CHAPTER 4

Job and Work Analysis

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Job analysis is a broad term commonly used to describe a wide variety of systematic procedures for examining, documenting, and drawing inferences about work activities, worker attributes, and work context. In light of recent workplace changes that deemphasize traditional conceptions of rigidly defined jobs, the broader term *work analysis* is sometimes advocated (Morgeson & Dierdorff, 2010; Pearlman & Sanchez, 2010; Sanchez & Levine, 1999). We see the tools and techniques developed under the job analysis label as applicable to changing work structures, and the use of the term "job analysis" is not meant to convey a narrow focus on rigidly prescribed jobs.

There has been criticism in recent years of job analysis as an outdated concept; our sense is that that criticism is based on one narrow purpose of job analysis, namely, the formalization of job duties through a written job description, resulting in a rigid prescription of job duties. Job analysis is generally viewed within industrial–organizational (I-O) psychology as a foundational activity carried out to support some organizational activity requiring job information (e.g., developing a selection system, designing a training program). That jobs are becoming more flexible and less prescribed does not negate or even reduce the need for the work of I-O psychologists in these domains, and we see no reduction in the need for or importance of job analysis in the work of I-O psychologists.

In this chapter, we open with a conceptual overview of the range of choices facing the individual conducting a job analysis. We do not attempt to detail the extensive array of available job analytic techniques; Gael's (1988) two-volume handbook remains the most detailed available source of information; Brannick, Levine, and Morgeson's (2007) book presents a range of job analysis methods based on a review of common practice issues. Harvey (1991), Sanchez and Levine (2001), and Morgeson and Dierdorff (2010) wrote other handbook chapters on the topic. Building on our chapter in the first edition of this *Handbook* (Sackett & Laczo, 2003), we then discuss a set of topics that reflect important changes and challenges to job analysis that have emerged over the past decade. The chapter is of necessity selective; we cannot review all job analysis research in the space available here.

The first topic is the development and recent evaluation of the Occupational Information Network (O*NET; Peterson, Mumford, Borman, Jeanneret, & Fleishman, 1999), a comprehensive job analysis system designed to replace the *Dictionary of Occupational Titles* (DOT; U.S. Department of Labor, 1991). It represents an ongoing major effort to develop a comprehensive and flexible set of job descriptors. Second, we discuss the growing trend toward the incorporation of personality variables in job analysis, paralleling the growth of interest in personality within the field of I-O psychology overall. Third, we examine the growth of competency modeling, which is often presented as an alternative to or replacement for job analysis. Fourth, we review fundamental principles in the field of

cognitive task analysis, which involve efforts to understand unobservable cognitive processes. Fifth, we examine the growth of strategic job analysis, which focuses on analysis for changing job situations and projections about work in the future. Sixth, and finally, we discuss recent developments focusing on the topic of sources of inaccuracy in job analysis.

OVERVIEW: JOB ANALYSIS REQUIRES MANY CHOICES

When one encounters job analysis for the first time, one often confronts a seemingly bewildering array of methods and techniques. They vary on a number of dimensions that we will briefly outline here to set the stage for a discussion of why and how choices are made among these techniques.

Activity Versus Attribute

Perhaps the most fundamental distinction in job analysis is between a focus on the activities performed by the worker and a focus on the attributes contributing to successful performance of these activities. A focus on activities is sometimes labeled *work-oriented* and involves an examination of the tasks or behaviors performed on the job. A focus on attributes is sometimes labeled *worker-oriented* and involves an examination into characteristics (e.g., knowledge, skills, abilities) that contribute to successful job performance. Some techniques focus solely on activities (e.g., task inventory approaches), while others focus solely on attributes (e.g., Fleishman's Ability Requirements Scale; Fleishman, Quaintance, & Broedling, 1984). Other approaches incorporate separate analyses of both activities and attributes, followed by some process for linking activities and attributes (i.e., determining which attributes contribute to the performance of which activities). Thus, the choice can be made to focus solely on activities or solely on attributes, or to incorporate both in the analysis.

General Versus Specific

In either activity- or attribute-oriented job analysis, decisions have to be made as to level of detail and specificity needed. For example, job activities of a child welfare caseworker can be described in highly specific terms (e.g., interviews child to determine whether the child is being physically or sexually abused), in moderately specific terms (e.g., conducts interviews), or in very general terms (e.g., gathers information verbally). All three of these do indeed describe the job: it is not that one is more "correct" than another. The degree of detail needed may vary from one application to another, and thus a critical decision to be made in any job analysis application is the determination of the position on the specificity–generality continuum that is most appropriate.

Qualitative Versus Quantitative

A job can be described qualitatively, as in the case of a narrative description of job duties, or quantitatively, as in methods that involve numeric evaluations on a fixed set of scales. For example, one standardized job analysis questionnaire, the Position Analysis Questionnaire (PAQ; McCormick & Jeanneret, 1988), involves rating the degree to which 187 statements are descriptive of the job in question. Thus, the same job can be described qualitatively via a narrative or a listing of job activities and/or attributes, or quantitatively as a profile of rating on the 187 PAQ items (or a smaller set of dimensions derived from these 187 items). Critical incidents (Flanagan, 1954), which involve descriptions of effective and ineffective worker behavior, represent another technique that can be used both qualitatively and quantitatively.

Taxonomy-Based Versus Blank Slate

Quantitative approaches to job analysis, as introduced in the preceding section, can make use of preestablished taxonomies of job characteristics; alternatively, they may be developed without the use of such taxonomies. The PAQ, as noted above, is one example of a taxonomy-based approach, working at the level of relatively general work activities applicable across a broad range of jobs. An example at the level of job attributes is the Fleishman Ability Requirements Scales; with these scales, jobs can be rated regarding how much each of 52 abilities is needed for job performance. In contrast are approaches that use observers or informants (e.g., incumbents or supervisors) to generate lists of job activities or attributes; once developed, such lists may be rated on time spent, criticality, or other dimensions as a means of narrowing the list to the most critical activities or attributes. Because these blank slate approaches develop activity and/or attribute lists for specific jobs or job families, they have the potential for a higher degree of detail and specificity than taxonomy-based approaches.

Observer-Based Versus Informant-Based

Information about work activities and attributes is sometimes obtained via direct observations of the work by a trained job analyst, who then distills these observations

into qualitative descriptions or quantitative evaluations of work activities or attributes. In other circumstances, information comes directly from informants, most commonly job incumbents or their direct supervisors, who may be asked to list job activities and attributes, or to evaluate activities and attributes on a variety of scales (e.g., the frequency with which an activity is performed, or the criticality of an attribute to effective job performance). The use of multiple informants (at times, hundreds or thousands of incumbents) permits the examination of consistency in responding and the identification of clusters of respondents with differing patterns of work activities.

KSA Versus KSAO

There is a long tradition of focusing on knowledge, skills, and abilities (KSA) in conducting attribute-oriented job analysis. This perspective is seen by some as limiting, in that it does not include other personal characteristics linked to job performance or valued by the organization, such as personality traits, attitudes, and values. Adding "other personal characteristics" to the KSA acronym results in a broader range of attributes being included in the picture of the job that emerges from the analysis. Broadening job analysis to incorporate the full range of these "other" characteristics is one hallmark of techniques labeled *competency modeling*, which have gained in popularity recently and are viewed by some as supplanting "traditional" job analysis; we treat competency modeling in detail later in this chapter.

Single Job Versus Job Comparison

In some applications, the focus is on a single job, as in the case of an assignment to develop a selection system for an entry-level firefighter. In other cases, the focus is on documenting similarities and differences between jobs or positions. Examples include comparing jobs within an organization to determine whether multiple jobs can be treated as the same for some given purpose (e.g., can the same selection system be used for multiple job titles?), documenting job similarity across firms for purposes of transporting some human resource (HR) system (e.g., can a selection system developed in one firm be used in another?), and examining commonalities and interrelationships among jobs in a firm for internal staffing purposes (e.g., promotions, career ladders).

Descriptive Versus Prescriptive

There is a long tradition of viewing job analysis as a set of methods for describing a job as currently constituted. Also worthy of recognition, however, are a variety of situations in which the goal is to be prescriptive rather than descriptive. Examples include scenarios where the work of one or more expert performers is studied with the goal of prescribing procedures to be followed by others, or prescriptions about activities or attributes for an about-to-be-created job that does not currently exist. Strategic job analysis, discussed later in this chapter, is also an example of a job analysis technique used for the purpose of forecasting future job requirements.

