grade 12 and 9 for adults--were identified as having a minimum of at least 20 cases. The occupational content of these groups is summarized in Table 1. Appendices C and D provide specifics.

Mapping Career Groups on the Hexagon

Holland (1979) proposes the use of 3-letter codes to summarize the predominant interests of persons and occupations. For example, if a person's standard scores on the R, I, A, S, E, and C Scales of the SCII are 47, 42, 57, 62, 54, and 51, respectively, the person's 3-letter code is SAE. Mean scores for members of an occupation can be used in the same way to produce a 3-letter code to summarize the interests of the group.

Another way to summarize predominant interests is to use the data/ideas (D/I) and things/people (T/P) dimensions cited above to map individuals or occupations onto Holland's hexagon. Formulas for mapping interests on these dimensions (Prediger, 1981) are based on the geometry of the hexagon. A hexagon, such as the one in Figure 2, has 60^{o} angles between adjacent types. The Cartesian coordinates for the types serve as weights in formulas for calculating scores on the two dimensions. The formulas are as follows:

$$\text{D/I score} = (0.00 \times R) - (1.73 \times I) - (1.73 \times A) + (0.00 \times S) + (1.73 \times E) + (1.73 \times C)$$

$$\text{T/P score} = (2.00 \times R) + (1.00 \times I) - (1.00 \times A) - (2.00 \times S) - (1.00 \times E) + (1.00 \times C)$$

For example, in the D/I formula, R and S scores receive weights of zero because they are on the horizontal axis and, thus, are neutral with respect to the D/I dimension. On the T/P dimension, however, their distance from the center of the hexagon is twice as large as that of the remaining four scales.

In order to locate 3-letter codes on the two dimensions, the relative importance of the three codes must first be determined. The reason for this can be understood by examining an intuitive procedure for mapping 3-letter codes. Suppose that an occupation's 3-letter code is CIR. If we wish to map these interests and the only code available is C, we would locate the occupation between the data and things poles, where C is located on Figure 2. However, if both codes C and I are known, the occupation's location would be shifted toward I. Since the high-point code is C, the location would remain closer to C than to I. If the third code is known, a small shift toward R would be made, but since R is the third code, this shift would be smaller than the shift toward the second code, I. The final location would be a point somewhat near the things pole on the data (upper) side of the things/people axis.

This intuitive procedure translates the relative importance of the three scores into distance measures--the higher the score ranks, the larger the "shift" in location. By actually assigning scores to the interests represented in a 3-letter code, one can more precisely define the relative importance of the interests in determining a location on the hexagon. Although the best assignment of scores is a matter for further research, the procedure of assigning scores of 4, 2, and 1 to the interests ranked first, second, and third has received empirical support (Prediger, 1981, 1982).

Based on these considerations, the following procedures were used to obtain D/I and T/P scores for sample members. First, 3-letter codes were obtained by ranking each person's six UNIACT T-scores. Then scores of 4, 2,

and 1 were assigned to the three letters, as described above. The remaining three interest scales were assigned zeros. For example, if the 3-letter code corresponding to the three highest ranked T-scores is CIR, the scores used in the two formulas provided above would be R = 1, I = 2, A = 0, S = 0, E = 0, and C = 4. Applying this set of scores to the formulas results in a D/I score of 3.5 and a T/P score of 8.0. These scores can be plotted on a hexagon such as the one in Figure 3. As suggested above, these scores result in a point somewhat near the things pole on the data (upper) side of the T/P axis. D/I scores range from -10 to +10 (rounded), and T/P scores range from -11 to +11.

Because these formulas can not be employed when there are ties among the three highest scores, ties for second and third were broken randomly. Cases having ties for the highest interest score were excluded from all data analyses. This screen excluded 102 cases for Grade 12, and 44 cases for adults.

After D/I and T/P scores were calculated for each sample member, mean D/I and T/P scores were obtained for every career group in both samples. These scores were used to plot the locations of career groups on the hexagon.

Obtaining Expert Judgments

Career group locations on Holland's hexagon provide evidence of construct validity to the degree that they correspond to expectations. In this study, expectations were primarily based on judgments from a panel of experts.

Procedure. A three-page booklet (see Appendix B) was developed for the purpose of obtaining expert judgments on career group locations. This booklet received two rounds of tryouts (three panel members per tryout) and revisions prior to use by the final set of panel members. The leaflet consisted of three components: (1) definitions of the four basic work tasks (data, ideas, people, and things); (2) an explanation of how an occupation can be located on a two-dimensional figure according to predominant work tasks; and (3) instructions for

assigning career groups to work task categories. Work task categories were represented by a circle divided into 12 equal sections, each varying in degree of involvement with data, ideas, people, and things (see the diagram on page 2 of Appendix B). Because this circle categorized work tasks on the basis of the D/I and T/P dimensions, panel members were, in effect, instructed to locate each career group in a section of Holland's hexagon. The 12 sections are identical to the 12 regions on the ACT World-of-Work Map (Appendix A).

In developing the leaflet, we recognized that there were two types of judgments that panel members could make. One judgment was to assign career groups to work task categories on the basis of the vocational interests of career group members. The other judgment was to assign career groups on the basis of predominant work tasks. Work task judgments were used in this study because it would appear that judges are more likely to be knowledgeable about work tasks. Since the interests of persons in occupations can not be directly observed, such judgments would probably be inferred from knowledge of the occupation's work tasks.

Panel members made judgments on 12 career groups (six per sample). Within each job cluster, the group having the largest number of cases was listed in the booklet (see page 3 of Appendix B). So that they could focus judgments on the carer groups, per se, panel members were not told the nature of the samples.

Career groups in the first tryout booklet were described by a list of occupations comprising that group. However, most career groups contained numerous occupations with only a few cases. Feedback from tryout panel members indicated that this made judgments difficult. In order to reduce the number of occupations and yet maintain sufficient information to adequately describe the groups, occupations were selected for listing in the final

booklet such that together they accounted for more than 50% of their career group's total size.

Panel members individually assigned each of the 12 career groups to one of the 12 work task categories described above. They were told they could put more than one career group into any work task category, but were not informed that there was one career group per job cluster. Approximately one week after assigning career groups to work task categories, panel members met to discuss their assignments and to arrive at a consensus, if possible, in the case of discrepancies. A doctoral level research psychologist served as group facilitator during the consensus meeting. This person had no prior role in the study, was not aware of the study's results, and thus was unlikely to exert unintentional influence on the panel members' judgments. The facilitator sought to keep discussion on task and to provide non-directive assistance in working toward consensus on the career group assignments. This meeting resulted in a consensus for all 12 career groups.

The adult career group representing the Technical Job Cluster was excluded from all data analyses because it contained fewer than 20 cases. Thus, for analysis purposes, panel members provided judgments on 11 career groups.

Panel members. The members of the final panel were chosen because of their knowledge and experience in occupational classification, vocational psychology, or a combination of these areas. The first panel member, an author of over 30 publications in areas related to career development and vocational guidance, was a professor in counselor education with 20 years of teaching experience in vocational psychology, career guidance, and job placement. The second had 18 years of research and marketing experience related to the delivery of career planning services. His research experience

included assisting in the development of a comprehensive occupational classification system linked to the 3rd edition Dictionary of Occupational Titles (DOT) Worker Trait Group Classification. The third panel member had 5 years of experience describing and classifying occupations both as an employment interviewer and as a labor market analyst/classification specialist. He also had several years of experience, both in internships and in student personnel work, providing career guidance and career-related testing. The first two panel members had doctorates in counseling-related fields, and the third had a masters degree in student personnel work.

Determining Congruence Between Data and Judgments

Agreement between the interests of career group members and panel member judgments of their work tasks was assessed by representing the respective hexagon locations as angles on the D/I and T/P dimensions, and taking the absolute difference in degrees between the two angles. Determining an angle for interests is straightforward because any two scores which locate a point on two dimensions can be converted to an angle by computing their arc tangent. However, panel judgments did not result in a point on two dimensions. Rather, panel members reached consensus on a work task category corresponding to a 30^{o} range of angles. Therefore, the angle at the midpoint of the category selected by the panel was used to represent the expert's judgment.

Consider the following example: The mean D/I and T/P scores for members of a career group have a ratio of 8 to 3. Since both scores are positive, the angle representing their interests will be found in the upper right quadrant of the hexagon. The computed arc tangent is 69^{o}. Assume panel members judge the work tasks for this group to be oriented primarily to data, and secondarily to things (refer to page 2 of Appendix B). This category is

associated with angles ranging from 60° to 90°, and the midpoint is 75°. The congruence score, the absolute difference between 69° and 75°, would be 6°.

As another example, consider the same angle for interests (69°) and a panel judgment category that is oriented primarily to things, and secondarily to ideas. This category is associated with angles ranging from 330° to 360°, and the midpoint is 345° (or -15°). The congruence score, the absolute difference between 69° and -15°, would be 84° (69° plus 15°).

Results

The primary purpose of this study was to show how two work task dimensions can be used to examine the construct validity of interest inventories that assess Holland's six types. Data were initially collected for 1,548 Grade 12 students and 3,085 adults. Screens applied to the Grade 12 sample excluded 470 cases, resulting in a final sample of 1,078 (497 males and 581 females). Screens applied to the adults excluded 2,360 cases, resulting in a final sample of 725 (287 males and 438 females). For the Grade 12 sample, career groups were formed on the basis of career choice (preference) and certainty. For the adult sample, career groups were formed on the basis of actual occupation and an indicator of satisfaction.

Agreement Between Results and Expert Judgments

Evidence relevant to the construct validity of UNIACT can be obtained by comparing actual career group locations on the hexagon to the work task categories assigned by the panel of experts. The hexagon locations for the Grade 12 and adult career groups are mapped in Figures 3 and 4, respectively. The dots inside the hexagon represent the locations of career groups based on interest data. The letters on the outer edge of the hexagon indicate career group assignments to work task categories by the panel. The predominant occupations in each of the career groups are listed in Table 1 (Appendices C &

D provide a more complete list of these occupations). D/I and T/P mean scores for all career groups are shown in Table 2.

