



## O\*NET® Analyst Occupational Ratings: Linkage Revisit

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## Introduction

The Occupational Information Network (O\*NET®) provides comprehensive information about the occupations within the U.S. economy. Most of the information is collected from job incumbents; however, occupational analysts provide the importance and level information regarding the abilities and skills associated with each occupation. In order to ensure the currency of the O\*NET database, new ratings are collected on a continual basis. The process for collecting these ratings from analysts and the nature of the stimulus material has been documented in prior reports (e.g., Fleisher & Tsacoumis, 2012a; 2012b).

In general, the stimulus material contains information about the occupation, such as title and definition, job zone, a list of the important and supplemental tasks including importance ratings, and knowledge information. Analysts use this information to become familiar with the occupation and to inform their importance and level ratings. In addition, for each ability and skill, the stimulus material indicates the name and definition for each construct, including the level scale anchors showing how the ability or skill is manifested in an occupational context and a list of the important Generalized Work Activities (GWAs) and Work Context (WC) statements that are linked to each ability or skill. To clarify, for a given occupation, a GWA or WC statement has two requirements to appear in the stimulus material for any given ability or skill. First, the GWA or WC statement must have been deemed important for the target occupation as indicated by a rating of 3 or above from job incumbents. Second, the ability/skill must be linked to the GWA or WC statement, as determined by a group of subject matter experts (SMEs). The first requirement establishes that the GWA or WC statement is relevant to the target occupation, whereas the second requirement establishes whether a given ability or skill is necessary to carry out the behavior (GWA) or to perform in the environment (WC) described by the statement.

This report summarizes work conducted in late 2014 and early 2015 to revisit linkages between the 52 abilities in the O\*NET Content Model and a subset of physically-oriented GWA and WC statements. This effort was carried out in response to user feedback indicating that ratings on physical and psychomotor abilities for some occupations seemed to be lower than would be expected intuitively. Below, the process associated with the linkage revisiting process, including the updated linkages that resulted from the process, is described in detail. As of Analysis Cycle 16, the updated linkages have been programmed into HumRRO's database system used for generating the stimulus material that is disseminated to analysts.

## Background

### *Impetus to Revisiting the Linkages*

In the Summer of 2014, O\*NET received feedback from customers indicating that the ratings for the physical and psychomotor abilities (e.g., Ability #28 - Rate Control) seemed low for the occupation 27-2021.00 Athletes and Sports Competitors<sup>1</sup>. After confirming that the ratings in the O\*NET system accurately reflected the analysts' original ratings, we solicited feedback from the analysts to determine if they felt that the stimulus material provided sufficient information to make accurate judgments about some of the physical and psychomotor abilities. They indicated that, per their training, they rely solely on the information presented in the stimulus material; they do not make

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<sup>1</sup> Email from David Rivkin, dated August 6, 2014.

inferences about the nature of the work. They also stated that because the task statements tend to be somewhat general, it is often difficult to determine whether physical/psychomotor abilities are required. Rather, there are several GWA and WC statements that they would expect to appear in the stimulus material if physical/psychomotor abilities are relevant. When these statements do not appear, the analysts take that into account when rating the physical and psychomotor abilities.

At this point, HumRRO and O\*NET staff met<sup>2</sup> to discuss steps to address the issue. It was decided during this meeting that the best course of action would be to revisit the SME linkage ratings for the GWA and WC statements. The linkage revisit would focus on physically-oriented GWA and WC statements, given their particular relevance to physically-demanding occupations and analysts' use of such statements in assessing importance and level for worker characteristics and requirements. Furthermore, given the relatively non-physical nature of the skill constructs and the fact that the original inquiry pertained only to the abilities, the linkage revisit would also focus only on the 52 abilities.

Because of the timing (between Analysis Cycles 15 and 16), the linkage revisiting process was scheduled to occur prior to the start of Cycle 16 so that the updated linkages could be programmed for use in creating stimulus material for the upcoming cycle. The list of GWA and WC statements included in the linkage revisiting process are shown in Tables 1 and 2.

### *Linkage revisiting process*

Eight SMEs - four of whom were involved in providing the original linkage judgments - participated in this revisiting process. All participants have a Ph.D. in Industrial/Organizational Psychology or a closely-related discipline and possess extensive experience in job analysis.