JOB ANALYSIS METHODS MUST ALIGN WITH PURPOSE: ONE SIZE DOES NOT FIT ALL

Any given job analysis application can be classified in terms of the preceding categories. Note that these choices are not orthogonal. In some cases, a decision about one of the above variables constrains choices on others. The "KSA vs. KSAO" distinction, for example, comes into play only if one has chosen to conduct an attribute-oriented job analysis, rather than solely an activity-oriented analysis. As another example, the "qualitative vs. quantitative" distinction may be a choice when one's objective is the analysis of a single job; when comparing multiple jobs, however, a quantitative approach is a virtual necessity. If, say, each of 50 jobs is described in terms of a profile of ratings of attribute requirements using a common set of attribute requirement scales, the comparison of various jobs is manageable, which it would not be if 50 separate qualitative analyses had been conducted.

One set of key points we wish to emphasize early in this chapter is that job analysis is not a mechanical, off-the-shelf, routine activity. Neither is it a one-size-fits-all activity, where a single type of job analysis data, once obtained, can be used to support virtually any HR activity. Clearly inappropriate is the position that one can identify a preferred job analysis method and apply it to any situation. We believe that these points are not well appreciated, and develop in this chapter a series of examples to illustrate the complexities of job analysis and the need for careful professional judgment in the choice of a job analysis method for a particular application.

The first example, dealing with the theme of generality versus specificity in the choice of the job descriptor, involves a job analysis of the job "psychologist," as described by Sackett (1991). A dispute had arisen as to whether different specialties within psychology—clinical, counseling, I-O, and school—were similar enough that a common licensing exam was appropriate for these four specialties. The Educational Testing Service (ETS)

was commissioned to conduct a comparative job analysis of these four areas (Rosenfeld, Shimberg, & Thornton, 1983). An inventory of 59 responsibilities and 111 techniques and knowledge areas was designed and mailed to a carefully selected sample of licensed psychologists. The study found a common core of responsibilities among all four specialties and chided various practice areas for emphasizing the uniqueness of their own group.

We assert that a survey instrument could have been designed that would have produced different results. The more general the data collected, the more likely it is that jobs will appear similar; conversely, the more specific the inventory items, the greater the apparent differences among jobs. The art of job analysis lies in determining a level of specificity that meets the purposes of the particular job analysis application. Consider some of the statements comprising the ETS inventory. Responsibility 1 reads: "Conduct interviews with client/patient, family members or others to gain an understanding of an individual's perceived problem." This is endorsed by a high proportion of respondents from all specialties, yet it can mean dramatically different things, from interviewing a corporate executive to gain insight into an organization's incentive pay plan to interviewing a 7-year-old suspected victim of child abuse. Other examples include: "Observe the behavior of individuals who are the focus of concern," and "Formulate a working hypothesis or diagnosis regarding problems or dysfunctions to be addressed." Again, these can refer to dramatically different activities. More to the point, given that the purpose of the job analysis was to support the creation of one or more licensing exams, these can require different skills, abilities, training, and experience. By being more specific and rephrasing Responsibility 1 as multiple tasks ("interview business clients," "interview adult patients," "interview children"), the chances of concluding that the jobs are different increase. By getting even more general ("gather information verbally"), the chances of concluding that the jobs are similar increase. Each of these levels of specificity present information that is true. However, the question of which level of specificity is appropriate depends on the purpose for which the information is being collected.

A second example, also from Sackett (1991), illustrates that one may reach different conclusions if different categories of job descriptors are chosen (e.g., focusing on job activities versus focusing on abilities required for job performance). In a multiorganization study of bank teller and customer service jobs (Richardson, Bellows, Henry, & Co., 1983), a 66-item activity questionnaire (e.g., "cashes savings bonds," "verifies signatures," "types entries onto standardized forms") and a 32-item ability requirement questionnaire (e.g., "ability to sort and classify forms," "ability to compute using decimals," "ability to pay attention to detail") were administered. Although the vast majority of incumbents held the title "paying and receiving teller," 20 other job titles were found (e.g., new accounts representative, customer service representative, drive-in teller, safe deposit custodian). The issue was whether these 20 jobs were sufficiently similar to the job of paying and receiving teller that a selection test battery developed for the paying and receiving tellers could also be used for the other jobs. A correlation between each job and the paying and receiving teller was computed, first based on the activity ratings, and then based on the ability ratings. In a number of cases, dramatically different findings emerged. The new accounts representative, customer service representative, and safe deposit custodian correlated 0.21, 0.14, and 0.09, respectively, with the paying and receiving teller when comparing the jobs based on similarity of rated activities. These same three jobs correlated 0.90, 0.92, and 0.88 with the paying and receiving teller when comparing the jobs based on similarity of rated ability requirements. Thus, the use of different job descriptors leads to different conclusions about job similarity. Conceptually, one could argue that for purposes of developing an ability test battery, the ability requirements data seem better suited. If data on these same jobs were being collected to determine whether a common training program for new hires was feasible, one might argue that the activity data seem better suited. The question "Which jobs are sufficiently similar that they can be treated the same?" cannot be answered without information as to the purpose for which the jobs are being compared.

As a third example, consider one additional aspect of the choice of the job descriptor, namely, the nature of the data to be collected about the descriptor chosen. It is common to ask job experts to rate the importance of each job component. However, importance can be conceptualized in a number of ways, three of which are discussed here. Using abilities as an example, one approach to importance is in terms of time: what proportion of total time on the job is spent using the ability in question. A second approach is in terms of contribution to variance in job performance: to what extent does the ability in question contribute to differentiating the more successful employees from the less successful. A third approach is in terms of level: what degree of a given ability is needed for successful job performance. Conceptually, it is clear that these three can be completely independent. The abilities that are used most frequently may be possessed by virtually all incumbents

and thus not contribute to variance in job performance. A given ability may contribute equally to variance in job performance in two jobs, yet the level of ability needed may differ dramatically across the jobs. Thus, even if it were agreed that abilities required is the appropriate job descriptor for a particular application, operationalizing ability as importance, frequency of use, contribution to variance in performance, or level required can lead to different conclusions.

The use of one operationalization of importance where another seems better suited is found in Arvey and Begalla's (1975) examination of the job of homemaker. They compared the PAQ profile for the position of "homemaker" with each of the large number of profiles in the PAQ database. These comparisons were made to determine which jobs were amenable to entry by homemakers. Jobs most similar in PAQ profiles were patrolman, home economist, airport maintenance chief, and kitchen helper; a number of supervisory positions followed closely (electrician foreman, gas plant maintenance foreman, fire captain) in the list of the 20 most similar positions. Arvey and Begalla note that a major theme running through many of the occupations listed was a trouble-shooting emergency handling orientation.

Based on this list of most similar occupations, it is not clear that the goal of identifying jobs amenable to entry by homemakers was met. Arvey and Begalla (1975) note this and interpret their findings with appropriate caution. The rating scales used in the PAQ typically reflect time spent. We would hypothesize that different patterns of similarity would be found if "level required" rather than "time spent" were used to rate items. Conceptually, level required seems better suited to the tasks of identifying jobs amenable to entry by homemakers. Jobs very similar in the amount of time spent on the PAQ dimension "processing information" may be very different in the level of information processing involved.

In sum, careful alignment of the needs of a specific job analysis application with the various choices made in conducting job analysis is at the heart of successful job analysis. We turn now to a discussion of a variety of recent developments in job analysis.

FROM THE *DICTIONARY OF OCCUPATIONAL TITLES* TO THE O*NET

For decades, the *Dictionary of Occupation Titles* was the most comprehensive source of occupational information available, containing information on over 12,000 jobs. However, as Dunnette (1999) noted, a number of features limited its usefulness, including (a) a focus on occupation-specific narrative information, thus limiting the opportunities for cross-job comparison; (b) a focus on tasks, rather than worker attributes; and (c) difficulties in keeping the information current due to the time and expense involved in updating job information. In the early 1990s, an advisory panel was constituted to review the DOT.

In 1993, the Advisory Panel for the *Dictionary of Occupational Titles* (APDOT) released its final report, offering a detailed blueprint for a replacement for the existing DOT (APDOT, 1993). They offered a number of recommendations, including recommendations that the DOT should cover all occupations in the U.S economy; that a single occupational classification system should be used; that structured job analysis questionnaires be the primary strategy for data collection; and that a flexible, automated, readily accessible database be created, among others.

Two additional recommendations will be singled out here as of exceptional importance. The first is that the information to be obtained about each occupation should be based on what APDOT called its "Content Model." The Content Model calls for collecting broad information about each occupation, falling into four categories:

1. Worker Attributes, including aptitudes, occupation-specific knowledge and skill, and personal qualities.
2. Work Context, including information about the organizational context (such as organizational culture) and the work context (such as physical working conditions).
3. Labor Market Context, including future employment prospects for the occupation.
4. Work Content and Outcomes, including tasks performed, services rendered, and products produced.

Within this Content Model, the Worker Attributes category is of particular importance, as it reflects APDOT's recommendations as to the basis for content-oriented occupational clustering. Of particular interest is a set of five descriptors that APDOT offered as an approximate hierarchy from generality to specificity:

1. Aptitudes and abilities, including cognitive, spatial/perceptual, psychomotor, sensory, and physical abilities.
2. Workplace basic skills, defined as developed abilities required to some degree in virtually all jobs, including reading, writing, and arithmetic. APDOT acknowledged the close relationship of these to the aptitude/ability category above.

