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Updating Occupational Ability Profiles with O*NET® Content Model Descriptors

Volume I: Report

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Executive Summary

The purpose of the present effort was to update the Occupational Ability Profiles (OAPs) for the O*NET® Ability Profiler Career Exploration Tool. The Ability Profiler describes individuals' enduring attributes along nine dimensions: (a) Arithmetic Reasoning (AR), (b) Verbal Ability (VA), (c) Spatial Ability (SA), (d) Computation (CM), (e) Clerical Perception (CP), (f) Form Perception (FP), (g) Motor Coordination (MC), (h) Manual Dexterity (MD), and (i) Finger Dexterity (FD). Profiles of scores along these nine dimensions for each occupation make up the OAPs, which form the basis for matching job seekers' scores on the Ability Profiler to the occupations in the O*NET system.

New OAPs were computed using the most current ratings of the Knowledge, Skills, Abilities, and Generalized Work Activities (GWA) describing each occupation in the O*NET 13.0 database. The first step involved identifying one or more descriptor scales that share the same underlying construct as each Ability Profiler dimension. To accomplish this, five expert raters identified the O*NET domain descriptors (i.e., Knowledge, Skill, Ability, or GWA) that are very similar each of the Ability Profiler dimensions.

Subsequent to this linkage process, we conducted extensive analyses to determine the most accurate approach to computing the OAPs. These analyses revolved around three core issues:

1. *Whether the OAPs should be computed using ratings of Importance, Level, or some combination of the two.* Multiple versions of the OAPs were computed and evaluated using (a) the bivariate correlations between the different versions, (b) descriptive statistics (e.g., mean, standard deviation), and (c) the changes in rank order for each Ability Profiler dimension (i.e., "face validity"). Results of these analyses suggested that the Level scale improved the interpretability of the dimension scores. Thus, the OAPs were computed using a unit-weighted combination of the Importance and Level scales.

2. *Whether the O*NET Knowledge and Skill descriptors should be included with scales from the Abilities domain in the computation of the OAPs.* Two versions of the OAPs (one using the Knowledge, Skill, and Ability scales; one using only the Ability scales) were computed and evaluated using the same three analyses applied to the Importance/Level question above. Results suggested that the Knowledge and Skill scales added interpretability to the affected Ability Profiler dimensions. Therefore, they were included in the computation of the final OAPs.

3. *Whether the "Control Precision" descriptor should be included in the computation of Manual Dexterity and Finger Dexterity.* Two version of these scales were computed (one including Control Precision; one excluding it) and evaluated using the same three analyses applied to the previous two questions. Results suggested that Control Precision would detract from the interpretation of the Manual Dexterity and Finger Dexterity Ability Profiler dimensions. Therefore, it was excluded from the final computation of the OAPs.

Upon completion of these analyses, the OAPs were computed and validated using (a) other information from the O*NET system and (b) the previously computed OAPs. Results suggested that:

1. Occupations in higher Job Zones (e.g., 4, 5) tended to score higher on cognitively loaded Ability Profiler dimensions such as Arithmetic Reasoning. By contrast, occupations in lower Job Zones (e.g., 1, 2) tended to score higher on physical Ability Profiler dimensions such as Motor Coordination. Given that Job Zone classifications are determined mainly by educational requirements, this pattern of findings was consistent with expectations and thus provided some validation evidence for the new OAPs.

2. The newly computed OAPs yielded logically consistent occupations from individual score profiles. For example, a sample profile that has high Arithmetic Reasoning and Computation scores on the Ability Profiler yields such suggested occupations as Mathematicians, Actuaries, and Mathematical Technicians. This provides further "face validity" evidence for the OAPs.

3. The newly computed and previously computed OAPs overlapped to some extent, but were clearly distinct. Correlations between the two versions of the corresponding scales ranged from -.59 to .87 (Mean r = .14). When the sample was limited to 50 occupations that have changed little over the last 10-15 years, the correlations ranged from -.43 to .84 (Mean r = .29). This conclusion was further supported with pattern similarity analyses using a combination of cluster and discriminant function analysis.

These results suggest that, from a qualitative interpretation perspective, the OAPs were valid for matching individual scores on the Ability Profiler to occupations. Furthermore, comparing the new OAPs to those originally computed suggested the two profiles were measuring similar aspects of individual abilities, but were also clearly distinct. While additional work to validate these OAPs with incumbent data and criterion information would be beneficial, these results suggest that linking O*NET Ability Profiler results to OAPs is beneficial to individuals identifying occupations as potential careers.

UPDATING OCCUPATIONAL ABILITY PROFILES WITH O*NET® CONTENT MODEL DESCRIPTORS

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UPDATING OCCUPATIONAL ABILITY PROFILES WITH O*NET® CONTENT MODEL DESCRIPTORS

Introduction

The Occupational Information Network (O*NET®) is a system for exploring, searching, and researching occupation and worker requirements for over 800 occupations. These descriptors include tasks performed in an occupation, the knowledge, skills, and abilities needed to perform those tasks effectively, work styles, work contexts, among others. One application of the O*NET system is to use this descriptive information to help individuals exploring careers identify occupations that best suit their interests, values, and abilities. The National Center for O*NET Development has developed a number of Career Exploration Tools designed to help job seekers in these efforts. When users complete a Career Exploration Tool, they receive a "score profile" on a number of dimensions (e.g., realistic or investigative interests, verbal or arithmetic abilities). Their profile can then be matched to the profiles associated with the occupations in the O*NET system. The job-seeker can then explore the identified occupations further.

The purpose of the present effort was to update the occupational profiles for one of these Career Exploration Tools – the Ability Profiler. Abilities can be described as enduring attributes of an individual that influence his/her performance (Fleishman, Costanza, & Marshall-Mies, 1999). The Ability Profiler assesses nine dimensions: (a) Arithmetic Reasoning, (b) Verbal Ability, (c) Spatial Ability, (d) Computation, (e) Clerical Perception, (f) Form Perception, (g) Motor Coordination, (h) Manual Dexterity, and (i) Finger Dexterity. Profiles of scores on these dimensions for each occupation constitute the Occupational Ability Profiles (OAPs), which form the basis for linking an individual's scores on the Ability Profiler to occupations in the O*NET system. McCloy, Campbell, Oswald, Rivkin, and Lewis (1999) computed the first set of OAPs. An update to these profiles was initiated because (a) the nature of many occupations has changed over the course of the last 10 or more years, and (b) O*NET now contains a number of New and Emerging occupations that do not have profile scores (National Center for O*NET Development, 2006). The update was accomplished by using occupational descriptor data collected as part of O*NET's content model to create new profile scores.

Background

Occupational Ability Profiles (OAPs)

The Ability Profiler is an updated and modified version of the General Aptitude Test Battery (GATB), a test that measures an individual's ability along nine dimensions (see Table 1). Although administered primarily in paper and pencil format, additional materials are required for some portions of the test. The OAPs were originally developed using a combination of information from the *Dictionary of Occupational Titles* (*DOT*; U.S. Department of Labor, 1991) and archival validity data for GATB (McCloy et al., 1999). Specifically, 48 job analysis variables for more than 12,000 occupations were pulled from the *DOT*. These variables were reduced using principal components analysis to create seven predictor dimensions. Using the GATB validation data (which was available for 545 of the 12,000+ occupations), scores for each of the nine Ability Profiler dimensions were regressed on the *DOT*-based predictor dimensions.

Prediction equations were then created for each Ability Profiler dimension so the predictors could be used to estimate profile scores for all of the occupations. Score profiles for the individual *DOT* occupations were then aggregated to form score profiles for the Occupational Units[1] (OUs) that made up the O*NET system at that time.

Table 1. Ability Profiler Dimension Descriptions

Ability Profiler Dimension	Dimension Description
Arithmetic Reasoning (AR)	The ability to use several math skills and logical thinking to solve problems in everyday situations. It involves gathering and sorting through all information related to a problem, making educated guesses about how best to solve the problem, picking a likely way to solve it, and then explaining your decisions. This ability is important in such fields as engineering, construction, finance, sales, mathematics, science, and technology.
Verbal Ability (VA)	The ability to understand the meaning of words and use them effectively in good communication when you listen, speak, or write. This ability is important in such fields as communications, education, law, literary arts, and sales.
Spatial Ability (SA)	The ability to form pictures of objects in your mind. It involves easily understanding how drawings represent real objects and correctly imagining how parts fit together. This ability is important in such fields as architecture, carpentry, engineering, technology, the visual arts, interior design, and clothing design.
Computation (CM)	The ability to use arithmetic operations of addition, subtraction, multiplication, and division to solve everyday problems involving numbers. This ability is important in such fields as engineering, finance, mathematics, science, and technology.
Clerical Perception (CP)	The ability to quickly and accurately see differences in detail in printed material. The material may be text or numbers on a page, in lists, or in tables. It involves noticing if there are mistakes in the text and numbers, or if there are careless errors in working math problems. This ability measures "speed of perception," which is required in many industrial jobs, even when these jobs do not have verbal or numerical content. This ability is important in such fields as administration, claims processing, library services, office machine operation, packaging, and word processing.
Form Perception (FP)	The ability to quickly and accurately see details in objects, pictures, or drawings. It involves noticing little differences in shapes of figures, shading, and lengths and widths of lines. This ability is important in such fields as craft arts, craft technology, jewelry making, production technology, production work, and quality control.
Motor Coordination (MC)	The ability to quickly and accurately coordinate eyes with hands or fingers when making precise hand movements. This ability is important in such fields as appliance repair, beauty services, office machine operations, packaging, and typing.
Manual Dexterity (MD)	The ability to quickly and accurately move hands easily and skillfully. Ability to work with hands in placing and turning motions. This ability is important in such fields as painting, auto body repair, equipment operations, production work, vehicle operations, and woodworking.
Finger Dexterity (FD)	The ability to move your fingers skillfully and easily. It involves using your fingers to handle small objects quickly and accurately. This ability is important in such fields as assembly work, barbering, bindery work, dentistry, and watch making and repair.

[1] The 1,122 OUs were created by grouping 11,761 DOT occupations using a combination of rational judgment and statistical analysis (cf. Drewes, Tarantino, Atkins, & Paige, 2004). The OUs have since been replaced by the Standard Occupational Classification (SOC) system.

In the present analysis, new GATB/Ability Profiler data were unavailable to create new prediction equations in the same manner as McCloy and his colleagues (1999). In the intervening years however, O*NET occupational data have been expanded and updated, providing a rich source of information for an expanded list of occupations. The present analysis took advantage of the comprehensiveness of the O*NET system to create new OAPs. All analyses were conducted on the July 29, 2008 release of O*NET Database 13.0.[2]

*O*NET Content Model*

One of the critical innovations of the O*NET system was its provision of a common framework for describing all occupations (see Peterson et al., 1997, and Peterson, Mumford, Borman, Jeanneret, & Fleishman, 1999). These descriptors included characteristics of the workers (e.g., abilities, interests), characteristics of the occupation itself (e.g., tasks, tools), and requirements for entry (e.g., education, knowledge). Each descriptive domain can be thought of as a separate "window" into the occupation (Peterson, 1997). The implication of describing occupations in this way is that each descriptive domain must provide a complete picture of the occupation from the view of that "window." Thus, each domain consists of a detailed taxonomy of individual descriptors. The extent to which these individual descriptors apply to a particular occupation is measured using two rating scales: (a) the importance of the descriptor to performing the job, and (b) the level at which it is performed on the job (Peterson, Mumford, Levin, Green, & Waksberg, 1999). The ratings on these scales were provided by either job incumbents or trained analysts (Tsacoumis & Van Iddekinge, 2006).

In the present analysis, the primary concern was with content model domains that would be most useful in creating OAPs. Four domains were potentially useful for this task: (a) knowledge, (b) skills, (c) abilities, and (d) generalized work activities. These four content model domains (i.e., K, S, A, and G) were chosen because they were closest to the individual-capability focus of the O*NET Ability Profiler. The first three domains – knowledge, skills, and abilities – describe attributes of the worker. The knowledge domain includes general categories of facts and principles that are necessary to complete occupational tasks (Costanza, Fleishman, & Marshall-Mies, 1999). Skills are processes for applying that knowledge to occupation tasks (Mumford, Peterson, & Childs, 1999). Finally, abilities (unlike skills) are *enduring* capabilities of an individual that predict worker performance on a range of tasks (Fleishman et al., 1999). The fourth domain that could potentially be useful in generating OAPs contains Generalized Work Activity (GWA) descriptors. GWAs are groups of tasks critical to the execution of a work function (Jeanneret, Borman, Kubisiak, & Hanson, 1999). The descriptors embedded within each of these domains were examined in more detail to determine whether any of the individual descriptors could be used as surrogates for the Ability Profiler dimensions. To accomplish this, the O*NET content model descriptors needed to be linked to the Ability Profiler dimensions.

[2] The first version of the O*NET database was released in October 1998 (O*NET 98). Since August of 2000 (O*NET 3.0), the data has been updated at least once per year. O*NET 13.0 represents the ninth update of the database. More information about this data can be found on the O*NET Resource Center website at http://www.onetcenter.org/database.html.