Grade 12 sample. As described in the Method section, congruence scores were obtained by computing the absolute difference in degrees (angles) between the empirical data and panel member judgments. Congruence scores for the Grade 12 career groups were as follows: Group B (29^{o}), D (4^{o}), G (24^{o}), M (28^{o}), S (83^{o}), and U (11^{o}). The mean for the six groups was 30^{o}. For perspective, the expected mean difference between random pairs of angles is 90^{o}--three times the overall mean of 30^{o} found here. Alternatively, 30^{o} can be thought of as half the distance between adjacent Holland types (60^{o}). In the context of these benchmarks, the results indicate that the Grade 12 empirical data are in general agreement with the panel judgments.

Given these results, it is not surprising that the career group locations (Figure 3) generally make good sense. For example, Groups B (Management & Planning) and D (Financial Transactions) are found "up North" near the data pole of the D/I dimension. This appears reasonable given the considerable involvement with data work tasks of occupations such as accounting and business management (see Table 1). Given the generally recognized differences between management and accounting occupations with respect to people and things work tasks, it is also not surprising that the management group is located in the Data/people category (primarily data and secondarily people work tasks), while accounting is located in the Data/things category. As another example, Group G (Vehicle Operation & Repair) is found toward the things pole of the T/P dimension, whereas Group U (Education & Related Services) is found on the other side of the hexagon, toward the people pole.

The only clear lack of agreement in Figure 3 is for Group S (consisting primarily of students stating a preference for lawyer, broadcaster or

journalist). The experts placed these occupations in the Ideas/people work task category. However, interest scores indicate a people orientation, primarily. Possibly, high school seniors who do not like ideas work tasks will experience disinterest as they prepare for these fields. The World-of-Work Map, which is based both on job analysis data and the interests of workers (see next section), places Group S midway between the people and ideas "poles."

In order to obtain perspective on the extent to which career group locations might generalize to other samples, the standard error of each career group's mean angle (SEM) was calculated. For the six career groups, SEMs ranged from 3.5° for Career Group D to 6.6° for Career Group G. The 95% confidence limits for Career Group D (mean angle of 79°) are ±1.96SEM or 72° to 86°. For Career Group G (mean angle of 351°), the limits are 338° to 4°. Thus, for samples of reasonable size, the angular measure has a relative small sampling error when judged in the context of the angular distance between Holland's types (60°).

Adult sample. Congruence scores obtained for adults range from 5° for Group D to 96° for Group T, with a mean of 41°. Again, the mean congruence score is considerably smaller than the expected mean difference between random pairs of angles (90°), and is less than the distance between adjacent Holland types (60°).

SEMs for the five adult career groups ranged from 4.4° for Career Group D to 7.9° for Career Group S. The 95% confidence limits are 61° to 79° for Career Group D and 149° to 181° for Career Group S. As before, the angular measure has a relatively small sampling error for samples of reasonable size. Congruence scores for Group S (60°) and T (96°) were especially large. Adults in Group S (primarily paralegal/legal assistant occupations) are located close to the origin, indicating that their interests lack clarity.

Without clearly defined interests, level of agreement between interests and panel judgment is difficult to interpret. Despite this, both interest scores and panel members placed Group S in the people-data quadrant. The interest scores for Group T (primarily nursing occupations) place the group further down the D/I dimension than expected by the panel. Yet, the interest data are consistent with Lamb and Prediger (1981), who reported that nursing students scored highest on the Science Scale in six of seven samples of 2-year and 4-year college females. Perhaps nursing provides a socially acceptable career choice for females with science interests.

Across the two samples, many career groups displayed general agreement with the panel members. The interest inventory results for one of the three noteworthy discrepancies (adult Group T) is supported by prior empirical findings. It should be noted that some discrepancies may be due to our asking panel members to focus on work tasks instead of worker interests. Prediger (1982) obtained correlations between worker interests and their work tasks, both expressed as D/I and T/P scores. The correlations, which ranged from .68 to .81 in two samples (563 occupations), were substantial--but far from perfect.

Agreement Between Results and World-of-Work Map

Although not the primary focus of this report, ACT's World-of-Work Map (WWM; see Appendix A) provides another basis for examining UNIACT construct validity. For example, one can compare the empirical locations of career groups (viz., job families) obtained in this study with job family locations on the WWM. As described by ACT (1988), job analysis data for all occupations in the 4th edition DOT (U.S. Department of Labor, 1977), as well as interest scores for persons in 991 occupational groups, were used to determine job family locations on the WWM.

Even though the WWM shows the locations of job families on the two work tasks dimensions, WWM locations and the locations reported here are not strictly comparable for three reasons. First, information used to determine WWM job family locations included more than just interest scores, as noted above. Second, the career groups used in this study consisted only of occupations reported by respondents. Many occupations included in the WWM job families are not represented in the groups here. Third, during the development of the WWM, data from each occupation within a job family contributed equally to determining the location of the job family on the map. In contrast, the locations of career groups in this report primarily reflect the interests of persons in the most frequently reported occupations. Nevertheless, the map locations of career groups on the hexagon and job families on the WWM are generally similar. Congruence scores for the Grade 12 sample range from 0^{o} to 69^{o}, with a mean of 22^{o}. Adult congruence scores range from 1^{o} to 71^{o}, with a mean of 32^{o}. Figure 5 shows the locations for all 27 career groups with 20 or more cases, and Appendix A shows the locations of job families on the WWM. Compare, for example, Career Groups A, B, and C with Job Families A, B, and C.

Figure 5 can also be used to compare the locations of Grade 12 and adult career groups. Despite the different procedures used in forming the groups, and the somewhat different sets of occupations making up the career groups, the locations of corresponding career groups for these two samples show a surprising level of similarity. Compare, for example, Groups A, B, and C across the two samples. For the nine pairs of career groups across the two samples, congruence scores range from 3^{o} to 59^{o}, with a mean of 25^{o}. Additional observations are left to the reader.

Mean Score Profiles

The more common approach to evaluating the construct validity of an interest inventory is to examine interest score profiles. Mean score visual profiles for the largest career groups in each of the job clusters (i.e., the same eleven groups presented in Figure 3 and 4) are shown in Figures 6-9. The horizontal line ($\underline{M}$ = 50) on each figure shows the performance of the 1983 UNIACT norm group, a nationally representative sample of high school seniors.

Figures 6-9 show that, for both samples, results generally conform to expectations. That is, most groups score highest on the scale corresponding to their job cluster. For example, in both samples the Management and Planning groups score highest on the Business Contact Scale, the Financial Transactions groups score highest on the Business Operations Scale, and the Engineering and Other Applied Technologies groups score highest on the Science Scale. In total, 8 of the 11 profiles are in accord with expectations. The three exceptions involve the same career groups with low agreement between mapped interests and expert judgments: Applied Arts for both samples and General Health Care for adults.

Tables 3 and 4 present mean scores and highest scales for all career groups with at least 20 cases (i.e., the same groups presented in Figure 5). Again, results generally conform to expectations. Highest scale results indicate that 20 of 27 career groups (74%) scored highest on the appropriate scale. Inspection of the scale scores reveal that, in cases where the highest scale is unexpected, the mean score for the appropriate scale usually ranked second. A detailed examination of these results is left to the reader.

Discussion

UNIACT scores for 27 career groups from two samples were depicted as locations on Holland's hexagon. Results demonstrated the use of the D/I and

T/P dimensions in evaluating the construct validity of interest inventories that assess Holland's six types. In addition, 6-score profiles were presented to allow the reader to compare the usefulness of these two qualitative procedures.

Advantages of Mapping

Factors favoring the use of multiple-score profiles are well known. Most vocational researchers and counselors are familiar with them (as well as 3-letter codes), and find them readily interpretable. The advantages of mapping groups on the hexagon, while less well known, are apparent from the results reported here. The mapping procedure efficiently summarizes information contained in a score profile for Holland's types by converting 3-letter codes into a location on Holland's hexagon. As a result, numerous groups can be presented on the same hexagon (e.g., 27 are shown in Figure 5) without loss of interpretability. Because numerous groups can be mapped, the location of one group can be easily compared to the locations of other groups. In contrast, visual profiles become difficult to decipher when more than a few appear together. Imagine, for example, 27 profiles in Figure 6.

Another advantage of mapping pertains to the measurement of congruence. Congruence in studies examining the construct validity of measures of Holland's types is often reported in terms of the percentage of groups with high-point codes in line with expectations, e.g., "20 of 27 career groups (74%) scored highest on the appropriate scale." A more precise measure of congruence can be obtained when interests and expectations are expressed as locations on Holland's hexagon. As shown here, the congruence measure is simply the difference between the angles for interests and expectations. This difference can be compared to benchmark values such as the maximum difference

between pairs of angles (180^{o}), the mean difference between random pairs of angles (90^{o}), or the difference between Holland's types (60^{o}).

More broadly, a congruence measure based on hexagon distance can serve a number of important research purposes. For example, it can be used to examine (a) similarities and differences among occupations (Prediger, 1981), (b) interest agreement between individuals and occupations (Swaney & Prediger, 1985), and (c) the consistency of scores obtained by a counselee on various measures of Holland types (Prediger, 1982).

Other indices have been devised to assess agreement between pairs of 3-letter codes. Probably the most popular indices have been proposed by Zener and Schnuelle (1976) and Iachan (1984, 1990), both of which have been advocated by Holland (1979, 1985b). These indicies are based on letter matches (e.g., are R and C in both codes?) and letter/position matches (e.g., is R the first letter in both codes?). Unlike these atheoretical indicies (e.g., relationships among Holland's types are ignored), the angular congruence measure illustrated here makes use of the hexagonal similarities among Holland's six types. An angular congruence measure also uses a universal scale (360^{o}) that has intuitive meaning when anchored to the hexagon. The Zener-Schnuelle and Iachan congruence measures use ad hoc scales.