3. Cross-functional skills, defined as developed generic skills required across broad ranges of jobs. Examples include information gathering, negotiating, and organizing and planning.
4. Occupation-specific skills, defined as ability to perform activities that are relatively job specific, such as reading blueprints, repairing electrical appliances, and operating a milling machine.
5. Occupation-specific knowledge, defined as understanding of facts, principles, processes, and methods specific to a particular subject area. Examples include knowledge of patent law, knowledge of financial planning, and knowledge of spreadsheet software.

Pearlman (1993), a member of APDOT, argues persuasively for the adoption of the APDOT Content Model in addressing questions about skill requirements. He notes that the term *skills* is used by different people to refer to virtually every category within the Worker Attributes section of the Content Model. Pearlman concludes that the skills literature "is in fact a veritable 'Tower of Babel,'" with the term *skills* used to refer to everything from basic abilities to workforce basic skills to cross-functional generic skills to occupation-specific skills. In many cases, the term is extended to what the Content Model calls *personal qualities*, such as responsibility, sociability, and honesty. Thus, the adoption of the terminology of the Content Model would permit progress to be made by ensuring that there is a common understanding when talking about "closing the skills gap" or "setting skill standards."

What is significant is rather than choosing among these different levels of attribute requirements, APDOT called for obtaining information about attribute requirements at each of these levels. This leads to the second APDOT recommendation to be singled out as of particular importance, namely, that the information about occupations be detailed and the database be sufficiently flexible to permit differentiation and clustering of occupations based on user needs. Thus, APDOT recognized the key point that purpose must drive occupational clustering, and that if the DOT is to meet multiple purposes, then information about attribute requirements must be available at multiple levels, and user-specific clustering must be available.

Ideally, an occupational database would permit infinite flexibility in occupational clustering. A user could identify the set of descriptors that meet the purpose at hand and generate occupational clusters based specifically on the chosen set of descriptors. A counselor working with an individual job seeker could choose a set of descriptors that reflect the skills, experience, education, and interests of the job seeker and identify the occupations with requirements that closely match the job seeker. An educational institution providing training in particular skills could identify occupations requiring those skills. An employer considering eliminating a particular job could identify jobs with similar requirements to determine whether redeployment was a viable alternative to downsizing. The ongoing development of the O*NET reflects continuing efforts to bring this ideal to reality.

An extensive program of research that refined the APDOT Content Model and developed and evaluated an extensive series of job analysis questionnaires to tap each component of the model is described in a book summarizing the O*NET research, edited by Peterson et al. (1999). Figure 4.1 presents the O*NET Content Model that served as the organizing blueprint for the program of research.

The O*NET research illustrates many of what we view as the crucial issues in job analysis highlighted in the opening section of this chapter. The O*NET researchers developed nine separate questionnaires to assess abilities, skills, knowledge, training and education requirements, generalized work activities, work context, organizational context, occupational values, and work styles. They recognized the central premise that the purpose of job analysis drives the information needed; thus, in order to serve multiple purposes, a wide range of types of information was needed. They also recognized the importance of the differing scales on which job activities and attributes could be rated, and thus gave careful attention to the choice of the rating scales used for each questionnaire. For example, skills were evaluated on three scales: level needed, importance, and whether the skill is needed at point of job entry, thus permitting the user to determine which descriptor best fits the needs of a particular application.

For each of the nine questionnaires, initial data from multiple incumbents in each of roughly 30 occupations was obtained (as discussed below, data on many more occupations have been gathered since this initial work). For each questionnaire, interrater agreement was examined, as was the factor structure of the questionnaire items. Agreement between incumbents and job analysts was examined for some of the questionnaires. Across the nine questionnaires, over 300 pieces of job information were collected; the separate factor analyses of each questionnaire produced a total of 38 factors. These 38 were used as the basis for cross-domain comparison; a second-order

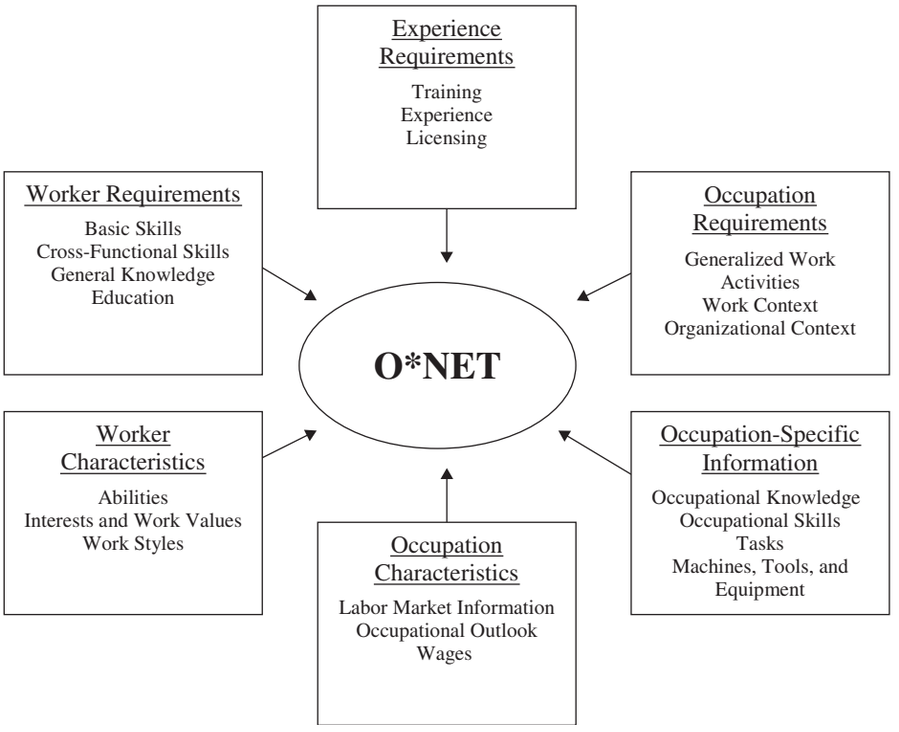

Figure 4.1 O*NET content model. Taken from Peterson et al. (1999, p. 25). Reprinted with permission.

factor analysis of these 38 factors produced four factors: management/achievement, manual/physical, office work, and technical vs. interpersonal. Thus, an occupation can be characterized at varying levels of detail: 300 individual ratings, 38 first-order factor scores, or 4 broad second-order factor scores.

All of this information is contained in a relational database, accessible to the general public at www.online.onetcenter.org. The system has considerable flexibility. One can start with a skill or ability profile and find occupations matching the profile; alternately, one can start with an occupation and find occupations with similar characteristics.

Several comments about O*NET are in order. First, because of the overarching interest in comparing occupations, the O*NET focuses on job information that is applicable across occupations, rather than occupationally specific information (e.g., detailed task information). In addition, it uses an occupational classification system that currently results in 1,102 occupations, as opposed to the roughly 12,000 occupational groupings in the DOT. Thus, the information is relatively general. It is certainly possible that work within a given occupation varies in important ways in any single organization from the occupational profile for the occupation contained in the O*NET, and individual organizations or individuals using O*NET might for a variety of purposes wish to examine similarities and differences between O*NET ratings and firm-specific ratings. Some of the individual items reflect features that surely vary across organizations (e.g., the work values item "workers on this job have coworkers who are easy to get along with").

Second, the O*NET remains a work in progress. In 2008, approximately 10 years after the O*NET launch, a National Research Council panel was convened to evaluate the O*NET and make recommendations about its future directions (National Research Council, 2010). More specifically, the panel was charged with inventorying and evaluating the uses of O*NET, exploring the linkages of O*NET with the Standard Occupational Classification (SOC) system and other datasets, and identifying ways to improve O*NET in terms of cost-effectiveness, efficiency, and currency. To accomplish these tasks, the panel obtained O*NET information from the Department of Labor and other sources, reviewed relevant published and unpublished literature, and held a series of workshops in which experts presented perspectives on O*NET. The general conclusion is that the O*NET provides a useful database that is frequently accessed by a broad array of users. Notably, the panel also concluded that two key

priorities are a continued emphasis on data quality and enhancement of service to users.

In terms of research use, the O*NET data, content model, and questionnaires have been used for a number of studies since the publication of the initial database. For example, either O*NET data or its corresponding SOC has been used for studies on topics such as job component validation of assessments (Jeanneret & Strong, 2003; LaPolice, Carter, & Johnson, 2008), role theory in managerial jobs (Dierdorff, Rubin, & Morgeson, 2009), career guidance (Converse, Oswald, Gillespie, Field, & Bizot, 2004), Web-based job analysis (Reiter-Palmon, Brown, Sandall, Buboltz, & Nimps, 2006), and expatriate assignment effectiveness (Shin, Morgeson, & Campion, 2007). We anticipate that the breadth of data and its accessibility will allow for much future research.