Linkage Activity

Overview

As described above, the method for generating OAPs is based on identifying which O*NET constructs, if any, are similar to (or overlap with) each Ability Profiler dimension. This framework was created by having experts link constructs from four taxonomic domains of the O*NET content model (Knowledges, Skills, Abilities, and GWAs – KSAGs) to the nine Ability Profiler dimensions (see Table 1). Then, the importance and level ratings for those O*NET constructs that were linked to Ability Profiler dimensions were used to compute new OAPs.

Procedures

Five senior-level HumRRO staff members constituted the "expert raters" for the linkage activity. Each member had a doctorate, more than 20 years of experience in the field of industrial-organizational psychology, and in-depth knowledge of O*NET. Each rater received a packet of materials to complete the linkage task.

The primary document in this packet was the "O*NET Occupational Ability Profiles (OAPs) Linkage Exercise Instructions" (see Appendix A), which gave the raters a high-level description of the project and specific instructions for completing the linkage exercise. The raters completed the linkage exercise in five steps. In Step 1, the raters reviewed a description of the Ability Profiler dimensions and the items associated with those dimensions. The raters also received a separate document containing a description of the Ability Profiler dimensions (from O*NET, 2002) and sample items accompanying those dimensions. In Step 2, the raters reviewed the constructs in the four taxonomic domains of the O*NET content model (i.e., KSA and G). Raters also received a separate document describing these constructs.

In Step 3, the raters completed their ratings using the rating sheet provided. Raters linked a KSAG construct to the Ability Profiler dimension only if *the construct underlying the KSAG is the same as the construct underlying the Ability Profiler dimension*. Raters completed the linkage exercise one O*NET content model domain at a time (i.e., completed all of the linkages for Knowledges, then completed all of the linkages for Skills, and so forth). Each rater was instructed to start with a different content model domain to control for order and fatigue effects.

In addition to the four documents described above (the instructions, Ability Profiler dimension descriptions, O*NET descriptions, and the linkage worksheet), the raters also received the following information in case they would find it informative in completing the linkage exercise: (a) the full Ability Profiler instrument with all of the items, (b) instructions for administering the Ability Profiler, (c) a sample score report for the Ability Profiler, and (d) the Importance and Level scales that accompany the O*NET content model constructs. The raters had three weeks to complete the linkage exercise.

Linkage Results

After all five raters had completed the linkage activity, it became apparent that one rater had interpreted the rater training instructions differently from the other four. This rater had linked 225 KSAGs and Ability Profiler dimensions. By contrast, the number of linkages made by the remaining four raters ranged from 13 to 33. Further discussion between the researchers and the outlying rater revealed where the misunderstanding had occurred and the rater volunteered to redo her ratings prior to the linkage meeting. Her recompleted ratings linked 34 KSAGs with the Ability Profiler dimensions.

The number of raters suggesting a linkage between two constructs was summed. If four or five of the five raters linked an O*NET domain descriptor (i.e., a KSAG) to an Ability Profiler dimension, then a linkage was established and that KSAG was earmarked to be automatically considered *included* in the computation of the OAPs for that dimension. If zero or one rater linked a KSAG to an Ability Profiler dimension, then no linkage was established and that KSAG construct was automatically *excluded* from the computation of that OAP dimension. If two or three of the five raters linked KSAG to an Ability Profiler dimension, then the linkage was labeled "*contested*." The raters discussed the contested linkages as a group until they reached a final decision regarding whether the KSAG should be included in the OAP computation.

Using the outlying rater's recompleted ratings, the overall agreement among the five raters was quite high (98.4%). This number was only slightly inflated by the fact that no GWAs were linked to an Ability Profiler dimension. When GWAs were omitted from the interrater agreement analyses, the coefficient remains high (98.1%). The average index of interrater reliability (KR20 = .90) also was high. Overall, 13 KSAs[3] were linked (i.e., either four or five raters indicated a linkage) and 16 were contested (i.e., either two or three raters indicated a linkage). A summary of the constructs linked and contested can be found in Table 2.

Linkage Meeting

The contested linkages were discussed in a meeting with the five HumRRO raters and two representatives from the National Center for O*NET Development. During the meeting, 16 judgments were discussed until a decision was made to retain the linkage or drop it. As a result, 11 linkages were retained (summarized in Table 2).

During the course of this discussion, there was no clear consensus on the "Control Precision" O*NET Ability, which to some appeared to be a borderline representation of the MD and FD Ability Profiler dimensions. To resolve this issue, the raters suggested that these two Ability Profiler dimensions be computed in two ways: with Control Precision and without Control Precision. These two computations could then be compared to determine whether the Control Precision construct added explanatory power to the Ability Profiler dimensions.

[3] Henceforth, the "G" will be dropped from this abbreviation because there were no linkages between the GWAs and Ability Profiler dimensions

A second issue emerging in the course of discussing the contested linkages was whether the Knowledge and Skill domains were necessary to compute the OAPs. At least one construct from O*NET's Ability domain was linked to each of the nine Ability Profiler dimensions, so the Knowledge and Skill domains might not be necessary. Again the raters suggested that this issue be resolved with further data analysis.

Table 2. O*NET Knowledge, Skills, Abilities, (KSAs) linked to Ability Profiler Dimensions

Ability Profiler Dimension	O*NET KSAs Linked	Contested O*NET KSAs
Arithmetic Reasoning (AR)	**Mathematics (Knowledge)** [a] **Mathematics (Skill)** [a] **Mathematical Reasoning (Ability)**	Deductive Reasoning (Ability)
Verbal Ability (VA)	**Writing (Skill)** [a] **Oral Comprehension (Ability)** **Oral Expression (Ability)** **Written Expression (Ability)**	**English Language (Knowledge)** [a] **Reading Comprehension (Skill)** [a] **Speaking (Skill)** [a] **Written Comprehension (Ability)** Speech Recognition (Ability) Speech Clarity (Ability)
Spatial Ability (SA)	**Visualization (Ability)**	Spatial Orientation (Ability)
Computation (CM)	**Number Facility (Ability)**	**Mathematics (Knowledge)** [a] **Mathematics (Skill)** [a]
Clerical Perception (CP)	**Perceptual Speed (Ability)**	
Form Perception (FP)	**Perceptual Speed (Ability)**	
Motor Coordination (MC)		Control Precision (Ability) **Wrist-Finger Speed (Ability)**
Manual Dexterity (MD)	**Manual Dexterity (Ability)**	**Control Precision (Ability)** [b] **Wrist-Finger Speed (Ability)**
Finger Dexterity (FD)	**Finger Dexterity (Ability)**	**Control Precision (Ability)** [b] **Wrist-Finger Speed (Ability)**

Note. O*NET content model domain scales in bold were retained after the linkage meeting.
[a] Further analyses were performed, the construct was eventually retained in the OAP computations
[b] Further analyses were performed, the construct was eventually dropped from the OAP computations

A final issue emerging from the linkage discussion was whether anything could be done with the CP and FP Ability Profiler dimensions. Having the same O*NET descriptor ("Perceptual Speed") representing both dimensions could have negative consequences for using the OAPs to link Ability Profiler scores to occupations. The raters acknowledged that they could link no other O*NET descriptors to these two dimensions. Further analyses could shed light on the extent to which the matching dimensions would problematic in using the OAPs to match job-seekers to occupations.

OAP Dimension Analyses

Before computation of the O*NET OAPs could proceed, four outstanding issues required resolution:

1. Which type of O*NET rating scales – Importance (IMP), Level (LVL), or combination thereof – should be used to compute the OAPs?

2. Should the O*NET "Knowledge" and "Skill" domain descriptors be included in the final computation of the OAPs, or should only the "Abilities" scales be used?

3. Should the "Control Precision" scale be included in the computation of the MD and FD AP dimensions?

4. Will having one O*NET scale represent the CP and FP Ability Profiler dimensions have an adverse effect on using the Ability Profiler as a Career Exploration Tool?

Because these questions could not be answered with any referent information[4] (e.g., actual scores on the Ability Profiler, criterion information, and so on), descriptive and face validity analyses were employed.

Rating Scale Combinations

The O*NET KSAs for each occupation were assessed using two rating scales completed by job incumbents (the knowledge and skill domains) or O*NET analysts (the abilities domain). The IMP scale asked raters to assess on a five-point scale the importance of a particular KSA to job performance. The LVL scale asked raters to assess on a 0 to 7 scale the difficulty level at which the KSA needs to be performed on the job. The Level scale included several specific examples (anchors) at different scale points for each construct. Importance was assessed on a 1 to 5 scale, ranging from Not Important to Extremely Important. The availability of data from these two scales suggests two viable options for computing the O*NET OAPs. The first option is to use the IMP scales only; the second is to use some combination of the IMP and LVL scales. Using the complete list of KSA constructs provided in the expert linkage meeting (Table 2), two versions of the OAPs were computed:

1. OAPs created by computing a mean of the O*NET IMP scales linked to that dimension, and

2. OAPs created by computing a creating a unit-weighted sum of the mean IMP scales and mean LVL scales.

For example, the first version of the Computation (CM) Ability Profiler dimension was computed by taking the mean of the Number Facility (Ability), Mathematics (Knowledge), and Mathematics (Skill) IMP scales. The second version was computed by taking that mean and adding it to the mean of the LVL scales.

[4] The exception to this is the previously computed OAPs from the McCloy et al. (1999) study. While there are a number of issues with comparing the new OAPs to the previously computed ones (e.g., method differences leading to different error variance, history and maturation effects), the old data can be used to determine whether the new OAPs would yield similar linked results.

Three analyses were conducted to evaluate which version has more utility for computing OAPs. First, bivariate correlations between the two types of Ability Profiler dimensions were computed to determine their similarity. The results in Table 3 suggested that the two versions were closely related (see the bolded correlations along the diagonal). However, because the OAP scales will be used for individual assessment purposes, even minor differences in their computation can have large implications for those trying to find their best-matched jobs.

Table 3. Bivariate Correlations between Importance (IMP) and Importance and Level (IMP + LVL) Ability Profiler Dimensions

	Importance + Level Scales								
Importance Only Scales	AR	VA	SA	CM	CP	FP	MC	MD	FD
Arithmetic Reasoning (AR)	**.97**	.37	.21	.97	.26	.26	–.10	–.18	–.11
Verbal Ability (VA)	.42	**.97**	–.20	.38	–.13	–.13	–.60	–.69	–.64
Spatial Ability (SA)	.20	–.16	**.98**	.22	.54	.54	.42	.50	.57
Computation (CM)	.94	.32	.22	**.97**	.30	.30	–.06	–.13	–.06
Clerical Perception (CP)	.23	–.09	.52	.28	**.97**	.97	.41	.43	.52
Form Perception (FP)	.23	–.09	.52	.28	.97	**.97**	.41	.43	.52
Motor Coordination (MC)	–.18	–.60	.40	–.13	.41	.41	**.99**	.86	.87
Manual Dexterity (MD)	–.26	–.69	.48	–.22	.44	.44	.86	**.99**	.97
Finger Dexterity (FD)	–.18	–.62	.54	–.13	.54	.54	.87	.96	**.99**

Note. Correlations with magnitude above .06 are significant at the $p < .01$ level. $N = 809$.

Table 4. Descriptive Information for Importance (IMP) and Importance and Level (IMP + LVL) Ability Profiler Dimensions

	Min	Max	*M*	*SD*	Skew	Kurt	Alpha
	Importance Only Scales						
Arithmetic Reasoning (AR)	1.14	4.89	2.86	0.58	0.25	0.31	.84
Verbal Ability (VA)	2.17	4.68	3.56	0.51	–0.14	–0.73	.95
Spatial Ability (SA)	1.00	4.43	2.69	0.59	–0.26	–0.01	--
Computation (CM)	1.18	4.89	2.84	0.55	0.21	0.31	.81
Clerical Perception (CP)	1.00	4.13	2.73	0.50	–0.46	0.07	--
Form Perception (FP)	1.00	4.13	2.73	0.50	–0.46	0.07	--
Motor Coordination (MC)	1.00	3.38	1.71	0.58	0.39	–1.02	--
Manual Dexterity (MD)	1.00	3.88	2.25	0.76	–0.12	–1.15	.91
Finger Dexterity (FD)	1.08	3.84	2.33	0.64	–0.07	–1.05	.86
	Importance + Level Scales						
Arithmetic Reasoning (AR)	1.38	11.32	5.82	1.50	0.28	0.39	.92
Verbal Ability (VA)	3.94	10.27	7.35	1.29	–0.03	–0.67	.97
Spatial Ability (SA)	1.00	9.26	5.45	1.44	–0.40	0.13	.93
Computation (CM)	1.50	10.82	5.83	1.43	0.23	0.40	.90
Clerical Perception (CP)	1.00	9.26	5.31	1.10	–0.55	0.61	.93
Form Perception (FP)	1.00	9.26	5.31	1.10	–0.55	0.61	.93
Motor Coordination (MC)	1.00	7.01	2.86	1.50	0.30	–1.12	.94
Manual Dexterity (MD)	1.00	8.50	4.09	1.80	–0.24	–1.10	.95
Finger Dexterity (FD)	1.17	8.50	4.31	1.53	–0.15	–1.00	.93

Note. $N = 809$.