The linkage revisiting process consisted of two primary steps: independent linkage judgments and a group consensus meeting. Participants were given instructions and materials needed to provide individual, independent ratings of the linkages between the abilities and the physically-oriented GWA and WC statements (see Appendix A). Participants were also given the definitions for all abilities, including the level scale anchors, as well as an Excel file for providing linkage judgments. These materials were emailed to analysts on December 4, 2014.

Participants were given two weeks to complete the individual linkage exercise and return the Excel file containing their linkage judgments. After receiving the individual linkage rating files, HumRRO counted the number of participants indicating a linkage between each GWA or WC statement and each ability. A minimum of five SMEs had to indicate the presence of a linkage in order for a linkage to be considered established. Situations where four analysts indicated the presence of a linkage were considered "borderline" cases at this stage.

The second step in the linkage revisiting process was the full-day group consensus meeting<sup>3</sup>. The meeting began by restating the purpose of the linkage revisiting task. Then, HumRRO described materials to be reviewed during the meeting (i.e., summary results, linkage matrix, and abilities information) and established roles and ground rules for the meeting. SMEs then discussed all borderline linkages as well as any other cases of linkages or non-linkages that one of the SMEs called into question. In cases where SMEs changed their endorsement of a linkage, the revised count was tabulated and used to denote the final linkage status. Remaining

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<sup>2</sup> Meeting held on October 8, 2014 at the HumRRO office in Alexandria, VA.

<sup>3</sup> Meeting held on January 8, 2015 at the HumRRO office in Alexandria, VA.

instances where exactly four SMEs indicated a linkage following discussion were ultimately treated as not linked.

**Table 1. Physically-Oriented Work Context Descriptors Examined in Linkage Revisit**

<b>Work Context Descriptor</b>
12. Being in conflict situations
14. Dealing with violent or physically aggressive people
17. Working outdoors, exposed to all weather conditions
18. Working outdoors, under cover (like in an open shed)
19. Working in an open vehicle or operating equipment (like a tractor)
20. Working in a closed vehicle or operating enclosed equipment (like a car)
21. Being physically close to other people
26. Being exposed to cramped work space that requires getting into awkward positions
27. Being exposed to whole body vibration (like operating a jackhammer or earth moving equipment)
30. Being exposed to high places (This can happen for workers who work on poles, scaffolding, catwalks, or ladders longer than 8 feet in length.)
34. Sitting
35. Standing
36. Climbing ladders, scaffolds, poles, etc.
37. Walking or running
38. Kneeling, crouching, stooping, or crawling
39. Keeping or regaining balance
40. Using hands to handle, control, or feel objects, tools, or controls
41. Bending or twisting body
42. Making repetitive motions
43. Wearing common protective or safety equipment such as safety shoes, glasses, gloves, hearing protection, hardhats, or life jacket
44. Wearing specialized protective or safety equipment such as breathing apparatus, safety harness, full protection suits, or radiation protection
46. Making decisions that affect other people or the image or reputation or financial resources of employer
49. Performing automated work
50. Being very exact or highly accurate
51. Performing continuous, repetitious physical activities (like key entry) or mental activities (like checking entries in a ledger)
53. Being in a competitive environment
55. Keeping a pace set by machinery or equipment
56A. Keeping a regular work schedule (established routine, set schedule)
56B. Keeping an irregular work schedule (changes with weather conditions, production demands, or contract duration)
56C. Keeping a seasonal work schedule (only during certain times of the year)



**Table 2. Physically-Oriented Generalized Work Activity Descriptors Examined in Linkage Revisit**

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**Generalized Work Activity Descriptor**