As described above, at the outset of the O*NET program, only a small number of occupations were thoroughly examined. As of the writing of this chapter, the current database, O*NET 15.0, contains updated information on 855 of the 1,102 occupations, with 217 occupations having been updated a second time. Despite this, there remain 137 occupations for which data have not been collected. Additionally, subsequent to the development of the prototype Content Model, the O*NET Center has made changes to components of the Content Model, along with evaluating methods by which the database is populated. For example, the initial databases were populated with data from ratings by job analysts based on written job information. A central concern was that analysts may have relied in part on job stereotypes in the absence of sufficient job detail, and thus that the ratings reflect raters' implicit theories about the structure of work. Currently, ratings are gathered from different sources (job incumbents, analysts, or occupational experts) depending on the type of descriptor in the Content Model. Aside from documented issues with various data sources in job analysis (see Morgeson & Dierdorff, 2010, for a recent review), it is sometimes the case that a single database contains ratings from these different sources. Finally, it is worth noting that initial SOC coding resulted in 1,122 occupational units; revisions sponsored by the O*NET Center in 2006 and 2009 now arrange the data into 1,102 occupations. Further details on these changes are beyond the scope of this chapter and can be explored in more detail in the series of reports archived at www.onetcenter.org. These caveats aside, the O*NET does represent a major achievement in its design of a comprehensive framework for conceptualizing occupational information.

JOB ANALYSIS FOR IDENTIFYING PERSONALITY DIMENSIONS RELEVANT TO JOB PERFORMANCE

The well-documented revival of interest in personality as a determinant of job performance within I/O psychology has also had an impact on job analysis. At least one commentator (Jackson, 1990) has posited that the failure to incorporate personality in the scope of job analytic efforts was an important contributor to the long period of dormancy in the use of personality measures. We discuss here a variety of ways in which personality variables have recently been incorporated into job analytic work.

The first is the use of a job analytic tool to directly evaluate the job relevance of each dimension within a multidimensional instrument. As an example, the well-known NEO Personality Inventory (NEO-PI), has an instrument labeled the NEO Job Profiler (Costa, McCrae, & Kay, 1995). The NEO-PI has 6 subdimensions for each of the Big 5 personality dimensions, resulting in a total of 30 subdimensions. The Profiler lists and defines each subdimension, and each is rated separately on a dichotomous job relevance scale; the relevant dimensions are then rated on a desirability–undesirability continuum. Thus, this approach represents direct ratings of the relevance of personality dimensions for the job in question.

The second approach is also linked to a specific personality instrument, but involves rating whether job behaviors that have been linked to the personality dimensions of interest are part of the job in question. An example of this is the use of a behavioral rating form linked to the Personnel Decisions International Employment Inventory (EI; Paajanen, Hansen, & McClellan, 1993). The EI measures factors in the domain of dependability, responsibility, and conscientiousness. An extensive list of work behaviors reflecting manifestations of these factors was developed, and ratings of the relevance of those behaviors for the job in question helps determine the applicability of the EI to the situation at hand. This behavioral rating form is also used for criterion development purposes: the subset of behaviors rated by managers as relevant to the target job become the basis for a criterion instrument whereby supervisors rate employees on each of the behaviors. Thus, for criterion-related validation purposes, the EI is correlated with ratings on a job-specific set of behaviors initially rated as relevant to the situation. In sum, the first approach above involves direct rating of the relevance of personality dimensions; the second approach outlined here involves ratings by managers of the relevance of job behaviors, which have been linked

by researchers to the personality dimensions measured by the EI.

A third example is the work of Raymark, Schmit, and Guion (1997) on development of the Personality-Related Position Requirements Form (PPRF), which also involves the rating of specific job behaviors that are then linked to personality dimensions. The distinction we make here is that this work is not designed to support a specific personality measure, but rather as a general approach to identifying the personality characteristics relevant to a job. Raymark et al. describe a multistage research process resulting in a set of 12 personality dimensions, hierarchically structured under the Big 5. A large sample of psychologists made ratings linking a large set of behaviors to these dimensions. The result is a 107-item behavioral rating form from which the relevance of each of the 12 personality factors can be inferred. Raymark et al. document that this form does reliably differentiate between various occupations. They acknowledge that the question yet unanswered is whether those personality dimensions identified as relevant are indeed more predictive of job performance than the less relevant dimensions. Another example of this approach, namely, the use of behavior ratings which are then linked to personality dimensions, is the O*NET work under the rubric of "work styles" (Borman, Kubisiak, & Schneider, 1999).

The examples used here all involve what we termed in the initial section of this chapter *taxonomic,* as opposed to "blank slate" approaches to job analysis. As noted there, blank slate approaches are job specific, and involve using various mechanisms to produce lists of important job activities and/or job attributes. Many applications, such as personnel selection work, involve obtaining both, and then using subject matter expert (SME) judgments to link activities and attributes. It is common for such a linkage process to also be used to infer the importance of various job attributes, with attribute importance a function of the number and importance of the activities to which attributes are linked. To the extent that a traditional KSA framework is adopted, such a process will not include personality characteristics among the relevant job attributes. If a broader KSAO framework is adopted, carefully defined personality characteristics can become part of the set of job attributes under consideration; much applied work now does so. We offer as a cautionary note the observation that it is critical to describe all activities at the same level of detail and specificity if one wishes to infer relative attribute importance from linkages to activities. The tradition of detailed KSA analysis means that it is likely that cognitively loaded work activities are described in considerable detail. In some settings, we see "softer," less cognitively loaded aspects of work described at a higher level of generality. If, using a simplified example, the activity "adds, subtracts, multiplies, and divides whole numbers" is written as four separate task statements, but the activity "responds to inquiries from coworkers, customers, and media representatives" is written as a single summary statement, a different conclusion about the relative importance of cognitively loaded versus less cognitively loaded attributes is likely to be drawn than if the same level of detail is used for both domains.

Despite the potential utility of personality-based job analysis techniques, recent research has shown that the personalities of those who provide the data may introduce bias into the job analysis process. Although similar issues may be important for any job analysis data [see our discussion of Morgeson & Campion's (1997) framework later in this chapter], Cucina, Vasilopoulos, and Sehgal (2005) showed that student raters tended to emphasize their own (self-reported) personality characteristics when rating the importance of personality dimensions for success as a student. Aguinis, Mazurkiewicz, and Heggestad (2009) reported that a frame-of-reference training intervention was effective in reducing the amount of bias in personality-based job analysis ratings attributable to raters' personalities. Finally, researchers have focused on these issues as they relate to potential bias in questionnaire data. We suggest that personality-based biases may also be worth investigating in other forms of job analysis data collection, such as subject matter expert panels, interviews, or the collection/reporting of behaviorally based critical incidents.

In sum, a variety of approaches have emerged that incorporate personality factors into job analysis. The relative merits of direct judgments of personality dimension importance versus approaches that involve judgments about job behaviors, from which inferences about relevant personality dimensions are drawn, remains an interesting issue not resolved at present.

COMPETENCY MODELING

Easily the most visible change in the analysis of work in the past 2 decades is the rise of a variety of approaches under the rubric *competency modeling*. The term is used to refer to a variety of different approaches, and has evolved considerably over this time. The origins of the competency modeling approach to job analysis can be traced back to

an article that first proposed the use of competencies in organizational settings (McClelland, 1973). Titled "Testing for Competence, Not Intelligence," the article posited that intelligence was not related to job performance, and that a wide range of characteristics, labeled competencies, could be identified, which differentiated between superior and average performers. Barrett and Depinet (1991) document the wide range of errors in McClelland's paper, including mischaracterizing the research linking cognitive ability to job performance and failing to acknowledge the wide array of measures other than cognitive ability used in employment settings. Despite its serious shortcomings, the paper was quite influential; McClelland and a variety of coworkers continued to develop the notion of "competencies" (Boyatzis, 1982; Spencer & Spencer, 1993).

The assertion that task-based approaches are unable to capture the changing nature of work strengthened the call for competency-based systems in organizations (Lawler, 1994). Although the practice of competency modeling has become widespread, often as a replacement for job analysis, the field of industrial–organizational psychology has certainly not led the charge (Schippmann et al., 2000). Until the results of a Society for Industrial and Organizational Psychology (SIOP) task force project comparing competency modeling and job analysis were published (Job Analysis and Competency Modeling Task Force; Schippmann et al., 2000), attempts to meaningfully distinguish between the two general methods of analyzing jobs were few. In addition, despite the current popularity of competency modeling in organizations, consistent definitions of the term *competency* do not exist, and even authorities in the field are unable to arrive at a clear meaning of the term (Schippmann et al., 2000).