Descriptive statistics comparing Ability Profiler dimension scores on the two versions were also compared to determine whether one method yields more advantageous scale scores than another. The results in Table 4 suggested a few advantages for including the LVL scale in dimension scores. First, internal consistency estimates could be computed for all of the Ability Profiler dimensions when using the IMP and LVL scales. This was not the case for the scores computed using IMP only, suggesting they were more vulnerable to idiosyncrasies in the O*NET ratings. Second, there was more variability in the Ability Profiler dimension scores when they included LVL. This suggested that the IMP and LVL scores would be better able to discriminate between individuals with similar profiles than the IMP-only scales. However, the IMP + LVL scales also tended to be more skewed from normality.

Taken together, these results suggested a slight advantage for the IMP + LVL version of the OAP computations. However, one could argue that the variability added by the LVL scale might not improve OAP interpretability. The extra discriminatory power is useful only if it adds the "right" kind of nuance to the Ability Profiler scores. For example, by rank ordering the O*NET occupations by the Finger Dexterity (FD) Ability Profiler dimension, occupations that require the most and least FD could be determined. These rank orders would change depending on the way the dimension was scored. The question then becomes whether including LVL changes this order in such a way as to improve interpretability. Put another way, adding LVL to the FD dimension score would make sense only if the rank order changed in a way consistent with a qualitative understanding of the occupations.

Table 5. The Occupations Ranked in the Top 10 for the Finger Dexterity (FD) Ability Profiler Dimension

Top 10 Occupations Computed with IMP-Only Scales	Job Zone	*M*	Top 10 Occupations Computed with IMP + LVL Scales	Job Zone	*M*
Oral and Maxillofacial Surgeons	5	3.84	Oral and Maxillofacial Surgeons	5	8.50
Manufactured Building and Mobile Home Installers	2	3.84	Jewelers	3	7.71
Structural Iron and Steel Workers	2	3.63	Dentists, General	5	7.42
Cabinetmakers and Bench Carpenters	3	3.59	Packaging and Filling Machine Operators and Tenders	2	7.42
Upholsterers	2	3.59	Manufactured Building and Mobile Home Installers	2	7.34
Excavating and Loading Machine and Dragline Operators	2	3.59	Heating and Air Conditioning Mechanics and Installers	3	7.17
Packaging and Filling Machine Operators and Tenders	2	3.59	Surgeons	5	7.17
Airline Pilots, Copilots, and Flight Engineers	4	3.59	Cabinetmakers and Bench Carpenters	3	7.13
Potters, Manufacturing	3	3.55	Aircraft Mechanics and Service Technicians	3	7.09
Aircraft Mechanics and Service Technicians	3	3.54	Structural Iron and Steel Workers	2	7.05

Note. *M* = Mean.

The results in Table 5 suggest that including LVL does enhance the interpretability of the occupation ranks. Specifically, the occupations requiring the highest levels of FD, computed using the IMP and LVL scales, included oral/maxillofacial surgeons, jewelers, and dentists. By contrast, the occupations requiring the highest levels of FD when computed using only the IMP scale were oral/maxillofacial surgeons, manufactured building/mobile home installers, and structural iron and steel workers. Based on common sense understanding of these occupations, few would argue that higher levels of FD are required to perform the tasks of home installers and steel workers than jewelers and dentists, suggesting that the variance added by the LVL scale does in fact improve the interpretability of the Ability Profiler dimension scores. This suggested that OAPs computed using IMP + LVL would be more "face valid" than OAPs computed using the IMP scale only.

A related issue is whether the IMP and LVL scales should be weighted equally. The fact that the LVL scale ranges from 0 to 7 and the IMP scale ranges from 1 to 5 suggests that LVL information might be overrepresented in a unit-weighted composite. For this reason, a third version of the Ability Profiler scores was computed using the formula 2*IMP + LVL.[5] Consistent with the above analyses, the relative rank orders of the O*NET occupations when computed using the two scoring methods were compared to determine whether one version was more interpretable. The authors carefully examined changes in top rank orders (similar to Table 5, see Appendix B) across the Ability Profiler dimensions and found no consistent interpretability advantage for one method over another. Because there was no theoretical or practical reason to assign more weight to the IMP scale, the OAPs were computed using a unit-weighted combination of the IMP and LVL scales.

*O*NET Knowledge and Skills Domains*

The second question concerned whether scales from the O*NET Knowledge and Skills domains should be included in the final computation of the OAPs, as opposed to using only the Abilities scales. This applies only to the Arithmetic Reasoning (AR), Verbal Ability (VA), and Computation (CM) Ability Profiler dimensions, because they were the only dimensions linked to non-Ability descriptors. To determine whether the Knowledge and Skills scales should be included in the final OAPs, two versions of the AR, VA, and CM scales were computed: (a) with the Knowledge, Skills, and Abilities scales; and (b) with only the Ability scales. The same basic analysis strategy used to compare the IMP/LVL scale variants was employed for the Ability-only vs. KSA versions. First, descriptives and bivariate correlations were computed for the two versions of the AR, VA, and CM scales.

An examination of Table 6 suggested that there was statistically little advantage to using one computation method over another. The internal consistency, variability, and deviations from normality were comparable for both scoring methods. However, one potential advantage to using

[5] Computations using LVL only were excluded from this analysis because the algorithm matching job-seekers to occupations was meant to maximize the number of career exploration opportunities for individuals, regardless of their ability levels (i.e., it is their profile *patterns* that are important, not the magnitude of their scores). LVL scales are more closely tied to specialization (i.e., occupations that require more preparation); therefore it was important to have the IMP scales included in any OAP computation.

the Ability-only version of the OAPs was that there would be less overlap between the AR and CM scales, which would lead to more conceptual clarity and easier interpretation of results. On the other hand, Table 7 suggested that the KSA version of the scales may have higher face validity. For example, according to the Ability-only OAPs, mathematical technicians have higher AR than mathematicians, and physicists and aerospace engineers have the highest VA among all occupations. These results, combined with the fact that the expert raters stated that these Knowledge and Skills represent the same construct as the Ability Profiler dimension, suggested that the final OAPs should include all of the linked descriptors, not just the O*NET Abilities.

Table 6. Descriptives and Bivariate Intercorrelations for the Ability Only and KSA OAP Scales

	AP Scale	Min	Max	*M*	*SD*	Skew	Kurt	1	2	3	4	5	6
						KSAG Scales							
1.	AR	1.38	11.32	5.82	1.50	0.28	0.39	*.92*					
2.	VA	3.94	10.27	7.35	1.29	-0.03	-0.67	.51	*.97*				
3.	CM	1.50	10.82	5.83	1.43	0.23	0.40	.99	.47	*.90*			
						Ability Only Scales							
4.	AR	1.00	11.00	4.67	1.62	0.35	0.48	.85	.53	.83	*.92*		
5.	VA	3.98	10.01	7.20	1.19	-0.10	-0.80	.50	.96	.45	.57	*.97*	
6.	CM	1.26	10.60	4.68	1.48	0.21	0.23	.75	.38	.79	.89	.41	*.90*

Note. AR = Arithmetic Reasoning, VA = Verbal Ability, CM = Computation, AP = Ability Profiler. All correlations significant at $p < .01$. $N = 809$. Coefficient alphas are in italics along the diagonal.

Table 7. Top 10 Occupations for the Arithmetic Reasoning (AR), Verbal Ability (VA), and Computation (CM) Scales Comparing KSA and Ability Only Versions

Ten's for KSAG Scales	Job Zone	*M*	Ten's for Abilities Only Scales	Job Zone	*M*
			Arithmetic Reasoning (AR)		
Mathematicians	5	11.32	Mathematical Technicians	4	11.00
Physicists	5	11.03	Physicists	5	10.50
Operations Research Analysts	5	10.70	Mathematicians	5	10.38
Mathematical Technicians	4	10.66	Aerospace Engineers	5	10.38
Actuaries	5	10.47	Statisticians	5	10.01
Mathematical Science Teachers, Postsecondary	5	10.42	Statistical Assistants	3	9.38
Astronomers	5	10.31	Operations Research Analysts	5	9.25
Statisticians	5	10.12	Actuaries	5	8.88
Engineering Teachers, Postsecondary	5	9.90	Mathematical Science Teachers, Postsecondary	5	8.76
Statistical Assistants	3	9.45	Mechanical Drafters	3	8.50
			Verbal Ability (VA)		
Law Teachers, Postsecondary	5	10.27	Physicists	5	10.00
English Language and Literature Teachers, Postsecondary	5	10.19	Aerospace Engineers	5	9.88
Environmental Science Teachers, Postsecondary	5	10.07	Agricultural Sciences Teachers, Postsecondary	5	9.75
Health Specialties Teachers, Postsecondary	5	10.05	Law Teachers, Postsecondary	5	9.75
Social Work Teachers, Postsecondary	5	10.04	Biological Science Teachers, Postsecondary	5	9.63

Ten's for KSAG Scales	Job Zone	*M*	Ten's for Abilities Only Scales	Job Zone	*M*
Physicists	5	10.03	Chemistry Teachers, Postsecondary	5	9.59
Political Science Teachers, Postsecondary	5	10.03	Health Specialties Teachers, Postsecondary	5	9.57
Anthropology and Archeology Teachers, Postsecondary	5	10.03	Foreign Language and Literature Teachers, Postsecondary	5	9.47
Agricultural Sciences Teachers, Postsecondary	5	10.02	Geography Teachers, Postsecondary	5	9.47
Atmospheric, Earth, Marine, and Space Teachers, Postsecondary	5	9.99	Medical Scientists, Except Epidemiologists	5	9.44
			Computation (CM)		
Mathematicians	5	10.82	Mathematical Technicians	4	10.6
Physicists	5	10.82	Physicists	5	9.88
Mathematical Technicians	4	10.53	Statisticians	5	9.5
Operations Research Analysts	5	10.49	Statistical Assistants	3	8.88
Astronomers	5	10.06	Mathematicians	5	8.88
Mathematical Science Teachers, Postsecondary	5	10.00	Operations Research Analysts	5	8.63
Actuaries	5	9.97	Auditors	4	8.38
Statisticians	5	9.95	Budget Analysts	4	8.38
Engineering Teachers, Postsecondary	5	9.86	Personal Financial Advisors	4	8.25
Agricultural Engineers	4	9.32	Mechanical Engineers	4	8.13

Control Precision

Recall that the expert panel considered linking the O*NET Ability "Control Precision" to the Manual Dexterity (MD) and Finger Dexterity (FD) Ability Profiler dimensions. They felt the linkage was relevant but might not represent the same construct. This led to the third question, which asked whether the Control Precision O*NET Ability scale should be included in the computation of these Ability Profiler dimensions. Put another way, does adding Control Precision to the computation of MD and FD add to their interpretability?

Table 8. Descriptive Information for IMP and IMP + LVL AP Dimensions

	Min	Max	*M*	*SD*	Skew	Kurt	Alpha
With Control Precision Included							
Manual Dexterity (MD)	1.00	8.50	4.09	1.80	-0.24	-1.10	.95
Finger Dexterity (FD)	1.17	8.50	4.31	1.53	-0.15	-1.00	.93
Without Control Precision							
Manual Dexterity (MD)	1.00	7.94	3.78	1.69	-0.18	-1.13	.92
Finger Dexterity (FD)	1.00	7.94	4.11	1.33	-0.04	-0.80	.91

Not surprisingly, the two versions (with and without Control Precision) were highly correlated: .98 for MD and .96 for FD. Also, as with previous comparisons, the descriptive statistics were comparable for both computation methods (see Table 8). However, when the relative rank orders were compared for the two methods (see Table 9), the results suggested that the OAPs computed without Control Precision may be preferred. For example, instrumental musicians and typists were ranked higher on MD and FD, a fact consistent with the tasks for those occupations. Given that the original question was whether Control Precision *adds* anything

to the MD and FD scales, these results suggested that it did not and might in fact detract from these scales. For these reasons, Control Precision was not included as part of the MD and FD scales in computing the OAPs.