It is important to note that the angular congruence measure is not based on actual hexagon locations. That is, angular distance (difference) between two locations is assessed rather than linear distance. This is because actual locations on the hexagon are a function of both interest type (angle) and clarity (consistency of scores for Holland's types). Inconsistent 3-letter codes (e.g., RSE) are located closer to the center of the hexagon than consistent codes (e.g., RIC). Thus, a linear measure of congruence (as proposed by Cole et al., 1971) confounds congruence of interest type with

similarity of interest consistency. Only congruence of interest type is indicated by the angular measure.

UNIACT Construct Validity

Results from both samples provide evidence supporting the construct validity of the revised UNIACT. The locations of the 11 career groups on the hexagon (Figures 3 and 4) generally conformed to expectations based on expert judgment. Mean congruence scores for the Grade 12 and adult samples were 30^{o} and 41^{o}, respectively. In addition, the locations of the 27 career groups on the hexagon (Figure 5) generally appeared sensible. (Also see Appendix E, which provides UNIACT "hit rates"--a more traditional index of construct validity.)

One of the unexpected study results was the location of nurses on the hexagon--nearer the ideas pole rather than the people pole. Because this result is consistent with results for several other samples (as discussed above), consideration should be given to reassigning nursing occupations to a job family in the Science Job Cluster.

As noted in the Method section, the panel of experts assigned career groups to hexagon regions on the basis of work tasks, despite the fact that career groups were empirically located on the hexagon using interest scores. The use of panel assignment based on work tasks rather than work-related interests may have lowered the degree of agreement between actual career group locations and panel assignments. In the future, researchers using panel judgments as criteria for interest inventory validation (as "truth") may want to ask panel members to locate occupations on the hexagon on the basis of typical interests of occupational group members rather than typical work tasks.

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Table 1

Overview of Occupations in Career Groups

JOB CLUSTER and career group	Grade 12	Adults
BUSINESS CONTACT		
A. Marketing & Sales	Travel agent, marketing/sales	Sales clerk, marketing/sales
B. Management & Planning	Manager (e.g., business, store, restaurant)	Manager (e.g., office, store, sales), personnel worker, adm. asst.
BUSINESS OPERATIONS		
C. Records & Communications	Secretary	Secretary, clerk
D. Financial Transactions	Accountant	Accountant
TECHNICAL		
G. Vehicle Operation & Repair	Mechanic, pilot	[a]
H. Construction & Maintenance	Construction worker, carpenter	[a]
I. Ag. & Natural Resources	Forestry & related, farmer	[a]
SCIENCE		
M. Engineering & Applied Tech.	Engineer	Engineer, computer programmer
N. Medical Specialties & Tech.	Veterinarian, dentist, X-ray tech.	[a]
O. Natural Sciences & Math	Biologist, chemist	[a]
P. Social Sciences	Psychologist	[a]
ARTS		
Q. Applied Arts (Visual)	Architect, comm. artist, fashion merch.	[a]
R. Creative/Performing Arts	Musician/singer, music-art teacher	[a]
S. Applied Arts (Written/Spoken)	Lawyer, TV/radio broadcaster, journalist	Paralegal/legal assistant
SOCIAL SERVICE		
T. General Health Care	Nurse	Nurse (LPN, RN)
U. Education & Related Services	Teacher (elementary, secondary)	Teacher (elementary, secondary)
V. Social & Government Services	Social worker, police officer, athlete	Police officer, social worker
W. Personal/Customer Services	Cosmetologist	[a]

Note. Because some career groups included a number of occupations, only predominant occupations are shown here. Taken together, the occupations listed for a given career group accounted for more than 50% of its total size. See Appendices C and D for an extended list of occupations and N-counts by career group.

[a]Minimum of 20 eligible cases not available. The following career groups (job families) in the ACT Occupational Classification System (ACT, 1988) are not represented in either the Grade 12 or adult sample: E, F, J, K, & L.

Table 2

Mean Data/Ideas (D/I) and Things/People (T/P) UNIACT Scores and Angles for Grade 12 and Adult Samples

JOB CLUSTER and career group	Grade 12 N[a]	Grade 12 D/I	Grade 12 T/P	Grade 12 Angle	Adults N[a]	Adults D/I	Adults T/P	Adults Angle
BUSINESS CONTACT	119	4.62	-1.84	112	153	2.50	-1.47	120
A. Marketing & Sales	37	3.33	-2.73	129	55	1.86	-2.35	142
B. Management & Planning	82	5.21	-1.44	106	98	2.87	-0.98	109
BUSINESS OPERATIONS	111	7.02	0.39	87	144	3.43	1.92	61
C. Records & Communications	31	6.33	-0.87	98	48	2.00	1.94	46
D. Financial Transactions	71	7.68	1.47	79	79	5.32	1.95	70
TECHNICAL	114	-0.96	4.03	347	38	-1.87	5.40	341
G. Vehicle Operation & Repair	45	-0.70	4.44	351	b			
H. Construction & Maintenance	20	0.79	5.25	9	b			
I. Ag. & Natural Resources	23	-3.08	3.17	312	b			
SCIENCE	228	-1.88	1.22	303	118	-2.59	3.90	326
M. Engineering & Applied Tech.	119	-0.99	3.19	343	95	-2.34	4.50	333
N. Medical Specialties & Tech.	46	-2.11	0.74	289	b			
O. Natural Sciences & Math	26	-6.87	1.65	284	b			
P. Social Sciences	37	-0.94	-4.81	191	b			
ARTS	222	-1.34	-3.19	203	74	-2.93	-1.04	250
Q. Applied Arts (Visual)	77	-1.26	-1.12	228	b			
R. Creative/Performing Arts	52	-5.04	-4.02	231	b			
S. Applied Arts (Written/Spoken)	93	0.65	-4.44	172	38	0.50	-1.92	165
SOCIAL SERVICE	284	-0.81	-3.17	194	198	-3.14	-1.45	245
T. General Health Care	102	-2.69	-2.92	222	74	-3.88	-0.59	261
U. Education & Related Services	110	-0.25	-3.96	184	73	-2.87	-1.47	243
V. Social & Government Services	47	0.22	-1.32	171	35	-1.04	-2.94	200
W. Personal/Customer Services	25	2.50	-4.16	149	b			

Note. For the 27 career groups (18 for Grade 12 sample and 9 for adult sample), D/I standard deviations (SDs) range from 4.03 to 7.15 (median of 5.95); T/P SDs range from 3.56 to 7.26 (median of 5.46).

[a]In some cases, the Ns for career groups do not sum to the Ns for job clusters because the clusters include data for career groups with fewer than 20 cases.

[b]Minimum of 20 eligible cases not available.

Table 3

Mean Interest Scores for Grade 12 Sample

JOB CLUSTER and career group	N[a]	UNIACT scale BC	BO	TEC	SCI	ART	SOC	Highest scale
BUSINESS CONTACT (BC)	119	56.4	53.1	42.3	44.3	46.3	48.2	BC
A. Marketing & Sales	37	55.4	51.1	41.4	44.2	48.1	49.7	BC
B. Management & Planning	82	56.9	54.0	42.7	44.3	45.5	47.6	BC
BUSINESS OPERATIONS (BO)	111	54.3	59.1	41.6	42.6	43.4	45.6	BO
C. Records & Communications	31	52.2	55.6	41.4	40.7	42.9	47.4	BO
D. Financial Transactions	71	55.0	61.7	41.1	43.5	43.1	44.3	BO
TECHNICAL (TEC)	114	43.3	42.8	49.3	46.0	41.9	41.8	TEC
G. Vehicle Operation & Repair	45	43.1	42.1	48.1	45.7	41.0	40.0	TEC
H. Construction & Maintenance	20	46.3	45.8	52.4	46.2	44.7	45.0	TEC
I. Ag. & Natural Resources	23	40.7	42.2	48.2	50.3	41.2	40.6	SCI
SCIENCE (SCI)	228	48.2	46.3	48.2	53.5	48.1	47.8	SCI
M. Engineering & Applied Tech.	119	47.4	47.2	50.5	51.8	46.5	44.8	SCI
N. Medical Specialties & Tech.	46	49.5	47.9	47.0	55.7	47.5	49.9	SCI
O. Natural Sciences & Math	26	44.4	43.4	49.4	63.2	50.0	48.7	SCI
P. Social Sciences	37	52.1	43.5	41.6	49.6	52.6	54.3	SOC
ARTS (ART)	222	49.8	44.3	41.6	45.6	54.2	47.3	ART
Q. Applied Arts (Visual)	77	47.7	45.6	45.0	46.3	53.3	44.2	ART
R. Creative/Performing Arts	52	43.4	39.7	37.5	42.9	57.3	46.1	ART
S. Applied Arts (Written/ Spoken)	93	55.1	45.7	40.9	46.5	53.3	50.5	BC
SOCIAL SERVICE (SOC)	284	48.8	45.2	42.7	48.8	49.0	52.1	SOC
T. General Health Care	102	47.5	43.8	42.4	52.9	47.9	52.8	SCI
U. Education & Related Services	110	50.1	46.5	42.3	48.2	51.7	52.8	SOC
V. Social & Government Services	47	48.0	44.3	44.5	43.9	45.7	49.0	SOC
W. Personal/Customer Services	25	50.2	46.4	41.4	43.5	47.4	52.2	SOC

Note. Standard scores (M = 50, SD = 10) are based on a nationally representative sample of Grade 12 students.

[a]In some cases, the Ns for career groups do not sum to the Ns for job clusters because the clusters include data from career groups with fewer than 20 cases.