One early theme in competency modeling refers to the practice of identifying the characteristics or attributes that are needed for effective performance on the job, specifically in terms of those characteristics held by exceptional performers (DuBois, 1999). Although these characteristics or competencies typically consist of the well-known KSAs, other authors also include such variables as motives, traits, or attitudes (e.g., Spencer & Spencer, 1993). Elsewhere, competencies are defined as the actual behaviors that distinguish superior performers from poor performers (Dalton, 1997). Under this approach, a competency model ideally consists of a set of competencies that have been identified as necessary for successful performance, with behavioral indicators associated with high performance on each competency specified to illustrate successful performance on that competency.

There are a number of issues associated with the competency modeling approach to analyzing jobs. First is the notion that competency modeling is a replacement for traditional forms of job analysis. The problem with this line of thought is the misguided assumption that job analysis methodologies purport to identify *only* the tasks and activities associated with a job, and fail to assess the personal characteristics and attributes associated with success on the job (e.g., Spencer & Spencer, 1993). This assertion is simply incorrect; examples of worker-oriented job analysis focusing on worker attributes abound, as has been illustrated throughout this chapter. To some extent, such confusion may be due to differences in how terms such as *job analysis, job specification,* and *work analysis* are used in the literature (e.g., Harvey, 1991; Pearlman & Sanchez, 2010). In addition, competencies reflecting personal characteristics such as sociability are certainly included in KSAO approaches to job analysis. Finally, many competencies that appear throughout the literature and in competency models are ill-defined concepts with no clear meaning (e.g., the meaning of a competency such as *visioning;* Pearlman & Barney, 2000).

It may be valuable here to consider where competencies tend to be placed in frameworks of work behavior. For example, using the Campbell, McCloy, Oppler, and Sager (1993) model of performance (see also Campbell, McHenry, & Wise, 1990, for a similar framework) to frame our discussion, competencies appear to be variously defined as either individual difference determinants of performance (e.g., Campion, Fink, Ruggeberg, Carr, Phillips, & Odman, 2011; Pulakos, 2009) or specific performance components (e.g., Bartram, 2005; Hogan, Davies, & Hogan, 2007; Lievens, Sanchez, Bartram, & Brown, 2010; Tett, Guterman, Bleier, & Murphy, 2000). As a consequence, there still is not a prevailing view on exactly what a competency represents, or under which circumstances competencies are intended to represent determinants or components of performance. Pearlman and Barney (2000) also add that any deficiencies in the meaning of a competency will translate into deficiencies in selection tools (or otherwise) that make use of those constructs. Thus, the meaning and definition of individual competencies requires further clarification before they can be accurately measured and put into use in organizations.

The approach to competency modeling previously discussed focuses, like job analysis, at the level of the job. A more recent use of the term *competency modeling* focuses at a much broader level—often, the entire organization. In this usage, competencies are attributes

or behaviors that cut across jobs, reflecting central organizational values. When the focus is on a single job or job family, the differences between competency modeling and traditional job analysis may be semantic. However, the notion of an organization-wide competency model is something conceptually very different. Any set of characteristics relevant across an entire organization is of necessity quite broad. Specifying a set of attributes valued across the organization is typically an attempt to specify what the organization will value and reward. Note the future tense: the specification of what the organization will value and reward is often part of an attempt at organizational change. The set of attributes specified in the competency model may not come from an analysis of the attributes of current employees, but rather may reflect top managers' vision as to what will be valued and rewarded in the future.

Some organization-wide competency models are quite generic. For example, one large organization offered an organization-wide competency model including the following 10 competencies: business awareness, communication, teamwork, resilience, influencing others, critical thinking, managing conflict and change, results orientation, innovation, and functional excellence. We do not identify the organization in order to make a point about the generic nature of models such as this: we challenge the reader to make any inferences as to what kind of organization this is. However, other models do indeed capture distinctive values of the organization, such as empowering employees at all levels to take initiative to satisfy a customer.

The intent of an organization-wide model is that all subsequent human resource activities be designed with this model in mind. Thus, these characteristics would be incorporated in performance appraisal systems and selection systems. A characteristic such as teamwork can be given greater emphasis in the evaluation of current employees or in selecting future employees than was the case in the past. Note that what is commonly viewed as "doing one's job" is relegated in the preceding model to a catchall competency, namely, functional excellence. Thus, the organization is emphasizing that a broader set of features than excellence in the performance of prescribed job tasks is to be valued and rewarded. In short, when the term *competency modeling* is used to refer to an organization-wide model rather than a job-specific model, the differences from traditional job analysis are much more than semantic.

Based on a review of the literature and interviews with experts in the field, Schippmann et al. (2000) attempted to clarify the distinction between job analysis and competency modeling approaches. Their report identified 17 variables on which competency modeling and job analysis could be compared, and rated each variable according to the level of rigor at which they were practiced. These variables are summarized in Table 4.1. The first 10 variables represent evaluative, front-end activities that can be expected to influence the quality of the inferences to be drawn from the resulting analysis. Job analysis was seen as demonstrating more rigor on every evaluative criterion with the exception of establishing a link to business goals and strategies. The final 7 variables are meant to be nonevaluative and focus on the uses of the resulting information and the type of characteristics investigated. In this case, job analysis was generally rated as less rigorous than competency modeling except for the focus on technical skills and the development of selection and decision applications.

Although a useful comparison of the two methodologies, the variables listed in Table 4.1 can be distilled into a smaller number of dimensions that represent the most fundamental differences between competency modeling and job analysis. These dimensions are: breadth of analysis, unit of analysis, type of characteristic studied, general use

TABLE 4.1 Level of Rigor Comparison: Competency Modeling Versus Job Analysis

Variable
Evaluative Criteria
1. Method of investigation and data collection[b]
2. Type of descriptor content collected[b]
3. Procedures for developing descriptor content[b]
4. Level of detail of descriptor content[b]
5. Linking research results to business goals[a]
6. Extent of descriptor content review[b]
7. Ranking or prioritizing of descriptor content[b]
8. Assessment of reliability of results[b]
9. Retention criteria for items and categories[b]
10. Documentation of research process[b]
Nonevaluative Criteria
1. Focus on core competencies[a]
2. Focus on technical skills[b]
3. Organizational fit versus job match[a]
4. Focus on values and personality orientation[a]
5. Face validity of content[a]
6. Training and development applications[a]
7. Selection and decision applications[b]

[a]Rated more rigorous for competency modeling.
[b]Rated more rigorous for job analysis.
Taken from Schippmann et al. (2000).

of data, and methodological rigor. Each dimension is discussed next.

The first major dimension on which competency modeling and job analysis differ concerns the completeness of the resulting picture of a job. Job-level competency models typically identify those characteristics that differentiate superior from average performers (Spencer & Spencer, 1993). Thus, they focus on attributes rather than activities, while job analysis may focus on either or both. More crucially, when job analysis focuses on attributes the goal is commonly to present a complete picture of job requirements.

Second, competency modeling generally focuses on any attribute that is related to performance, and as such includes the full range of KSAOs. Thus, it is indistinguishable in its domain coverage from worker-oriented job analysis with a KSAO focus. Job analysis, depending on the methodology, can be either work oriented, focusing on the tasks and activities involved in a job; worker oriented, focusing on the KSAs necessary to perform the job, and thus broader than competency modeling; or may incorporate elements of both approaches.

Third, competency modeling, particularly organization-level approaches, is more prescriptive or future oriented than job analysis, often emerging from espoused firm values or the beliefs of senior managers and based on inferences about future work requirements (Dalton, 1997; McLagan, 1997). Job analysis is commonly, though not necessarily, descriptive in nature, providing a picture of the job as it is constituted at a particular point in time. This distinction is encapsulated by the greater focus in competency modeling on linking research results to business strategy, as outlined in Table 4.1. More specifically, competency modeling has a greater focus than job analysis on the integration of the desired qualities of individuals with organizational strategies and goals, and in using this information to inform HR systems (DuBois, 1999; Lucia & Lepsinger, 1999; McLagan, 1997).

Finally, competency modeling and job analysis can differ greatly on the level of methodological rigor and validation that each entails. There is no intrinsic reason that the two must differ, but in practice the differences are often substantial. Traditional job analysis commonly involves multiple methods, careful selection of SMEs, documentation of the degree of agreement among multiple informants, links between attributes, and activities to support hypothesized attribute requirements. Although some descriptions of competency modeling procedures reflect similar rigor (e.g., Spencer & Spencer, 1993), in other instances the focus is on the speed with which a set of competencies can be identified, such as asking managers to check what they believe to be relevant attributes from a preset list (e.g., Mansfield, 1996).