Table 9. Comparison of Rank Change of Manual and Finger Dexterity Scales Depending on the Addition of Control Precision

Occupation	Job Zone	RANK With CP	RANK No CP	Diff
Manual Dexterity (MD)				
Musicians, Instrumental	3	252	28	224
Data Entry Keyers	2	317	122	195
Tellers	2	397	208	189
Cashiers	1	256	78	178
Word Processors and Typists	2	341	170	171
Radiologic Technicians	3	266	377	-111
Ship and Boat Captains	3	154	267	-113
Hazardous Materials Removal Workers	2	165	281	-116
Shuttle Car Operators	2	124	266	-142
Bus Drivers, Transit and Intercity	2	174	333	-159
Finger Dexterity (FD)				
Correspondence Clerks	2	493	194	299
Musicians, Instrumental	3	256	35	221
Word Processors and Typists	2	257	36	221
Travel Agents	3	598	388	210
Insurance Policy Processing Clerks	2	622	431	191
Ambulance Drivers and Attendants, Except Emergency Medical Technicians	2	392	550	-158
Parking Enforcement Workers	2	488	647	-159
Municipal Fire Fighting and Prevention Supervisors	3	501	688	-187
Farm Labor Contractors	2	532	721	-189
Shuttle Car Operators	2	317	510	-193

Note. CP = Control Precision. Table shows the change in rank order of the occupations when the MD and FD scales were computed with or without CP. The occupations that changed the most in either direction are tabled. A higher rank (i.e., lower number) indicates a higher score on the scale.

Clerical and Form Perception Match

The purpose of these analyses was to determine what adverse consequences, if any, would be incurred by having matching scores for the Control Precision (CP) and Form Perception (FP) Ability Profiler dimensions. To address this issue, we first examined the OAPs computed by McCloy and colleagues (1999) to investigate the original degree of overlap between the CP and FP dimensions. Results suggested that the two dimensions were correlated .95, or a 90% overlap in variance. The implication of this finding is that occupations that tended to require high levels of one dimension also tended to require high amounts of the other. Thus, it appears that relatively few occupations would have had a high CP and low FP score, or vice versa.

Table 10. Top 10 Occupations Sample Score Profiles that vary on CP and FP

Top 10 Occupations	CP = FP	CP > FP	FP > CP
Locomotive Firers	.85	.83	.83
Tank Car, Truck, and Ship Loaders	.82	.79	.79
Packaging and Filling Machine Operators and Tenders	.81	.79	.79
Pump Operators, Except Wellhead Pumpers	.80	.78	.78
Molding and Casting Workers	.78	.75	.75
Petroleum Pump System Operators, Refinery Operators, and Gaugers	.75	.73	.73
Separating, Filtering, Clarifying, Precipitating, and Still Machine Setters, Operators, and Tenders	.75	.73	.73
Extruding, Forming, Pressing, and Compacting Machine Setters, Operators, and Tenders	.72	.70	.70
Furnace, Kiln, Oven, Drier, and Kettle Operators and Tenders	.72	.70	.70
Gas Plant Operators	.71	.69	.69

Note. CP = Clerical Perception, FP = Form Perception. Values are bivariate correlations that indicate the degree to which an individual's profile matches the occupation's profile. The individual's profile was manipulated in each of the three columns.

CP = FP: The individual's score on CP and FP were made equal and higher than the scores for the other seven Ability Profiler dimensions.

CP > FP: The individual's score on CP was made higher than the scores for FP. Both scales had higher scores than the other seven Ability Profiler dimensions.

FP > CP: The individual's score on FP was made higher than the scores for CP. Both scales had higher scores than the other seven Ability Profiler dimensions.

Despite this finding, it was still important to examine this issue from the perspective of an individual client, because he/she would feel the impact of any limitations in the scoring system. The implication of having the two dimensions overlap is that, in the rare case where an individual has dramatically different CP and FP scores on the Ability Profiler, the OAPs that return will not capture that distinction. Table 10 illustrates this possibility. In this example, three sample Ability Profiles were created. In the first profile (the "CP = FP" column), the CP and FP scores were the same. In the second profile (CP > FP), the score for the CP dimension was higher than the score for the FP dimension. In the third profile (FP > CP), the score for the FP dimension was higher than the score for the CP dimension. In all three of these profiles, the remaining seven dimensions (AR, VA, and so on) were held constant and with lower scores than the FP and CP dimensions. As the results in Table 10 demonstrate, all three profiles yielded the same occupation matches in terms of their relative rank order. This pattern holds for all of the remaining occupations as well.

Although little can be done to ameliorate this issue using the data currently at our disposal, these results may have implications for how scores are reported. For example, future instruments that contain the OAPs may want to treat CP and FP together. Attention is now turned to the computation of validation evidence for the OAPs as a whole. See Appendix F (separate volume) of this report for a complete list of occupations and profiles.

OAP Validation Evidence

As described previously, limited information was available to validate the OAPs produced by the expert raters. Specifically, we were limited to two sources of information: (a)

other data on the O*NET system, and (b) the previously computed OAPs (McCloy et al., 1999). These sources were used below to conduct preliminary validation analyses.

Job Zone Evidence

The Job Zone classification scheme reflects the amount of preparation required for an occupation (National Center for O*NET Development, 2008). Because the classification is primarily driven by vocational preparation, we would expect that the higher Job Zone occupations would require higher Ability Profiler scores for the cognitively oriented dimensions (e.g., AR, VA, CM), and lower Job Zone occupations would require higher scores for the more physically oriented dimensions (e.g., MC, MD, and FD). These expectations were tested by computing the mean scores for each Ability Profiler dimension for the occupations in each Job Zone. Mean differences among the Job Zones were tested using a one-way analysis of variance (ANOVA) with a post-hoc multiple comparison procedure (Games-Howell). The results of this procedure are reported in Table 11.

Table 11. Summary of OAPs by Job Zone

		Job Zone				
		1	2	3	4	5
Arithmetic Reasoning (AR)	*M*	4.23[a]	5.15[b]	5.95[c]	6.70[d]	6.78[d]
	SD	(1.10)	(1.08)	(1.19)	(1.44)	(1.74)
Verbal Ability (VA)	*M*	5.49[a]	6.38[b]	7.34[c]	8.38[d]	9.18[e]
	SD	(0.71)	(0.76)	(0.76)	(0.49)	(0.61)
Spatial Ability (SA)	*M*	4.65[a]	5.37[b]	5.79[c]	5.76[c]	4.91[a]
	SD	(1.38)	(1.32)	(1.49)	(1.25)	(1.51)
Computation (CM)	*M*	4.39[a]	5.24[b]	5.94[c]	6.63[d]	6.63[d]
	SD	(1.11)	(1.07)	(1.14)	(1.41)	(1.68)
Clerical Perception (CP)	*M*	4.53[a]	5.41[b]	5.55[b]	5.37[b]	4.85[a]
	SD	(1.21)	(1.06)	(1.03)	(0.95)	(1.15)
Form Perception (FP)	*M*	4.53[a]	5.41[b]	5.55[b]	5.37[b]	4.85[a]
	SD	(1.21)	(1.06)	(1.03)	(0.95)	(1.15)
Motor Coordination (MC)	*M*	3.50[bc]	3.63[c]	3.02[b]	1.93[a]	1.64[a]
	SD	(1.54)	(1.40)	(1.35)	(1.00)	(1.07)
Manual Dexterity (MD)	*M*	4.64[c]	4.73[c]	4.09[b]	2.46[a]	2.18[a]
	SD	(1.28)	(1.27)	(1.43)	(1.20)	(1.57)
Finger Dexterity (FD)	*M*	4.29[cd]	4.70[d]	4.38[c]	3.39[b]	3.00[a]
	SD	(1.34)	(1.14)	(1.25)	(0.84)	(1.29)

Note. Superscripts indicate statistically significant differences using the Games-Howell procedure; dotted boxes indicate the two highest mean scores (regardless of significance) for each Ability Profiler dimension.

The results in Table 11 were generally in line with expectations. Job Zones 4 and 5 tend to have higher Ability Profiler dimension for more cognitively oriented dimensions (e.g., AR and VA), while lower Job Zones tend to have higher scores for physical dimensions (e.g., MC, MD, and FD). These results are consistent with expectations and therefore provided preliminary validation evidence for the OAPs.

Face Validity Evidence

The second piece of validation evidence again falls under the "face validity" heading that described previous analyses because they are based on an intuitive interpretation of a pattern of results. In this analysis, descriptive Ability Profiler scores were created and linked to the newly computed OAPs. This was done to determine whether the occupations most closely matched to the sample profiles met common-sense expectations of the occupations that should emerge from these sample profiles. Consistent with previous scoring procedures, the sample Ability Profiler scores and the occupations were matched by correlating the sample scores with the OAPs (McCloy et al., 1999). The created Ability Profiler scores are displayed in Table 12. To make interpretation of the matching occupations easier, the five profiles were made very distinct (i.e., they have clearly higher scores on some dimensions).

Table 12. Fictional Assessment Profile Descriptions

AP Profile	AP Profile Description	Scores Assigned								
		AR	VA	SA	CM	CP	FP	MC	MD	FD
Profile 1	High on Verbal Ability (VA), moderate to low on everything else, particularly bad at math.	52	88	62	39	69	70	73	65	60
Profile 2	High on Mathematical Abilities (AR and CM), but moderate to low on everything else.	92	68	75	88	66	71	68	61	62
Profile 3	High on Spatial Ability (SA) and Form Perception (FP), moderate to low on everything else.	70	74	95	75	72	92	58	62	69
Profile 4	High on the physical dimension (MC, FD, and MD), but low on the cognitive ones.	55	66	62	67	59	70	98	94	92
Profile 5	High on Verbal (VA, CP) and Mathematical (AR, CM) dimensions, moderate on all else	89	92	75	96	90	78	70	78	72

Note. Scores correspond to percentage scores on the Ability Profiler (AP). For example, 52 = 52% correct on that examination. Profiles were generated based on relative differences in scores, rather than actual scoring norms. For example, here a "low" score might be in the 30s or 50s, but norming data might indicate that a real "low" score (in terms of percentiles) might be higher. This makes interpretation of the results easier, because the scales for each dimension are the same. Actual scores on the various AP tests have differing score ranges, from a maximum score of 29 on the Arithmetic Reasoning test to a maximum of 253 on the Place test (the test used to measure Manual Dexterity).

The occupations linked to the sample profiles in Table 12 suggested that the OAPs served their intended purpose of matching individuals' Ability Profiler scores to occupations best suited to their ability (see the Tables in Appendix C for a complete picture of the results). For example, Profile 1 had particularly high VA dimension scores. Within Job Zones 3 and 4, the top occupations linked include court reporters, medical transcriptionists, poets, lyricists, creative writers, copy writers, proofreaders, and translators. Some of the occupations linked within Job Zone 5 included physical therapists, chiropractors, and surgeons. While on its face these

occupations may not fit with the Profile 1 scores, a deeper examination suggests that these matches may be driven by the low mathematical (AR, CM) and spatial (SA) dimension scores and moderate physical dimension scores (MC, MD, FD). Figure 1 shows a graphical representation of Profile 1 with the three closest-matching occupations. Notice these three occupations most closely match Profile 1 despite their differences in dimension score levels. This can be attributed to the use of the correlation coefficient as the matching statistic, which matches on profile shape rather than level.

For the sample profile with high mathematical scores (Profile 2), some of the matched occupations across Job Zones included mathematicians (Job Zone 5), mathematical technicians (Job Zone 4), statistical assistants (Job Zone 3), gaming change persons and booth cashiers (Job Zone 2), and counter and rental clerks (Job Zone 1). These occupations were also consistent with common-sense expectations. The same was also true for Profile 3, which had high Ability Profiler scores for the SA and FP dimensions. Matched occupations for this profile included geographers (Job Zone 5), graphic designers (Job Zone 4), ship pilots (Job Zone 3), aircraft structure, surfaces, rigging, and systems assemblers (Job Zone 2), and hunters and trappers (Job Zone 1).

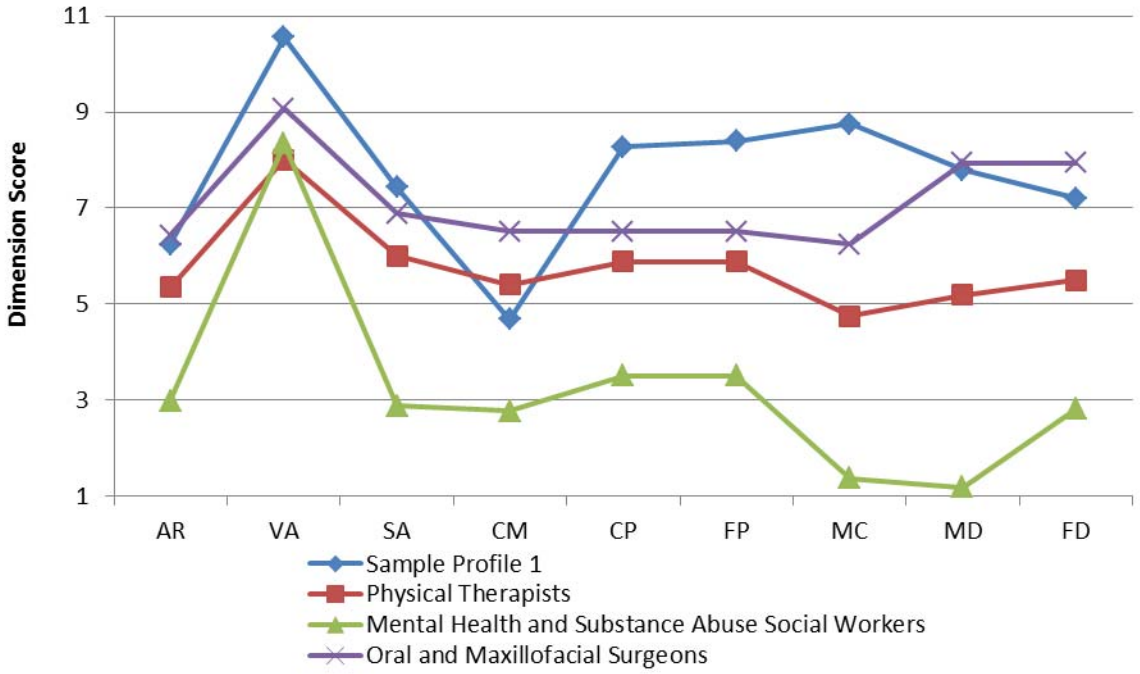

Figure 1. Three Occupations Matched to Sample Profile 1

Profile 4, which had high scores for physical dimensions and low scores for cognitive dimensions, also had matches that were consistent with expectations and that were also consistent with the Job Zone analysis results above. Across Job Zones 4 and 5, only one occupation correlated positively with this profile (oral and maxillofacial surgeons). This was consistent with the finding that Job Zones 4 and 5 are more cognitively oriented. Sample Profile 5, on the other hand, which had high scores on the VA, AR, and CM Ability Profiler dimensions, was strongly and positively correlated with a number of occupations in Job Zones 4 and 5. Taken

together, the results of this analysis suggest that when the OAPs are eventually implemented operationally, the occupations matched with the ability profiles will make intuitive sense.