Table 4

Mean Interest Scores for Adult Sample

JOB CLUSTER and career group	N[a]	UNIACT scale BC	BO	TEC	SCI	ART	SOC	Highest scale
BUSINESS CONTACT (BC)	153	58.9	54.0	50.3	53.8	51.0	53.2	BC
A. Marketing & Sales	55	59.6	52.7	50.3	54.2	51.3	54.9	BC
B. Management & Planning	98	58.5	54.7	50.3	53.5	50.9	52.3	BC
BUSINESS OPERATIONS (BO)	144	52.4	59.4	48.6	51.1	46.8	49.0	BO
C. Records & Communications	48	49.7	57.1	48.6	50.6	47.0	47.7	BO
D. Financial Transactions	79	54.2	62.1	48.0	50.4	46.2	50.2	BO
TECHNICAL (TEC)	38	50.1	51.7	61.6	56.5	48.1	49.8	TEC
SCIENCE (SCI)	118	50.3	49.7	57.0	59.0	50.4	50.5	SCI
M. Engineering & Applied Tech.	95	49.9	49.3	57.4	58.7	49.4	49.5	SCI
ARTS (ART)	74	51.0	45.8	49.5	55.8	57.7	50.4	ART
S. Applied Arts (Written/ Spoken)	38	55.3	47.8	46.8	54.5	54.0	51.0	BC
SOCIAL SERVICE (SOC)	198	50.9	45.8	49.8	57.2	51.4	56.0	SCI
T. General Health Care	74	49.7	44.4	49.9	59.2	49.5	55.4	SCI
U. Education & Related Services	73	51.6	47.3	49.2	57.3	52.6	56.4	SCI
V. Social & Government Services	35	52.8	46.3	50.3	52.6	50.3	55.7	SOC

Note. Standard scores (M = 50, SD = 10) are based on a nationally representative sample of Grade 12 students.

[a]In some cases, the Ns for career groups do not sum to the Ns for job clusters because the clusters include data from career groups with fewer than 20 cases.

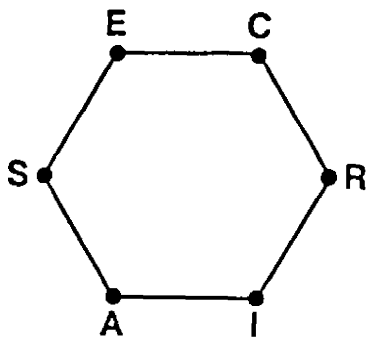

Figure 1. Holland's six types and their hexagonal relationship.

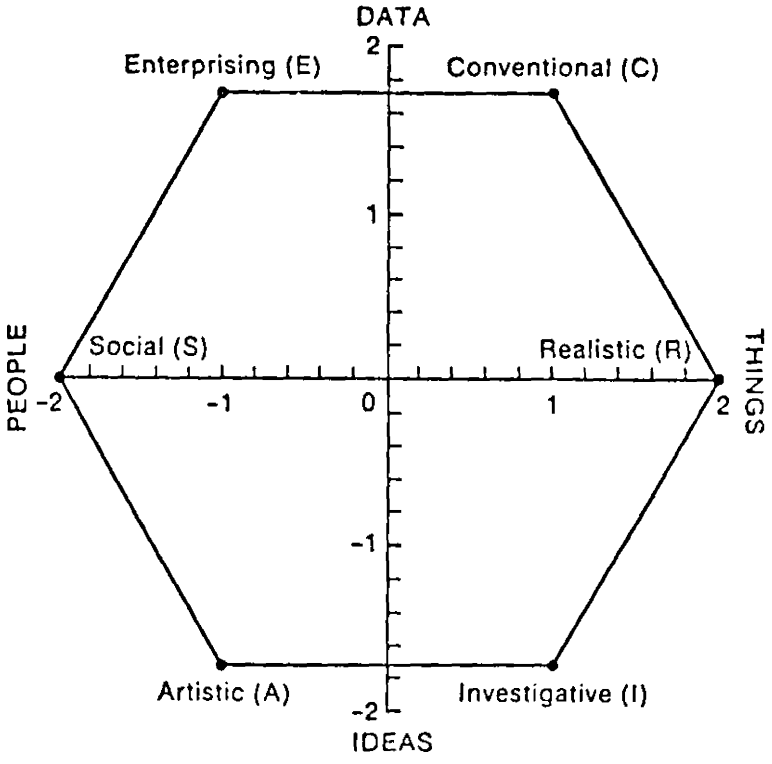

Figure 2. Locations of Holland's types on the data/ideas and things/people dimensions.

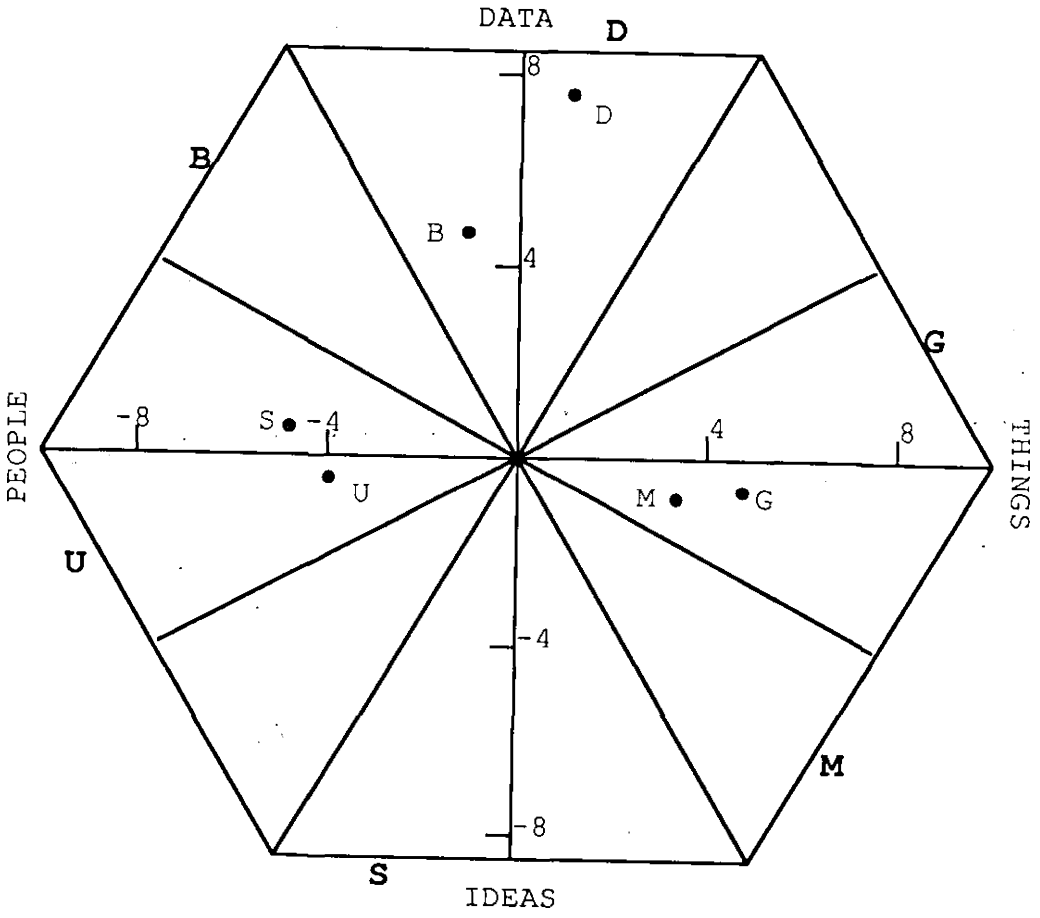

Figure 3. Grade 12 career group locations and expert judgments. (Dots inside the hexagon represent the locations of career groups based on interest scores. Letters on the edge of the hexagon represent career group assignments to work task categories--sections of the hexagon--by the panel of experts.)

B: Management & Planning
D: Financial Transactions
G: Vehicle Operation & Repair
M: Engineering & Applied Technologies
S: Applied Arts (Written & Spoken)
U: Education & Related Services

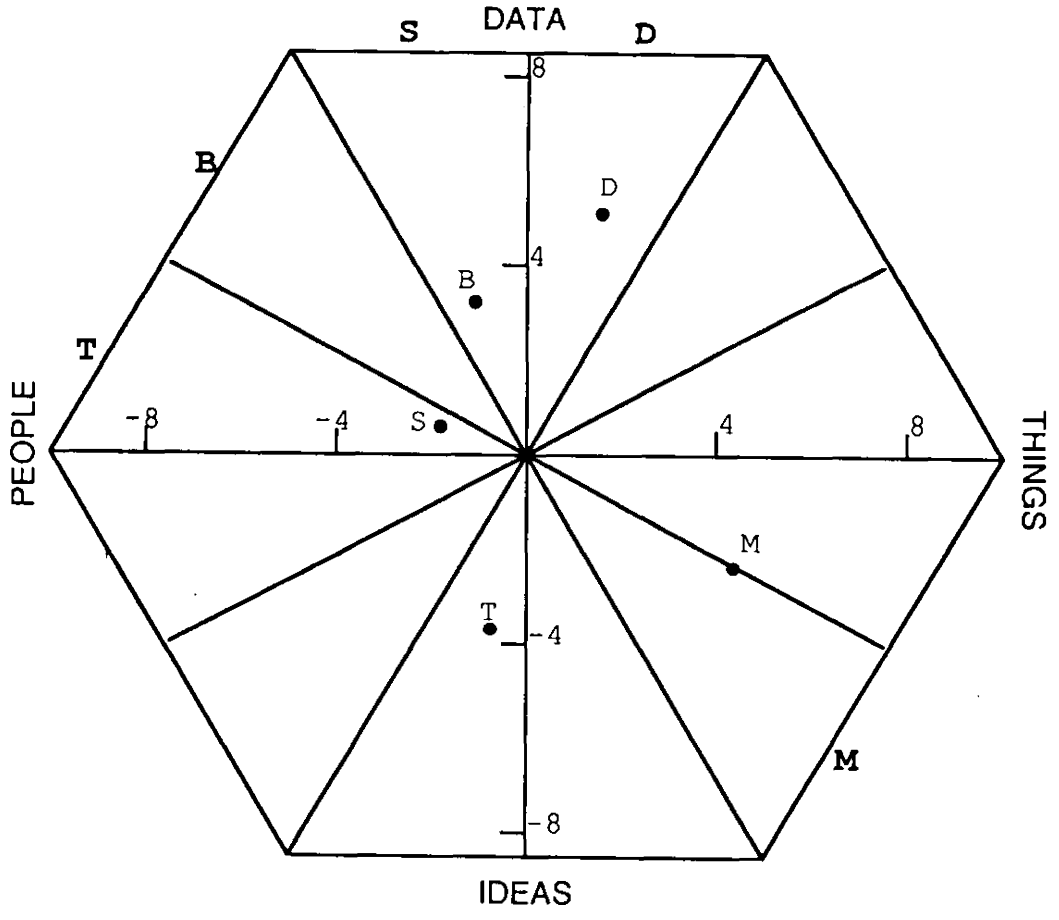

Figure 4. Adult career group locations and expert judgments. (Dots inside the hexagon represent the locations of the career groups based on interest scores. Letters on the edge of the hexagon represent career group assignments to work task categories--sections of the hexagon--by the panel of experts.)