Sanchez and Levine (2009) provide an additional perspective, suggesting that considering competency modeling and job analysis as complementary procedures would be more beneficial than necessarily choosing one at the exclusion of the other, as the literature often implies. They posit that organization-level competency modeling and job analysis are designed to achieve fundamentally different outcomes and encourage researchers and practitioners to consider ways in which the two methods can be kept distinct. Specifically, they differentiate job analysis and competency modeling along the following dimensions: purpose (describe behavior vs. influence behavior), view of the job (an external object to be described vs. a role to be enacted), focus (job vs. organization), time orientation (past vs. future), performance level (typical vs. maximum), and measurement approach (measuring a latent trait vs. use of clinical judgment for holistic understanding). Their conceptual analysis allows for sidestepping many of the critiques applicable to competency modeling when it is intended as a replacement for job analysis. However, some of the characteristics Sanchez and Levine ascribe to job analysis or competency modeling tend to refer to a given variation of applying each technique. For example, as discussed in our introductory section on choices in job analysis, job analysis may be either descriptive or prescriptive, depending on the purpose of the initiative. Still, Sanchez and Levine's work represents an initial effort to offer clear distinctions between job analysis and competency modeling. Whether their framework represents a viable distinction that can be put into widespread practice remains to be seen.

So what is competency modeling? First, at the job level, we view it as a form of worker-oriented job analysis that focuses on broader characteristics of individuals and on using these characteristics to inform HR practices. As such, it is inappropriate to proclaim competency modeling as a replacement for job analysis, as each approach has a different focus and the appropriateness of either methodology should depend on the purpose of the analysis (Cronshaw, 1998). Ideally, an integration of the rigor of traditional job analysis with the broad focus of competency modeling can be achieved. While we have emphasized in various places in this chapter the broadening of job analysis from a KSA focus to a KSAO focus, the data presented by Schippmann et al. show that the typical job analysis effort today remains focused more heavily on technical skills than on personality characteristics and

values. Competency modeling's broader KSAO focus is certainly consistent with the movement in I-O psychology over the past 2 decades to incorporate noncognitive variables more heavily in our research and practice. Second, at the organization level, competency modeling attempts to identify characteristics related to overall organizational fit and to the organization's vision (Schippmann et al., 2000). Models at this level tend to have a high degree of face validity to the organization and can be written in terms that managers in the organization understand.

Hybrid approaches also may provide job information that can be used for a broad array of purposes. Research by Lievens, Sanchez, and De Corte (2004) shows that blending competency and task ratings results in greater interrater reliability and between-job discriminability among job raters than using competency ratings alone. Lievens et al. and other researchers have studied issues related to the so-called "inferential leap" inherent to competency ratings. Because we see parallels in the work conducted on competency modeling inferences to those of job analysis, we discuss further work on evaluating the validity and accuracy of competency modeling and job analysis data and procedures in our later section on accuracy in job analysis.

We see potential value in scrutinizing assumptions made about the quality of competency modeling due to the wide variety of practices that appear to fall within the label. Our sense is that definitional issues still abound regarding the practice of competency modeling. Given the variety of practices that fall within the label, researchers and practitioners should document the particular variation on competency modeling in use. Although the Schippmann et al. (2000) report maintains status as a cardinal reference regarding competency modeling practices, it is important to remember that some of the conclusions noted by the task force are based on a small number of expert opinions (a caveat prominently acknowledged by Schippmann et al.). Accordingly, if competencies are to be used in research and practice settings, we encourage the use of unambiguous operational definitions of competencies since the terms *competency* and *competency model* remain nondescript. This recommendation is consistent with a recent set of suggestions for best practices in competency modeling provided by Campion et al. (2011). While their recommendations are largely based on applied experience with competency modeling, we suspect that Campion et al.'s best practices will serve as important guidance for practice in this area.

Pragmatically, there is also a need to be more attentive to the need for offering timely solutions to organizations. Competency modeling practice makes clear the need for less time-consuming job analysis procedures. As other commentators have noted (Guion, 1998), in some settings, particularly job analysis for personnel selection, job analysis is done largely for purposes of legal defensibility: rigor and detail become ends in themselves. That extraordinary detail is needed to meet legal requirements in such instances should not spill over into the notion that all job analysis is a 6-month process. As always, the purpose of job analysis should remain in the forefront.

COGNITIVE TASK ANALYSIS

The term *cognitive task analysis* (CTA), sometimes referred to as cognitive job analysis, has been defined in various ways and is associated with numerous methodologies. Generally, CTA refers to a collection of approaches that purport to identify and model the cognitive processes underlying task performance (Chipman, Schraagen, & Shalin, 2000; Shute, Sugrue, & Willis, 1997), with a particular focus on the determinants of expert versus novice performance for a given task (Gordon & Gill, 1997; Means, 1993). Although the term *CTA* first emerged in the late 1970s, the field has grown substantially in the past decade, and some authors seem to have forgotten that most methodologies are adapted from the domain of cognition and expertise (see Olson & Biolsi, 1991, for a review of knowledge representation techniques in expertise). Instead, CTA is sometimes treated as if it evolved entirely on its own (Annett, 2000). The value added for CTA is not that it represents a collection of new activities for analyzing performance, but that it represents the application of cognitive techniques to the determination of expert versus novice performance in the workplace, facilitating high levels of knowledge and skill (Lesgold, 2000).

CTA is often contrasted with behavioral task analysis. Whereas the former seeks to capture the unobservable knowledge and thought processes that guide behavior (i.e., *how* people do their jobs), the latter seeks to capture observable behavior in terms of the actual task activities performed on the job (i.e., *what* people do on their jobs). Proponents of CTA claim that due to the increasing use of technology in the workplace, jobs are becoming increasingly complex and mentally challenging, necessitating a more cognitive approach to the analysis of job tasks (e.g., Gordon & Gill, 1997; Ryder & Redding, 1993; Seamster, Redding, & Kaempf, 2000). Thus, it is believed that task analysis methodologies may be inadequate procedures for

capturing how people perform in jobs that require cognitive skill. However, separating the unobservable cognitive functions of a job from the observable behavioral functions of jobs may limit the usefulness of the overall analysis, and both types of information are often necessary for a complete understanding of the tasks involved (Chipman et al., 2000; Gordon & Gill, 1997; Shute et al., 1997). Thus, rather than acting as a replacement for task analysis approaches, CTA should be considered a supplement, because neither method alone may be able to provide all of the information necessary for analyzing how an individual performs his or her job (Ryder & Redding, 1993).

At the same time, situations likely exist in which CTA is not necessary for fully understanding task performance. Because approaches to CTA are generally time-consuming, labor-intensive, and expensive endeavors (Potter, Roth, Woods, & Elm, 2000; Seamster et al., 2000), it would be wise to first consider the nature and purpose of the analysis before choosing a CTA methodology over a different job analysis methodology. Although most examples of CTA have been conducted for highly complex jobs (e.g., air traffic controllers, air force technicians; Means, 1993), some investigations have been conducted for more commonplace jobs outside of the military domain (e.g., dental hygienists, Mislevy, Steinberg, Breyer, Almond, & Johnson, 1999; whitewater rafting guides, O'Hare, Wiggins, Williams, & Wong, 1998; livestock judges, Hoffman, Shadbolt, Burton, & Klein, 1995). It is easy to imagine the application of CTA techniques to any job that requires some degree of decision-making or cognitive skills, but again, such analysis may not be necessary in order to gain an understanding of what constitutes effective performance.

As with traditional types of job analysis, CTA methodologies abound, and although they share the common goal of understanding the cognitive processes that underlie performance, there is little comparative information available as to which methods are appropriate under different circumstances and for different job settings (Chipman et al., 2000). (Seamster et al., 2000, do provide suggestions for which methods are appropriate for different skill domains.) In addition, there appears to be no evidence that any single approach is useful across all domains (Schraagen, Chipman, & Shute, 2000), or that different methods will result in the same data (Gordon & Gill, 1997). Thus, the use of multiple approaches with multiple experts would likely yield the most meaningful information (Potter et al., 2000). Chipman et al. (2000) suggest that the following issues should be taken into consideration when choosing a CTA methodology: the purpose of the analysis, the nature of the task and knowledge being analyzed, and the resources available for conducting the analysis, including relevant personnel.

Some of the more common CTA techniques include PARI (Prediction, Action, Results, Interpretation), DNA (Decompose, Network, and Assess), GOMS (Goals, Operators, Methods, and Selection), and COGNET (Cognition as a Network of Tasks). Examples of techniques borrowed from the domain of expertise include interviews and protocol analysis. Information on these and other procedures is available in Hoffman et al. (1995); Jonassen, Tessmer, and Hannum (1999); Olson and Biolsi (1991); and Zachary, Ryder, and Hicinbothom (1998).