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16. Performing General Physical Activities: Performing physical activities that require considerable use of your arms and legs and moving your whole body, such as climbing, lifting, balancing, walking, stooping, and handling of materials.
  17. Handling and Moving Objects: Using hands and arms in handling, installing, positioning, and moving materials, and manipulating things.
  18. Controlling Machines and Processes: Using either control mechanisms or direct physical activity to operate machines or processes (not including computers or vehicles).
  19. Working with Computers: Using computers and computer systems (including hardware and software) to program, write software, set up functions, enter data, or process information.
  20. Operating Vehicles, Mechanized Devices, or Equipment: Running, maneuvering, navigating, or driving vehicles or mechanized equipment, such as forklifts, passenger vehicles, aircraft, or water craft.
  21. Drafting, Laying Out, and Specifying Technical Devices, Parts, and Equipment: Providing documentation, detailed instructions, drawings, or specifications to tell others about how devices, parts, equipment, or structures are to be fabricated, constructed, assembled, modified, maintained, or used.
  22. Repairing and Maintaining Mechanical Equipment: Servicing, repairing, adjusting, and testing machines, devices, moving parts, and equipment that operate primarily on the basis of mechanical (not electronic) principles.
  23. Repairing and Maintaining Electronic Equipment: Servicing, repairing, calibrating, regulating, fine-tuning, or testing machines, devices, and equipment that operate primarily on the basis of electrical or electronic (not mechanical) principles.
  24. Documenting/Recording Information: Entering, transcribing, recording, storing, or maintaining information in written or electronic/magnetic form.
  29. Assisting and Caring for Others: Providing personal assistance, medical attention, emotional support, or other personal care to others such as coworkers, customers, or patients.
  30. Selling or Influencing Others: Convincing others to buy merchandise/goods or to otherwise change their minds or actions.
  32. Performing for or Working Directly with the Public: Performing for people or dealing directly with the public. This includes serving customers in restaurants and stores, and receiving clients or guests.
  37. Coaching and Developing Others: Identifying the developmental needs of others and coaching, mentoring, or otherwise helping others to improve their knowledge or skills.
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**Revised Linkage Results**

Tables 3 and 4 provide the updated linkages for the GWA and WC statements, respectively. Rows associated with GWA or WC statements that were not revisited reflect the original linkages. Rows associated with the physically-oriented GWA or WC statements that were revisited are shaded in grey.

The overall structure of the revised linkage ratings was highly stable relative to the initial linkages. Of the 2,236 possible linkages (52 abilities \* 43 physically-oriented GWA/WC statements) examined in the linkage revisiting process, the linkage status (linked versus not linked) remained the same for approximately 96% (2,152) of the linkages. Most of the 2,152 unchanged cases were attributable to instances where a linkage was not made either initially or upon revisit (2,027 instances of a non-linkage on both occasions). Given the purpose of the linkage revisiting process, such stability in results would be expected; although one would anticipate some change, the overall structure of the linkages should remain consistent given that SMEs were not provided any rationale to change their ratings.

Of the 2,236 possible linkages, 84 changed status between the original and revisited rating process (i.e., originally linked but not linked upon revision or vice versa). Of these 84, 20 were linked originally, but were not linked upon revision. Conversely, there were 64 cases where a linkage was not indicated originally, but was indicated during the revisit. This yielded a net gain of 44 linkages following the revisiting process; the total number of linkages increased from 145 (105 linkages involving GWA statements; 40 linkages involving WC statements) to 189 (124 linkages involving GWA statements; 65 linkages involving WC statements).

Of particular interest for the linkage revisit were the 19 physical and psychomotor abilities (10 physical abilities, nine psychomotor abilities). In the original results, 54 linkages included physical or psychomotor abilities; 35 of these involved the psychomotor abilities, and 19 involved the physical abilities. Upon revisit, 82 linkages included physical or psychomotor abilities; 36 of these involved the psychomotor abilities, and 46 involved physical abilities. Thus, of the linkages gained from the revisiting process, a larger number was attributable to the physical abilities relative to the psychomotor abilities.

To further illustrate the effect of the linkage revisiting process on the prevalence of linkages involving the physical and psychomotor abilities, Figures 1 and 2 show the percentage of physically-oriented GWA and WC statements that each ability construct was linked to originally and after the linkage revisit. Figure 1 shows the percentage of all statements (both GWA and WC combined) linked to the ability constructs. For instance, Static Strength was linked to approximately 5% of the statements originally (2/43), but was linked to roughly 7% of the statements upon revision (3/43). Figure 2 shows the percentage of all statements linked to the ability constructs separately by GWA and WC.

As shown in Figure 1, the physical abilities tended to be linked to a larger percentage of the statements following the linkage revisiting process. This trend was particularly evident for Trunk Strength, Extent Flexibility, and Gross Body Equilibrium. Dynamic Flexibility was not linked to any statements originally or following the revisit. Results for abilities in the psychomotor domain indicate that some abilities were linked to more GWA and WC statements following the revisit (e.g., Manual Dexterity, Control Precision, Reaction Time), whereas small decreases were observed for other abilities (e.g., Arm-Hand Steadiness, Multilimb Coordination).

Figure 2 highlights differences in the frequency of linkages by statement type (GWA versus WC). For the physical abilities, there was not a clear pattern favoring the GWA or WC statements in terms of changes in the percentage of linkages when comparing the original versus revisited linkages. Some constructs (e.g., Extent Flexibility) saw a larger increase in linkages involving GWA statements, whereas other constructs (e.g., Gross Body Equilibrium) saw a larger increase in linkages involving WC statements. Similar results were observed for the psychomotor abilities, although the relative differences between the original and revisited results were somewhat obscured by the large percentages of linkages involving the GWA statements.