B: Management & Planning
D: Financial Transactions
M: Engineering & Applied Technologies
S: Applied Arts (Written & Spoken)
T: General Health Care

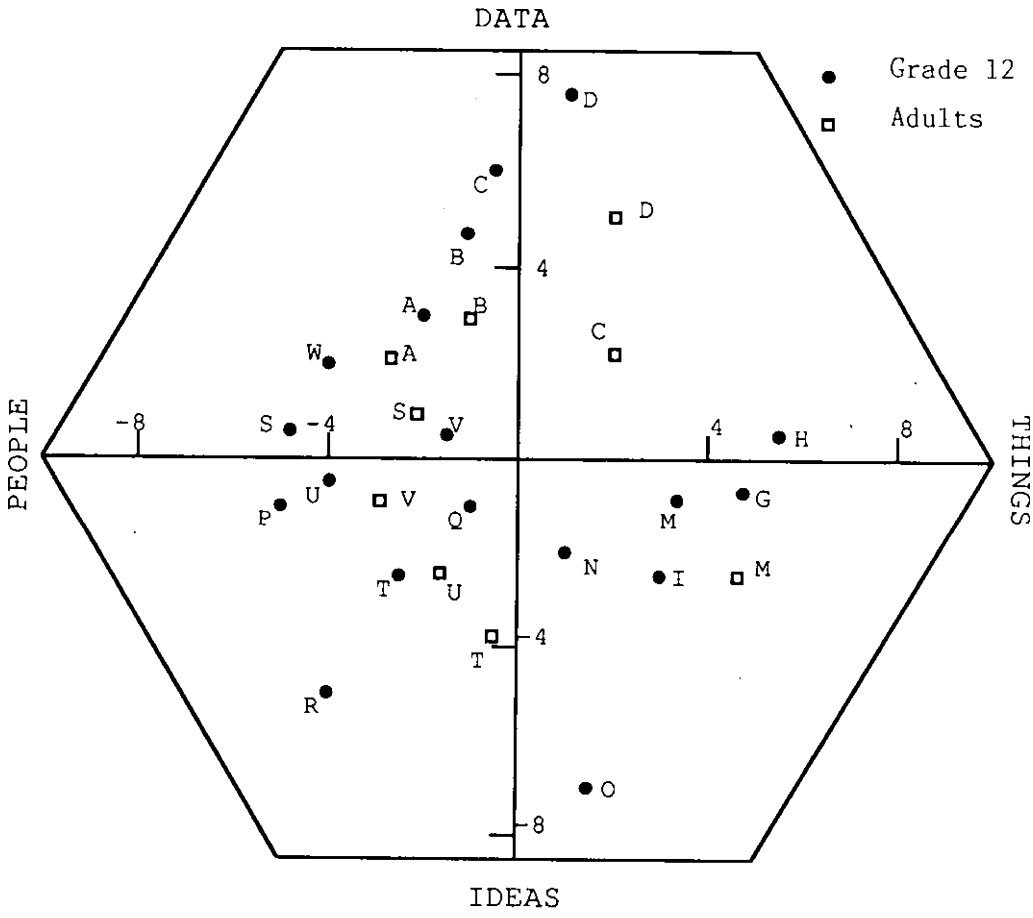

Figure 5. Grade 12 and adult career group locations for all groups with 20 or more cases.

A: Marketing & Sales
B: Management & Planning
C: Records & Communications
D: Financial Transactions
G: Vehicle Operation & Repair
H: Construction & Maintenance
I: Agriculture & Natural Resources
M: Engineering & Applied Technologies
N: Medical Specialties & Technologies
O: Natural Sciences & Mathematics
P: Social Sciences
Q: Applied Arts (Visual)
R: Creative/Performing Arts
S: Applied Arts (Written & Spoken)
T: General Health Care
U: Education & Related Services
V: Social & Government Services
W: Personal/Customer Services

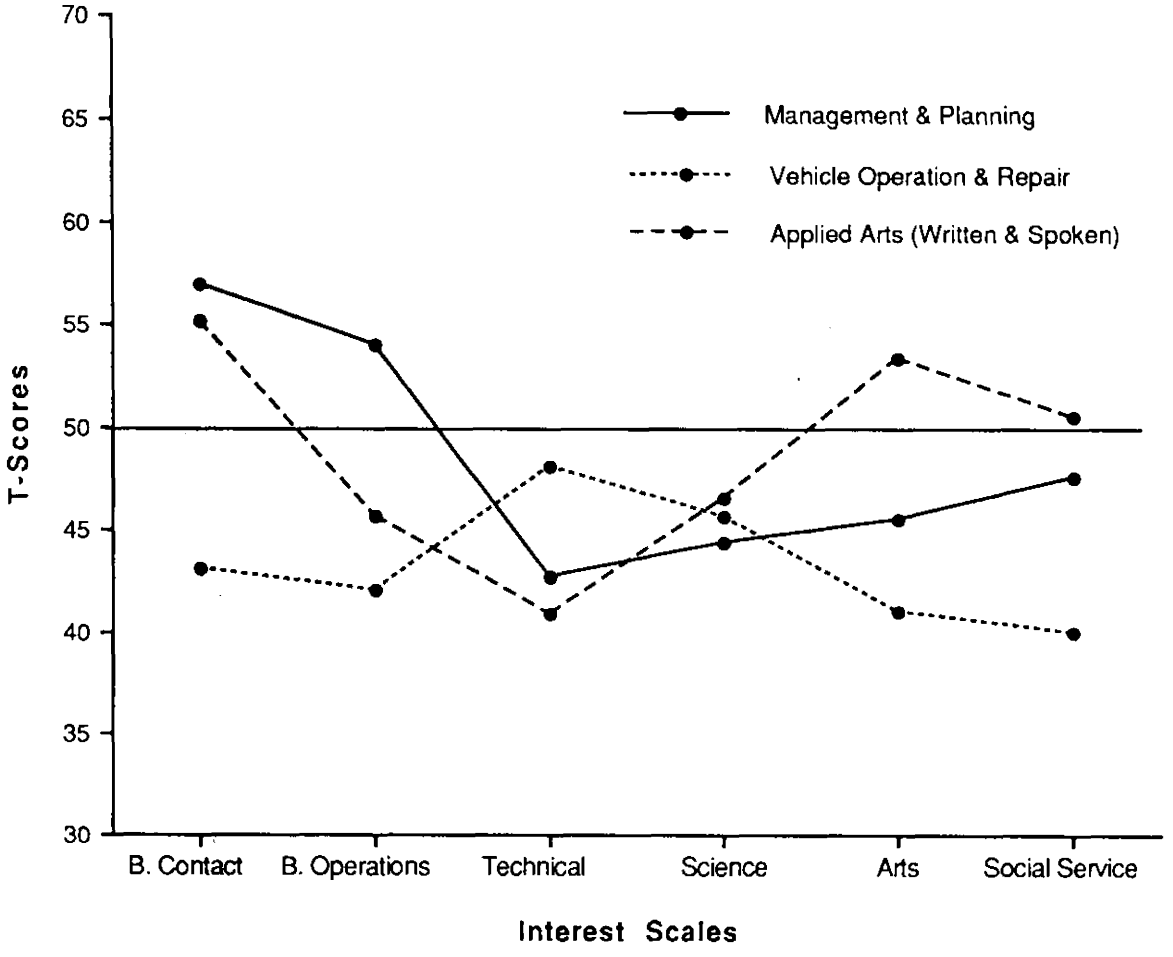

Figure 6. Grade 12 interest scale profiles for the largest career group within the Business Contact, Technical, and Arts job clusters, respectively.