Because the use of CTA as a job analytic technique is relatively recent, a number of issues have yet to be resolved. First, for someone new to the field of CTA, there is little documented information available concerning how to actually perform the different techniques, making replication difficult (Shute et al., 1997; Yates & Feldon, 2008). In addition, the procedures are somewhat complex and difficult (Gordon & Gill, 1997), are not refined to the extent that standardized methods exist (Shute et al., 1997), and require that the analyst become familiar with the technical details of the particular domain being studied (Means, 1993). Thus, the amount of time and effort required by each individual involved in the analysis and the lack of information on how to conduct a CTA potentially limits the usefulness of the procedures in operational settings. This is evidenced by the limited number of CTAs being performed by a relatively limited number of persons who are generally experienced in the domain of cognitive science (Seamster et al., 2000).

Second, there is little information available on how to use the information collected during a CTA, specifically, on how to go from the data to a solution, such as the design of training programs or other systems within organizations (Chipman et al., 2000; Gordon & Gill, 1997). The large quantity of data generated by a CTA makes development of a design solution even more difficult (Potter et al., 2000).

Third, there is a lack of information on the quality of the data gleaned from CTA techniques. Thus, there is a need to assess the relative strengths and weaknesses of the different techniques to determine the conditions under which the use of each technique is optimal, and finally, to assess the reliability and validity of the different techniques. A dissertation by Yates (2007; Yates & Feldon, 2008) provides a summary of CTA techniques that is intended to function as a taxonomy for identifying optimal procedures in a given situation. They note that the

proliferation of CTA methods is a likely cause of confusion for those wanting to conduct such an analysis. Yates's research represents the most recent source of which we are aware detailing the breadth of CTA methods. Clark, Feldon, Van Merrienboer, Yates, and Early (2008) also discuss difficulties with assessing the psychometric properties of CTA techniques. Reliability could be assessed by comparing the results of different analysts using the same procedures, and validity assessment would involve comparing the results of multiple experts using multiple procedures (Shute et al., 1997). The lack of this kind of information is likely a result of the intensive nature of the data collection process.

To conclude, CTA represents an intriguing way of analyzing jobs. However, the lack of information available concerning the relative merits of different methodologies for conducting CTA limits applicability at present. An interesting area that is gaining in study is the application of CTA methodologies to team tasks and decision making to determine the knowledge shared by team members and how it is used to elicit effective performance (e.g., Blickensderfer, Cannon-Bowers, Salas, & Baker, 2000; Klein, 2000).

STRATEGIC JOB ANALYSIS

Traditional forms of job analysis generally assume that the "job" is a static entity, and SMEs are generally chosen based on the assumption that they have experience with or knowledge of the job in question. However, due to changing jobs and organizations, some would argue that the notion of a static, unchanging job may no longer be appropriate. In addition, new jobs are being created all the time, partially a result of downsizing, globalization, and the increased use of computer technology (Schneider & Konz, 1989). Thus, the use of SMEs with prior knowledge and experience may not be possible (Sanchez & Levine, 1999), and new methods of determining the tasks and abilities required on future jobs become necessary. The goal of strategic job analysis is to determine the tasks that will be performed and the abilities required for effective performance in jobs (that may or may not currently exist) as they are expected to exist in the future (Schneider & Konz, 1989). Thus, strategic job analysis represents a shift from descriptive job analysis (what is currently done on the job) to predictive job analysis (what will be done on the job in the future; Cronshaw, 1998).

Few empirical examples of strategic job analysis currently exist (e.g., Arvey, Salas, & Gialluca, 1992; Bruskiewicz & Bosshardt, 1996), and most working examples in the literature are based on personal business experience or suggestions about what might constitute effective forecasting techniques (Pearlman & Barney, 2000; Sanchez, 1994; Sanchez & Levine, 1999; Schneider & Konz, 1989). Arvey et al. (1992) suggested that existing relationships between task- and ability-based job analytic information could be used to predict the skill requirements of future jobs, assuming a stable covariance structure of task–ability matrices that adequately captured the domain of skills and abilities to be forecasted. They found that if only a limited number of tasks were known, future skill requirements could be forecasted based on current knowledge about which tasks predicted which abilities. However, as Arvey et al. point out, the ability to forecast future job requirements does not assure that those skills or abilities will actually be essential to that job.

Using a very different methodology, Bruskiewicz and Bosshardt (1996) compared job analytic ratings made by a group of SMEs involved in creating a new position (immediately prior to when the position was filled) to ratings made by a group of incumbents who had been working in the new position for nine months. High levels of agreement between SMEs and incumbents were found, where SMEs with more direct experience in the job design process provided ratings most similar to incumbents. However, because those SMEs were directly involved in the redesign process, it is likely that they were completely familiar with what the job would entail, and thus were not providing a true predictive forecast. A more informative study would have involved SMEs completing two concurrent job analysis questionnaires prior to being informed that they would be involved in the redesign process—one for the job as it existed prior to redesign, and one for the job as they would forecast it to exist in the future. After the redesign process, incumbent ratings of the job as it currently existed could be gathered and compared to the previous SME forecasts to assess the accuracy of their predictions.

Although empirical analyses of strategic job analysis are few in number, prescriptive information is provided in the literature. Group discussion techniques are the most commonly recommended methodology for conducting a strategic job analysis (Pearlman & Barney, 2000; Sanchez, 1994; Sanchez & Levine, 1999; Schneider & Konz, 1989). These techniques generally involve bringing together a group of SMEs (e.g., incumbents, managers, strategy analysts) and brainstorming about the expected task and ability requirements of future jobs. SMEs may be

asked to identify possible organizational or environmental conditions that could affect future jobs (e.g., changing labor markets, technology, demographics, political or economic trends; Sanchez & Levine, 1999; Schneider & Konz, 1989), to think about what aspects of jobs are the most likely to change and what skills or attributes are important to those aspects (Pearlman & Barney, 2000), or to visualize how future tasks might be performed, particularly in consideration of likely technological change (Sanchez & Levine, 1999).

Although a seemingly useful tool for the development of business strategy and the prediction of future human resource functions, strategic job analysis represents a relatively new field of study, and many issues have yet to be resolved. Although the group discussion techniques listed above are reportedly in use by the authors, no evidence exists as to their utility as forecasting tools. Thus, a primary concern lies in assessing the validity of strategic job analytic information, namely, how to accurately examine and describe existing jobs in the future or jobs that do not currently exist (Cronshaw, 1998; Schneider & Konz, 1989). Because the world of work has undergone so many changes in recent years (e.g., see Howard, 1995), the possibility of even more change in the future is likely, making it a difficult task to accurately predict variables that may affect how work and jobs will be conceived of, or the skills and abilities that will be required for future jobs. If future predictions can be shown to be valid predictors of actual requirements and activities, it would be possible to defend the development of, for example, selection systems based on this kind of information (Schneider & Konz, 1989). However, until more empirical evidence for the validity of strategic job analytic information is obtained, the usefulness of the method cannot be determined.

A second point to be made is the fact that some of the activities described under strategic job analysis are activities that any competent job analyst could be expected to perform. For example, it is reasonable to expect that a job analyst would inquire about the future of a target job, particularly if that job had recently changed or could be expected to change in a predicable way. A third potential concern lies in who the most accurate judges of future skills and abilities are. As with traditional forms of job analysis, the best practice would likely be to gather information from as many sources as possible (e.g., Schneider & Konz, 1989).

Finally, there is also the possibility that techniques other than group discussion may be useful ways to gather information for the future. For example, CTA techniques may be useful for forecasting jobs that involve complex tasks or technical skills. Clearly, the emphasis on changing work structures and processes means that strategic job analysis methods will continue to be a significant activity. With this in mind, we suggest that the relative paucity of recent research specifically oriented toward strategic job analysis is principally a labeling issue. That is, the emphasis on strategic focus appears to merge with competency modeling practices, as the espoused advantage of competency modeling is an explicit tie to organizational strategy. For this reason, readers interested in strategic job analysis concepts may do well to investigate the competency modeling literature.

ACCURACY IN JOB ANALYSIS

Morgeson and Campion (1997) presented an important challenge to the field with a provocative article that drew on a wide variety of literatures in setting forth a framework that identified 16 potential social and cognitive sources of inaccuracy in job analysis. The word *potential* is critical; in many cases, the authors were making a conceptual argument that a potential source of inaccuracy is feasible rather than offering documentation of actual effects. Morgeson and Campion suggested that researchers have largely ignored issues of accuracy; given the central role of job analysis as a foundational activity for much of the work of I-O psychologists, they believe that this inattention is a serious problem. This work remains a cardinal reference in the discussion of job analysis accuracy [see also Morgeson & Campion (2012) for an updated chapter on the same topic]. Additionally, a point/counterpoint in the *Journal of Organizational Behavior* presents current dominant perspectives on conceptualizing accuracy and error in job analysis (Harvey & Wilson, 2000; Morgeson & Campion, 2000; Sanchez & Levine, 2000). We will provide an overview of Morgeson and Campion's sources of inaccuracy, discuss relevant empirical work using various perspectives on accuracy, and offer a variety of comments.