Comparison to Previous OAPs

As a final way of testing the validity of the OAPs, the newly computed profiles were compared to the regression-based OAPs (McCloy et al., 1999). The comparison was made in two ways. First, the individual OAP dimension scores were compared in the two studies using bivariate correlation coefficients. Second, the OAP patterns were compared using a combination of cluster and discriminant function analysis. Although we did not expect that the old and new OAPs would overlap completely, there should be some consistency between the two.

The results of the first analysis, comparing the old OAP dimension scores with the new ones, are presented in Table 13. The top half of the table represents the bivariate correlations between the old and new scores for all of the occupations that were in both datasets. Along the diagonal in bold are the main correlations of interest – the same dimension computed at different points in time (1999 vs. 2009) and using different methods (prediction equations vs. O*NET data). Table 13 suggests mixed results. Consistent with expectations, the correlations for the AR, VA, SA, and CM dimensions were moderate to highly correlated between the two methods. However, the same was not true for the remaining dimensions. In fact, the two measures were significantly negatively correlated with one another for the MC, MD, and FD scales.

Table 13. Bivariate Correlations between the Original and New OAPs

	Original OAPs								
New OAPs	AR	VA	SA	CM	CP	FP	MC	MD	FD
				All Overlapping Occupations (N = 666)					
Arithmetic Reasoning (AR)	**.58****	.49**	.59**	.56**	.46**	.53**	.37**	.41**	.30**
Verbal Ability (VA)	.83**	**.87****	.70**	.85**	.85**	.83**	.82**	.54**	.60**
Spatial Ability (SA)	.06	– .07	**.25****	.00	– .15**	.02	– .18**	.27**	.14**
Computation (CM)	.54**	.45**	.55**	**.52****	.42**	.49**	.34**	.39**	.27**
Clerical Perception (CP)	.03	– .05	.15**	.01	**– .06**	.05	– .07	.25**	.19**
Form Perception (FP)	.03	– .05	.15**	.01	– .06	**.05**	– .07	.25**	.19**
Motor Coordination (MC)	– .46**	– .56**	– .27**	– .50**	– .59**	– .47**	**– .59****	– .13**	– .27**
Manual Dexterity (MD)	– .57**	– .68**	– .33**	– .62**	– .72**	– .57**	– .70**	**– .15****	– .29**
Finger Dexterity (FD)	– .39**	– .53**	– .16**	– .45**	– .57**	– .41**	– .58**	– .02	**– .20****
				Sample of Non-Changing Occupations (N = 50)					
Arithmetic Reasoning (AR)	**.62****	.53**	.61**	.60**	.50**	.55**	.39**	.40**	.26
Verbal Ability (VA)	.84**	**.84****	.76**	.84**	.81**	.81**	.75**	.61**	.55**
Spatial Ability (SA)	.33*	.17	**.49****	.26	.07	.25**	– .01	.44**	.23
Computation (CM)	.60**	.52**	.58**	**.58****	.49**	.53**	.39**	.39**	.25
Clerical Perception (CP)	.31*	.28*	.33*	.31*	**.28***	.32*	.25	.36*	.31*
Form Perception (FP)	.31*	.28*	.33*	.31*	.28*	**.32***	.25	.36*	.31*
Motor Coordination (MC)	– .28*	– .38**	– .10	– .32*	– .42**	– .28*	**– .43****	.04	– .12
Manual Dexterity (MD)	– .45**	– .57**	– .23	– .50**	– .62**	– .45**	– .61**	**– .06**	– .22
Finger Dexterity (FD)	– .12	– .26	.08	– .18	– .33*	– .15	– .36*	.18	**– .04**

Note. **p < .01, *p < .05.

One potential explanation for these near-zero and negative correlations is the expanded role technology has played in the workplace over the course of the 10 years. These changes occurred in such a way that dimensions formerly important to perform some occupations may no longer be required. To account for this possibility, a subset of 50 occupations that were least likely to substantively change over this period of time were selected. Occupations that were selected to sample across job families[6] and Job Zones (see Appendix D for a complete list) possess certain technological requirements. To some extent, almost all occupations have changed in nature due to technological shifts. The goal here, then, was to select occupations where the impact was minimized. Therefore, occupations that did not require a lot of software technology or knowledge of computers and computer systems were chosen. The correlation analyses were then repeated, with the results presented in the bottom half of Table 13. Once again, the correlations for the AR, VA, SA, and CM dimensions were in the expected direction. To this list, the CP and FP dimensions can also be added when the sample is limited to occupations that have changed little. However, results for MC (negatively correlated), MD, and FD (correlations near zero) were not in the expected direction. This indicates that there were clearly some difference between the current OAP computations and previous ones.

There are a couple of reasons to believe these differences may not necessarily be problematic. First, the present scores, by using the O*NET KSA ratings, are measuring what abilities are *required* to perform the job, whereas the previously computed OAP used regression equation-derived scores. Each method has its merits, but one advantage to the current OAPs is many of the dimensions are more distinct, as evidenced by the intercorrelations presented in Table 14. This suggests that there may be less spurious covariance in the newly created OAPs than in the empirically created versions. Second, the top five and bottom five occupations are more consistent with a rational interpretation of Motor Coordination (MC) when they are sorted by the new scores rather than the original. This suggests that the new OAPs may be more interpretable than the empirically created.

Table 14. OAP Dimension Intercorrelations

	AR	VA	SA	CM	CP	FP	MC	MD	FD
Arithmetic Reasoning (AR)	—	.96**	.94**	.99**	.91**	.98**	.86**	.75**	.72**
Verbal Ability (VA)	.52**	—	.83**	.98**	.98**	.97**	.96**	.68**	.74**
Spatial Ability (SA)	.27**	– .08*	—	.90**	.74**	.90**	.68**	.87**	.74**
Computation (CM)	.99**	.48**	.27**	—	.96**	.99**	.91**	.73**	.73**
Clerical Perception (CP)	.28**	– .03	.55**	.32**	—	.95**	.98**	.62**	.71**
Form Perception (FP)	.28**	– .03	.55**	.32**	1.00**	—	.92**	.81**	.82**
Motor Coordination (MC)	– .15**	– .56**	.38**	– .11**	.39**	.39**	—	.63**	.77**
Manual Dexterity (MD)	– .25**	– .66**	.43**	– .22**	.39**	.39**	.90**	—	.91**
Finger Dexterity (FD)	– .09*	– .52**	.53**	– .04	.54**	.54**	.91**	.91**	—

Note. $N = 666$. Newly computed OAPs are below the diagonal; previously computed OAPs are above the diagonal.
**$p < .01$, *$p < .05$.

The above analyses demonstrated the distinctiveness of the two OAP dimensions. The next set of analyses was meant to test whether the OAP *patterns* were similar across the two

[6] The exception was the "Computer and Mathematical" family. Due to the nature of the job family in this case, only one occupation was identified as being acceptably stable over the time period.

iterations. The similarity of the two patterns was tested using a *k*-means cluster analysis and discriminant function analysis (DFA). Cluster analysis refers to a group of procedures used to group similar entities (in this case, the O*NET occupations) using the pattern profiles of a set of variables (in this case, the OAPs). In *k*-means cluster analysis, occupations are assigned to a predetermined number of groups (in this case, four[7]) based on their similarity. The "similarity" among profiles was determined using a squared Euclidean distance metric. Once the similarity among all of the occupations had been ascertained, the *k*-means cluster analysis assigned the occupations to the four groups in a way that minimized within-group variability.

Table 15. The Occupations Ranked in the Top 5 and Bottom 5 for the Newly Created and Empirically Created Motor Coordination (MC) Ability Profiler Dimensions

New (Rationally-Created) Occupations	MC Score	Original (Empirically-Created) Occupations	MC Score
		Top 5 Occupations	
Data Entry Keyers	7.01	Judges, Magistrate Judges, and Magistrates	153.18
Word Processors and Typists	6.88	Psychiatrists	152.50
Manufactured Building and Mobile Home Installers	6.76	Pilots, Ship	151.46
Packaging and Filling Machine Operators and Tenders	6.38	Clinical Psychologists	151.10
Glass Blowers, Molders, Benders, and Finishers	6.26	Lawyers	150.52
		Bottom 5 Occupations	
Ambulance Drivers and Attendants, Except Emergency Medical Technicians	1.00	Forest and Conservation Workers	65.42
Lifeguards, Ski Patrol, and Other Recreational Protective Service Workers	1.00	Helpers--Painters, Paperhangers, Plasterers, and Stucco Masons	63.46
Maids and Housekeeping Cleaners	1.00	Carpet Installers	62.23
Baggage Porters and Bellhops	1.00	Refuse and Recyclable Material Collectors	60.86
Models	1.00	Stevedores, Except Equipment Operators	59.76

To compare the similarity of the profiles for both sets of OAPs, *k*-means cluster analysis was performed on the O*NET occupations using the original OAPs as the input variables. This procedure assigned occupations to one of four groups. DFA classification analysis was then used to determine whether the new OAPs could be used to classify occupations into the same four

[7] The number to use as a group seed point was determined using the Ward hierarchical cluster analysis method. An examination of both the incremental sums of square and the dendrogram suggested a four-cluster solution was optimal for the occupations computed using the original OAPs.

groups. This analysis derives classification equations from the predictor data for each group, and then uses the equations to classify each case (i.e., the occupations) into one of the *a priori* groups. Comparisons can then be made between the predicted group classifications and the actual classification scheme created by the *k*-means analysis. The results of this analysis are summarized in Table 16. The key finding was that 68.2% of the cases were correctly classified using the DFA classification analysis into the *k*-means cluster groupings. This suggests that although the patterns were not overlapping between the Old and New OAPs, there was enough consistency to suggest that they are measuring similar things. The overall classification rate of 68.2% is greater than chance rates (25%-35%) of classifying occupations into the same groups, even accounting for sample size.

Table 16. Classification Disparity between Old and New OAPs Using Discriminant Function Analysis

Cluster groupings created with k-means using the original OAPs	Number of occupations in each group	Probability of correctly classifying into group (assume equal weights)	Probability of correctly classifying into group (weighted based on *N* in each group)	Number correctly classified using new OAPs with DFA classification	Percent correctly classified using new OAPs with DFA classification
1	90	25%	13.5%	40	44.4%
2	126	25%	18.9%	83	65.9%
3	212	25%	31.8%	160	75.5%
4	238	25%	35.7%	171	71.8%
Totals	**666**			**435**	**68.2%**

These results suggest that although there were distinctions in the newly computed OAPs, there was enough consistency to suggest that they were not assessing completely different things. These results, combined with the Job Zone and face validity analyses conducted above, suggest that there is enough evidence for the validity of the new OAPs to warrant their use in matching job seeker Ability Profiler scores to occupations.

Results Summary

The above analyses can be divided into two categories. In the first category, analyses were conducted to determine how the OAPs would be computed. Three key decisions were made based on these analyses:

1. The OAPs comprised a unit-weighted combination of the Importance and Level scales.

2. Where appropriate, Knowledge, Skills, and Abilities scales were included in the computation of the OAPs.

3. Control Precision was omitted from the computation of the Manual Dexterity and Finger Dexterity Ability Profiler dimensions.

In addition, analyses were conducted to illustrate the loss of explanatory power resulting from having only one descriptor (Perceptual Speed) representing two Ability Profiler dimensions

(Clerical Perception and Form Perception). Results suggested that individual differences in scores on those two dimensions would not be reflected in the linked occupations.