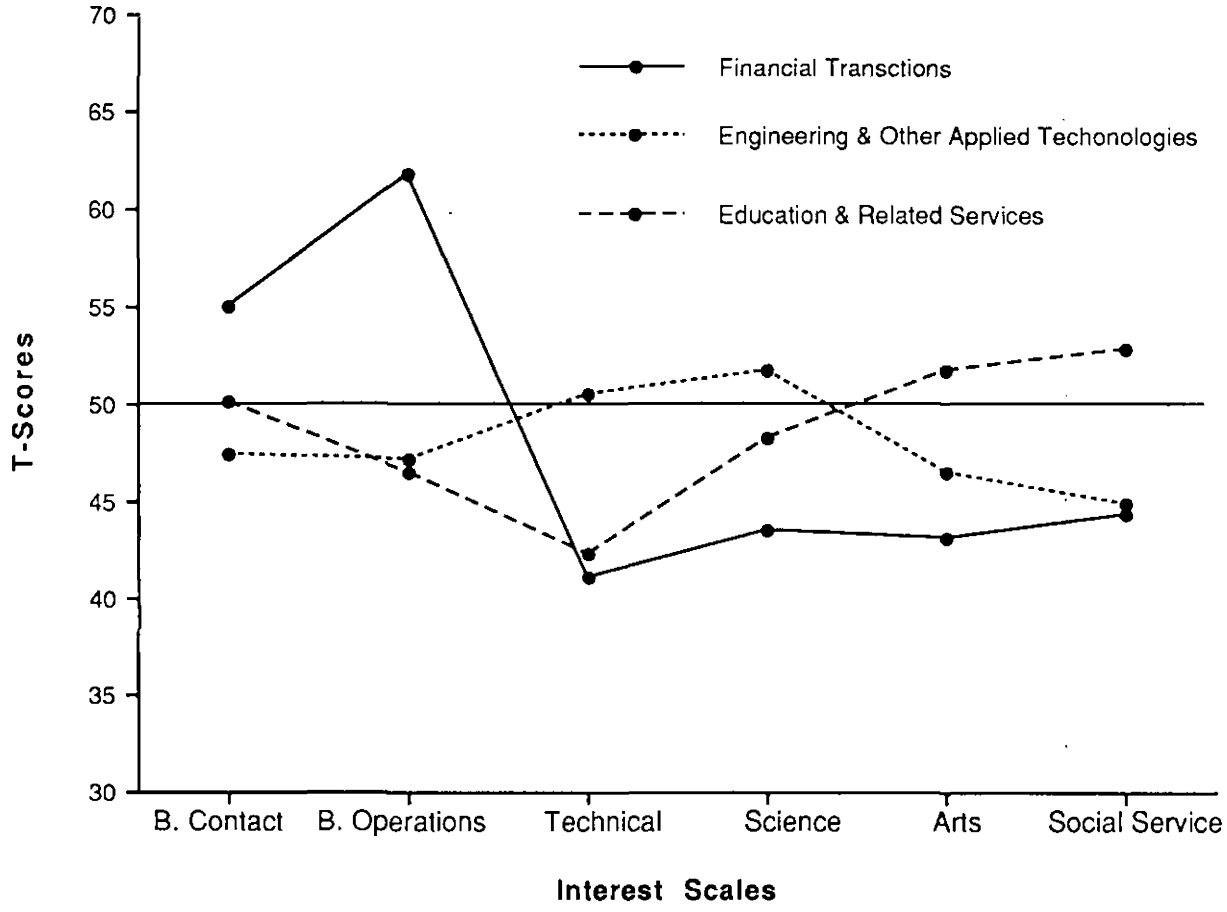

Figure 7. Grade 12 interest scale profiles for the largest career group within the Business Operations, Science, and Social Service job clusters, respectively.

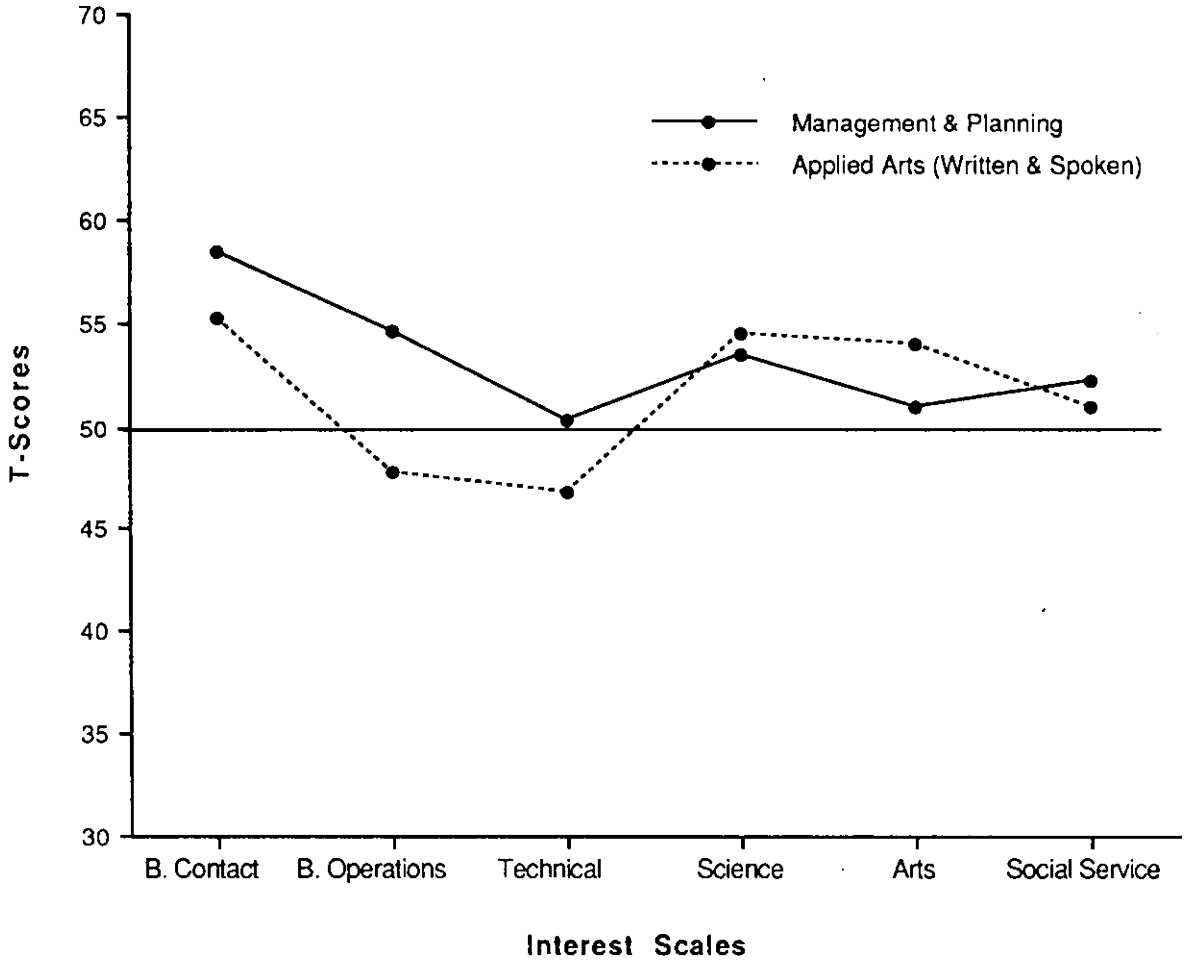

Figure 8. Adult interest scale profiles for the largest career group within the Business Contact and Arts job clusters, respectively.

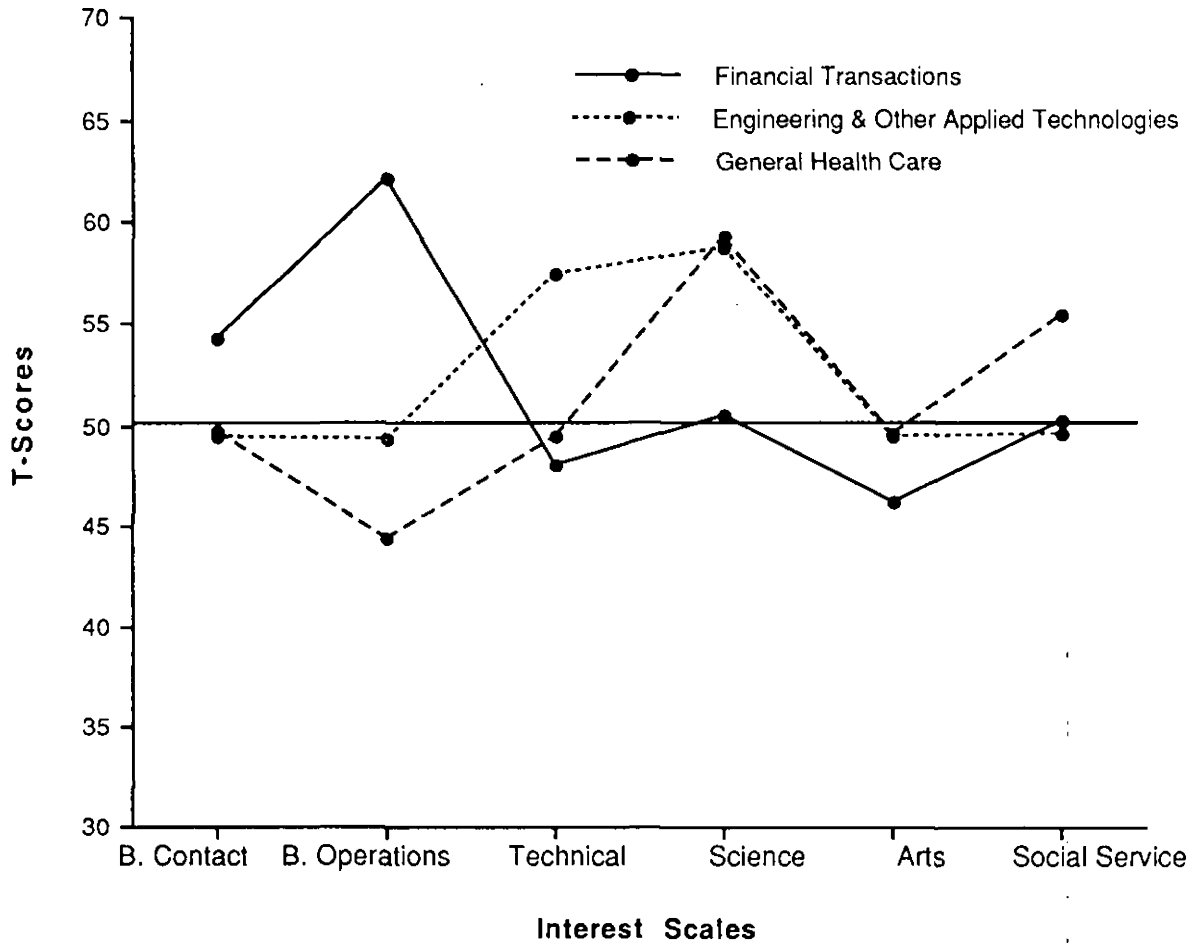

Figure 9. Adult interest scale profiles for the largest career group within the Business Operations, Science, and Social Service job clusters, respectively.