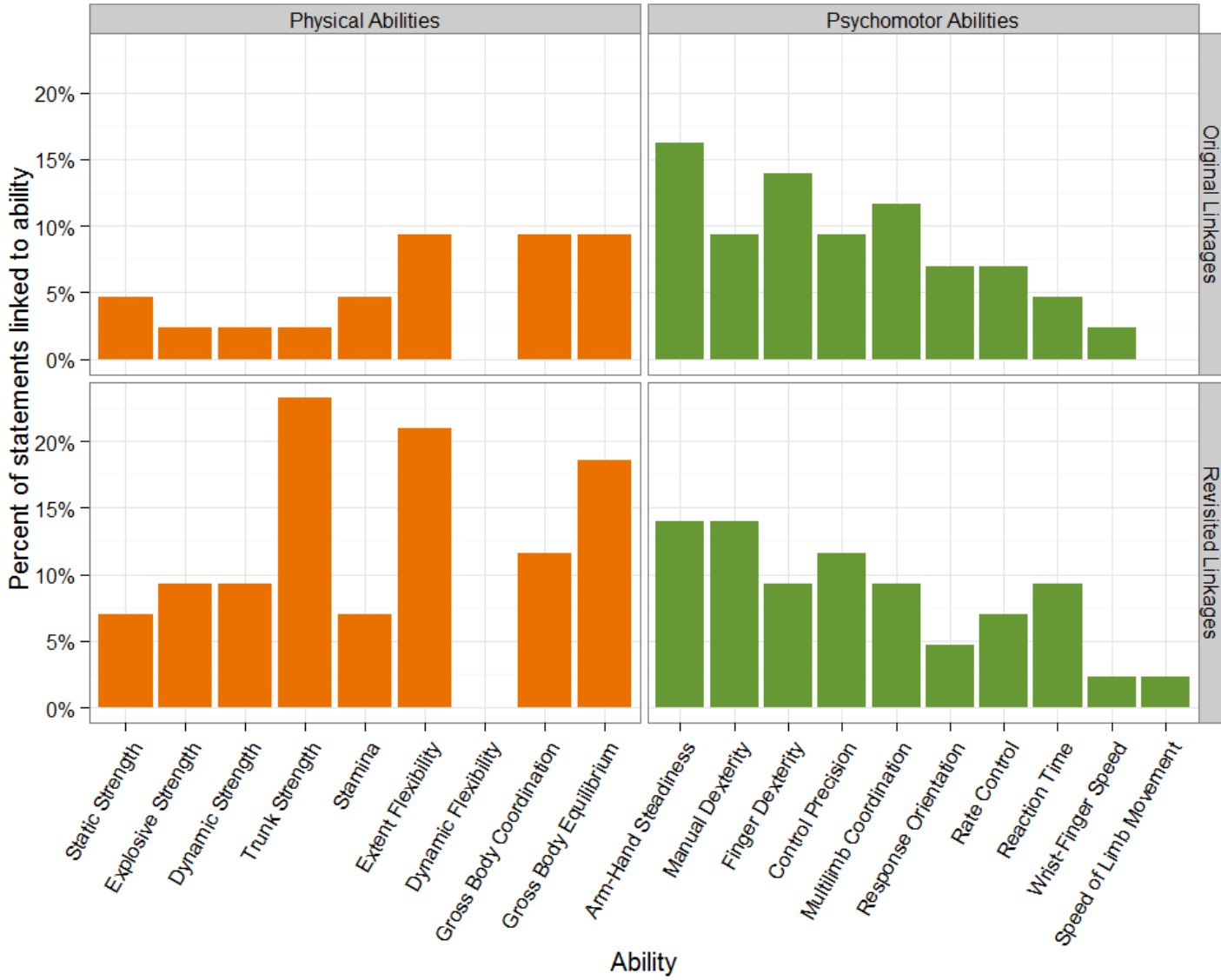


Figure 1. Percent of all physically-oriented statements (GWA and WC) linked to each ability.