In the second category, validation evidence was gathered for the OAPs using data from the O*NET system and the previously computed OAPs. Results suggested that

1. The OAP dimension scores were logically consistent with what is known about Job Zones. Specifically, cognitively loaded Ability Profiler dimensions were associated with higher Job Zones, while physically oriented Ability Profiler dimensions were associated with lower Job Zones.

2. The occupations emerging from an analysis comparing sample profiles to the OAPs yielded results that were logically consistent with a qualitative understanding of these occupations. This suggests the OAPs are face valid and will yield similarly interpretable results when implemented operationally.

3. A comparison of the new OAPs to those originally computed suggested that although there is overlap, the two versions are meaningfully distinct.

Summary

The present study created new OAPs using existing O*NET data. First, five expert raters identified the O*NET content model descriptors that shared the same underlying construct as the Ability Profiler dimensions. Then, analyses were conducted to refine the computation of the OAPs. The final formulas for computing the OAPs can be found in Appendix E, while the final OAPs can be found in Appendix F. Once the final scores were computed, further analyses were conducted to determine whether the OAPs were valid. Results suggested that, from a qualitative interpretation perspective, the OAPs are appropriate for matching individual scores on the Ability Profiler to occupations. Furthermore, comparing the new OAPs to those originally computed (McCloy et al., 1999) suggested the two profiles are measuring similar aspects of individual abilities, but are also clearly distinct. While additional work to validate these OAPs with incumbent data and criterion information would be beneficial, these results suggest that the OAPs will serve the intended purpose of matching job seekers to potential careers for which they are best suited.

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Appendix A: Linkage Exercise Instructions

O*NET Occupational Ability Profiles (OAPs) Linkage Exercise Instructions

Thank you for agreeing help us develop Occupational Ability Profiles (OAPs) for O*NET. The broad purpose of this task is to update one of O*NET's Career Exploration tools – the Ability Profiler (AP) – using existing O*NET data. To accomplish this, we are asking you to perform a linkage exercise that answers the question: *Is the construct underlying the O*NET variable the same as the construct underlying the AP dimension?* Relevant background information and instructions for completing this task are presented below.

Background

O*NET has developed a number of *Career Exploration Tools* to assist users with several career counseling diagnostics, such as what occupations they would like, what they would be best at, and so forth. For example, each of the 812 O*NET occupations has an interest profile based upon Holland's six RIASEC dimensions, as they are assessed in O*NET's Interest Profiler. The extent to which the users' pattern of scores on the Interest Profiler matches the pattern of scores for a particular occupation indicates the likelihood that they would be "interested" in that occupation.

Previous interest and values profiles have been developed using rater judgments of importance (McCloy, Waugh, Medsker, Wall, Rivkin, & Lewis, 1999; Rounds, Smith, Hubert, Lewis, & Rivkin, 1999). In these cases, raters take a list of worker characteristics (e.g., interests) and rate each O*NET occupation on the extent to which it satisfies each one. These efforts have found the rater method to be superior to empirical methods of profile development (McCloy et al., 1999). The present project will use a comparable approach when developing the ability profiles, but with existing ratings of importance on the O*NET knowledge, abilities, skills, and Generalized Work Activities (GWAs) in lieu of independent rater evaluations.

Individuals interested in determining their personal ability profile, and in turn occupations for which they may be a good fit, will use O*NET's Ability Profiler (AP). The AP measures an individual's ability on nine dimensions: verbal ability, arithmetic reasoning, computation, spatial ability, form perception, clerical perception, motor coordination, finger dexterity, and manual dexterity. Because there is no direct correspondence between the O*NET knowledges, abilities, skills, and GWAs (KSAGs) and the AP dimensions, a central portion of this effort will be devoted to linking the former with the latter. That's where you, the raters, play a role. Once these linkages have been completed, OAPs can be developed using existing ratings of importance for each occupation in the O*NET SOC system.

Current Task

As noted above, we will be using the existing KSAG importance ratings to develop the OAPs. Your task is to link these KSAG constructs to the nine AP dimensions. Specifically, we want to know *if the construct underlying the O*NET construct is the same as the construct underlying the AP dimension.* We also ask that you participate in a follow-up meeting to discuss any

"borderline" linkages (see below). The KSAGs that you link to each AP dimensions will be used to create composite scores for developing the OAPs.

Linkage Task

Step 1. Review the AP Dimension Descriptives and Items

A description of the AP dimensions and some sample items can be found in the following document:

- AP_Dimension_Descriptions.doc

The sample items will help you understand the AP dimensions and, hence, the underlying construct being measured.

Step 2. Review the O*NET Relevant Content Areas

As noted above, we are focusing on the constructs associated with the knowledges, abilities, skills, and GWAs. A description of these areas is available in the following document:

- ONET_Dimension_Descriptions_1.xls

Step 3. Complete the Linkages

Using the Excel sheets provided, indicate ***whether the construct underlying the O*NET variable is the same as the construct underlying the AP dimension***.

We recommend completing this task one O*NET content area at a time. In other words, do all of the linkages for O*NET Skill 1, then Skill 2, and so forth. We ask that each rater start with a different O*NET area to control for fatigue-related artifacts. The assigned starting areas are below:

- Rater 1, Rater 5 – Knowledge (start with Knowledge, then do Skills, Abilities, and GWAs)
- Rater 2 – Skills (start with Skills, then do Abilities … and so forth)
- Rater 3 – Abilities
- Rater 4 – GWAs

Please, only make linkages between constructs that seem the same, not ones that may be distally related. Also, you may link each KSAG to more than one AP dimension. We expect this to be a rare occurrence, but know that the option is available to you.

The linkage worksheets are provided in this document:

- OAP_LinkageSheets.xls

Step 4. Submit the Linkage Worksheet

Please provide your final judgments to Matt Allen (either electronically or hard copy) by **COB July 23.**

Follow-Up Meeting

A KSAG and AP dimension will be considered "linked" if four or five raters indicate that the two constructs are the same and "not linked" if no one or only one rater judges the constructs to be the same. However, if two or three raters indicate a linkage, the results will be considered inconclusive and up for discussion. At this point, all raters will convene for a meeting to discuss these "borderline" linkages to determine if, in fact, the constructs in question are the same.

Other Resources

- Visit www.onetcenter.org to learn more about O*NET
- Visit www.online.onetcenter.org to explore occupations through O*NET
- Go to the project folder for additional materials:
    - The full Ability Profiler instrument with all of the items (AP-instrument.pdf)
    - Instructions for administering the Ability Profiler (AP-admin.pdf)
    - A sample score report for the Ability Profiler (AP_ScoreReport_Sample.doc)
    - The full set of O*NET rating scales (ONET_rating_scales.pdf)

Once again, thank you for helping us complete this task!

Appendix B: Top 10 Occupations by Score Creation Method

Table B.1. The Occupations Ranked in the Top 10 for the Arithmetic Reasoning (AR) Ability Profiler Dimension

	Top 10 Occupations Computed with IMP-Only Scales	Job Zone	*M*	Top 10 Occupations Computed with IMP + LVL Scales	Job Zone	*M*	Top 10 Occupations Computed with 2*IMP + LVL Scales	Job Zone	*M*
1.	Mathematical Technicians	4	4.89	Mathematicians	5	11.32	Mathematicians	5	16.20
2.	Mathematicians	5	4.88	Physicists	5	11.03	Physicists	5	15.71
3.	Operations Research Analysts	5	4.79	Operations Research Analysts	5	10.70	Mathematical Technicians	4	15.55
4.	Mathematical Science Teachers, Postsecondary	5	4.71	Mathematical Technicians	4	10.66	Operations Research Analysts	5	15.49
5.	Physicists	5	4.68	Actuaries	5	10.47	Mathematical Science Teachers, Postsecondary	5	15.13
6.	Actuaries	5	4.66	Mathematical Science Teachers, Postsecondary	5	10.42	Actuaries	5	15.13
7.	Statisticians	5	4.56	Astronomers	5	10.31	Astronomers	5	14.78
8.	Astronomers	5	4.47	Statisticians	5	10.12	Statisticians	5	14.68
9.	Statistical Assistants	3	4.46	Engineering Teachers, Postsecondary	5	9.90	Engineering Teachers, Postsecondary	5	14.30
10.	Engineering Teachers, Postsecondary	5	4.40	Statistical Assistants	3	9.45	Statistical Assistants	3	13.91

Table B.2. The Occupations Ranked in the Top 10 for the Verbal Ability (VA) Ability Profiler Dimension

	Top 10 Occupations Computed with IMP-Only Scales	Job Zone	*M*	Top 10 Occupations Computed with IMP + LVL Scales	Job Zone	*M*	Top 10 Occupations Computed with 2*IMP + LVL Scales	Job Zone	*M*
1.	English Language and Literature Teachers, Postsecondary	5	4.68	Law Teachers, Postsecondary	5	10.27	English Language and Literature Teachers, Postsecondary	5	14.88
2.	Social Work Teachers, Postsecondary	5	4.61	English Language and Literature Teachers, Postsecondary	5	10.19	Law Teachers, Postsecondary	5	14.80
3.	Sociology Teachers, Postsecondary	5	4.59	Environmental Science Teachers, Postsecondary	5	10.07	Social Work Teachers, Postsecondary	5	14.65
4.	Criminal Justice and Law Enforcement Teachers, Postsecondary	5	4.59	Health Specialties Teachers, Postsecondary	5	10.05	Political Science Teachers, Postsecondary	5	14.56
5.	History Teachers, Postsecondary	5	4.58	Social Work Teachers, Postsecondary	5	10.04	Environmental Science Teachers, Postsecondary	5	14.56
6.	Area, Ethnic, and Cultural Studies Teachers, Postsecondary	5	4.57	Physicists	5	10.03	Anthropology and Archeology Teachers, Postsecondary	5	14.55
7.	Public Relations Specialists	4	4.56	Political Science Teachers, Postsecondary	5	10.03	Area, Ethnic, and Cultural Studies Teachers, Postsecondary	5	14.54
8.	Nursing Instructors and Teachers, Postsecondary	5	4.56	Anthropology and Archeology Teachers, Postsecondary	5	10.03	Health Specialties Teachers, Postsecondary	5	14.53
9.	Education Administrators, Elementary and Secondary School	5	4.56	Agricultural Sciences Teachers, Postsecondary	5	10.02	History Teachers, Postsecondary	5	14.53
10.	Philosophy and Religion Teachers, Postsecondary	5	4.55	Atmospheric, Earth, Marine, and Space Sciences Teachers, Postsecondary	5	9.99	Nursing Instructors and Teachers, Postsecondary	5	14.51

Table B.3. The Occupations Ranked in the Top 10 for the Spatial Ability (SA) Ability Profiler Dimension

	Top 10 Occupations Computed with IMP-Only Scales	Job Zone	*M*	Top 10 Occupations Computed with IMP + LVL Scales	Job Zone	*M*	Top 10 Occupations Computed with 2*IMP + LVL Scales	Job Zone	*M*
1.	Tile and Marble Setters	2	4.43	Mechanical Drafters	3	9.26	Mechanical Drafters	3	13.64
2.	Mechanical Drafters	3	4.38	Coaches and Scouts	5	9.14	Interior Designers	3	13.39
3.	Interior Designers	3	4.38	Architectural Drafters	3	9.13	Architectural Drafters	3	13.38
4.	Architectural Drafters	3	4.25	Interior Designers	3	9.01	Aerospace Engineers	5	12.89
5.	Fabric and Apparel Patternmakers	3	4.13	Aerospace Engineers	5	9.01	Tile and Marble Setters	2	12.72
6.	Landscape Architects	4	4.00	Fabric and Apparel Patternmakers	3	8.51	Coaches and Scouts	5	12.71
7.	Fine Artists, Including Painters, Sculptors, and Illustrators	3	4.00	Biomedical Engineers	4	8.51	Fabric and Apparel Patternmakers	3	12.64
8.	Millwrights	3	4.00	Landscape Architects	4	8.38	Biomedical Engineers	4	12.39
9.	Aerospace Engineers	5	3.88	Millwrights	3	8.38	Landscape Architects	4	12.38
10.	Directors- Stage, Motion Pictures, Television, and Radio	4	3.88	Civil Engineering Technicians	3	8.38	Millwrights	3	12.38

Table B.4. The Occupations Ranked in the Top 10 for the Computation (CM) Ability Profiler Dimension