APPENDICES

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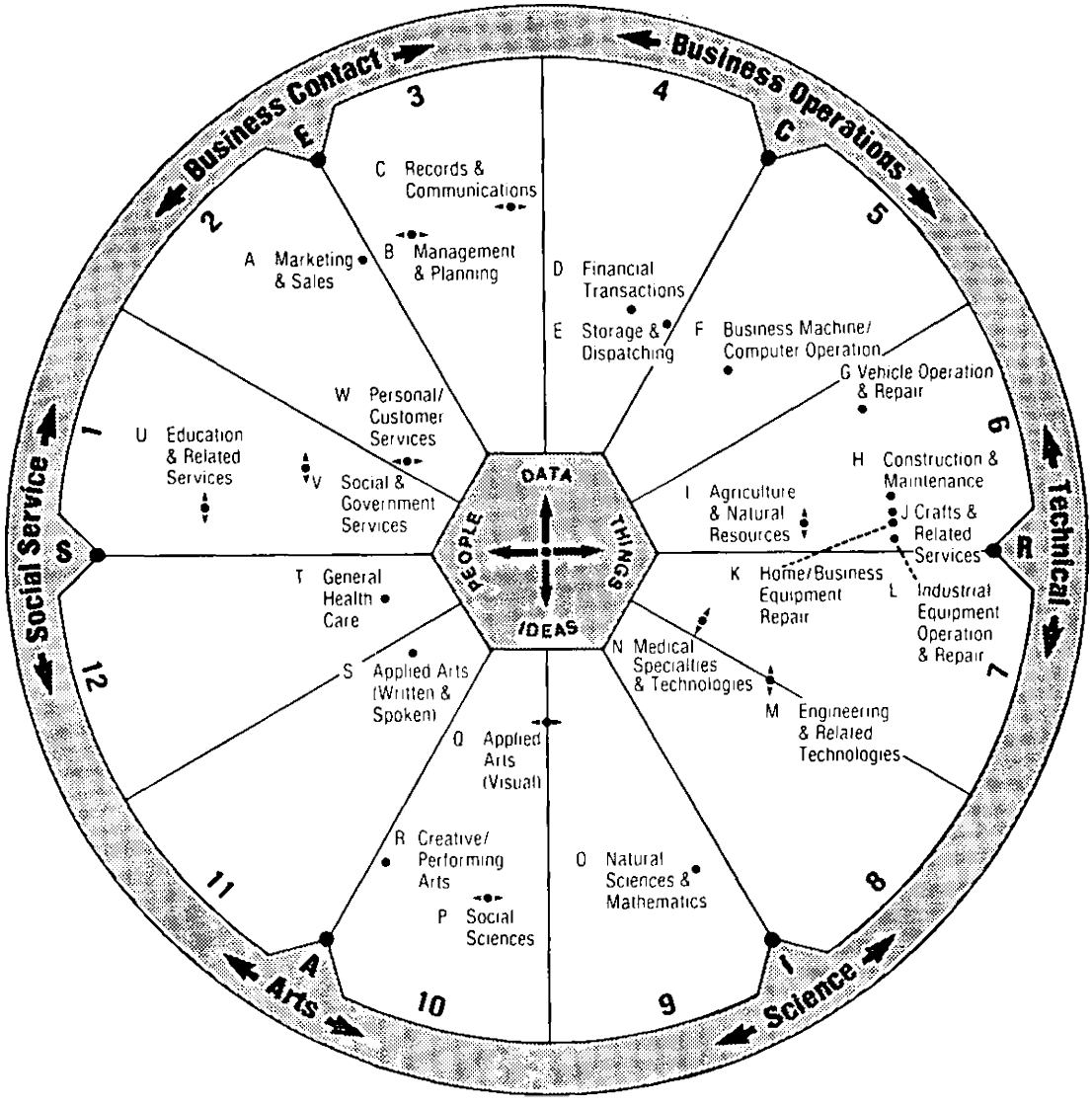
APPENDIX A

WORLD-OF-WORK MAP
(2nd Edition)



About the Map

- The World-of-Work Map arranges job families (groups of similar jobs) into 12 regions. Together, the job families cover all U.S. jobs. Although the jobs in a family differ in their locations, most are located near the point shown.
- A job family's location is based on its primary work tasks—working with DATA, IDEAS, PEOPLE, and THINGS. Arrows show that work tasks often heavily involve both PEOPLE and THINGS (◄●►) or DATA and IDEAS (▲ ▼).
- Six general areas of the work world and related Holland types are indicated around the edge of the map. Job Family Charts (available from ACT) list over 500 occupations by general area, job family, and preparation level. They cover more than 95% of the labor force.

APPENDIX B

Work Sheets Used by Panel of Experts

Name _____

Date _____

Assigning Occupational Groups to Work Task Categories

1. WE NEED YOUR HELP!

Your expert judgments are needed to assist us in examining the validity of the revised edition of the ACT Interest Inventory. Persons in two samples were asked to complete the ACT Interest Inventory and to indicate the occupation they were pursuing. We then grouped together occupations we judged to be similar. Your task is to assign each of these occupational groups to one of 12 work task categories. To do this, you first need to know about the four basic work tasks.

2. FOUR BASIC WORK TASKS

Research suggests that occupations differ in how much they involve working with the four basic work tasks: PEOPLE, DATA, THINGS, and IDEAS.

- PEOPLE tasks are inter-personal tasks such as caring for, educating, entertaining, serving, persuading, or directing others.

- DATA tasks are impersonal tasks involving procedures and transactions that expedite goods/services consumption by people (for example, by organizing, recording, verifying, or transmitting facts, numbers, instructions, etc.).

- THINGS tasks are non-personal tasks involving machines, tools, living things, and materials such as food, wood, or metal.

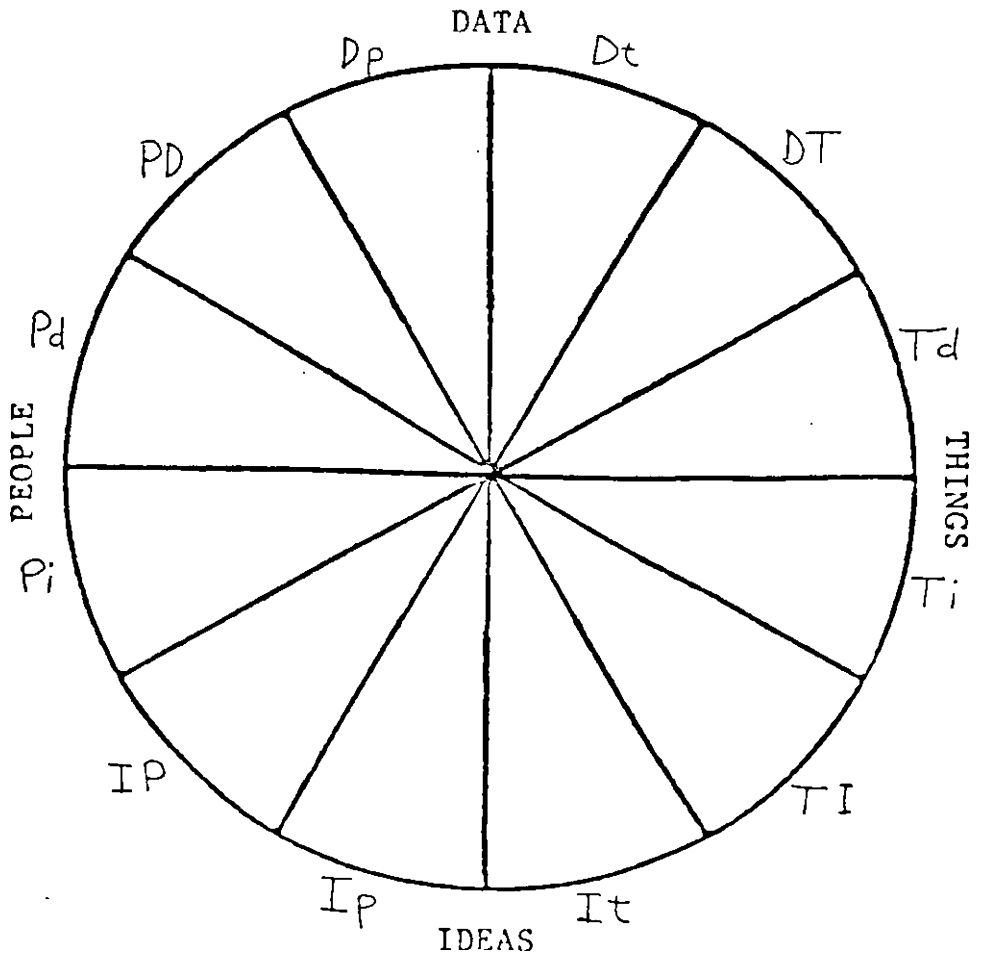
- IDEAS tasks are intra-personal tasks involving insights, theories, and new ways of expressing something with, for example, words, paint, equations, or music.

Any occupation will involve some work with all of these basic work tasks, but in most occupations one or two work tasks predominate. For example, scientists may work with data but their primary purpose is to create or apply scientific knowledge (i.e., ideas). Likewise, dentists work with people but their primary purpose is to treat problems of the teeth (i.e., things). As you assign our occupational groups to categories, you will need to decide on the one or two predominate work tasks.

Some combinations of work tasks are more common than others. For example, occupations having high involvement with PEOPLE and DATA are far more common than occupations having high involvement with PEOPLE and THINGS. A few of the 12 most common combinations of work tasks are described below:

Pd: PEOPLE predominate with a lesser degree of data involvement.
PD: PEOPLE and DATA are about equally represented.
Dp: DATA predominate with a lesser degree of people involvement.
Dt: DATA predominate with a lesser degree of things involvement.
DT: DATA and THINGS are about equally represented.
Td: THINGS predominate with a lesser degree of data involvement.

Research suggests that differences among occupations can be represented by two bipolar dimensions of work tasks: a data/ideas dimension and a things/people dimension. The diagram below arranges the work task dimensions like compass directions on a map. The locations of the 12 most common work task combinations, represented by 12 "pie slices," are also shown.