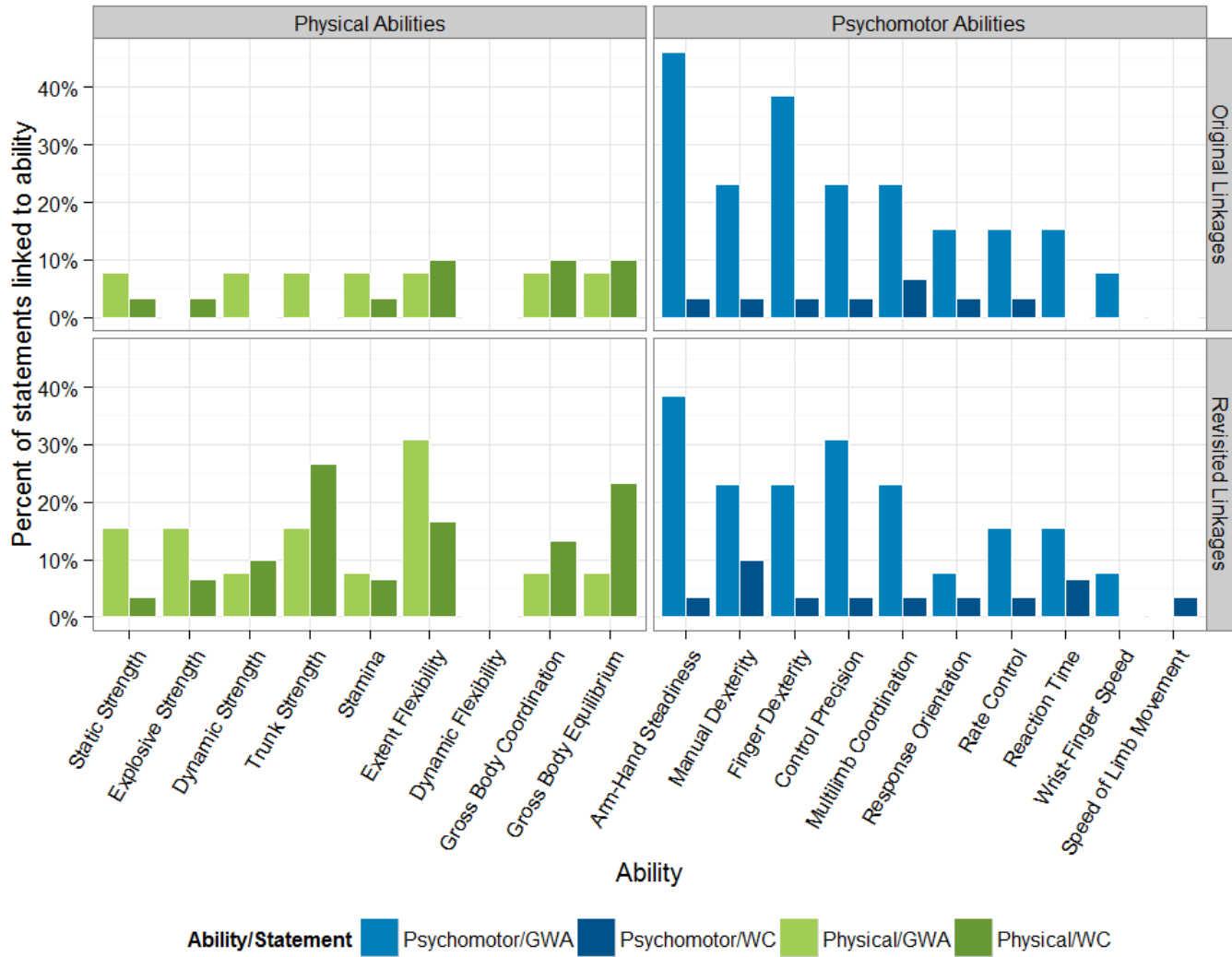


Figure 2. Percent of physically-oriented GWA and WC statements linked to each ability by statement type.

## Conclusion

The linkage revisiting process described above resulted in a set of revised linkages between the GWA and WC statements and the 52 ability constructs in the O\*NET Content Model. The purpose for conducting the linkage revisit was to address concerns expressed via user feedback that ratings on the physical and psychomotor abilities for some occupations might be lower than would be anticipated on an intuitive basis. The updated linkage data provide the most current information for use by the analysts. This data will be in effect going forward beginning with the Analysis Cycle 16 data collection effort.

## References

Fleisher, M. S., & Tsacoumis, S. (2012a). *O\*NET® analyst occupational abilities ratings: Procedures update* (FR-11-66). Alexandria, VA: Human Resources Research Organization.