	Top 10 Occupations Computed with IMP-Only Scales	Job Zone	*M*	Top 10 Occupations Computed with IMP + LVL Scales	Job Zone	*M*	Top 10 Occupations Computed with 2*IMP + LVL Scales	Job Zone	*M*
1.	Mathematical Technicians	4	4.89	Mathematicians	5	10.82	Mathematicians	5	15.45
2.	Operations Research Analysts	5	4.63	Physicists	5	10.82	Physicists	5	15.42
3.	Mathematicians	5	4.63	Mathematical Technicians	4	10.53	Mathematical Technicians	4	15.41
4.	Physicists	5	4.60	Operations Research Analysts	5	10.49	Operations Research Analysts	5	15.12
5.	Statisticians	5	4.43	Astronomers	5	10.06	Astronomers	5	14.45
6.	Mathematical Science Teachers, Postsecondary	5	4.42	Mathematical Science Teachers, Postsecondary	5	10.00	Mathematical Science Teachers, Postsecondary	5	14.42
7.	Astronomers	5	4.38	Actuaries	5	9.97	Statisticians	5	14.38
8.	Statistical Assistants	3	4.38	Statisticians	5	9.95	Actuaries	5	14.30
9.	Engineering Teachers, Postsecondary	5	4.36	Engineering Teachers, Postsecondary	5	9.86	Engineering Teachers, Postsecondary	5	14.22
10.	Actuaries	5	4.33	Agricultural Engineers	4	9.32	Statistical Assistants	3	13.66

Table B.5. The Occupations Ranked in the Top 10 for the Clerical Perception/Form Perception (CP/FP) Ability Profiler Dimension

	Top 10 Occupations Computed with IMP-Only Scales	Job Zone	*M*	Top 10 Occupations Computed with IMP + LVL Scales	Job Zone	*M*	Top 10 Occupations Computed with 2*IMP + LVL Scales	Job Zone	*M*
1.	Packaging and Filling Machine Operators and Tenders	2	4.13	Packaging and Filling Machine Operators and Tenders	2	9.26	Packaging and Filling Machine Operators and Tenders	2	13.39
2.	Airline Pilots, Copilots, and Flight Engineers	4	4.00	Air Traffic Controllers	3	8.25	Air Traffic Controllers	3	12.25
3.	Air Traffic Controllers	3	4.00	Airline Pilots, Copilots, and Flight Engineers	4	8.00	Airline Pilots, Copilots, and Flight Engineers	4	12.00
4.	Petroleum Pump System Operators, Refinery Operators, and Gaugers	2	3.88	Petroleum Pump System Operators, Refinery Operators, and Gaugers	2	7.88	Petroleum Pump System Operators, Refinery Operators, and Gaugers	2	11.76
5.	Numerical Tool and Process Control Programmers	3	3.75	Gas Plant Operators	3	7.75	Gas Plant Operators	3	11.50
6.	Nuclear Equipment Operation Technicians	3	3.75	Nuclear Equipment Operation Technicians	3	7.63	Nuclear Equipment Operation Technicians	3	11.38
7.	Environmental Compliance Inspectors	4	3.75	Nuclear Power Reactor Operators	3	7.50	Locomotive Engineers	2	11.13
8.	Government Property Inspectors and Investigators	3	3.75	Locomotive Engineers	2	7.38	Anesthesiologists	5	11.01
9.	Gas Plant Operators	3	3.75	Anesthesiologists	5	7.38	Automotive Master Mechanics	3	11.01
10.	Data Entry Keyers	2	3.75	Automotive Master Mechanics	3	7.38	Pump Operators, Except Wellhead Pumpers	2	11.01

Table B.6. The Occupations Ranked in the Top 10 for the Motor Coordination (MC) Ability Profiler Dimension

	Top 10 Occupations Computed with IMP-Only Scales	Job Zone	*M*	Top 10 Occupations Computed with IMP + LVL Scales	Job Zone	*M*	Top 10 Occupations Computed with 2*IMP + LVL Scales	Job Zone	*M*
1.	Manufactured Building and Mobile Home Installers	2	3.38	Data Entry Keyers	2	7.01	Data Entry Keyers	2	10.14
2.	Glass Blowers, Molders, Benders, and Finishers	3	3.13	Word Processors and Typists	2	6.88	Manufactured Building and Mobile Home Installers	2	10.14
3.	Data Entry Keyers	2	3.13	Manufactured Building and Mobile Home Installers	2	6.76	Word Processors and Typists	2	9.88
4.	Cooks, Restaurant	2	3.13	Packaging and Filling Machine Operators and Tenders	2	6.38	Glass Blowers, Molders, Benders, and Finishers	3	9.39
5.	Packaging and Filling Machine Operators and Tenders	2	3.00	Glass Blowers, Molders, Benders, and Finishers	3	6.26	Packaging and Filling Machine Operators and Tenders	2	9.38
6.	Grinding, Lapping, Polishing, and Buffing Machine Tool Setters, Operators, and Tenders, Metal and Plastic	2	3.00	Oral and Maxillofacial Surgeons	5	6.25	Cooks, Restaurant	2	9.26
7.	Oral and Maxillofacial Surgeons	5	3.00	Cooks, Restaurant	2	6.13	Oral and Maxillofacial Surgeons	5	9.25
8.	Computer-Controlled Machine Tool Operators, Metal and Plastic	2	3.00	Structural Iron and Steel Workers	2	5.88	Structural Iron and Steel Workers	2	8.76
9.	Cutting and Slicing Machine Setters, Operators, and Tenders	2	3.00	Potters, Manufacturing	3	5.88	Potters, Manufacturing	3	8.76
10.	Word Processors and Typists	2	3.00	Cooks, Short Order	1	5.88	Cooks, Short Order	1	8.76

Table B.7. The Occupations Ranked in the Top 10 for the Manual Dexterity (MD) Ability Profiler Dimension

	Top 10 Occupations Computed with IMP-Only Scales	Job Zone	*M*	Top 10 Occupations Computed with IMP + LVL Scales	Job Zone	*M*	Top 10 Occupations Computed with 2*IMP + LVL Scales	Job Zone	*M*
1.	Manufactured Building and Mobile Home Installers	2	3.88	Oral and Maxillofacial Surgeons	5	8.50	Oral and Maxillofacial Surgeons	5	12.26
2.	Excavating and Loading Machine and Dragline Operators	2	3.80	Surgeons	5	7.59	Packaging and Filling Machine Operators and Tenders	2	11.30
3.	Packaging and Filling Machine Operators and Tenders	2	3.75	Packaging and Filling Machine Operators and Tenders	2	7.55	Manufactured Building and Mobile Home Installers	2	11.26
4.	Oral and Maxillofacial Surgeons	5	3.75	Manufactured Building and Mobile Home Installers	2	7.38	Roof Bolters, Mining	2	11.13
5.	Roof Bolters, Mining	2	3.75	Roof Bolters, Mining	2	7.38	Excavating and Loading Machine and Dragline Operators	2	11.05
6.	Structural Iron and Steel Workers	2	3.75	Glass Blowers, Molders, Benders, and Finishers	3	7.30	Structural Iron and Steel Workers	2	10.97
7.	Airline Pilots, Copilots, and Flight Engineers	4	3.67	Excavating and Loading Machine and Dragline Operators	2	7.26	Glass Blowers, Molders, Benders, and Finishers	3	10.88
8.	Glass Blowers, Molders, Benders, and Finishers	3	3.59	Structural Iron and Steel Workers	2	7.21	Surgeons	5	10.88
9.	Upholsterers	2	3.59	Heating and Air Conditioning Mechanics and Installers	3	7.17	Airline Pilots, Copilots, and Flight Engineers	4	10.72
10.	Grinding, Lapping, Polishing, and Buffing Machine Tool Setters, Operators, and Tenders, Metal and Plastic	2	3.59	Jewelers	3	7.17	Cabinetmakers and Bench Carpenters	3	10.63

Table B.8. The Occupations Ranked in the Top 10 for the Finger Dexterity (FD) Ability Profiler Dimension

	Top 10 Occupations Computed with IMP-Only Scales	Job Zone	*M*	Top 10 Occupations Computed with IMP + LVL Scales	Job Zone	*M*	Top 10 Occupations Computed with 2*IMP + LVL Scales	Job Zone	*M*
1.	Oral and Maxillofacial Surgeons	5	3.84	Oral and Maxillofacial Surgeons	5	8.50	Oral and Maxillofacial Surgeons	5	12.34
2.	Manufactured Building and Mobile Home Installers	2	3.84	Jewelers	3	7.71	Jewelers	3	11.22
3.	Structural Iron and Steel Workers	2	3.63	Dentists, General	5	7.42	Manufactured Building and Mobile Home Installers	2	11.18
4.	Packaging and Filling Machine Operators and Tenders	2	3.59	Packaging and Filling Machine Operators and Tenders	2	7.42	Packaging and Filling Machine Operators and Tenders	2	11.01
5.	Excavating and Loading Machine and Dragline Operators	2	3.59	Manufactured Building and Mobile Home Installers	2	7.34	Dentists, General	5	10.80
6.	Cabinetmakers and Bench Carpenters	3	3.59	Heating and Air Conditioning Mechanics and Installers	3	7.17	Cabinetmakers and Bench Carpenters	3	10.72
7.	Upholsterers	2	3.59	Surgeons	5	7.17	Structural Iron and Steel Workers	2	10.68
8.	Airline Pilots, Copilots, and Flight Engineers	4	3.59	Cabinetmakers and Bench Carpenters	3	7.13	Aircraft Mechanics and Service Technicians	3	10.63
9.	Potters, Manufacturing	3	3.55	Aircraft Mechanics and Service Technicians	3	7.09	Heating and Air Conditioning Mechanics and Installers	3	10.59
10.	Aircraft Mechanics and Service Technicians	3	3.54	Structural Iron and Steel Workers	2	7.05	Excavating and Loading Machine and Dragline Operators	2	10.59

Appendix C: Sample Linkage Tables

Table C.1. Top 5 Occupations by Job Zone for Sample Profile 1

Zone	Rank	Occupation	*r*	*p*
5	1	Physical Therapists (JZ 5)	.59	.09
	2	Mental Health and Substance Abuse Social Workers (JZ 5)	.54	.13
	3	Oral and Maxillofacial Surgeons (JZ 5)	.51	.17
	4	Chiropractors (JZ 5)	.48	.19
	5	Surgeons (JZ 5)	.47	.20
4	1	Poets, Lyricists and Creative Writers (JZ 4)	.57	.11
	2	Proofreaders and Copy Markers (JZ 4)	.47	.21
	3	Copy Writers (JZ 4)	.46	.21
	4	Interpreters and Translators (JZ 4)	.45	.23
	5	Music Directors (JZ 4)	.42	.26
3	1	Court Reporters (JZ 3)	.79	.01
	2	Transit and Railroad Police (JZ 3)	.71	.03
	3	Medical Transcriptionists (JZ 3)	.70	.04
	4	Musicians, Instrumental (JZ 3)	.67	.05
	5	Emergency Medical Technicians and Paramedics (JZ 3)	.65	.06
2	1	Police, Fire, and Ambulance Dispatchers (JZ 2)	.88	.00
	2	Refuse and Recyclable Material Collectors (JZ 2)	.82	.01
	3	Subway and Streetcar Operators (JZ 2)	.81	.01
	4	Dental Assistants (JZ 2)	.78	.01
	5	Dental Laboratory Technicians (JZ 2)	.77	.02
1	1	Bridge and Lock Tenders (JZ 1)	.75	.02
	2	Crossing Guards (JZ 1)	.69	.04
	3	Cooks, Short Order (JZ 1)	.68	.04
	4	Food Preparation Workers (JZ 1)	.60	.09
	5	Dishwashers (JZ 1)	.57	.11

Note. High on Verbal Ability (VA), moderate to low on everything else, particularly bad at math.

Table C.2. Top 5 Occupations by Job Zone for Sample Profile 2

Zone	Rank	Occupation	*r*	*p*
5	1	Mathematicians (JZ 5)	.84	.00
	2	Operations Research Analysts (JZ 5)	.84	.00
	3	Actuaries (JZ 5)	.81	.01
	4	Mathematical Science Teachers, Postsecondary (JZ 5)	.81	.01
	5	Physicists (JZ 5)	.77	.02
4	1	Mathematical Technicians (JZ 4)	.82	.01
	2	Agricultural Engineers (JZ 4)	.80	.01
	3	Surveyors (JZ 4)	.76	.02
	4	Marine Engineers (JZ 4)	.76	.02
	5	Computer Software Engineers, Systems Software (JZ 4)	.75	.02
3	1	Numerical Tool and Process Control Programmers (JZ 3)	.82	.01
	2	Statistical Assistants (JZ 3)	.80	.01
	3	Milling and Planing Machine Setters, Operators, and Tenders, Metal and Plastic (JZ 3)	.79	.01
	4	Surveying Technicians (JZ 3)	.79	.01
	5	Stonemasons (JZ 3)	.78	.01
2	1	Drywall and Ceiling Tile Installers (JZ 2)	.82	.01
	2	Lathe and Turning Machine Tool Setters, Operators, and Tenders, Metal and Plastic (JZ 2)	.82	.01
	3	Lay-Out Workers, Metal and Plastic (JZ 2)	.75	.02
	4	Gaming Change Persons and Booth Cashiers (JZ 2)	.73	.03
	5	Helpers--Roofers (JZ 2)	.71	.03
1	1	Carpet Installers (JZ 1)	.75	.02
	2	Counter and Rental Clerks (JZ 1)	.64	.06
	3	Stock Clerks, Sales Floor (JZ 1)	.53	.14
	4	Hosts and Hostesses, Restaurant, Lounge, and Coffee Shop (JZ 1)	.50	.17
	5	Waiters and Waitresses (JZ 1)	.47	.20

Note. High on Mathematical Abilities (AR and CM), but moderate to low on everything else.