3. YOUR JUDGMENTS

The occupational groups mentioned earlier are listed by sample below. Your task is to assign each group to one of the 12 work task categories described on the previous page. Using a pencil, write the number of the group directly into the one pie slice that best describes the work tasks for that group. (You can put more than one group in the same category.)

Note: It is important that you not refer to an ACT World-of-Work Map while completing this task.

SAMPLE A

Group	Occupations in Group
1	Machinist Fireman
2	Accountant
3	Manager (Office; Store; Property; Sales) Human resources; personnel Administrative assistant
4	Engineer Computer programmer
5	Nurse, LPN, RN
6	Paralegal/Legal Assistant

SAMPLE B

Group	Occupations in Group
7	Manager (Business; Store; Restaurant)
8	Mechanic Pilot
9	Lawyer Communications (e.g., TV or radio broadcasting) Journalist
10	Accountant
11	Teacher (Secondary; Math; English; Business) Elementary teacher
12	Engineer

APPENDIX C

Occupational Group Classification for Grade 12 Sample

JOB CLUSTER and career group	Occupations in career group	N[a]
BUSINESS CONTACT		119
A. Marketing & Sales		37
	Travel agent	10
	Marketing	10
	Salesman	3
	Insurance underwriter	3
	Miscellaneous	11
B. Management & Planning		82
	Business manager/management	40
	Own business	9
	International business	7
	Restaurant/industry Produce manager/store	7
	Hotel/motel business/admin.	5
	Miscellaneous	14
BUSINESS OPERATIONS		111
C. Records & Communications		31
	Secretary	24
	Court reporter	4
	Miscellaneous	3
D. Financial Transactions		71
	Accountant, CPA	67
	Miscellaneous	4
TECHNICAL		114
G. Vehicle Operation & Repair		45
	Aircraft, auto, airline mechanic	20
	Pilot	11
	Auto repair	8
	Truck driving	4
	Miscellaneous	2
H. Construction & Maintenance		20
	Construction	7
	Electrician	6
	Carpentry	5
	Miscellaneous	2

APPENDIX C (continued)

JOB CLUSTER and career group	Occupations in career group	N[a]
I. Ag. & Natural Resources		23
	Game warden/conservationist/ wildlife management/parks department/forest service	12
	Agriculture/farmer	3
	Fisherman	3
	Miscellaneous	5
SCIENCE		228
M. Engineering & Applied Tech.		119
	Engineer (all types)	75
	Computer programmer	15
	Draftsman	8
	Computer science	7
	Computer tech/repair	5
	Systems analyst	4
	Miscellaneous	5
N. Medical Specialties & Tech.		46
	Veterinarian	14
	Dentist/orthodontist	8
	X-ray technician	4
	Dental assistant	4
	Pharmacist	3
	Optometry	3
	Miscellaneous	10
O. Natural Sciences & Math		26
	Oceanographer/marine bio.	6
	Science/wildlife/physical/ biological	4
	Chemist/biochemistry	4
	Biologist	3
	Meteorologist	3
	Miscellaneous	6
P. Social Sciences		37
	Psychologist	25
	Child psychologist	7
	Miscellaneous	5

APPENDIX C (continued)

JOB CLUSTER and career group	Occupations in career group	N[a]
ARTS		222
Q. Applied Arts (Visual)		77
	Architecture	18
	Commercial Art/Artist	17
	Interior decorator/design	12
	Fashion merchandising	11
	Graphic design	7
	Photographer	4
	Illustrator	4
	Miscellaneous	4
R. Creative/Performing Arts		52
	Musician/singer	24
	Teacher (Music, Art, Spanish)	11
	Actor/actress	8
	Dancer/dance instructor dance choreography	6
	Miscellaneous	3
S. Applied Arts (Written/Spoken)		93
	Lawyer	32
	Communications	13
	Journalism	13
	Broadcasting/reporter	7
	Paralegal	7
	Advertising	5
	Criminal justice/law	5
	Miscellaneous	11
SOCIAL SERVICES		284
T. General Health Care		102
	Nurse	50
	Physical therapist	15
	Doctor/surgeon/pediatrician	11
	Therapists (Speech, Recreational, Radiology, Respiratory, Occupational)	6
	Medical assistant	6
	Medicine	4
	Miscellaneous	10

APPENDIX C (continued)

JOB CLUSTER and career group	Occupations in career group	N[a]
U. Education & Related Services		110
	Teacher (Secondary, Elementary, Early Childhood)	78
	Counselor	8
	Coach	7
	Phys. ed teacher	6
	Child care worker	4
	Special ed. teacher	3
	Professor	3
	Miscellaneous	1
V. Social & Government Services		47
	Social work	11
	Policeman	10
	Professional athlete	6
	Law enforcement	6
	Law-FBI	4
	Miscellaneous	10
W. Personal/Customer Services		25
	Cosmotology/beautician	20
	Flight attendant	3
	Miscellaneous	2

Note. The miscellaneous category consists of all occupations with fewer than three cases.

[a]Career groups containing fewer than 20 cases were not included. Hence, in some cases the Ns for career groups do not add up to the Ns for job clusters.

APPENDIX D

Occupational Group Classification for Adult Sample

JOB CLUSTER and career group	Occupations in career group	N[a]
BUSINESS CONTACT		153
A. Marketing & Sales		55
	Sales clerk/salesperson	10
	Sales representative	8
	Sales	5
	Marketing	5
	Realtor	5
	Sales manager/administrator	4
	Insurance agent	4
	Advertising/retail assistant	20
	Journalist	3
	Reporter/announcer	3
	Miscellaneous	12
B. Management & Planning		98
	Managers (office, store, sales, etc.)	37
	Human resources/personnel	8
	Administrative assistant	6
	Business owner	6
	Banker	5
	Miscellaneous	36
BUSINESS OPERATIONS		144
C. Records & Communications		48
	Secretary	24
	Clerk	8
	Assistant	4
	Receptionist	3
	Miscellaneous	9
D. Financial Transactions		79
	Accountant	54
	Bookkeeper	11
	Analyst	3
	Miscellaneous	11
TECHNICAL		38

APPENDIX D (continued)

JOB CLUSTER and career group	Occupations in career group	N[a]
SCIENCE		118
M. Engineering & Applied Tech.		95
	Engineer	34
	Computer programmer	20
	Technicians	19
	Systems analyst	6
	Miscellaneous	16
ARTS		74
S. Applied Arts (Written/Spoken)		38
	Paralegal/legal assistant	20
	Journalist	3
	Reporter/announcer	3
	Miscellaneous	12
SOCIAL SERVICES		198
T. General Health Care		74
	Nurse (LPN, RN)	40
	Nurse's aide/assistant	11
	Therapist (Physical, Occupational)	4
	Clergy/pastor/minister	3
	Miscellaneous	16
U. Education & Related Services		73
	Teacher	37
	Daycare/preschool	9
	Teacher's aide	6
	Substitute teacher	4
	Professor	4
	Miscellaneous	13
V. Social & Government Services		35
	Sheriff/police	12
	Social worker	7
	Firefighter	6
	Miscellaneous	10

Note. The miscellaneous category consists of all occupations with fewer than three cases.

[a]Career groups containing fewer than 20 cases were not included. Hence, in some cases the Ns for career groups do not add up to the Ns for job clusters.

APPENDIX E

Criterion Group Hit Rates Based on High Point Codes

"Hit rate" analysis is a procedure frequently used to assess the criterion-related validity of interest inventories. The rationale and procedure were discussed by Prediger (1977). As used here, the term "hit" means a match between a person's high-point code (UNIACT scale with the highest score) and the person's ACT-OCS job cluster. The percentage of hits is then computed separately by job cluster. A summary index of validity is obtained by averaging hit rates for six job clusters. Results of hit rate analyses for the Grade 12 and adult samples are discussed below.

Grade 12 Sample

Table E1 presents the hit rate data based on the final sample of 1,078 Grade 12 students meeting the screens described in the Method section of this paper. Data on the principal diagonal represent the percentage of 12 graders with high-point codes that match their job clusters. The average hit rate for Grade 12 sample was 44%.

Because previous studies have shown that nurses frequently score highest on the Science Scale (see Results section), the average hit rate was also determined when the nursing career group was assigned to the Science Scale. As before, the hit rate was 44%.

Adult Sample

The results of hit rate analysis for adult sample are presented in the Table E2. Data were based on the final sample of 725 adults meeting the screens described in the Method section of this paper. The average hit rate for adult sample was 41%. When the nursing career group was reassigned (as with the Grade 12 sample), the average hit rate was 42%.

Table E1

UNIACT Hit Rates for Grade 12 Sample

High-point code	Job cluster containing career choice					
	BC	BO	TEC	SCI	ART	SOC
Business Contact (BC)	40	17	7	12	19	14
Business Operations (BO)	24	65	9	12	10	10
Technical (TEC)	6	4	45	17	7	9
Science (SCI)	4	2	24	36	5	18
Arts (ART)	13	4	8	13	47	18
Social Service (SOC)	12	8	8	10	12	31
Total N	119	111	114	228	222	284

Note. Table shows the proportion (decimals omitted) of persons in each job cluster who scored highest on each UNIACT scale (high-point code). The unweighted average hit rate (principal diagonal) is 44%.

Table E2

UNIACT Hit Rates for Adult Sample

	Job cluster containing current occupation					
High-point code	BC	BO	TEC	SCI	ART	SOC
Business Contact (BC)	39	17	0	12	23	11
Business Operations (BO)	17	49	5	9	8	4
Technical (TEC)	8	6	58	28	11	12
Science (SCI)	17	15	21	41	13	34
Arts (ART)	8	6	11	5	38	17
Social Service (SOC)	11	6	5	5	7	22
Total *N*	153	144	38	118	74	198

Note. Table shows the proportion (decimals omitted) of persons in each job cluster who scored highest on each UNIACT scale (high-point code). The unweighted average hit rate (principal diagonal) is 41%.