We will not develop here all 16 of the themes in the Morgeson and Campion (1997, 2012) work. The 16 are grouped into 4 broader categories; we will offer exemplars from each category. The first is social influence processes, which largely apply in settings where job analysis judgments are made in groups, rather than by individuals. If group consensus is required, pressures for conformity may be a source of bias; if a group product is required, the lack of individual identifiability may diminish motivation to devote attentional resources to the task. The second

is self-presentation processes, involving impression management, social desirability, and demand effects. Concerns about incumbents inflating the importance of their job are a longstanding issue, and result in the common practice of using multiple sources of job analysis information. The third is limitation in the information processing systems of respondents. Demands for large numbers of ratings, or for fine differentiations among job characteristics, may result in information overload, which may be resolved by some heuristic process to simplify the rating task. The final source is bias in information-processing systems, with examples including extraneous effects of features such as respondent job satisfaction or dissatisfaction.

We offer a number of comments about these issues. At the forefront is the fundamental issue of the criterion for job analysis accuracy: How would we know if an analysis is accurate or inaccurate? One argument is that one draws conclusions about job analysis accuracy from the outcomes of the human resource system or program developed on the basis of the job analysis (Sanchez & Levine, 1999, 2000). If the job analysis is used to select predictors, and the predictors prove to exhibit criterion-related validity, then one uses these consequences to infer that the job analysis was accurate. This is not fully satisfactory: for example, one would never know whether an important predictor was excluded from the validation study due to an omission in the job analysis. Note also that in a number of instances there is not an external criterion of human resource system effectiveness to draw on. In some applications, as in the reliance on content-oriented evidence of selection system validity, the job analysis information itself is the evidence on which one's conclusion about the selection system rides. Similarly, Harvey and Wilson (2000) note that the accuracy of job analysis is not dependent on the way the results are subsequently applied, and that it would be conceptually possible to gather conflicting information on the accuracy of job analysis data if two disparate uses of the data yield conflicting results.

Harvey and Wilson (2000) address the problem of job analysis accuracy by arguing that the term *job analysis* should be restricted to documenting observable work activities. The verification of incumbent information about work activities by job analysts permits conclusions to be drawn about job analysis accuracy. They propose *job specification* as the term for the process of making inferences about job attributes. We agree that the documentation of work activities is more straightforward and amenable to independent verification than the process of making inferences about required job attributes. We note, however, that *job analysis* is broadly used as an umbrella term for a wide range of activities involving the systematic study of work, including both activities and attributes, and do not view restriction of the use of the term as viable.

We briefly review recent developments in the examination of sources of variance in job analysis ratings. While identifying a source of variance (e.g., different ratings by incumbents vs. supervisors) does not directly answer the question of the relative accuracy of one over the other, such research does focus attention on these sources of variance. For example, Morgeson, Delaney-Klinger, Mayfield, Ferrara, and Campion (2004) investigated inflation in job analysis ratings, suggesting that relatively higher mean ratings for incumbents as opposed to other raters (e.g., analysts, supervisors) may be indicative of incumbents providing self-ratings as opposed to job ratings. Morgeson et al. suggested that impression control, identification with the job, and incumbents' perceptions of skill underutilization all contribute to relatively higher magnitude job descriptor ratings. However, an alternative hypothesis is that incumbents have a unique perspective on their job such that inflation may represent true variance instead of either random or systematic error variance in ratings.

In addition, Morgeson et al. (2004) reported that inflation was greater on job descriptors characterized by less specificity—that is, that inflation was greater on competency and ability (job specification) ratings than on task ratings. Similar results were reported by Dierdorff and Morgeson (2007, 2009) and Lievens, Sanchez, and De Corte (2004). A useful operational distinction regarding specificity is provided by Dierdorff and Morgeson (2009), who conceptualize tasks on the molecular end of the specificity continuum of worker requirements and competencies on the molar end. Dierdorff and Wilson (2003) conducted a meta-analysis of job analysis reliability, finding that, in general, raters of specific tasks exhibited higher reliability than those rating generalized work activities (see their results for some exceptions to this finding). Of note, they did not include job specification (e.g., worker attribute) ratings in their analyses. Regarding the rating source, Dierdorff and Wilson reported that analysts had the highest reliabilities, followed by technical experts and incumbents. Such research may have particular ramifications for procedures selected in the design of a job analysis study.

As noted at the beginning of this chapter, the job analyst must make choices about the source of information appropriate for a given job analysis context. Research by Lievens and colleagues provides empirical investigation into quality and accuracy relevant to data source

issues. In several studies of a competency modeling process, Lievens et al. (2004) found that interrater reliability and between-job discriminability were higher among job experts than inexperienced raters and were higher when increasingly specific job descriptors were used. Lievens et al. (2004) concluded that a competency modeling study could be improved in terms of psychometric accuracy by including elements of what has traditionally been defined as job analysis (i.e., including task information or ratings). Using the same criteria as Lievens et al. (2004), Lievens and Sanchez (2007) found that providing frame-of-reference training to analyst raters (referred to as consultants in the study) increased the interrater reliability and between-job discriminability of their ratings. They found that expert consultants, defined as those who were trained and had competency modeling experience, provided ratings that were most desirable, according to the two criteria. We suggest that an important contribution of these studies is the use of generalizability theory as a means to evaluate job analysis quality and accuracy criteria, which has been used successfully in other research (Lievens et al., 2010; Van Iddekinge, Putka, Raymark, & Eidson, 2005).

Two recent studies have used role theory as an explanation for low reliability in job incumbent ratings. The central premise is that low interrater reliability in job analysis ratings may be indicative of varying acceptable approaches to performing the same job, as opposed to error variance. Incumbents in such work conditions may have considerable latitude for defining how to perform. Dierdorff and Morgeson (2007) used O*NET data to show that low reliabilities inherent to lower specificity job descriptors (e.g., abilities, competencies) are to some extent a function of work context factors such as autonomy, amount of task interdependence, and job routinization. Similarly, a study by Lievens et al. (2010) tested the effects of work context (e.g., autonomy), complexity (e.g., extent of information processing), and types of activities performed (e.g., contact with others) on competency ratings. They found that up to 25% of variance in competency ratings was related to these factors, indicating that differences among raters are not always attributable to random error.

Finally, researchers have used the sources of variance/generalizability theory paradigm to gain insight into practical questions about the use of job analysis results. Van Iddekinge et al. (2005) used variance components analysis to inform decisions about whether job analysis data from multiple sites in an organization could be used to support transportability of an assessment procedure. Using this technique, Van Iddekinge et al. were able to identify the relative magnitudes of variance due to several important facets of their measurement design, such as raters, KSAOs, and demographic characteristics of raters. Such a technique may hold promise for similar applied and research situations in the future.

We see considerable value in the perspective taken by Guion (1998). Guion posits that job analysis is not science: it is an information-gathering tool to aid researchers in deciding what to do next. It always reflects subjective judgment. Morgeson and Campion (2000) reflect this position, noting that the term *accuracy* carries multiple connotations in the job analysis context. They propose that a focus on the inferences made on the basis of job analysis data dictates the appropriateness of methods used to evaluate the data. It may also be useful to evaluate the quality of both the job analysis process and data. With careful choices in decisions about what information to collect and how to collect it, one will obtain reliable and useful information. Careful attention to the types of issues raised by Morgeson and Campion (1997, 2012) can increase the likelihood that useful information will result from job analysis. But we do not see an available standard for proving the accuracy of a job analysis. The documentation of one's choices and the use of sound professional judgment in job analysis decisions is the best that can be expected.

CONCLUSION

Job analysis has long been an important foundational tool for I-O psychologists. This chapter highlights a number of relatively recent developments in the area. The chapter is an update of the version in the prior edition of this *Handbook,* and we note that the major themes we highlight are unchanged. While this chapter cites a considerable amount of new research, that research has extended our knowledge in ongoing areas of work. We have not identified new thematic directions since the prior edition.

The Content Model underlying the O*NET reflects a major effort toward a comprehensive model of job and worker characteristics, and represents a highly visible manifestation of the notion that multiple purposes require multiple types of job information. I-O psychology's rediscovery of personality has led to the development of a variety of dedicated tools for identifying the personality requirements of jobs, as well as to a broadening of the traditional KSA framework to include personality characteristics under the KSAO rubric. The business world's

embracing of competency modeling reflects a change in the way organizations view job information; the challenge is to meld the breadth and strategic focus of competency modeling with the rigor of traditional job analysis methods. Cognitive task analysis is the subject of considerable research, with the jury still out as to feasibility and value of widespread I-O applications. Strategic job analysis may become a more important tool, and appears increasingly tied to competency modeling, as organizations look increasingly toward the future. As work and organizations continue to change we look forward to continuing developments in job and work analysis.

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