Fleisher, M. S., & Tsacoumis, S. (2012b). *O\*NET® analyst occupational skills ratings: Procedures update* (FR-11-67). Alexandria, VA: Human Resources Research Organization.



## Appendix A

### Linkage Revisit Exercise: Participant Instructions

#### Background

As you know, the Occupational Information Network (O\*NET) is a comprehensive conceptual framework designed to serve as the foundation for a variety of human resource programs, such as school curriculum development, job placement, and training. Most of the job analytic information is collected from incumbents (e.g., Generalized Work Activities [GWAs], Work Context, Education, Work Styles, Knowledges). The National Center for O\*NET Development contracts with HumRRO to collect ability and skill ratings of occupations from occupational analysts.

Relevant occupation data are provided to the analysts in order to facilitate the rating process. Among other things, we show them incumbent ratings on GWAs and Work Context (WC) descriptors that are relevant for each ability or skill (i.e., that ability/skill is needed to perform that GWA or to work in that context). In order to determine which GWAs and WC descriptors are relevant to display for each ability/skill, we conducted a linkage exercise with eight participants in 2001. Some of you participated in that exercise.

Recently, O\*NET received feedback that suggested that the analysts may not have sufficient information about the physical and psychomotor requirements of the occupation. In response, we are revisiting the linkages between the abilities and a subset of GWAs/WC statements that *may* require a physical or psychomotor ability. Currently, there are relatively few GWAs and WC descriptors linked to the physical and psychomotor abilities. This situation leaves analysts with relatively little information regarding these work characteristics to inform their ratings for these abilities. Consequently, analysts have difficulty justifying higher importance or level ratings, which is particularly problematic for occupations where there would be an a priori rational expectation that physical and psychomotor abilities are relevant (e.g., Athletes and Sports Competitors).

That's where you come in. We need you to determine whether or not an ability is required to perform the GWA or work in the particular context.

#### Materials

1. Linkage Exercise: Participant Instructions (You're reading them right now.)
2. Abilities Definitions and Anchors
3. Ability-GWA & Ability-WC Excel Linkage Worksheet

The Excel worksheet is set up so that you consider one Ability-GWA or Ability-WC combination at a time. For example, the first judgment that you would make in the WC Linkage Sheet would be between WC #12 (*Being in conflict situations*) and Oral Comprehension.

## Specific Linkage Instructions

How do you determine whether an ability should be linked to a GWA or WC descriptor?

Ask yourself:

- ◆ “Is this ability needed to perform this GWA?”
- ◆ “Is this ability needed to perform work in this context?”

If the answer is “yes,” place an **X** in the cell corresponding to the ability to indicate that the ability should be linked to the GWA or WC descriptor.

If the answer is “no” – the ability should **not** be linked to the GWA or WC descriptor – then simply leave the cell **blank**. A blank entry will be interpreted as your indication that there is not a linkage between an ability and a GWA or WC descriptor.

If this question is difficult to answer, another way to think about it is:

- ◆ “Would an individual be able to perform this GWA or in this context if he/she were very *low* on this ability?”
  - If not, then the ability is needed to perform the GWA or to perform in that context, and you would indicate as such with an **X**.
  - If so, then the ability is not needed to perform the GWA or to perform in that context, and you would indicate as such by leaving the cell blank.

Some things to keep in mind:

- ◆ Do not think about the other GWAs or WC descriptors when making your linkage judgment. Each judgment should be independent.
- ◆ When making the linkages, ask yourself whether an ability is needed to perform a GWA or work in a particular context, *in general*, not in reference to a particular occupation.
- ◆ If you think about it carefully and you are still not sure, force yourself to make an approximate or “best-guess” judgment, put an **X** or leave the cell blank depending on your judgment, and place a “?” next to the cell. You also might want to make a brief note next to the “?” describing your concern. You will be able to refer your worksheets during the focus group that will follow this exercise.

Please e-mail your completed rating sheets to Matt Reeder ([mreeder@humrro.org](mailto:mreeder@humrro.org)) by no later than **Thursday, December 18, 2014 COB**.

## Next Steps

After you and your colleagues have completed your ratings, we will analyze the results of the ratings including an assessment of interrater agreement. During a focus group meeting including you and the other judges, we will review these results and finalize the linkages, including:

- (a) any necessary modifications to the linkages (e.g., six of the eight judges individually linked an ability to a GWA, but on careful examination of the group agrees that the linkage doesn't make theoretical sense) and
- (b) reaching consensus on close calls (e.g., four of the eight judges linked the GWA to the skill).