Table C.3. Top 5 Occupations by Job Zone for Sample Profile 3

Zone	Rank	Occupation	*r*	*p*
5	1	Coaches and Scouts (JZ 5)	.75	.02
	2	Geographers (JZ 5)	.61	.08
	3	Occupational Therapists (JZ 5)	.61	.08
	4	Chief Executives (JZ 5)	.59	.09
	5	Engineering Managers (JZ 5)	.59	.09
4	1	Graphic Designers (JZ 4)	.77	.01
	2	Art Directors (JZ 4)	.73	.03
	3	Set and Exhibit Designers (JZ 4)	.72	.03
	4	Meeting and Convention Planners (JZ 4)	.71	.03
	5	Landscape Architects (JZ 4)	.70	.04
3	1	Plumbers (JZ 3)	.87	.00
	2	Fabric and Apparel Patternmakers (JZ 3)	.83	.01
	3	Dancers (JZ 3)	.80	.01
	4	Pilots, Ship (JZ 3)	.80	.01
	5	Electrical and Electronics Repairers, Commercial and Industrial Equipment (JZ 3)	.79	.01
2	1	Forging Machine Setters, Operators, and Tenders, Metal and Plastic (JZ 2)	.81	.01
	2	Aircraft Structure, Surfaces, Rigging, and Systems Assemblers (JZ 2)	.81	.01
	3	Paving, Surfacing, and Tamping Equipment Operators (JZ 2)	.81	.01
	4	Printing Machine Operators (JZ 2)	.80	.01
	5	Textile Cutting Machine Setters, Operators, and Tenders (JZ 2)	.78	.01
1	1	Parking Lot Attendants (JZ 1)	.77	.01
	2	Hunters and Trappers (JZ 1)	.77	.02
	3	Taxi Drivers and Chauffeurs (JZ 1)	.69	.04
	4	Derrick Operators, Oil and Gas (JZ 1)	.69	.04
	5	Helpers--Production Workers (JZ 1)	.68	.04

Note. High on Spatial Ability (SA) and Form Perception (FP), moderate to low on everything else.

Table C.4. Top 5 Occupations by Job Zone for Sample Profile 4

Zone	Rank	Occupation	*r*	*p*
5	1	Oral and Maxillofacial Surgeons (JZ 5)	.21	.59
	2	Surgeons (JZ 5)	-.33	.39
	3	Dentists, General (JZ 5)	-.42	.26
	4	Physical Therapists (JZ 5)	-.44	.24
	5	Athletic Trainers (JZ 5)	-.46	.21
4	1	Poets, Lyricists and Creative Writers (JZ 4)	-.30	.43
	2	Probation Officers and Correctional Treatment Specialists (JZ 4)	-.43	.25
	3	Mathematical Technicians (JZ 4)	-.43	.25
	4	Mobile Heavy Equipment Mechanics, Except Engines (JZ 4)	-.45	.23
	5	Technical Writers (JZ 4)	-.52	.15
3	1	Musicians, Instrumental (JZ 3)	.68	.04
	2	Court Reporters (JZ 3)	.32	.41
	3	Barbers (JZ 3)	.25	.52
	4	Potters, Manufacturing (JZ 3)	.24	.53
	5	Glass Blowers, Molders, Benders, and Finishers (JZ 3)	.18	.65
2	1	Floor Sanders and Finishers (JZ 2)	.76	.02
	2	Roof Bolters, Mining (JZ 2)	.71	.03
	3	Painting, Coating, and Decorating Workers (JZ 2)	.69	.04
4	4	Data Entry Keyers (JZ 2)	.53	.14
	5	Sewers, Hand (JZ 4)	.40	.29
1	1	Pressers, Textile, Garment, and Related Materials (JZ 1)	.84	.00
	2	Meat, Poultry, and Fish Cutters and Trimmers (JZ 1)	.75	.02
	3	Cooks, Short Order (JZ 1)	.73	.03
	4	Slaughterers and Meat Packers (JZ 1)	.73	.03
	5	Dishwashers (JZ 1)	.69	.04

Note. High on the physical dimension (MC, FD, and MD), but low on the cognitive ones.

Table C.5. Top 5 Occupations by Job Zone for Sample Profile 5

Zone	Rank	Occupation	*r*	*p*
5	1	Pharmacists (JZ 5)	.89	.00
	2	Medical Scientists, Except Epidemiologists (JZ 5)	.86	.00
	3	Statisticians (JZ 5)	.86	.00
	4	Actuaries (JZ 5)	.86	.00
	5	Economists (JZ 5)	.86	.00
4	1	Personal Financial Advisors (JZ 4)	.87	.00
	2	Aquacultural Managers (JZ 4)	.87	.00
	3	Sales Agents, Securities and Commodities (JZ 4)	.87	.00
	4	Credit Analysts (JZ 4)	.87	.00
	5	Accountants (JZ 4)	.87	.00
3	1	Forest and Conservation Workers (JZ 3)	.92	.00
	2	Tax Preparers (JZ 3)	.89	.00
	3	Billing, Cost, and Rate Clerks (JZ 3)	.89	.00
	4	Procurement Clerks (JZ 3)	.89	.00
	5	Purchasing Agents, Except Wholesale, Retail, and Farm Products (JZ 3)	.89	.00
	1	Farm Labor Contractors (JZ 2)	.91	.00
2	2	Gaming Cage Workers (JZ 2)	.90	.00
	3	New Accounts Clerks (JZ 2)	.90	.00
	4	Slot Key Persons (JZ 2)	.89	.00
	5	Gaming Supervisors (JZ 2)	.88	.00
1	1	Counter and Rental Clerks (JZ 1)	.85	.00
	2	Hosts and Hostesses, Restaurant, Lounge, and Coffee Shop (JZ 1)	.81	.01
	3	Stock Clerks, Sales Floor (JZ 1)	.81	.01
	4	Baggage Porters and Bellhops (JZ 1)	.80	.01
	5	Driver/Sales Workers (JZ 1)	.78	.02

Note. High on Verbal (VA, CP) and Mathematical (AR, CM) dimensions, moderate on all else.

Appendix D: Occupations Used to Compare Old and New OAPs

Table D.1. Occupations Used to Compare Old and New Occupational Ability Profiles

	SOC Code	Occupation Title	Job Zone
1	11-3040.00	Human Resources Managers	4
2	11-9011.02	Agricultural Crop Farm Managers	4
3	11-9021.00	Construction Managers	4
4	13-1032.00	Insurance Appraisers, Auto Damage	3
5	13-2071.00	Loan Counselors	4
6	15-2021.00	Mathematicians	5
7	17-1022.00	Surveyors	4
8	17-2111.03	Product Safety Engineers	4
9	19-1012.00	Food Scientists and Technologists	5
10	19-1032.00	Foresters	4
11	19-4051.02	Nuclear Monitoring Technicians	3
12	23-1011.00	Lawyers	5
13	23-2092.00	Law Clerks	4
14	25-1123.00	English Language and Literature Teachers, Postsecondary	5
15	25-2042.00	Special Education Teachers, Middle School	4
16	25-4013.00	Museum Technicians and Conservators	3
17	27-2011.00	Actors	2
18	27-2042.02	Musicians, Instrumental	3
19	29-1021.00	Dentists, General	5
20	29-1121.00	Audiologists	5
21	29-2052.00	Pharmacy Technicians	2
22	31-1011.00	Home Health Aides	2
23	31-2022.00	Physical Therapist Aides	2
24	33-2011.01	Municipal Fire Fighters	3
25	33-3011.00	Bailiffs	2
26	33-9091.00	Crossing Guards	1
27	35-2011.00	Cooks, Fast Food	1
28	35-9021.00	Dishwashers	1
29	37-2012.00	Maids and Housekeeping Cleaners	1
30	37-3012.00	Pesticide Handlers, Sprayers, and Applicators, Vegetation	3
31	39-4011.00	Embalmers	3
32	39-5011.00	Barbers	3
33	39-6011.00	Baggage Porters and Bellhops	1
34	41-2011.00	Cashiers	1
35	41-2031.00	Retail Salespersons	2
36	41-9012.00	Models	1
37	43-5052.00	Postal Service Mail Carriers	2
38	43-5081.01	Stock Clerks, Sales Floor	1
39	45-1011.06	First-Line Supervisors and Manager/Supervisors - Fishery Workers	4
40	45-4021.00	Fallers	1
41	47-2022.00	Stonemasons	3
42	47-2151.00	Pipelayers	2
43	49-3022.00	Automotive Glass Installers and Repairers	2
44	49-3031.00	Bus and Truck Mechanics and Diesel Engine Specialists	3
45	49-3093.00	Tire Repairers and Changers	1
46	51-3021.00	Butchers and Meat Cutters	2
47	51-5012.00	Bookbinders	2
48	53-3041.00	Taxi Drivers and Chauffeurs	1
49	53-4012.00	Locomotive Firers	3
50	53-6031.00	Service Station Attendants	1

Appendix E: Formulas for Computing OAPs

*For a complete list of the O*NET descriptors used to compute the OAP dimensions, see Table 2.

Arithmetic Reasoning (AR) = [$MeanIMP_{Mathematics\ (Knowledge)}$ + $MeanIMP_{Mathematics\ (Skill)}$ + $MeanIMP_{Mathematical\ Reasoning\ (Ability)}$]/3 + [$MeanLVL_{Mathematics\ (Knowledge)}$ + $MeanLVL_{Mathematics\ (Skill)}$ + $MeanLVL_{Mathematical\ Reasoning\ (Ability)}$]/3.

Verbal Ability (VA) = [$MeanIMP_{Writing\ (Skill)}$ + $MeanIMP_{Oral\ Comprehension\ (Ability)}$ + $MeanIMP_{Oral\ Expression\ (Ability)}$ + $MeanIMP_{Written\ Expression\ (Ability)}$ + $MeanIMP_{English\ Language\ (Knowledge)}$ + $MeanIMP_{Reading\ Comprehension\ (Skill)}$ + $MeanIMP_{Speaking\ (Skill)}$ + $MeanIMP_{Written\ Comprehension\ (Ability)}$]/8 + [$MeanLVL_{Writing\ (Skill)}$ + $MeanLVL_{Oral\ Comprehension\ (Ability)}$ + $MeanLVL_{Oral\ Expression\ (Ability)}$ + $MeanLVL_{Written\ Expression\ (Ability)}$ + $MeanLVL_{English\ Language\ (Knowledge)}$ + $MeanLVL_{Reading\ Comprehension\ (Skill)}$ + $MeanLVL_{Speaking\ (Skill)}$ + $MeanLVL_{Written\ Comprehension\ (Ability)}$]/8.

Spatial Ability (SA) = $MeanIMP_{Visualization\ (Ability)}$ + $MeanLVL_{Visualization\ (Ability)}$.

Computation (CM) = [$MeanIMP_{Number\ Facility\ (Ability)}$ + $MeanIMP_{Mathematics\ (Knowledge)}$ + $MeanIMP_{Mathematics\ (Skill)}$]/3 + [$MeanLVL_{Number\ Facility\ (Ability)}$ + $MeanLVL_{Mathematics\ (Knowledge)}$ + $MeanLVL_{Mathematics\ (Skill)}$]//3.

Clerical Perception (CP) = $MeanIMP_{Perceptual\ Speed\ (Ability)}$ + $MeanLVL_{Perceptual\ Speed\ (Ability)}$.

Form Perception (FP) = $MeanIMP_{Perceptual\ Speed\ (Ability)}$ + $MeanLVL_{Perceptual\ Speed\ (Ability)}$.

Motor Coordination (MC) = $MeanIMP_{Wrist\text{-}Finger\ Speed\ (Ability)}$ + $MeanLVL_{Wrist\text{-}Finger\ Speed\ (Ability)}$.

Manual Dexterity (MD) = [$MeanIMP_{Manual\ Dexterity\ (Ability)}$ + $MeanIMP_{Wrist\text{-}Finger\ Speed\ (Ability)}$]/2 + [$MeanLVL_{Manual\ Dexterity\ (Ability)}$ + $MeanLVL_{Wrist\text{-}Finger\ Speed\ (Ability)}$]/2.

Finger Dexterity (FD) = [$MeanIMP_{Finger\ Dexterity\ (Ability)}$ + $MeanIMP_{Wrist\text{-}Finger\ Speed\ (Ability)}$]/2 + [$MeanLVL_{Manual\ Dexterity\ (Ability)}$ + $MeanLVL_{Wrist\text{-}Finger\ Speed\ (Ability)}$]/2.

Key:

MeanIMP = Average occupation importance score for target descriptor, as reported in the O*NET 13.0 database.

MeanLVL = Average occupation level score for target descriptor, as reported in the O*NET 13.0 database.